



# ON THE ICE



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by **PETER CLARKE**      photographs by **WARREN KRUPSAW**



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# Glossary

- Aft: in, near, or toward the back.
- AG: Aerographer's Mate; Navyman who collects, records, analyzes weather information and makes forecasts.
- ASA: Antarctic Support Activities; a command which maintains stations in Antarctica and provides most of the men who winter-over.
- AT: Aviation Electronics Technician; a Navyman who maintains, repairs, and installs aircraft electronics equipment.
- "Belly-Clapper": Balaclava; a cap. When pulled down it covers the face and neck with a slit for the eyes, nose, and mouth.
- Brash: a mass of sea ice fragments.
- Bucket: an accessory attached to a tractor.
- C-121J: a personnel and cargo transport aircraft; Super-Constellation or "Connie."
- Crevasse: a large crack formed wherever a thick sheet of land ice bends sharply.
- CTF-43: Commander, Task Force 43 (Rear Admiral Fred E. Bakutis).
- D-8: a large tractor.
- DER: Radar Picket Escort Destroyer.
- Down: out of commission; as a vehicle or aircraft is down for repairs; when applied to weather means non-operational or unfit for flying.
- Fast Ice: sea ice attached to the land.
- File: to submit flight plans stating route, weather, fuel, etc.
- Fork: an accessory attached to a tractor.
- GCA: Ground Control Approach; an aircraft landing aid to facilitate landing in poor visibility. Precise heading and altitude information is represented on the ground radar, and corrections are supplied to the pilot by the controller.
- Hack it: manage it or handle it.
- Hairy: scary.
- Herc: short for "Hercules;" the C-130 and LC-130 aircraft.
- JP4: a type of aircraft fuel, utilized in turbine (jet) engines.
- LC-47: Medium range, ski-equipped cargo aircraft; nicknamed the "Goon" (LC means ski-equipped cargo).
- LC-117: modified, higher performance version of the LC-47; "Super-Goon."
- LC-130: largest Deep Freeze cargo transport aircraft; nicknamed the "Hercules."
- LGP: low-ground-pressure. Refers to tracked vehicles having extra wide tracks to facilitate movement on soft surfaces.
- MCB-6: Mobile Construction Battalion Six; "SeaBee" detachment.
- NSF: National Science Foundation.
- Overhead: ceiling of a room or compartment.
- Pallet: skid for cargo.
- Pemmican: a concentrated food used for emergency rations.
- SAR: Search And Rescue.
- Sastrugi: wind-waves in snow; often with unusual shapes.
- Secure: to make fast; to tie; an order given on completion of a drill or exercise, meaning to withdraw from drill stations and duties.
- Skua: a large bird referred to as the "eagle of the Antarctic." Similar to a gull but not of the gull family.
- Sno-Cat: a large ladder-tracked four-pontoon tractor; useful in areas of soft snow.
- Strip: a nickname for Williams Field airstrip, near McMurdo Station.
- TACAN: an electronic navigational aid with transmissions broadcast from ground stations and received aboard an aircraft; display units aboard the aircraft show distance and magnetic direction to or from the station.
- Tech Rep: Technical Representative of a manufacturer of major equipment used in Deep Freeze; sent down to advise on mechanical difficulties or simply as liaison with Navy.
- USARP: U. S. Antarctic Research Program; scientists in Antarctica are often called "USARPs."
- UFN: until further notice.
- VX-6: Air Development Squadron Six; the Navy's "Antarctic Squadron."
- Winter-over: to stay in the Antarctic from March to October during the months of darkness and isolation.
- WX: Weather.
- XO: executive officer, usually of a ship or station.

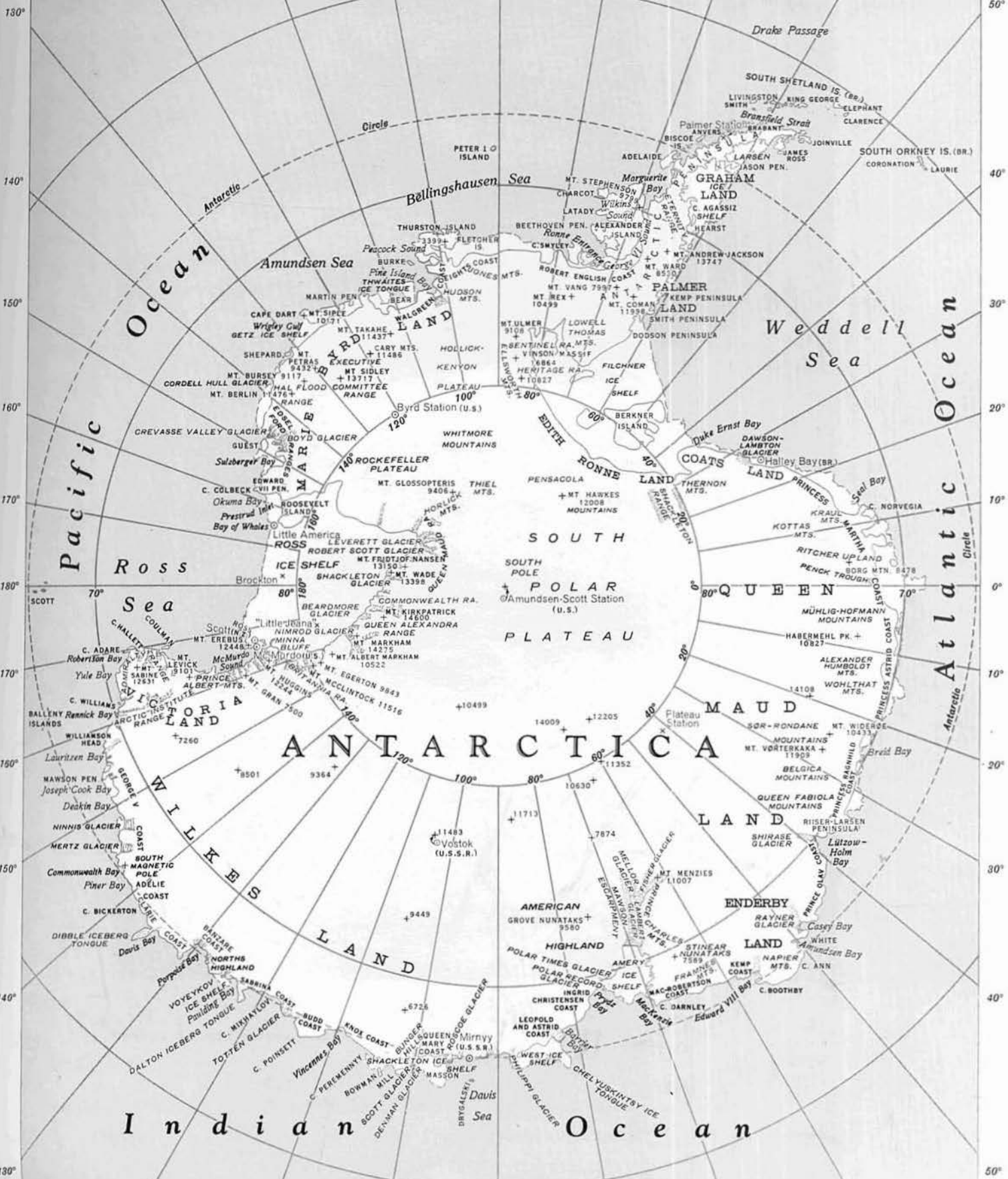
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# ANTARCTICA

# Indian Ocean



Flight Radioman Richard S. Simmons

## Dedication

Near the end of the season, after four years without a fatal aircraft accident, an LC-47 crashed on the Ross Ice Shelf near Admiral Byrd's old Little America base. All six men aboard were killed. The plane encountered a "white-out" — diffused light that bounces continuously between the ice and low clouds, leaving no horizon. This is the condition most dreaded by polar fliers, since it occurs — without warning — after the aircraft has been given weather clearance and is airborne.

Lieutenant Harold M. Morris, pilot.

Lieutenant William D. Fordell, co-pilot.

Lieutenant Commander Ronald Rosenthal, navigator.

Charles C. Kelley, Aviation Machinist's Mate third class, flight mechanic.

Wayne M. Shattuck, Aviation Machinist's Mate third class, flight mechanic.

Richard S. Simmons, Aviation Electronics Technician first class, flight radioman.

Five days later, on February 7, 1966, another man was killed unloading an aircraft at the South Pole.

Andrew B. Moulder, Storekeeper second class.



## ON THE ICE



Rear Admiral Fred E. Bakutis in the flag quarters at McMurdo. Admiral Bakutis is especially familiar with bad flying conditions, since one of his previous commands was the Alaskan Sea Frontier, where mountains, fog, and short runways often make landing even more hazardous than it is on the ice. A former fighter pilot, he shot down twelve enemy planes in the Pacific in World War II and, among many other decorations, holds the Navy Cross. A personal knowledge of flying is almost essential to a commander of "Operation Deep Freeze," as nearly everything in the interior of the Continent is brought in by aircraft. He is the fourth admiral to command the U. S. Naval Support Force Antarctica, and was selected for his imaginative grasp of the scientific as well as logistic problems peculiar to this operation. Brockton, a summer weather station on the Ross Ice Shelf, was named for his home town in Massachusetts.

The odd thing about the Antarctic is that anyone can live there at all. The weather and the terrain are so fierce that, on a summer day, a man alone can be sucked into oblivion. The Continent has been covered with ice for 11 million years, and not until 1957 did anyone spend a winter at the South Pole. In the ten years since then, facilities have been built up so carefully that a man can live "on the ice" almost in comfort, giving his attention to the bottom of the sea or the upper atmosphere. The scientific knowledge thus gained is already worth many times the original cost.

Each year, in the austral summer, the United States Navy sends a large force to the Antarctic in support of 150 to 200 scientists. "Operation Deep Freeze" manages to keep about ten ships and nearly two dozen aircraft operating in the coldest temperature on earth. About 200 Navy men spent the winter in 1966 — four to six months of it in darkness — to allow 36 scientists to maintain the continuity of their observations.

The scientist's measurements may not be analyzed for a year or more, but he has the satisfaction of knowing they may benefit his country and perhaps the entire world. Following the practice begun during the International Geophysical Year (1957-58), scientific information is freely exchanged by all nations with Antarctic bases. This unprecedented cooperation multiplies the quantity of data available to each investigator.

The National Science Foundation offers about \$7.5 million annually in grants. The scientist, or his university, tells the U. S. Antarctic Research Program (USARP) what he will need, down to the smallest net or coil of wire, and USARP discusses the logistic requirements with the Navy. The "lead time" is often as much as a year, since his project must be coordinated with others and he and his equipment must be delivered in the field together — at the end of the world's longest supply line.

The weather still makes most of the decisions in Antarctica. In order to overcome it, with machinery that must be maintained thousands of miles from home, the Navy has become ingenious at making the most out of a limited amount of equipment. On a budget of \$19.9 million, of which a staggering proportion goes into fuel and transportation, Deep Freeze probably gets as much for its money as any command in the armed forces.

Deep Freeze is the Navy's "blue chip" duty — not because it is easy but because of the caliber of the men. When it began, there were 16 volunteers for each opening, and even today reenlistment remains high. Like Rear Admiral Fred E. Bakutis, Commander Naval Support Force Antarctica (CTF-43), who during his career has survived many dangerous assignments, the men have courage. They are attracted to the ice for a variety of reasons, but undoubtedly for adventure and the feeling of being in on something important.

Since most of them are selected for Deep Freeze on the basis of their individual skills, they discover when they arrive on the ice that they are indispensable. They feel personally responsible for

their small units, and take pride in producing or repairing something on which many people depend. The harshness of the environment, the loneliness, and the long hours are relieved by close companionship and a rich humor. This humor hides their seriousness and their genuine idealism.

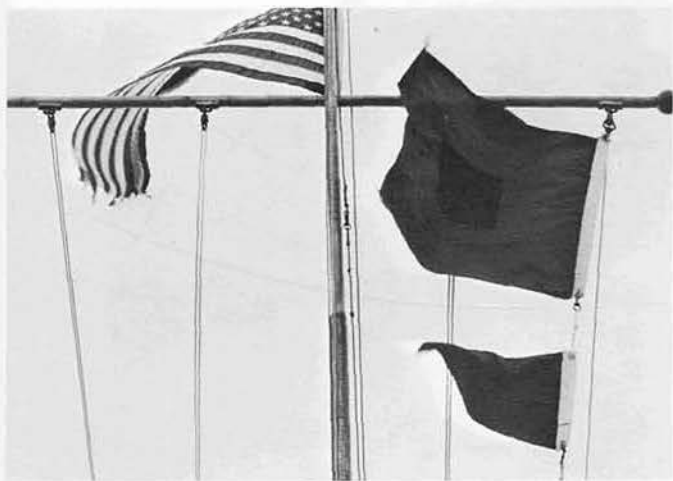
Like the support forces of other nations, the Navy offers assistance to anyone who requires it, whether to a Russian aircraft, an Argentine traverse party, or a New Zealander studying penguins. Dr. Henry M. Dater, the staff historian of Deep Freeze, says this attitude comes from "the ancient tradition of the sea of giving help to ships in distress and the feeling of polar explorers that, where nature is implacable, man had better unite for his own survival." As a precedent for the world, this arrangement in the Antarctic, extended by treaty for 30 years, may turn out to be historic.

On the ice, space and time are not what they seem. An aircraft leaves McMurdo today and arrives at Byrd Station yesterday. Mountains are farther away than they look, and the ground — in some weather — is closer. The latest communications equipment reports the geology of three hundred million years ago. To reflect the feeling of the Antarctic, this book takes certain liberties with space and time.

A Hercules LC-130 aircraft at Williams Field. A taxi-run that may be an all-time record was made by one of the Hercs in Deep Freeze '66. With visibility too low to take off, it simply taxied from the main station at Byrd to the VLF (Very Low Frequency) substation 14 miles away. Machines are especially beautiful in the Antarctic because they are rare. They stand out dramatically on the ice, and their purpose is immediately clear.



## "Rope Yarn"



These ominous flags, in various combinations, warn of an approaching weather condition that is generally more serious than it would be in civilized surroundings. When two of the square flags are hoisted, one above the other, they signify Storm Condition One. The red triangle means Low Visibility Condition One.

Zero-zero at McMurdo. A 40-knot wind carries the snow in from the south, and the flags at Antarctic Support Activities (ASA) Command spell out Storm Condition One. As in 1902, when Shackleton first saw it, the ground is covered thickly with the dull ashes thrown out by Mount Erebus. "The whole place had a weird and uncanny look, and reminded me of the desert in 'Childe Roland to the dark tower came.'"

The teletype for Commander Task Force 43 says: EXTERIOR CONSTR WORK SUSPENDED DUE TO WX . . . AIR OPS SUSPENDED DUE TO WX . . . MCMURDO SHIP CHANNEL, 10 MILES LONG. NOW 15.7 MILES FROM HUT POINT. 36 HOURS OF STRONG SOUTHERLY WINDS HAVE CLEARED 80 PERCENT OF THE BRASH FROM THE CHANNEL.

The message is copied by the icebreakers *Glacier* and *Burton Island*. "The breakers like to have a strong wind in their face," says Lt Glen Drummond in the weather room, "because it blows the loose ice out."

It is copied also by *Calcaterra*, which is on station about halfway to New Zealand. "Bulldog" Drummond thinks the weather ships have the worst duty on the ice. "They send up balloons and track them with radar. Maybe they have to send up as many as five, to get one clear, because of the seas and the wind and the rolling. They hang 'em in the antennas and everything else."

*Calcaterra* and *Thomas J. Gary*, both DERs (destroyer escorts with radar), are alternating this year on picket duty, three weeks on station and three weeks off. "We haven't always had two," says Drummond. "The ship would take six to ten days off, then get back out as quick as it could get refueled. They are the main reporting point on the 2,200-mile flight line between Christchurch, New Zealand, and McMurdo Station." They are there, also, in case an aircraft has to ditch between these two points.

It is not much worse than a blizzard in New England, except that there are no trees to stop the wind. The polar air flows down from the plateau, unhindered, for more than a thousand miles. The snowfall on the whole Continent averages only a foot or two a year, but at 15 miles per hour the wind begins to pick up drift. The next message says: ICE RUNWAYS 15/33 GRID AND 07/25 GRID CLOSED UFN DUE TO SNOW COVERAGE.

Down at BOQ-10 where the staff officers live, which ordinarily has a view more exciting than the Bay of Naples, they pull back the curtains at the picture window. There is nothing but a white void. A small speaker in the overhead warns all personnel, except those on urgent business, to remain inside. "Rope yarn" says someone in the hut, and it raises a wistful laugh. This, elsewhere, means a day off.

In the side of a big shabby building is a little door with "Herman's Rest Home" scrawled on it. The interior is jammed with vehicles, and is so vast and gloomy that a man working on

Below: The Royal Society Range, seen from Hut Point. It was named for the Royal Geographical Society in gratitude for its assistance to early English expeditions. At the foot of these mountains are some "dry valleys" which are left ice-free by receding glaciers. Most of the ice in this area of McMurdo Sound breaks out by January. At right is Marble Point, where the Navy at one time experimented with a permanent runway carved out of solid rock so that wheeled aircraft would not have to land on the unpredictable bay ice.



top of one of them is almost unnoticed. He is "Herman the German," the SeaBee boss of the gas or "light" shop where they repair anything that isn't Diesel. The center of affection is a glittering red "Fire Boss" on tracks. Since McMurdo with 70 buildings and 850 people is partially unprotected while it is down (out of commission), they are trying to get it out of there as fast as possible.

The Fire Boss carries 4,000 pounds of Ansul, a dry chemical; any liquid would freeze. Each track rests on four great tires, which are there only to keep it in place and provide some cushioning. They are "sandbagging" or just going along for the ride. In front is the smallest V-8 engine made by Ford, and it is hard to see how it can move the 30-inch tracks. Joe Harner, a mechanic, says the secret is in the gearing. At the rear, a man is inside its very vitals, with one foot hanging down and one eye visible through a small hole in the housing.

"Herman" descends from the truck, and turns out to be CM1 John Koehler, a mild man to be responsible for so much heavy equipment. He gets his odd name from occasionally putting on goggles, sliding his hat back on his head, and saying, "This is the way we did it in Field Marshal von Rommel's Panzers!" Contentment radiates through the shop, probably because the men know what they're doing. They would never admit it. "Sometimes I threaten to put on a robe and carry a staff, and go around and try to heal some of these things," says Koehler. "Some people call me The Healer."

Through a passageway is the machine shop, where MR1 Gordon Boyd is threading some large bolts for the SeaBees. His calendar says he still has 299 days to go. Although he is wintering-over at McMurdo, he seems happy to have a steady deck under his feet; he came off a destroyer in the Pacific. He has a helper or two, but he is often alone during his twelve-hour day. If a spare part is lacking, it would have to be sent ten thousand miles, so he improvises repairs that keep machines running all over McMurdo as well as at stations far out on the Continent. "My bench has never been clear in fifty-eight days," he says cheerfully. A chain of consequences reaches out from this shop. The fate of a field party, or a whole scientific program, may rest on Boyd's judgment.

On a clipboard behind him are diagrams of the same Fire Boss that is in the gas shop. He makes the rough drawings himself; he can't trust other people's measurements. An automatic hacksaw cuts the heads off the bolts, then Boyd threads them, turning the huge handles "by main strength." When he finishes, he flicks the switch on the lathe and begins turning a valve-insert guide rod for the pony engine of a D-4 Caterpillar bulldozer. The "pony" is a small gas engine that turns over the Diesel. Under a piece of glass on his desk, which in every other shop on the ice holds a picture of a girl from *Playboy*, is a quote from Emerson, "Place yourself in the middle of the stream of power and wisdom which animates all whom it floats, and you are without effort impelled to truth, to right and a perfect contentment."



"Uncle Herman," alias "the German," officially known as CM1 John L. Koehler, boss of the gas shop at McMurdo. With a small group of SeaBees, he uses all sorts of ingenious tricks, including prayer, to keep all the so-called "light" machines — anything that is not Diesel — in working order.

Below is MR1 Gordon Boyd, head (and sometimes only) man in the machine shop, which is adjacent to Koehler's emporium. Boyd, from Wakefield, Massachusetts, has been in the Navy eleven years and wintered-over this season at McMurdo.





Above is the "Strip," as the skiway, together with its temporary buildings, is known. Its location varies with the season. Near the end of the Deep Freeze '65 summer season, when the ice threatened to break out, the whole complex of buildings had to be moved about a mile and a half to the south. The rectangular building is the new sick bay, and behind it is the chow hall. White Island is in the background.

On the "Strip" the wind is approaching 65 knots. Only fifty yards away, two LC-130 Hercules on skis, as graceful as dolphins, are almost obscured by blowing snow. The other ski-aircraft, "Goony-Birds" and Otters, are tied down farther out. One of the Super-Constellations is left, like a waif, alone on the ice runway a couple of miles to the west. Its companion waits on wheels in the hot sun at Christchurch.

The Strip, which serves the skiway, is a village in itself and the men who work there seldom go up to the "Hill." The "Hercs" are kept flying around the clock, since the squadron is sometimes behind due to the weather. Each Hercules has two crews. Some of the pilots have bunks behind the Strip Coordinator's Office, in a Jamesway, a hut made of two layers of green fabric with fiberglass between. Here they rest until it is time to file for the next flight. The Strip has its own sick bay, movies, and chow hall.

In the chow hall — two Jamesways placed end to end with a pair of wings for the galley — half a dozen "air-dales" (aviation ratings) are having coffee. Bruce Benson, an Otter "plane captain" or mechanic, says that last season a chopper tried to land during a "white-out" — the continuous refraction of light between low clouds and the ice, with no shadows and no horizon. The crewman dropped a smoke flare to show the wind direction and to find out how close the ground was, but it went off inside the aircraft and temporarily blinded the pilot. The "helo" crashed, without injuring anyone, and was later retrieved by an icebreaker and a long line of men pulling on ropes — as practiced in the time of the Pyramids.

Benson is reminiscing about the time he fixed up a Weasel that had been "surveyed" or written off. It is the smallest thing on tracks, but he claims he got it up to 70 miles per hour on the ice runway and that one day he did the four miles from the Hill

in five minutes, slaloming between the flags that mark the safe ice. "When they found out how good it was, they took it back," says Woody Hill, another teller of tall tales and a fine mechanic.

The serious man at the table is Dick Andersen, who is a career counselor as well as an expert radioman. Because most of the Deep Freeze people are screened volunteers, and the way to get ahead is by advancing in rate through technical study, they listen to him. His words are convincing, since he wintered-over in 1962 and thought enough of the ice to return. He is proud of his long flights in the ancient "Goons" (LC-47/117 Dakotas); of the field parties they serve; and, above all, of the continuity of his experience here, which leads him to more and more understanding. He gets the connection between an apparently arbitrary scientific project and the fact that it depends on the Navy — on him. Andersen gets up to leave. Here, as everywhere on the ice, they work 12 hours a day, seven days a week.

Outside, it is no longer like New England. The Antarctic is as dry as a desert — in fact is classified as one — and the cold and the wind grind the snow to a fine powder. It is not the same as occasional snow falling on warm earth; it is aeons old. After the sun has loosened the snow, the blizzards come shouting in, as Byrd put it, filling the air with drift. Although blinded, Andersen

A Herc on the skiway. Williams Field was named for a driver who died when his tractor fell through the ice in the first year of Deep Freeze. Some of the vans containing communications equipment can be seen at right. In 1960, all flights between New Zealand and McMurdo had to be cancelled when sunspots knocked out radio communications for eight days in a row. Radio reliability used to be about 50 percent, but with a new type of antenna it is now about 90 percent.







"Welcome to Antarctica" can be ironic, when new arrivals land on a bitter day with blowing snow. This pleasant scene may change in five minutes. At the South Pole there is rarely much wind, even in winter, but cold *katabatic* winds flow almost uniformly down to the coasts from the center of the Continent. When they become gusty, they produce strange local "blizzards," with no falling snow. The sky may even be blue overhead.

*Far right:* The Strip, with Ross Island in background, looking approximately north. At extreme left (not visible here) is New Zealand's Scott Base and behind it McMurdo Station, or the "Hill," as it is called to distinguish it from the Strip. Out of sight to the right is Cape Crozier, with several of the most important rookeries of both the Emperor and the Adelie penguin. For several seasons the Naval Civil Engineering Laboratory has been working on a snow-compacted runway that would allow an LC-130F to land on wheels at a maximum weight of 135,000 pounds. If successful, it would be safe from the vagaries of fluctuating ice conditions.

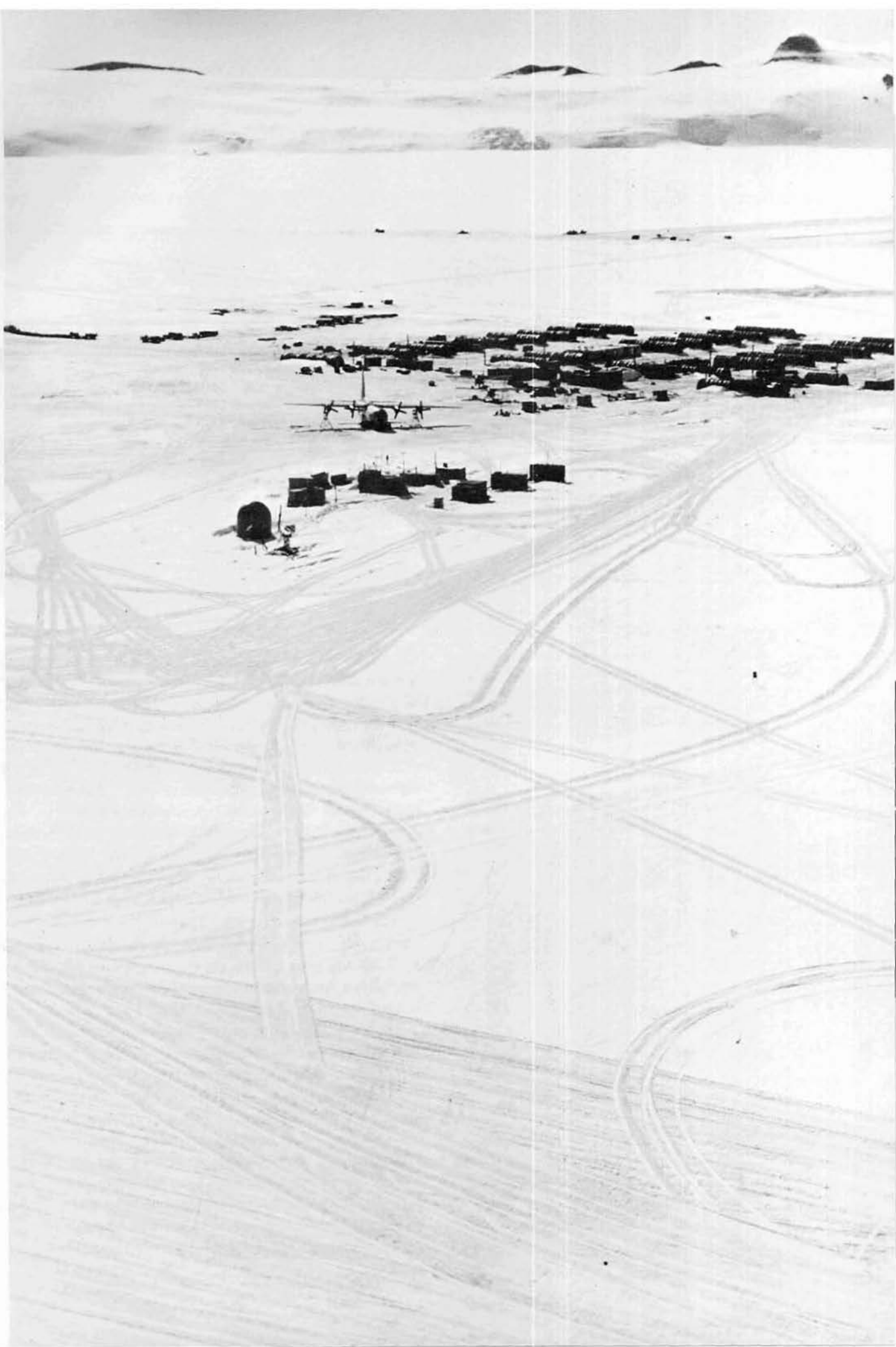
follows the ruts made by the heavy D-8 tractors. When he reaches the east-west avenue on the edge of the Strip, he tacks upwind toward a "Wannigan" or van full of electronics equipment. Once the door is closed, he is exhausted.

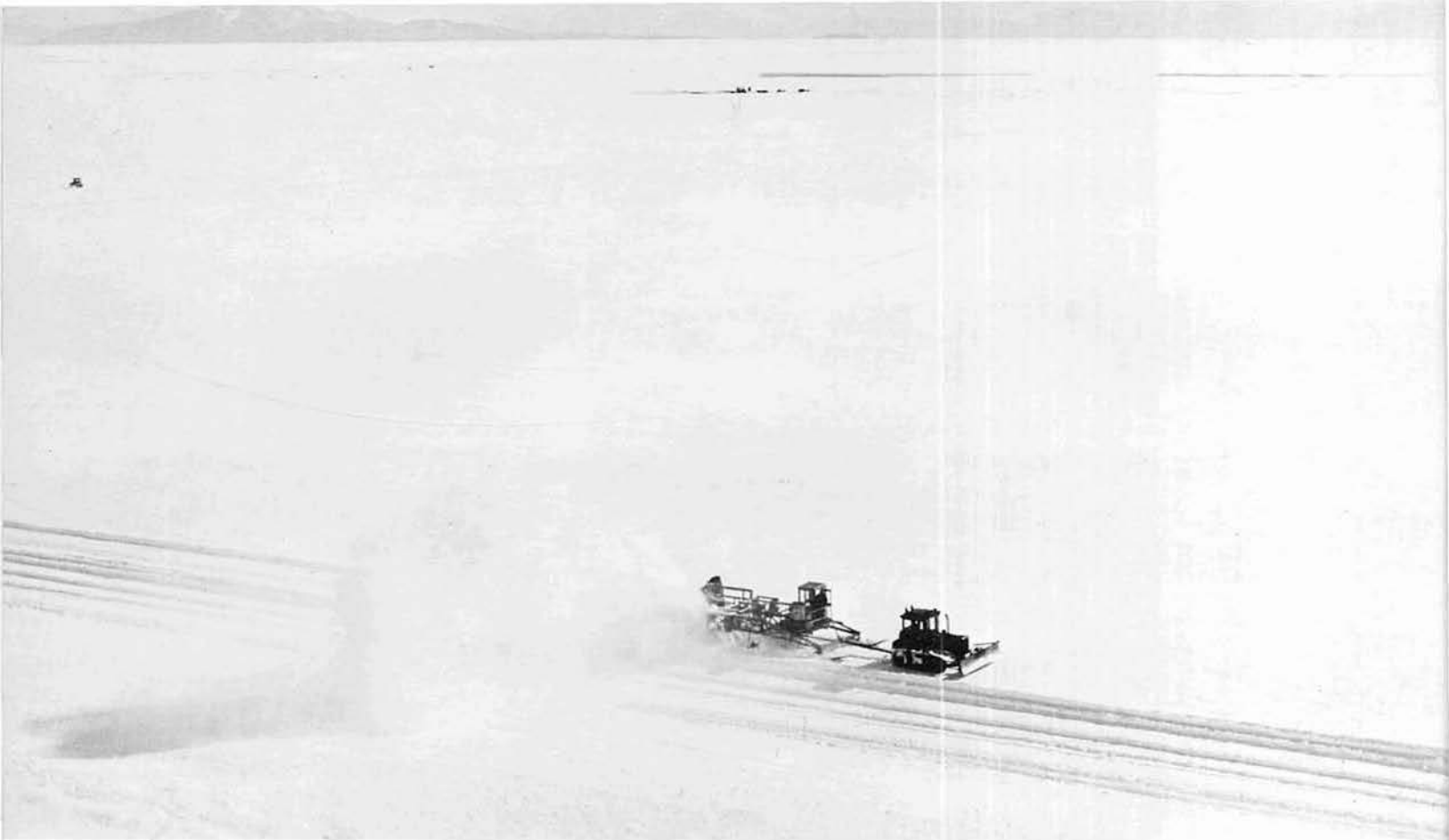
It is about the size of a long bedroom. On a bench is a TACAN (navigational aid) receiver and a simulated set of instruments, exactly as they appear in the aircraft. TACAN is what the pilot sees, whereas GCA (Ground Control Approach) shows the plane itself to a man on the ground who talks it down. This is test and training equipment. The main part is made up of a bank of "drawers" like cigar boxes, each one crammed with circuitry. There is a malfunction somewhere. Gary Watkins, a radioman, traces the trouble to one of the drawers and pulls it out, thus avoiding having to tear the whole thing down.

Someone pities the poor crews on the weather ships. It is about time for service exams and, since they are being held all over the world on the same day, those on picket duty who aspire to a higher rating are enjoying a 40-degree roll, seasickness, headaches, and so on. "It isn't fair. Everybody else is sitting in a comfortable room. Why can't he take it when he gets ashore?" Andersen explains that it is to prevent the possibility of the exams being compromised.

John Hesse is working the single sideband (short wave). On this little radio he can talk around the world. He doesn't seem impressed. "Admiral Byrd could do it thirty years ago." The avionics chief is Glenn Hunt, who wintered-over at McMurdo in 1962. The Strip of course was not in operation, but he was not idle. That winter, he and Claude "Buddy" English, who is now in helos, built the entire electronics set-up for Air Development Squadron Six (VX-6) on the Hill.

The equipment fills the room, which shakes from the force of the storm. Andersen says that, as an AT1 (Aviation Electronics Technician, first class), he is required to know it all: radar and electronics as well as his ordinary Navy duties. "The first school I went to was forty-two weeks." As people do in a snug place, they begin talking about how miserable it is outside. "Red" Axford has been working, until today, on a Goon with a hot magneto. This is the venerable DC-3 of civil aviation. As the plane's mechanic and "captain," he is expected to fix it on the deck, with the wind up his pants even in good weather. Since nobody does only one job, Dick Simmons, the plane's radioman, gives him a hand. Whenever he is at the Strip, "Red" also has a "gopher" to help him, Cunningham, who is training to become a mechanic.





A D-8 tractor clearing snow from the skiway at McMurdo. Looking south, with White Island and the Royal Society Range in background. One of the reasons a storm is so dreaded in the Antarctic is that it may take two or three days, working around the clock, before aircraft can use the runways again.

Far right: A helicopter, in this case a "horse" from one of the icebreakers, above the "helo pad," or landing area, at McMurdo. The station is at right, at the foot of Observation Hill. When the icebreakers first arrive and begin breaking the 20-odd-mile channel, they are out of sight to the northwest, but their choppers make frequent flights ashore carrying cargo and passengers.

They are talking about the difference between the Navy and the Air Force, a subject they never tire of. "The Air Force crews don't fly and repair their own planes — both. The Navy *does*. We fix 'em and fly 'em." When a young AT shudders at the thought of climbing up on a wing and tinkering with an engine, without a hangar, without even a canvas dodger, 2,200 miles from the nearest real shop, John Hesse says, "The best way to eliminate problems on the ice is not to come down here."

In the Chiefs' Lounge is a round table with a green baize cloth, and the traditional green-shaded lamp hanging above it. From the whiteness outside, with tractors prowling up and down, one comes into an atmosphere thick with smoke and with a *patois* that is heard nowhere else. The words are cryptic, but mostly they refer (although obliquely) to the business at hand: getting the stuff on the planes and getting the planes off the ground. Occasionally a man comes in out of the storm and says something to one of the chiefs at the table. He gets an immediate, brief answer. They know what is going on in every corner of their departments, and experience tells them how to deal with any problem.

James Elsworth Zimmer is a ferocious-looking man in his domain: loadmaster and cargo chief on the Strip. This is his third season. In 1964 he was aboard one of the two Hercs that left Quonset on a hot day in June, picked up a surgical team in Washington, and flew to Christchurch. John Hart, who is in charge of planes and crews on the Strip, was aboard the other. Hart's plane evacuated an injured man from McMurdo in mid-winter darkness, while Zimmer's stood by for possible search and rescue. Burning fuel drums were used to light the runway, and it

was the first time in history that a plane had landed on the Continent in winter. For missions like this the Navy selects its best men.

Garwood, the "ramrod," enters wearing a yellow jacket made of bird cloth. He is in charge of aircraft maintenance, and he watches John Giro make himself a cheeseburger the size of a fuel bladder. They take steaks or anything else from this icebox at any hour. The idea is to get nourishment as fast as possible, and get on with the work. "Jay Jay" Grayson, who is in charge of the "Firebird," one of the wheeled "Connies," can't bear to see it drawn into such frivolous work as transporting cargo and passengers from "Chee-chee" (Christchurch). He prefers to reserve it for photo-mapping, where three cameras are used simultaneously. The center camera is aimed straight down, and each of the others is at a 60-degree angle to the vertical. Trimetrogon photographs are made approximately every 30 seconds, along a predetermined flight line. "The reason I'm unreasonable about it," says Grayson, "is we've been trying to photograph Roosevelt Island near the Bay of Whales for six years now. The weather always sees us coming, and the island blends into the Ross Ice Shelf so we can't even see it."

A well is being drilled next to the new head, to reach the water under 160 feet of ice, and Jay Jay says, "One day they suckered a trout from the cook and put it on a line. They dropped it in the well and hollered, 'Got a bite!' Guys came running over, and when they pulled it up their jaws dropped open. . . ."

They are grouching because ASA (Supply) won't send them down what they need. Often they have to go up on the Hill to get it. Antarctic Support Activities does the "housekeeping" for Deep Freeze: fuel, food, water, sewage, public works, and so on, as well as maintaining all the stations on the ice. When VX-6 moved onto the Strip in October, they found the buildings in a relatively unfinished state, and completed the interior themselves. Someone says, "Probably there'll always be a shortage of equipment." They laugh. "VX-6 is supporting ASA." Living on the Strip as "orphans," neglected by the Hill, makes them closer. As in most remote villages, they are clannish.

Last February, the ice began breaking out of the Sound, and they thought the camp, runway, and planes would go to sea. The Hercs were used as trucks. Zimmer says, "We loaded beds, food, honey buckets, everything. They taxied 'em about a mile and a half back. Nobody got any sleep." He recalls two AT's driving D-8 tractors across a crack in the ice. "They did a real job."

In the weather room on the Hill, Cdr Art Kranz, acting operations officer, is talking about "Bulldog" Drummond. "He's one of the most experienced weather forecasters in the Antarctic. That Punta Arenas flight . . .!" He breaks off to look at a message from the icebreaker *Burton Island*: WX SAME AS GLACIER. BREAKING IN CHANNEL ASTERN GLACIER. WINDS CONTINUE HIGH, EASTERLY AND SOUTHEASTERLY. ESTIMATE 20 PERCENT BRASH IN CHANNEL. EVAPORATORS OPERATED AT CAPACITY LAST 24 HOURS.





“He has the confidence of all the pilots — that’s the most important thing — and of his senior officers. I would say that any pilot he briefed would go or not go, on the basis of his forecast. Because they know his previous operation.” Cdr Kranz is a meteorologist himself. “Last year, at the beginning of the season, he was aboard the Herc that flew from Punta Arenas, Chile, to McMurdo. That was a hairy one. He evaluated the weather information and held the plane for twenty-four hours.” Drummond now comes in the door, as Cdr Kranz goes over to the wardroom for a briefing on Plateau Station.

“The main thing is we were going west into the teeth of the wind,” Drummond explains, “with no reporting stations west of there — clear to New Zealand. The biggest gap in the world, on the weather map, is between New Zealand and South America. We went over Palmer Peninsula for one photo run. We got 95 percent. The only reporting station on the way was Byrd. We went to Punta Arenas again, then three days later back to McMurdo — we diverted along the coast to take pictures.”

“It’s a parlay,” he goes on. “For instance, you’ve got McMurdo and Byrd, and if you’re taking out a field party to the Sentinels it means the weather has to be good at all three. If you have weather that is *coincidentally* bad at both McMurdo and Byrd, you only lose so many hours, but if it’s *consecutively* bad you lose twice as many. You add on to this the availability of aircraft — say a plane is down for maintenance — and by the time the plane is perked up your weather is down.

“We get about twelve to seventeen reports in one synoptic period (every six hours) — from the whole Continent. In the States there are four hundred, and they report hourly. It’s like using Chicago, Norfolk, and Kansas City — they’re about the same distance — to forecast the weather in Washington, D.C. Every year it’s getting harder, because the scientific parties are going farther out. At first, the traverses were near the coast, or close to Byrd or Pole. But, now, they want to get way out there, like forty people in the Pensacola Mountains, 1,100 miles from here. Take Plateau. . . .”

The wardroom is a ramshackle sort of place. It’s where the movies are shown, and a beat-up piano can be made out against a wall in the dim light. The officers who drift in represent all the main divisions of Deep Freeze, and are there to smooth out the wrinkles in a plan that originated a year ago in Washington. It will put eight humans in a new station far out on the ice, in an unexplored area, for two winters to report on weather, geo-magnetism, aurora, and simply how they feel physically at 11,900 feet, 130 degrees below zero, and in six months of total darkness.

Plateau Station will have four vans, 8½ x 8½ x 36 feet, designed to fit inside a Herc, two small geo-magnetism buildings, and one emergency generator building, as well as three Jamesway huts. After an exploratory flight to determine the position of the station, flying at a constant altitude so as to detect any humps or hollows, the original plan is to “go in” between the 10th and 13th of December, with one knocked-down Jamesway hut, three men

from the National Science Foundation, and a radio operator. The question is: can the aircraft get back out, without excessive takeoff attempts?

There is very little "side" about who sits where. Capt Don Bursik, the Chief of Staff, with a hawklike profile, takes an uncomfortable folding chair in the shadows. The key figure is the slim young doctor, Lt Jim Gowan, who will command the wintering-over party. Yet the beauty of the operation is in its logistics, and Cdr Steve Kauffman, assistant chief of staff, in charge of construction, stakes out a high swivel stool for himself. Cdr "Moe" Morris, who is responsible for all aircraft as commanding officer of Squadron VX-6, explains that the initial flight will carry only 14,000 pounds payload and therefore no bulldozer.

"I do think we ought to position a Traxcavator at the Pole," says Cdr Kauffman. The South Pole will be the staging area, and he means that the bulldozer should be ready to be flown out to Plateau.

"Can three men put up a Jamesway at that altitude?" Arthur Weber wants to know. He is a civilian architect with the Navy's Bureau of Yards and Docks, who designed the vans and will follow them to the site. Since people need oxygen at more than 15,000 feet, Plateau will be near the limits of endurance.

*Far left: USARP Hal Preston, U. S. Weather Bureau, at the South Pole. Twice a day he sends up balloons that transmit their weather data back to the station by radio, using radar to track them as they are blown by the wind. This work is not without its hazards. A balloon inflation shelter exploded at the Pole on January 31, 1966. Luckily, no one was inside at the time. Ten SeaBees put up a new shelter in less than two weeks, relocating the release door according to prevailing winds in order to allow balloons to be released more easily.*

Lcdr Vince Law in the weather office at McMurdo. Lt Norm Terrell says, "Right now, we're running about 90 percent - flights forecast and not aborted." He keeps a forecast verification chart that shows how successful the current forecasting has been. "Getting the planes down safely is what we're interested in." He gets upper-layer reports from the balloons that are sent up twice a day, as well as daily reports from foreign stations on the ice. There is also a satellite that gives weather information, which is shared with the Russians and other nations.





Capt Don Bursik, Chief of Staff, is a humorous and penetrating man. Deep Freeze has always maintained an informal relationship between the Navy and the U. S. Antarctic Research Program (USARP) to allow greater flexibility in solving unusual problems, but Capt Bursik feels that in Deep Freeze '66 unit commanders were given even more autonomy.

"The weather here has interfered with practice drill," Cdr Kauffman answers.

"Everyone concerned is going to be at the Pole for two weeks' acclimatization," Dr. Gowan reminds them.

"So we take the Jamesway to the Pole?" asks Cdr Kauffman.

"Gonna be a job for three men to get that Jamesway up," Lcdr John Bell agrees. He is in charge of Supply.

"I'll go out with the first plane and stay until the second arrives," says Cdr Kauffman.

"You let us know how many people," Cdr Morris puts in, "so we know what our payload can be."

"The next event comes three days later when the Traxcavator can get in," Cdr Kauffman continues.

"Wait, let's back up here a little bit," drawls John Bell. He wants to know how many planes and on what dates.

"I wouldn't envision that it would take fourteen thousand pounds of equipment to support three people," says Ken Moulton. He is the "USARP rep." (senior scientist in the Antarctic for the United States Antarctic Research Program).

"I don't think you need two weeks to find the prevailing wind," says Dr. Gowan. "All that food . . . stay out there in that awful place . . . unnecessary . . . might as well stay at the Pole."

"The Traxcavator will be the only thing you can get on that second flight," Lcdr Bell points out. "What's the consump on that Trax?" Lt Bob Miller of Public Works says it uses seven gallons per hour. "Boy, that's gonna be an awful lot of DFA." At the temperatures they expect in winter, Diesel Fuel Arctic, a kerosene, turns to jelly.

"I've been talking to the Doctor," says Charlie Roberts, a civilian with the U. S. Weather Bureau, "and everybody is going to take longer on everything, at that altitude."

"Talk to some of those guys who went in the pressure chamber for thirty-six hours," Dr. Gowan nods. "They turned purple . . . blue . . . panting . . . and everything else. Constant headache. They couldn't do any work." He looks around the room meaningfully. "They were *not* acclimatized."

"Can you find the ridge all right," Ken Moulton asks, "or will we have to move the station?" The ridge is at 79° 30'S, 40° E. For medical and scientific records, they want to have the station at the highest possible point of the polar plateau. This is about the same height as the nearby "Pole of Inaccessibility," set up by the Russians for a similar purpose but presently unoccupied.

"How long do we allow for preparing the skiway?" Cdr Kauffman wants to know.

"We better start after the first flight," says Capt Bursik. "A week . . . subject to renegotiation." Someone says the Traxcavator moves at three miles per hour.

"We better have some way to survey that skiway, to make sure it's straight," Dr. Gowan suggests. He presses his point about the slowness of work at high altitude. "We're not going to be on duty twenty-four hours a day . . . maybe put one more man in there."

"Personally," says Charlie Roberts, "I would rather put an extra man in there." The general feeling is that if the machine can't clear the snow quickly the time is going to "back up" and delay the supply schedule.

"If it goes down (breaks), your time is going to back up anyway," John Bell points out. "It has no parts with it."

"We might as well find the prevailing wind and put stakes out," says Cdr Kauffman. "Do it by eyeball." Someone says the second Trax is due to go in on 27 December.

"Let's back up a minute," says John Bell.

They have been planning this operation with their departments for a year, and now, at the last moment, are just being extremely cautious. This is why they ask each other rudimentary questions. They discuss JATO (jet-assisted take-off) and how many bottles of it ought to be carried on each flight. Propellers don't have the same thrust in the thin air they will find at Plateau, and the engines don't develop full power at such a high altitude. Recently a Herc with Admiral Bakutis aboard tried ten times before getting airborne at the Pole of Inaccessibility.

"You're going to make two flights a day?" Cdr Kauffman asks.

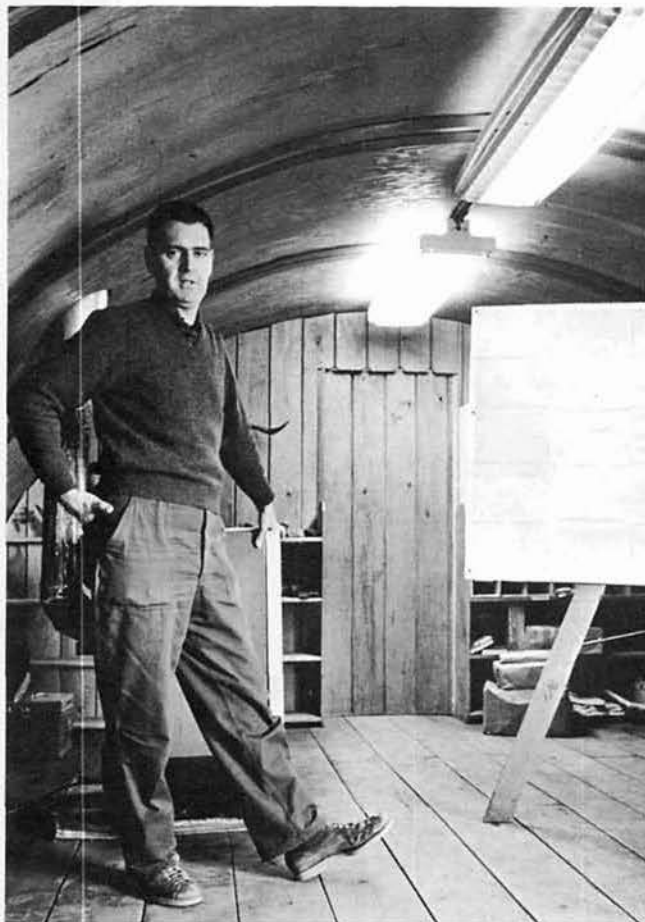
"This is commensurate with what you want elsewhere," replies Cdr Morris. He means the other air operations on the Continent, each one eating up aircraft-hours like peanuts.

Imagine an hourglass, magnified. The great surface at one end represents the immense amount of work done in Washington, Davisville, and Quonset, and the accumulated polar experience since Borchgrevink wintered-over at Cape Adare in 1899. All this is focused on four scientists and four Navy men at a point not only in space but in time. What they discover will then be fanned out and analyzed, until it becomes an even greater body of experience.

In the wardroom, after the second showing of the movie, a Tech. Rep. named Sal Fiore begins playing the piano. Lt Don Kahler goes out and comes back with a guitar. Fiore fetches his accordion. Cdr Morris has nothing on his mind but the 450 men and 21 aircraft of VX-6. Not long ago he piloted a Herc himself on a rescue mission, "parlayed" the weather at Byrd, Eights, the Sentinels, and McMurdo, and didn't close his eyes for 24 hours. He goes to his quarters across the hall, and returns with a wash-tub to which a string has been attached; he plays it with a broomstick, like a bass fiddle. Imperceptibly, suddenly, half a dozen expert, brave, overworked men are tuning up and playing jazz.

So ends a "rope yarn" day.

Ken Moulton, USARP representative at McMurdo, is a former meteorologist, but for eleven years he has been engaged in planning and administration. This was his seventh season in Antarctica, and he spent two winters in the Arctic. As senior scientist on the Continent, he was responsible for seeing that all USARP requirements were relayed to the Navy and that the scientists understood the logistic problems of the support force.



*Overleaf:* Breathtaking beauty is typical of mountains in the Antarctic. The glacier at lower left is similar to, but much smaller than, the famous Beardmore Glacier.







## *A Forgiving Aircraft*

The South Pole is 850 miles, as the skua flies, from the edge of the Ross Ice Shelf. The shelf is a Barrier of permanent ice the size of California, in places 1,000 feet thick, about 150 feet of it showing above the sea. It is formed by innumerable glaciers flowing through the Queen Maud Range from the polar plateau. Before the airplane, there were two ways of getting to the Pole across the shelf.

In 1908 Shackleton left Hut Point (now McMurdo Station), struggled 400 miles through soft snow, and went up the Beardmore Glacier which is over 100 miles long. It took him two weeks to get past the Glacier, but even before they entered it his party was eating the flesh of the Manchurian ponies they had brought to pull the sledges. Their third day on the Glacier, the last pony fell into a bottomless crevasse.

Amundsen started in 1911 from the Bay of Whales, 400 miles east of McMurdo. Due to the southeasterly trend of the mountains, he was able to remain on the relatively flat Barrier for an extra 100 miles, and he discovered the steeper but shorter Axel Heiberg Glacier. He and Shackleton each spent a month on the Barrier, but the Norwegians were pulled on skis by dogs and arrived at the mountains comparatively rested.

Scott, who was only weeks behind Amundsen, wrote in his diary on the Beardmore Glacier: "Ski are the thing, and here are my tiresome fellow countrymen too prejudiced to have prepared themselves for the event."

It costs \$800,000 to put skis on a Hercules, since so few of these aircraft have been fitted with them, and the bottoms are coated with a culinary wonder, Teflon. Wheels retract through the center of the skis, once the aircraft has left the concrete runways of New Zealand. In spite of this outlay, the ice can tear the skis off in a moment. The fact that this delicate assembly of metals and instruments has survived six years in the Terrible South speaks well for its design.

With its squat undercarriage, sitting close to the ground, the Herc appears cumbersome. If it required a mighty effort to take off, it would have to be confined to long hauls and long runways. Yet it can get off the ground in 20 seconds. It lands on the world's worst surfaces, and in places that were formerly accessible only to the much smaller LC-47. Coming in for a landing, the Herc looks like a gull; the Globemaster, which it replaced, resembled a sausage.

On the snow runway at McMurdo, "319" is turning up. One advantage of the turboprop is that it doesn't have to be preheated like a reciprocating engine. A Herc was forced down once between McMurdo and Byrd with ice crystals in the fuel, but it was soon repaired. When Cdr Morris of VX-6 was mulling over possible aircraft for future operations, he said, "If we were to try to design an airplane for the Antarctic, we would probably come up with the Hercules."

A Herc head-on. The fuel situation became so critical that the Hercs had to suspend their flights on December 19, 1965, the same day that the tanker *Alaina* arrived with JP4. They took to the air again two days later.



From the tail of 319 a ramp has been let down onto the snow; another ramp has been hoisted inside the plane, leaving room for a whole nuclear power plant — in sections. The nuclear plant at McMurdo was prefabricated in a series of "modules" weighing no more than 30,000 pounds each and measuring no more than 8'8" x 8'8" x 30', so that if necessary they could be shipped in Hercules LC-130s.

Under the soaring tail of the Herc comes a tractor that looks, head-on, like a modern sort of owl. It is towing a sled with drums of DFA. The pallets are slid aboard with the help of a winch in the forward part of the cargo space, and secured by W. H. Tamplet, the plane's loadmaster.

In spite of a slight wind, everyone is in high spirits. The optimism of just going somewhere is enough for the "deadheads," or passengers, and even the men who work on the ground are enjoying the air after a spell of bad weather. The Antarctic is said to be odorless, but the smell of a fine morning is as real as the "ice blink" at sea that glances off the clouds from the invisible ice pack. It is the smell of purity. The air, which has been silent, is filled with the sound of engines, the heartbeat of the Continent.

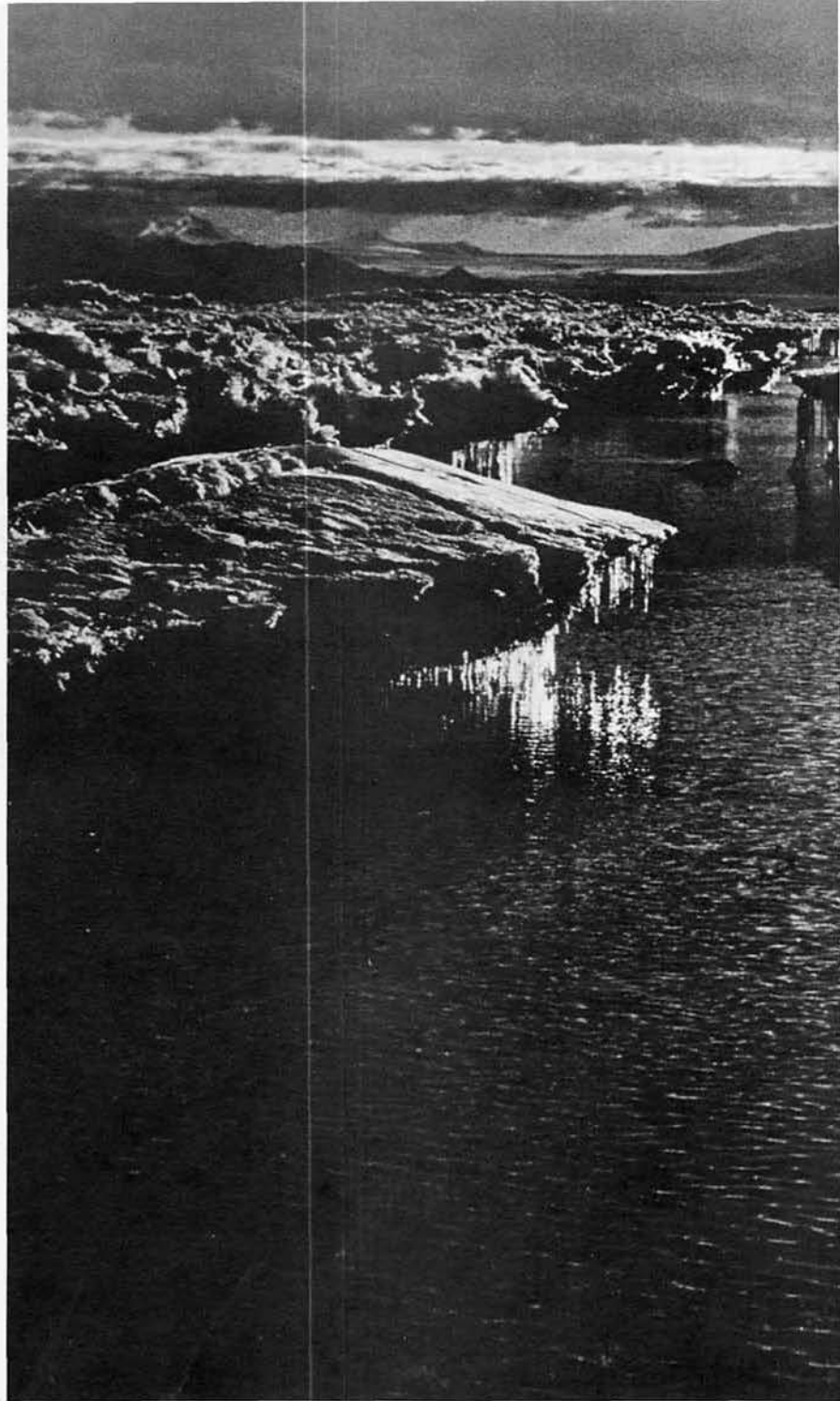
To the north, a plume of steam comes from 13,000-foot Mount Erebus; far to the right is Mount Terror — both named for the ships of James Clark Ross who was the first to see this coast, in 1841. Farther still but out of sight, at the eastern end of Ross Island, is Cape Crozier. In 1911, three men from Scott's expedition went there on foot, in absolute darkness, to test their gear and to have a look at the Emperor penguin, the only bird or animal that remains on the Continent in winter. One of the party, Apsley Cherry-Garrard, later called this trip, a mere 50 miles from McMurdo in a straight line, "the worst journey in the world."

Some of the Alaskan huskies kept by the New Zealanders at Scott Base, which is out of sight to the right. Dogs usually last about five seasons. "Then they start getting a bit stroppy," says John Murphy. "There was one at Hallett that went woof (wolf)." By special permission, under the Antarctic Treaty, they are fed seal meat.

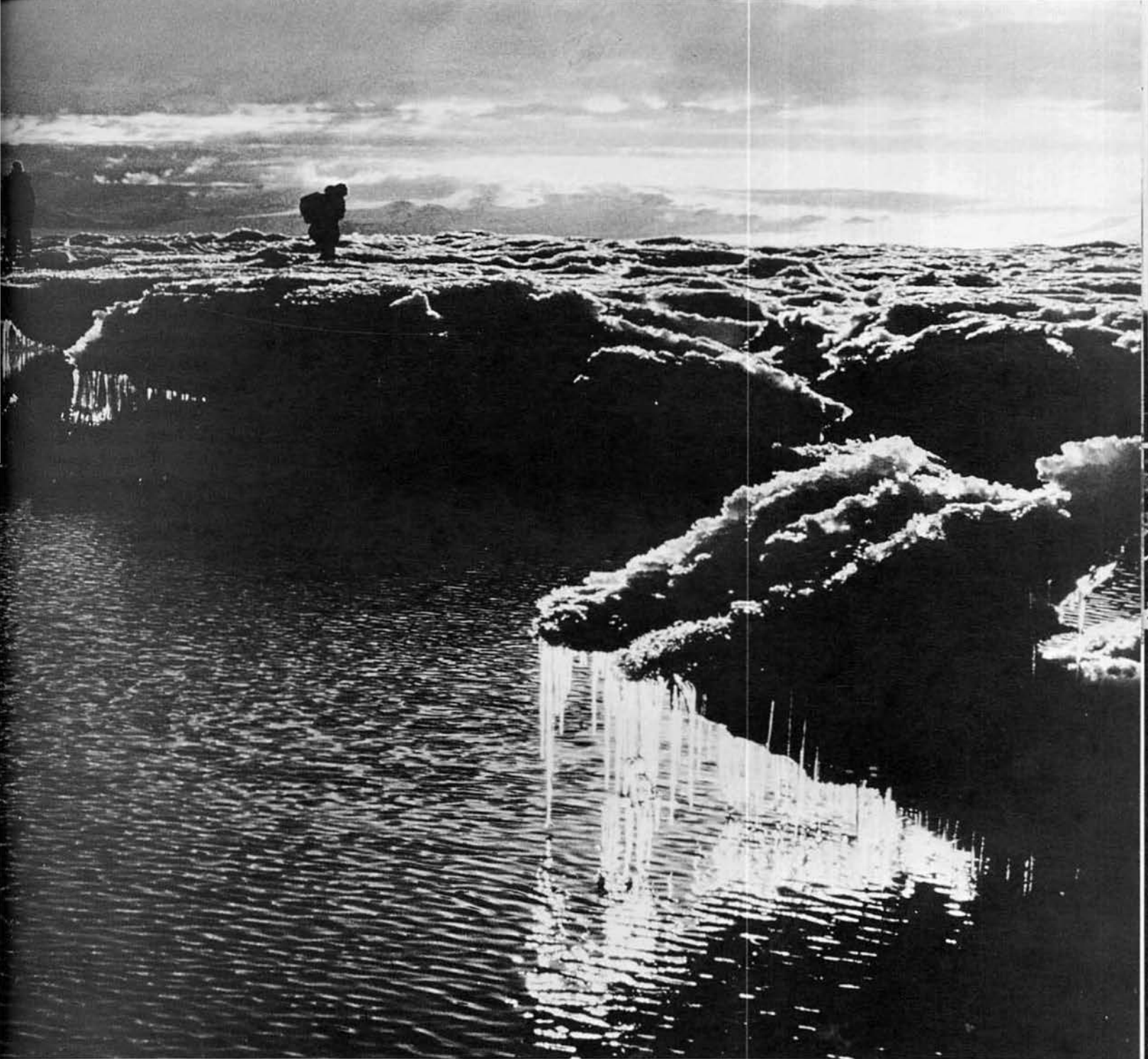




"Emperors are nomads — hard to track," said a biologist who was investigating their movements. So he put telemetric transmitters on them and, even a mile away, received the information he wanted. They mate in the middle of winter, in darkness. The scientist, privately, thought they were stupid to pick such a bad time. They are able to go three months without food, although the incubation period is only sixty days. The chicks gain weight rapidly, "and one we called Peter was twice as big as he had been the day before." In contrast to the Adelie penguins, an Emperor lays a single egg on sheer ice and hatches it by cradling it on its feet. Unlike Adelies, the Emperor will not attack a man, and unlike them, he has eyes that seem to be square.



The eerie quality of the Antarctic, the basic loneliness, is apparent in spite of the exuberance of the men. History is here, but it is short, meager, and generally grim. Admiral Bakutis is fond of paraphrasing an old polar motto: "It is not especially difficult, but it is mercilessly unforgiving of human error." One may drop through the ice at any moment. Although the Ross Ice Shelf, today, is hospitable to half a dozen glaciologists from Grand Valley State College in Michigan, recently their radio went out and they lost contact with McMurdo for a week. Another little party in the Taylor Dry Valley hopes the helicopter that set them down there will pick them up. Yet, in five minutes, a white-out may develop, or a blizzard that could delay the helo for days.



To walk over this weird terrain in the Dailey Islands, near  
McMurdo, involves many detours. It can take five hours  
to cover four miles.



Scott's hut at Cape Evans, where the second (and last) man to reach the South Pole on foot established a coastal base for his 1910-13 expedition. The hut was restored in 1960-61 by a party of seven New Zealanders. It had saved the lives of another expedition in 1915-17, when the great Ernest Shackleton tried to get through the Weddell Sea and across the Continent to join his second party in the McMurdo area. Shackleton himself endured an epic struggle at sea, and not until two years later was he able to rescue the men at Cape Evans.

The McMurdo area has probably served as a center for more explorers, of various nationalities, than any other place on the Continent. It is near enough to New Zealand, a friendly base to outfit ships, and is one of two coastal positions closest to the Pole. The other is the Filchner Ice Shelf on the Weddell Sea. Argentina and Chile, of course, are intensely interested in the Antarctic because only 600 miles separate Cape Horn from the Antarctic Peninsula.

Fifty years ago, expeditions used to come in and winter-over; then perhaps a "spring journey" to set out depots of fuel and food; then a dash inland in November or December; they departed never later than March 1, to keep the ship from being frozen in. The timetable today remains the same: the first icebreaker rarely arrives before the middle of December, leading the supply ships that bring in five and a half million gallons of fuel as well as general cargo. Both ships and planes usually get out by the end of February. The Antarctic, by forces greater than technology, still decides the length of the season.

Deep Freeze has only five months in which people can get in and out, and supply operations to the inland stations must be completed in this period. By the end of November, two of the Goons have received strike damage (they are written off), and





when these are subtracted from a total of 21 aircraft, of which five are helicopters, the timing of scientific programs may be affected. Field parties are demanding to get out. Later in the season, the four Hercs set a record by flying 23,000 miles in 24 hours, to deliver 267,000 pounds of cargo.

During this crucial month, November, when at least 500 people have to be flown in, the Air Force — under contract to the Navy — ferries men and priority cargo from Christchurch to McMurdo. Their Hercs, which have wheels only, land on the ice runway and return immediately to New Zealand. The “Icemaster,” a tall, genial Major named Bob Swanson, inspects the runway for cracks and snowdrifts and certifies it to be safe whenever Air Force flights are scheduled. This runway, being on sea or “annual” ice, is much more fragile than the skiway on the Barrier. It has been known to go to sea with little notice.

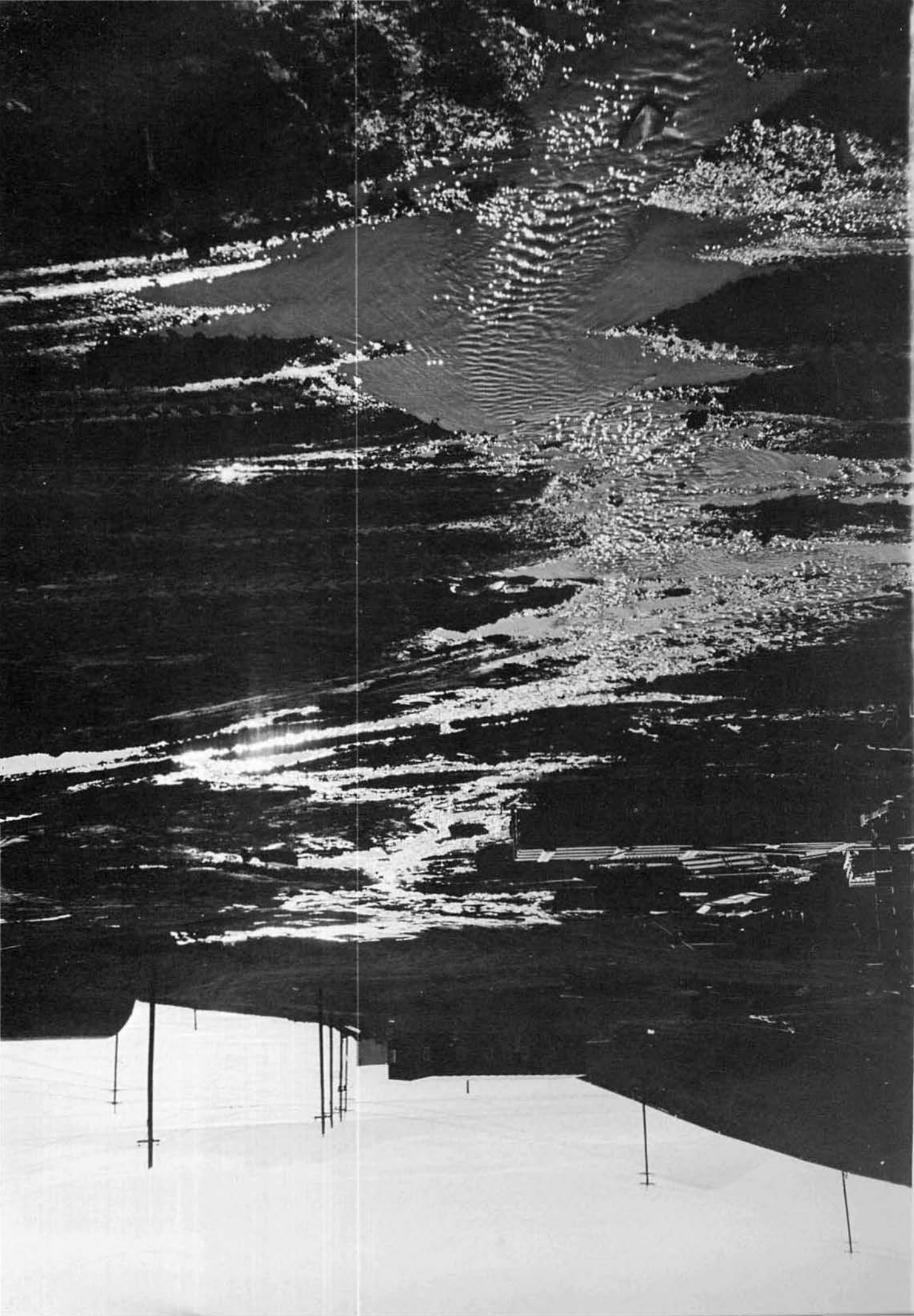
A skiway was laid out at McMurdo in 1957, in the dark, by the wintering-over party. It has always been a precarious thing, as was shown by the crack last year, and is moved every two or three years, depending on its condition. Near the end of September, 1962, the earliest opening date in the history of Deep Freeze, the wintering-over party had to prepare the skiway in high winds and a temperature of 60 degrees below zero. It was so cold that a heavy blade of one of the bulldozers broke when it touched the ice, and several windshields in the Hercs were shattered. Before the unprecedented emergency flight of 1964, when a Herc landed in the dark, a 10,000-foot skiway was cleared of a four-month accumulation of snow. The men worked 24 hours a day to reactivate the GCA and TACAN equipment, which had been in storage.

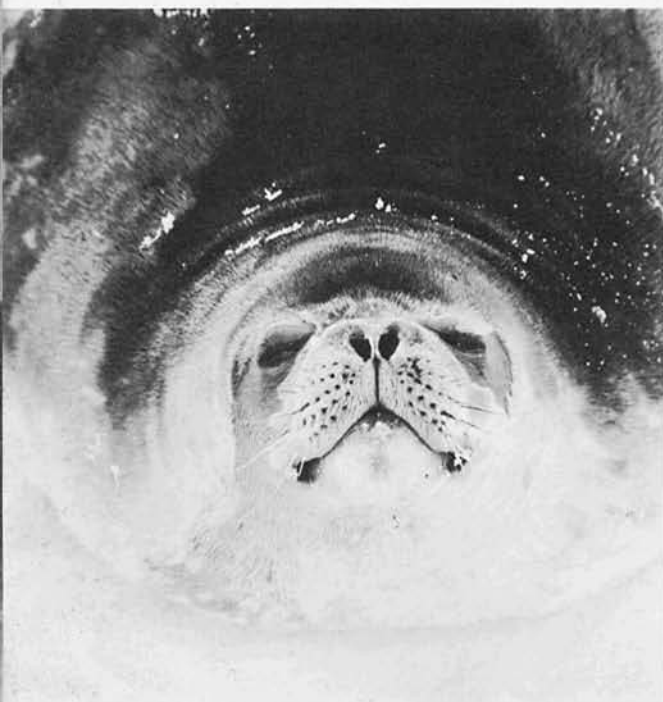
McMurdo Station. These nondescript buildings conceal an up-to-date communications system. Wires cannot be put underground because of the permafrost that makes digging difficult. The chapel, built by volunteer labor, is just visible at left. The big Quonset hut contains the ship's store, barber shop, and disbursing office.



Left: Snow on "Main Street." Bottom: A storm at McMurdo. Right: This end of McMurdo looks like a lumber camp in Saskatchewan, with its muddy streets and open ditches, tracked vehicles plugged into electric heaters overnight, enormous exposed pipes snaking their way through the station, piles of snow, and a tangle of telephone and electric wires. After a thaw, it is called "McMudhole."







Rudy Perchal, a small articulate civilian with the Navy Oceanographic Office, thinks the icebreakers may have changed the currents off Ross Island. Each year, they soften up some of the ice that was a buffer between the sea and the Barrier. Certainly by January the ice will be out as far as McMurdo, although ten years ago, in the same month, the edge was 40 miles north of McMurdo. Captain Hank Kosciusko, commanding officer of ASA, wants to know exactly what it's going to do, because once hoses had to be run from the tankers ten miles across the ice, with a pumping station every mile.

This morning a few Weddell seals are sprinkled on the ice, sleeping, near Pram Point where New Zealand maintains a small, year-round base. Off here the ice is scalloped, with a faint touch of blue, in a series of frozen ripples about twenty feet high. These are pressure ridges caused by part of the Ross Ice Shelf trying to get out past Pram Point. Bill Pinckard of the New York Zoological Society is removing the intestines from a seal, which he will examine for parasites back in the biological laboratory. When he has finished, he rolls the 800-pound carcass over to prevent the skuas from getting at it; later it will be fed to the huskies at Scott Base. In contrast to the North, where they are killed commercially, seals are not harvested in the Antarctic.

Men are cranking up the ramp on 319. Inside the plane, hanging overhead, are a lot of striped helmets. The crew wears these during landings and takeoffs, and if they are forced down in

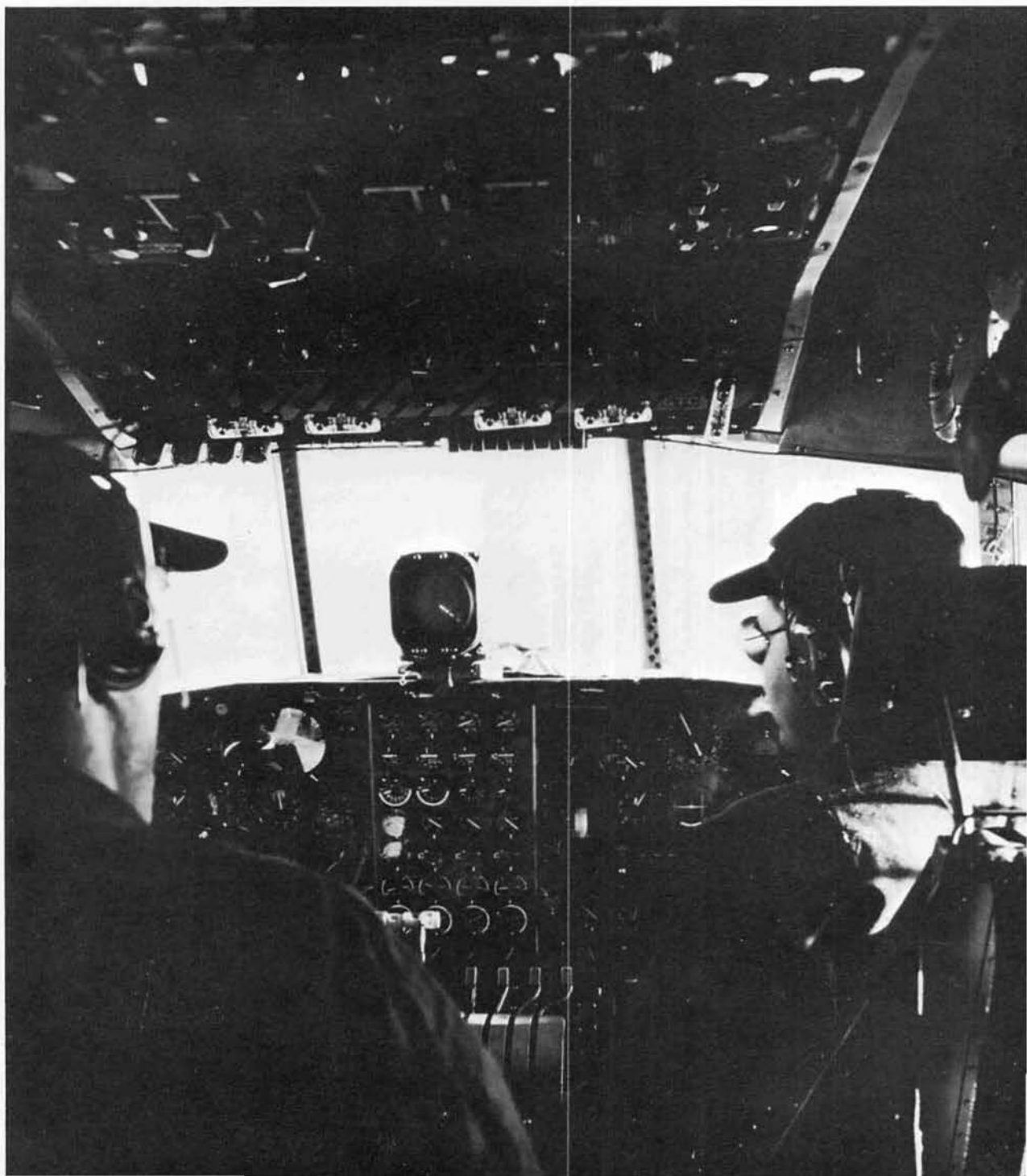
an isolated place they can be seen more easily by search aircraft. Half a dozen toy airplanes with miniature motors are tied up out of the way; someone asks if they are technical gadgets for the USARPs at the Pole. "Those are for the crew to play with," says Lt Leroy Frontz, the co-pilot.

A short, steep ladder leads to the flight deck — too small for a fistfight yet holding the plane commander, co-pilot, navigator, flight engineer, and perhaps a visiting congressman, as well as two folding bunks, a chart table, a small galley, and a mass of instruments including TACAN, radar, radio, and a periscopic sextant. Ltjg Jim Lacey, the navigator, prefers to shoot the sun, since compasses are unreliable so close to the Pole.

*At left, top:* Cape Crozier is the nearest place where the height of the Ross Ice Shelf can be appreciated. It runs for perhaps 400 miles, about 100 feet of it showing above the water. The cracks are in the sea ice.

*Bottom:* A Weddell seal weighing more than 1,000 pounds. Dr. Carleton Ray of the New York Zoological Society says that the Weddell seal is particularly valuable to the biologists because it is the only one that makes its home close to shore, under the very nose of the BioLab at McMurdo; furthermore, "any wild animal as tractable as the Weddell seal is a wonder of life on this Earth and worthy of our consideration and intent."

*Below:* The flight deck of a Herc.



Below: The loadmaster aboard one of the Air Force C-130s that fly in November between Christchurch and McMurdo, under contract to the Navy. His boots are of a special thermal construction, sometimes called "moon boots." Right: The cargo aboard a Herc is color-coded to avoid paperwork; the colors painted on the corners of the crates indicate what station in the interior of the Continent they are destined for, thus cutting down on the number of personnel who have to keep track of them in offices. A soft spot for a snooze can always be found on top of a sea bag, and a man can stretch his legs or walk aft for a coffee. An artist was fascinated by the patterns in the jumble of objects; he was reminded of the "shelter" drawings of Henry Moore in World War II.



Lcdr Dick Brabec taxis east. The cargo hold of a Herc looks like the inside of a barn. There are rollers, hooks, straps, the sides amidships padded with survival gear, an aluminum ladder, and special attachments for 74 litters. Several of these are in place, high up, as bunks for the crew. Most of the space is occupied by the fuel drums, but forward there is a row of seats on each side, facing inward, made of canvas and tubing, with a backrest of webbing.

The plane turns and starts down the skiway. There is not much of a wait for a signal from the tower, because there is no traffic. Dallas Herring and Chuck Hylland, members of the crew, check the seat belts stonily, violating the airline stewardess' rule of the Perpetual Smile. There seems to be infinite room to take off, but beyond the 13,000-foot skiway are seal holes, cracks, drifts, an occasional scientist's hut, and at the end of the shelf a ten-foot drop onto the sea ice.

To a passenger, the sense of danger is not as great here as it is in the United States, since the Navy maintains its own aircraft, and its people are "highly motivated" to stay alive. The Deep Freeze Navy pilots, like the skipper of a ship, have a "harbor" always in the back of their minds. In what Admiral Dufek called "the worst flying weather in the world," they usually find a place to set the plane down without hurting anybody.

When Byrd spent a winter alone on the Ross Ice Shelf, he wrote: "The tolerable quality of a dangerous existence is the fact that the human mind cannot remain continuously sensitive to anything. Repetition's dulling impact sees to that." On another of Shackleton's expeditions, his men endured 522 days of unbelievable conditions between South Georgia and Elephant Island, yet "they had adjusted with surprisingly little trouble to their new life, and most of them were quite sincerely happy. The adaptability of the human creature is such that they actually had to remind themselves on occasion of their desperate circumstances."

Thirty seconds after the start of its run, 319 is in the air. Lacey looks at his watch. It is 9 A.M., the precise moment filed in the flight plan. The butterfly wings of White and Black Islands are seen on either side; then Minna Bluff appears. Here Scott perished in 1912. He ran into bad weather, even on the Ice Shelf, and the leather washers on the stoppers of his oil tins became worthless in the cold. At each depot he found that much of the fuel — on which he depended for melting snow to make drinking water — had evaporated. At the end, he and his two remaining companions were held in their tent for ten days by a blizzard, a single day's march from the next depot.

Jerry Fichera, the flight engineer, comes aft. Lying on his stomach, he inspects the hydraulic worm of the landing gear through small glass ports in either side of the fuselage. He is responsible for all the machinery in this aircraft which has been perfected by the cumulative knowledge of fifty years. To starboard are the scintillating mountains of the Trans-Antarctic Range, a chain that goes across half the Continent and may have been linked with the Andes, according to one theory of continental drift.







Bronze bust of the late Rear Admiral Richard E. Byrd outside the chapel of Our Lady of the Snows at McMurdo. He was the first man to fly over the South Pole, in 1929, and the first Officer-in-Charge of the U.S. Antarctic Research Program, at the beginning of Deep Freeze in 1956. Admiral Byrd's own words are inscribed on the base of the memorial: "I am hopeful that Antarctica in its symbolic robe of white will shine forth as a continent of peace as nations working together there in the cause of science set an example of international cooperation."

At the foot of the 15,000-foot Mount Markham is a gap where Scott, with Shackleton as a member of his party, reached a new "farthest south" in 1902.

Within an hour, or (as Shackleton wrote) after a month of hard sledging, "there burst upon our view an open road to the South, for there stretched before us a great glacier running almost south and north between two mountain ranges." This is the Beardmore Glacier, so vast that it has several "mouths," and at one of them are the great granite pillars he spoke of. It seems to be flowing softly onto the shelf ice, although its tremendous pressure creates waves for miles on the surface of the Barrier. Lt Frontz says on the intercom, "I'll tell you what it's like . . . you've seen your wife pour batter out of a cake bowl. . . ."

On board is a man with the lean look of a British ambassador. He turns out to be L. M. Forbes, editor of the *Polar Record* in Cambridge, England, one of a number of publications Admiral Bakutis studied in order to prepare himself for the ice. Although he has not been in the Antarctic before, Mr. Forbes has known many of the explorers who opened up the Continent. Sir Charles Wright, for instance, who has just left here after a visit as a scientific consultant, accompanied Scott as far as the top of the Beardmore Glacier in 1911 and found his body near Minna Bluff in 1912. He has retired three times since 1947, but the continuity of his knowledge of the Antarctic makes him invaluable.

The work Sir Charles does in upper atmosphere physics has a direct bearing on the fate of 319 whose radio is in contact with Little Jeana, a summer weather station on the Barrier. He wrote recently, ". . . the ionosphere must be regularly monitored in the Antarctic to help maintain communications. When the normal complement of electrons is augmented by a burst from a solar flare, the D layer absorbs short-wave radio signals. Often the effect is severe enough to black out all radio communication and therefore also to ground all aircraft."

Mr. Forbes clambers up, walks aft on the tops of the oil drums, and drops to the deck near a door that slopes outward. Mindful of skin being stripped off by cold metal, he avoids the handles and leans against the door. "Those lines on the side of the *glassier*," he says, "are where the ice is breaking away from the mountains." The smaller mountains are covered almost to the top with ice, as if inundated. Some of it is blue, like the water in the Bahamas. Mr. Forbes says this color is due to the absence of snow. Scott wrote in his diary: "All this soft snow is an aftermath of our prolonged storm. Hereabouts Shackleton found hard blue ice. It seems an extraordinary difference in fortune, and at every step S.'s luck becomes more evident."

The "lucky" Shackleton had "falls, bruises, cut shins . . . the worst surface possible, sharp-edged blue ice full of chasms and crevasses, rising to hills and descending into gullies; in fact, a surface that could not be equalled in any polar work for difficulty in travelling." In the Age of the Goon, until five years ago, the LC-47s used to labor up the Glacier, barely gaining altitude as fast as the ice rose toward the plateau, but the Herc is flying effortlessly at 26,000 feet.

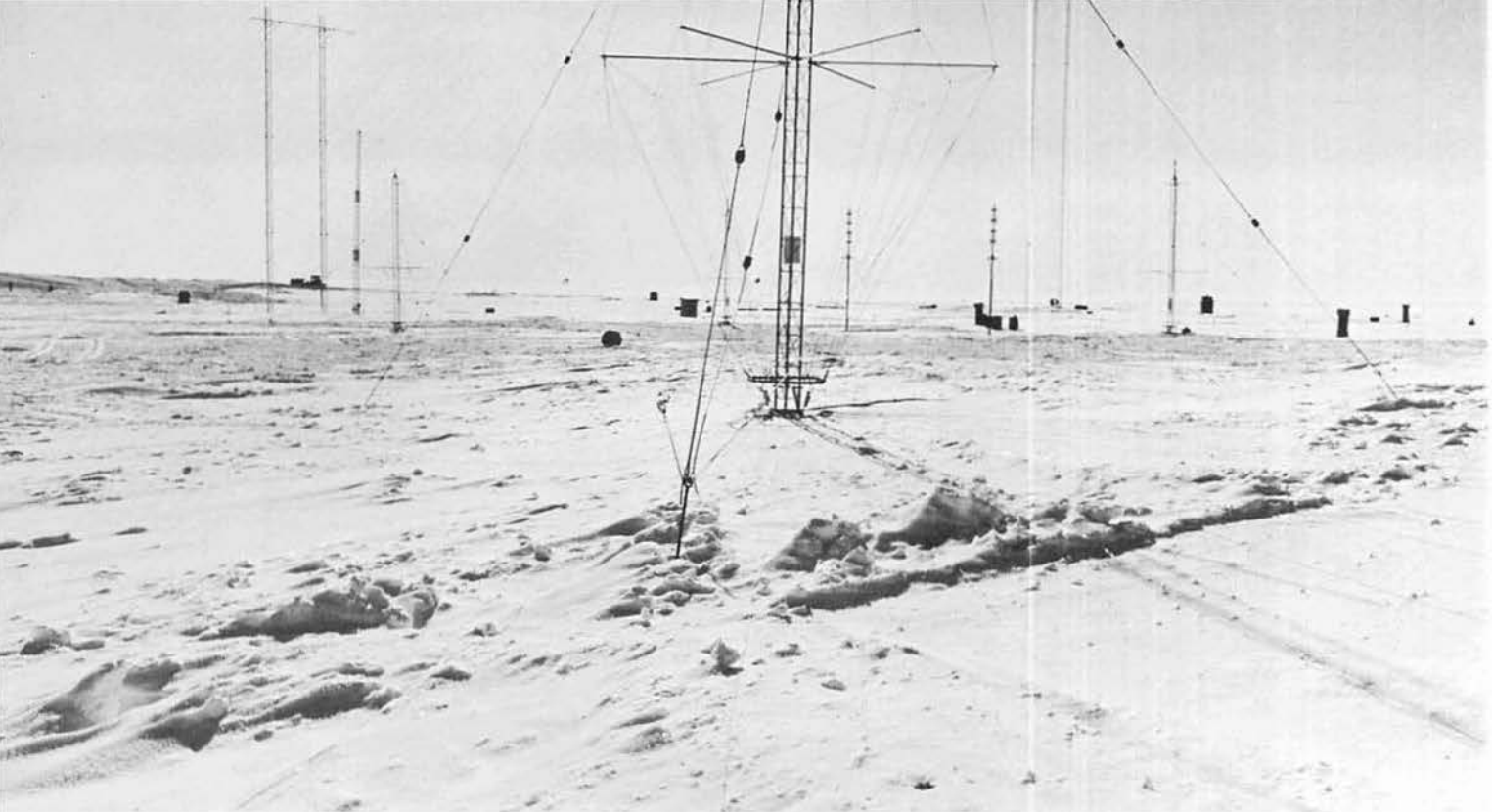
First glimpse of the Continent! The land below the nacelle of the Herc is in the vicinity of Cape Adare near Hallett Station, which was the first summer station to be reopened in Deep Freeze '66. The 2,200-mile flight from New Zealand would be even more hazardous if it were not for the weather reports received from Hallett. On September 6, an LC-47 landed on sea ice with nine members of ASA who put the station back in operation and laid out an ice runway. The latter could be used, in an emergency, for about one month (November) by the wheeled aircraft of the Air Force. In Deep Freeze '66, the first plane from New Zealand landed at McMurdo on October 1. The PSR (point of safe return) had been passed a little beyond the halfway point, where the picket ships *Gary* and *Calcaterra* alternated on ocean stations throughout the season. Even veterans of the Antarctic become excited when they first see land.





“Those slits or slotted areas are crevasses . . . the more obvious ones,” Mr. Forbes explains. They look like the darts made by a seamstress. There is not much snow on the range that goes off to the southeast, and in the distance is a large mountain that resembles a castle. As the plane approaches the plateau, the mountains are more and more covered, until they are mere *nunataks* or peaks protruding from the snow. Finally the tips cease altogether. Here the ice is 8,000 feet thick.





Above: Byrd Station. From one to two feet of snow falls in the Antarctic each year. This is gradually compressed until, at a depth of about 450 feet, it becomes pure ice. The deeper they go, the larger the ice crystals become. Snow on the surface takes about 1,600 years to reach a depth of 900 feet. Antarctica's ice sheet has warped the earth's crust and created the climate of the Continent, which in turn affects the surrounding oceans and the life in or near them.

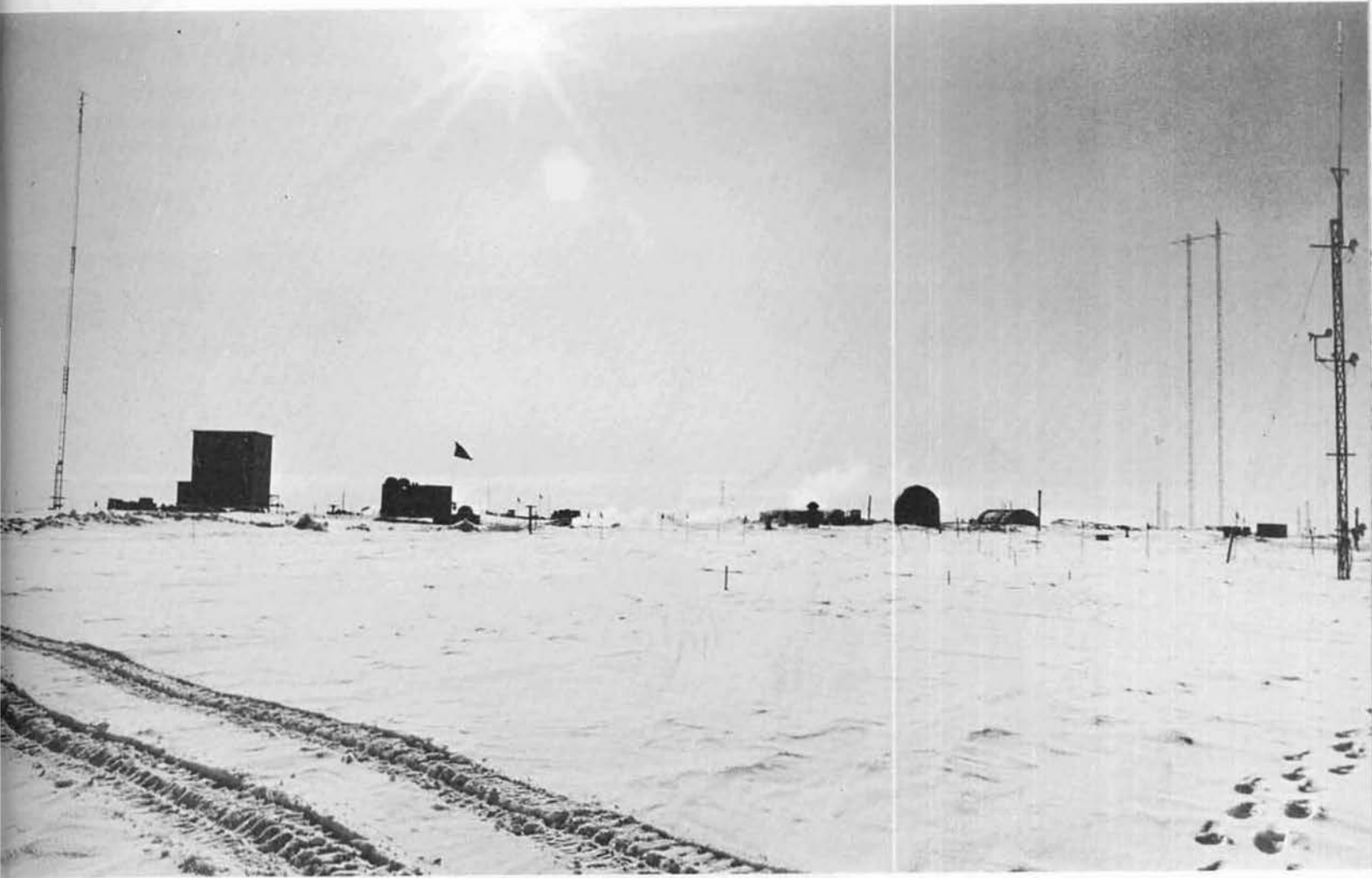
He walks up the ramp piled with sea bags, on one of which a man is sleeping, and makes his way past crates of fresh vegetables to a coffee urn strapped to the fuselage. On the way down he is careful not to step on the rollers, embedded in the deck, on which cargo is slid off the plane. "Good coffee, this. Better than the stuff you get in America. Ugh." At this point Shackleton's party had run out of raw frozen pony meat, which they chewed on the march, and were eking out their rations with the maize intended for the ponies.

After an hour's flying over a featureless plain, 319 starts losing altitude, about where Shackleton had to turn back because of a shortage of food. Mr. Forbes will have lunch at the Pole, before returning to McMurdo, and he begins putting on his cold-weather clothing. When he has finished, he has on thermal boots made of heavy white rubber, a complete suit of thermal underwear, a heavy shirt and pants, and the "many pockets" jacket and pants, both with liner.

In addition, he has a heavy wool scarf, a thick hat with earmuffs, and three pairs of gloves: knitted wool, black leather, and Bear Claws. The latter are about 18 inches long and made of leather padded inside and out with fleecy. In his pocket is a face mask, since the temperature at the Pole will be in the minus 40s.

Pole Station shows up clearly, since it was originally built on the surface. It has left its impression although it gradually disappeared under a nine-year accumulation of snow, leaving only a few huts, a lot of masts, and a Rawin dome for tracking weather balloons. The main body of the station is completely under the ice. Since there is nothing on the skiway to cast a shadow except 50-gallon drums, it is hard to tell how high the plane is. It could be fifty feet in the air, or five hundred. As far as the eye can see to starboard, the ice resembles a smooth sea or an endless desert.

*Below: The South Pole. The station is just below the surface, whereas Byrd was built deeper and covered with a special steel arch. As for the men who winter-over, the problem is best described by Admiral Byrd, who said that any man who elects to inhabit such a spot must reconcile himself to "... enduring the bitterest temperatures in nature, a long night as black as that on the dark side of the moon, and an isolation which no power on earth could lift for at least six months. Now, against cold the explorer has simple but ample defenses. Against the accidents which are the most serious risks of isolation he has inbred resourcefulness and ingenuity. But against darkness, nothing much but his own dignity."*



A slight scraping is felt as Lcdr Brabec sets the plane down. Then a sudden slowing, as the "brakes" are applied to save the skis. By reversing the propellers, the Herc can stop within 2,500 feet. After taxiing to the fuel pits, Lcdr Brabec shuts down three engines, leaving one running to keep the hydraulic system functioning. Off-loading usually takes about 20 minutes, although today, since Admiral Bakutis is aboard, 319 will wait for two hours. When the door is thrown open, a husky dog bounds up the steps and greets each member of the crew. Then she scrambles up the steep ladder to the flight deck where a little sign says: "Antarctic flying consists of hours of sheer boredom, interrupted by moments of stark terror."

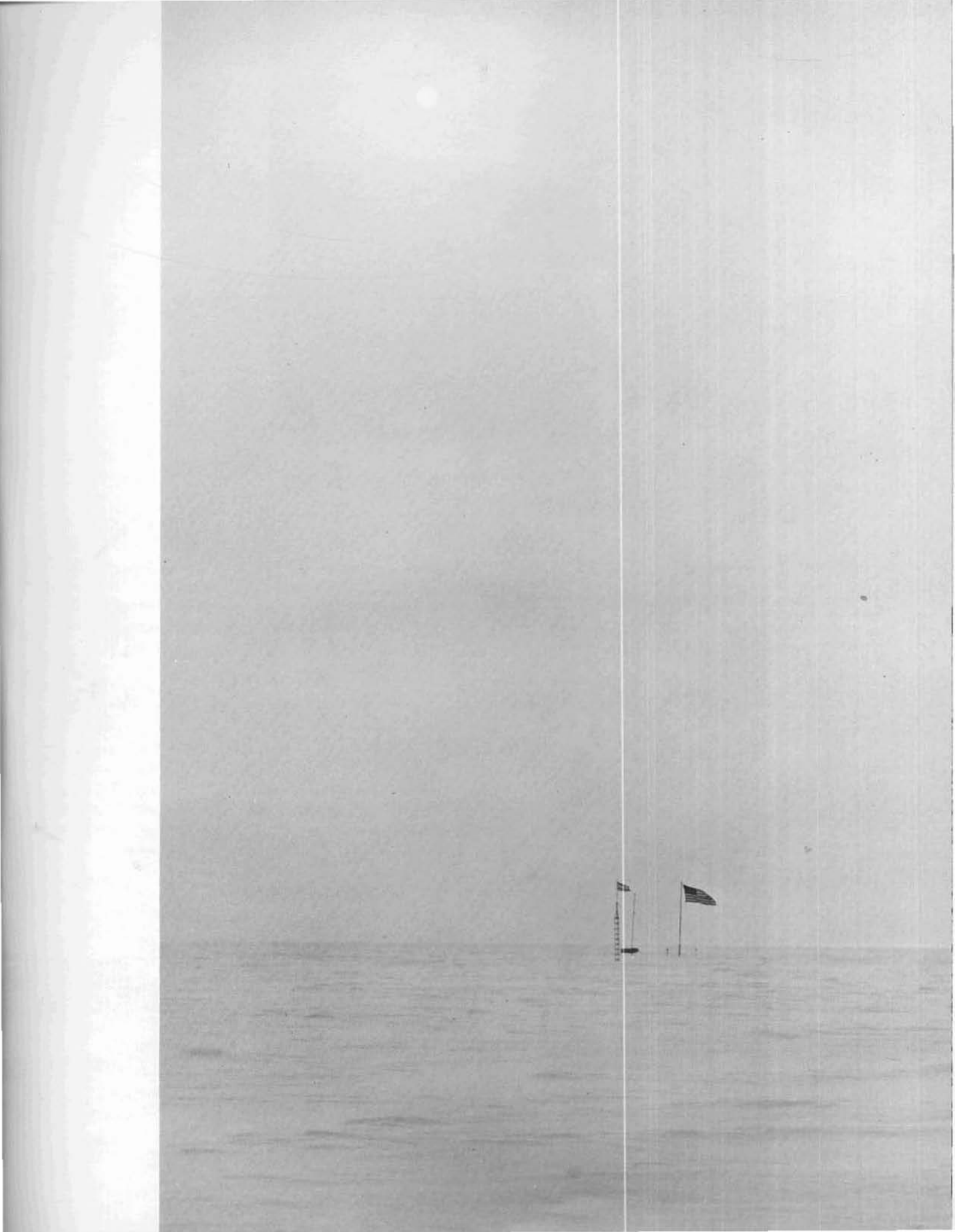
Dick Brabec is reassuring. "If anything fails," he explains, "it fails in a 'safe' position. A valve, for instance, will be turned automatically to a spot that can't endanger the aircraft. The design that's gone into these things is wonderful." The Hercs have an almost miraculous ability to endure conditions that would finish off any other plane. They can operate down to 65 degrees below zero, although occasionally they may develop mysterious ailments after years of punishing, open-field landings.

"The paper life of an LC-130 is twenty years," says Admiral Bakutis, "but they're pretty beat up. These are the original four we ordered in 1960, and the hours we put on them are half again as hard as the wear they would get in the States." This season two of them had cracks in the airframe, but Lockheed-Georgia came up with a special steel plate to correct the trouble. The company sends several technical representatives to the ice every season to keep an eye on them.

A Herc being unloaded at the South Pole, with a sled and a D-8 tractor. When a plane lands, anyone who is not on duty, often including scientists, comes to help unload it. Even the simplest movements here are awkward because of the extreme altitude, and shortly after this picture was taken the storekeeper was killed while helping to unload another aircraft. Walter Sullivan says that the human body adjusts itself to the climate by increasing its rate of metabolism. But the increase in adrenalin secretion sometimes causes men to be terribly "touchy" during the long winter. Whatever the problem, and whatever the conditions under which a job must be done, the Navy men usually say, "We can hack it."

*Right:* The geographical South Pole, about a quarter of a mile from the main station. The flags are the Norwegian, for Roald Amundsen who discovered the Pole in 1911, and the American, for the people who have lived there continuously since 1956.









A weather balloon at the South Pole.

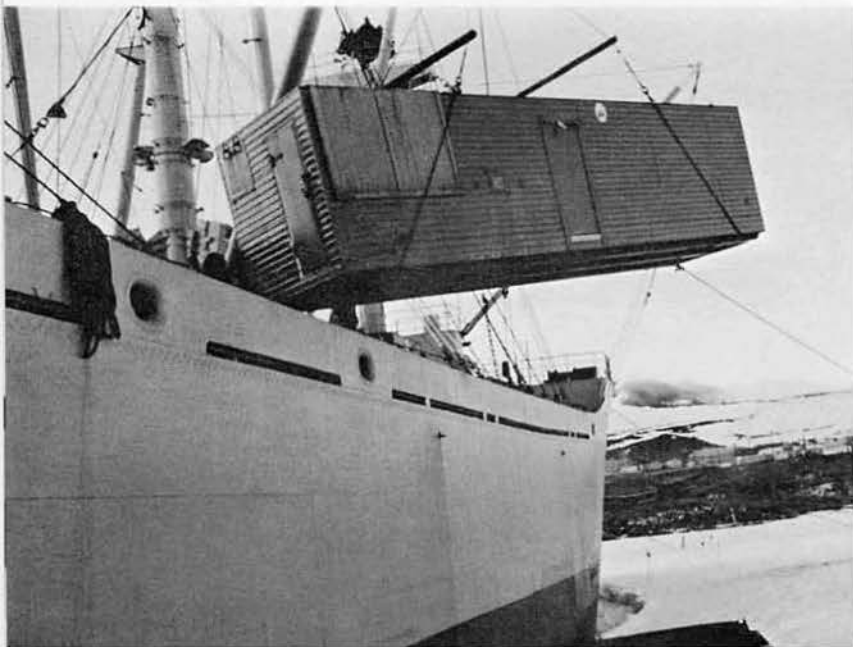
*Right:* An LC-130 Hercules on the ice at Williams Field, McMurdo. Under the plane's wing, at right, is Observation Hill which shelters McMurdo Station. At left is the Royal Society Range. The permanent ice of the Ross Shelf, here, is over 100 feet thick, but the runway for wheeled aircraft in the background is on sea or annual ice and may "go to sea" at any time.

J. R. Dantzer, one of the Lockheed Tech. Reps., explains magnaflux, a method of detecting cracks in metal: "If the part is small enough, it can be removed from the plane and subjected to electro-magnetic analysis. You coat the suspect area with magnetic filings or shavings, and when you polarize it, north and south, the filings will form a wavy line that will be the line of the crack."

Previous types of large cargo planes used in Deep Freeze couldn't handle the rough surfaces found almost everywhere on the Continent, but the Hercules is so successful that it is replacing the overland traverse in which tractor trains reach remote areas. Henry Storm, the lanky bosun's mate who is in charge of refueling at the Pole, says that once the fuel lines iced up on a LC-130, causing it to lose power, and it landed on one engine:

"That Herc's a real forgiving aircraft."





The U. S. Navy's Operation Deep Freeze supports scientific studies in the Antarctic with one of the longest and most complex supply operations in the world. Here is the notorious "Nineteen Mile Ship." That's how long the *USNS Pvt. John R. Towle* will have to be in order to hold all the cargo the various units are waiting for. The van being swung over the side was designed in Washington, D.C., built in Calgary, Alberta, put aboard the ship at the Deep Freeze base in Davisville, R.I., and flown from McMurdo to the remotest part of Antarctica.

In spite of modern transport methods, men are as vital to the operation as they were when the early explorers man-hauled their heavy sledges 60 years ago. The van is set on the ice, instead of the quay, so that it can be pulled four miles to the snow runway by a heavy D-8 tractor. The Navy's summer support of the year-round scientific program sponsored by the National Science Foundation requires that all ships and aircraft converge in the Antarctic at precisely the right moment, with the right instruments and materials. The ship shown here has sailed many thousands of miles, making only one round trip per season to furnish the supplies necessary to back up ventures far out on the ice.





A typical day in the Antarctic, with a partial white-out condition. If the wind were to pick up a little more, blowing snow would obscure the skiway and the Strip would be "down" or non-operational.

Lockheed-Georgia's LC-130 Hercules has revolutionized exploration in the Antarctic. In spite of its weight and the amount of cargo it carries, it can drop onto an unprepared snow surface as lightly as a bird. It can get off the ground in 30 seconds and land, if necessary, within 2,500 feet. Its turbine-powered engines have no trouble in cold, thin air, and with a pressurized cabin it cruises at over 30,000 feet, out of reach of the highest mountains. Vehicles are flown out to the area of a scientific investigation and either left there in the almost rust-free air or returned to McMurdo for overhaul. The Herc also brings food, fuel, spare parts, and mail to the scientists and Navymen. Thus the scientist can fly down from the United States in October and have a whole summer season of four months in the field before leaving in February.

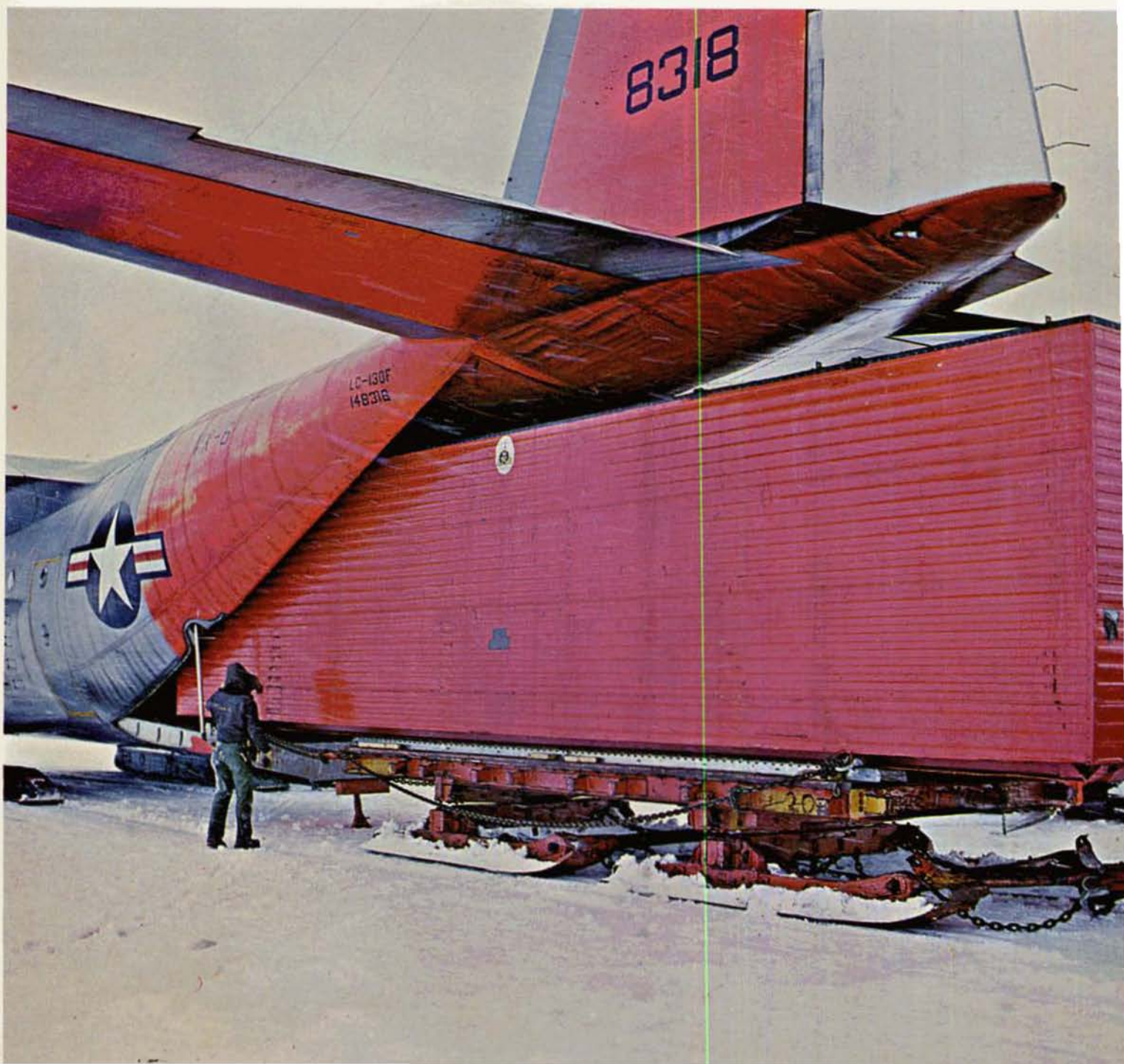
The flexibility of this arrangement is far greater than the old system where the scientist could cover only a few miles on the surface, laboriously, having to consider every pound carefully. Byrd Station and the South Pole have become staging areas, from which the Hercs re-supply stations or field parties. From Byrd, they are within reasonable distance of Eights, Ellsworth, Camp Minnesota, and the Horlick and Pensacola Mountains. From Pole, they supply Plateau and the Queen Maud Land traverse.

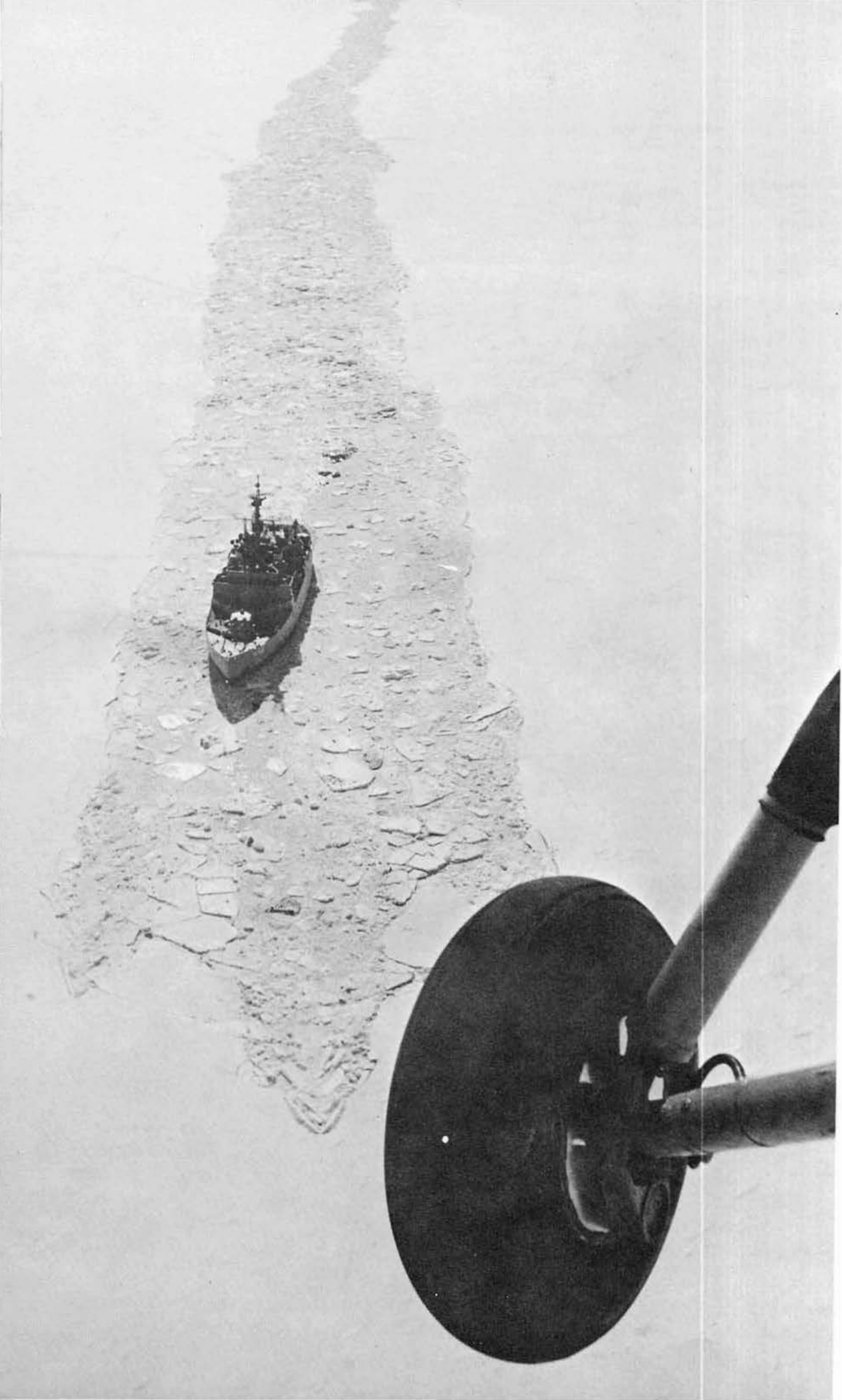


The Plateau Station vans were designed to fit snugly inside the Hercules. At left, there doesn't seem to be a chance. At lower left, the plane's loadmaster stands on the ramp and waits to be shown before he moves out of the way, below.

The van was designed by the Navy's Bureau of Yards and Docks to meet every conceivable need of the four Navymen and four scientists who will stay from February to December at the new Plateau Station in the coldest, highest, most remote part of the Continent. The curtains to afford privacy and the colors of the walls were made as cheerful as possible, but there are few windows since for six months it will be dark outside. This van will be connected to others by a roof and floor creating extra space for work and relaxation.

Plateau Station was one of the most important objectives of Deep Freeze '66. The station's main purposes are for research in Very Low Frequency radio reception, aurora, meteorology, and geomagnetism. An important by-product is the opportunity to study human behavior and psychological reactions at extreme altitudes. Plateau's altitude is 11,900 feet, and the temperature may go as low as 130 degrees below zero. The Navy doctor in charge checks regularly on the men's response to an altitude that is effectively very near the limit that can be tolerated without oxygen. Before the station was isolated for the winter, it was visited by a NASA representative who wanted to find out what the space program could learn from this "experiment in living" for possible landings on other planets.



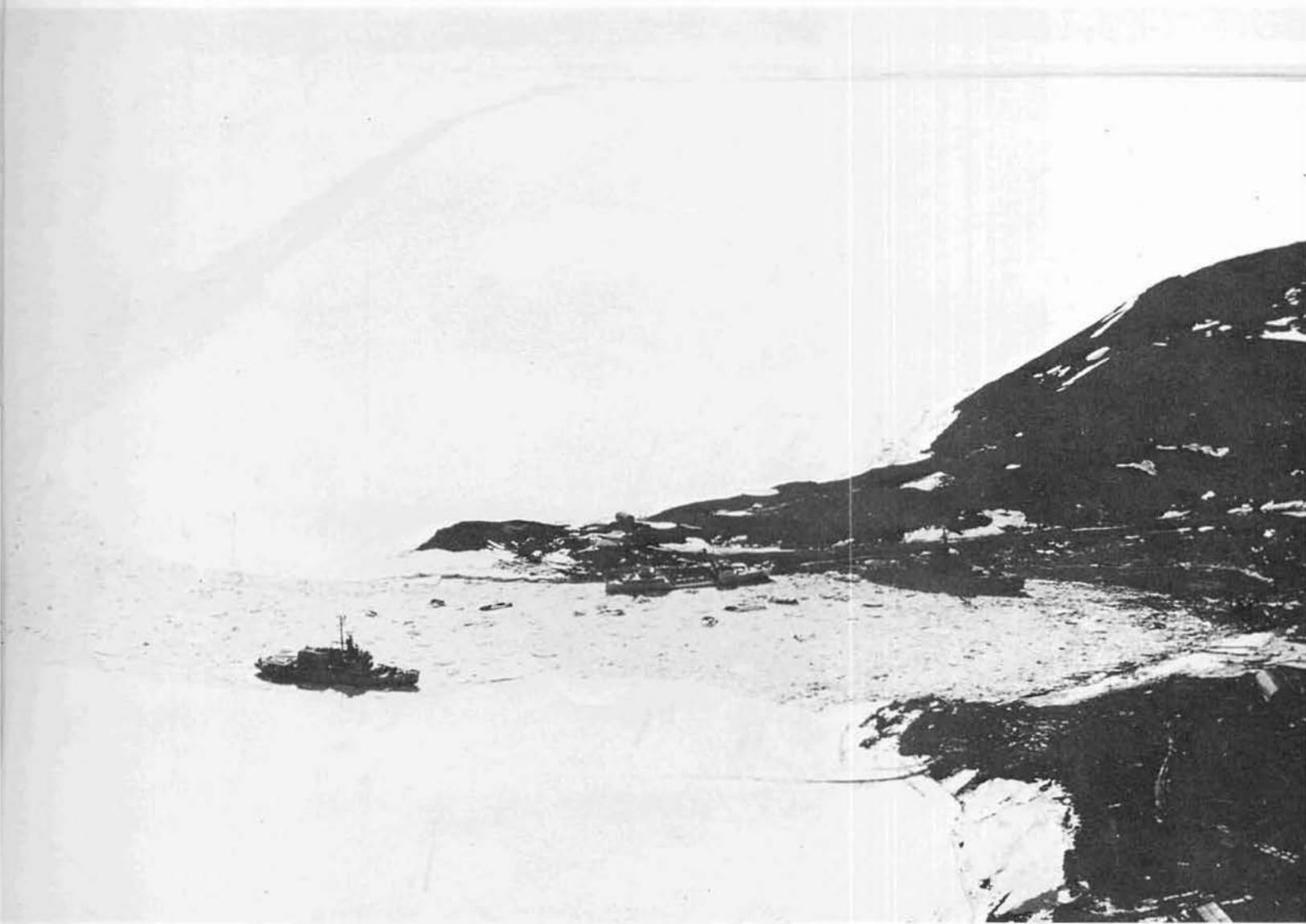


"Pretty soon," says Cdr Jim Newman, the ship operations officer, "it'll be the thing to do — to go out on the point and watch 'em bustin' ice." For two months McMurdo sound was an expanse of white, relieved only by a few Weddell seals sprinkled on the ice near Hut Point. Then, early in December, from a helicopter, icebreakers were seen far to the north. The ship's radio reports their patient mile and a half each day. By December 11, *Glacier* is close enough to Hut Point for the people at McMurdo to stand on the rocks in their spare time and enjoy a new diversion.

As seen in the photo at left, three cuts are made, 20 degrees apart. With throttles full ahead, *Glacier* rides up on the six-foot ice for perhaps one-third her length and crushes it with her weight. The trick is to stop the engines before the ship loses way and gets caught in the ice. The two 17-foot propellers help to churn the brash

or loose ice out of the way. Then she backs down three or four lengths to prepare for another charge. Each cut takes about six minutes, and this year it was three weeks before the channel was ready. The wheel in the foreground belongs to one of *Glacier's* helicopters, which are used for ice reconnaissance, special cargo, and ferrying scientists to otherwise inaccessible locations.

*Below, Atka* enters Winter Quarters Bay, with McMurdo Station at lower right. As in the old days, ships must wait for Nature to open McMurdo Sound, but now the icebreakers cut a channel from the Sound to McMurdo Station and allow the ships to come in a little earlier than in years past. Deep Freeze '65 was the first year in the history of the operation when it was not necessary to unload cargo on the sea ice and haul it to McMurdo on sleds. Tankers used to have to stay off as far as ten miles and pump their fuel ashore.





Below is a stunning view of the Royal Society Range, which is actually 70 miles away. *Glacier* and *Burton Island* have just brought *Alatna* into Winter Quarters Bay, although a giant ice floe blocked the entrance to the channel. The ice floe was first estimated to be nine times the area of Manhattan Island. *Alatna*, escorted by the icebreaker *Atka*, arrived at the entrance on December 12, carrying 1,162,766 gallons of JP4, desperately needed by the Hercs. The three icebreakers tried to push the floe out of the way, but it jammed against the fast ice. *Glacier* finally managed to split the floe, and *Alatna* reached *McMurdo* – a distance of some 20 miles – one week late, on December 19.

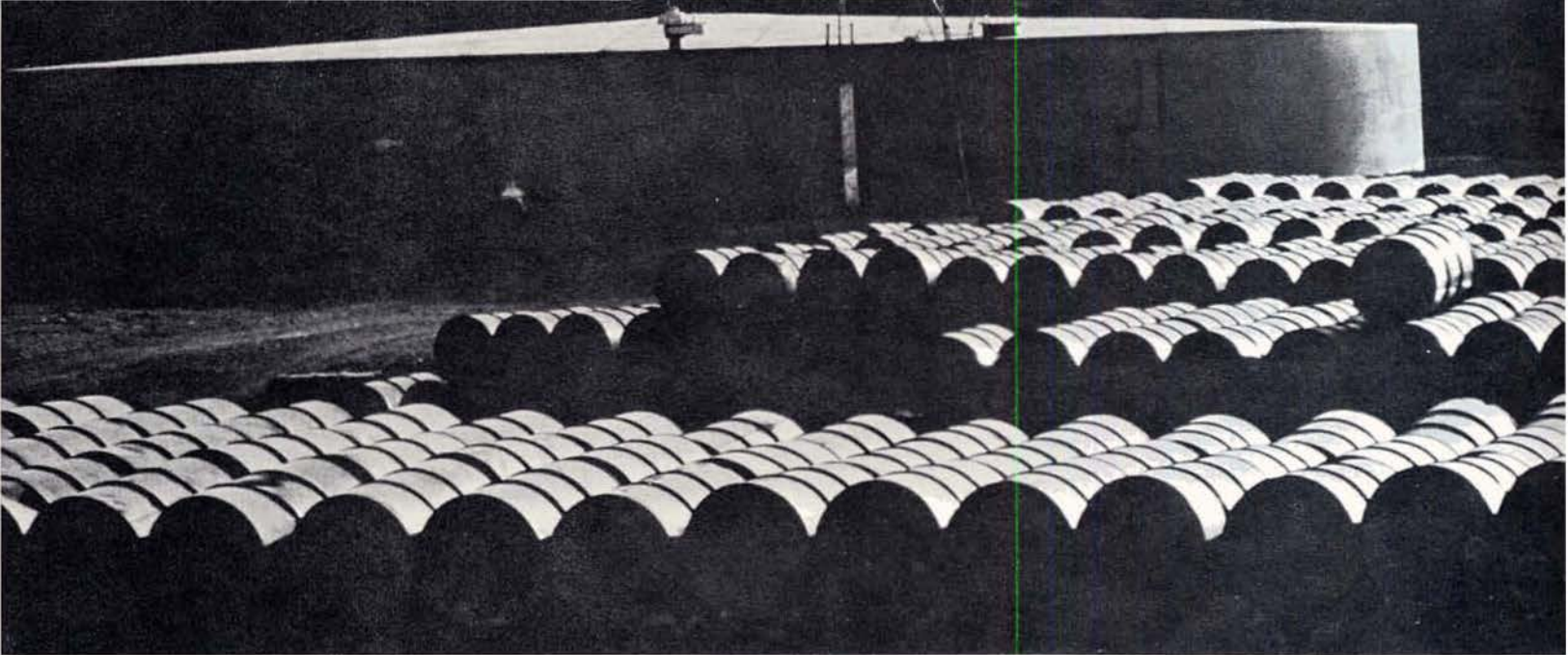
At the left in the photo, halfway up *Glacier's* mast, can be seen her "Loft-Conn" where she is controlled when breaking ice. It is 100 feet above the water and provides a peaceful place from which to survey the penguins and killer whales that appear when the ship first reaches the fast ice. *Glacier* is America's largest icebreaker, with 280 officers and men.





Above: McMurdo Station is built on one of the few bare patches in the Antarctic. This is not due entirely to the warming effect of the lava ash that covers the area around Mt. Erebus, since only a part of the tip of the peninsula is ice-free. More likely it is an accident of the wind, which removes the winter snows and leaves an area of barren ground in summer.

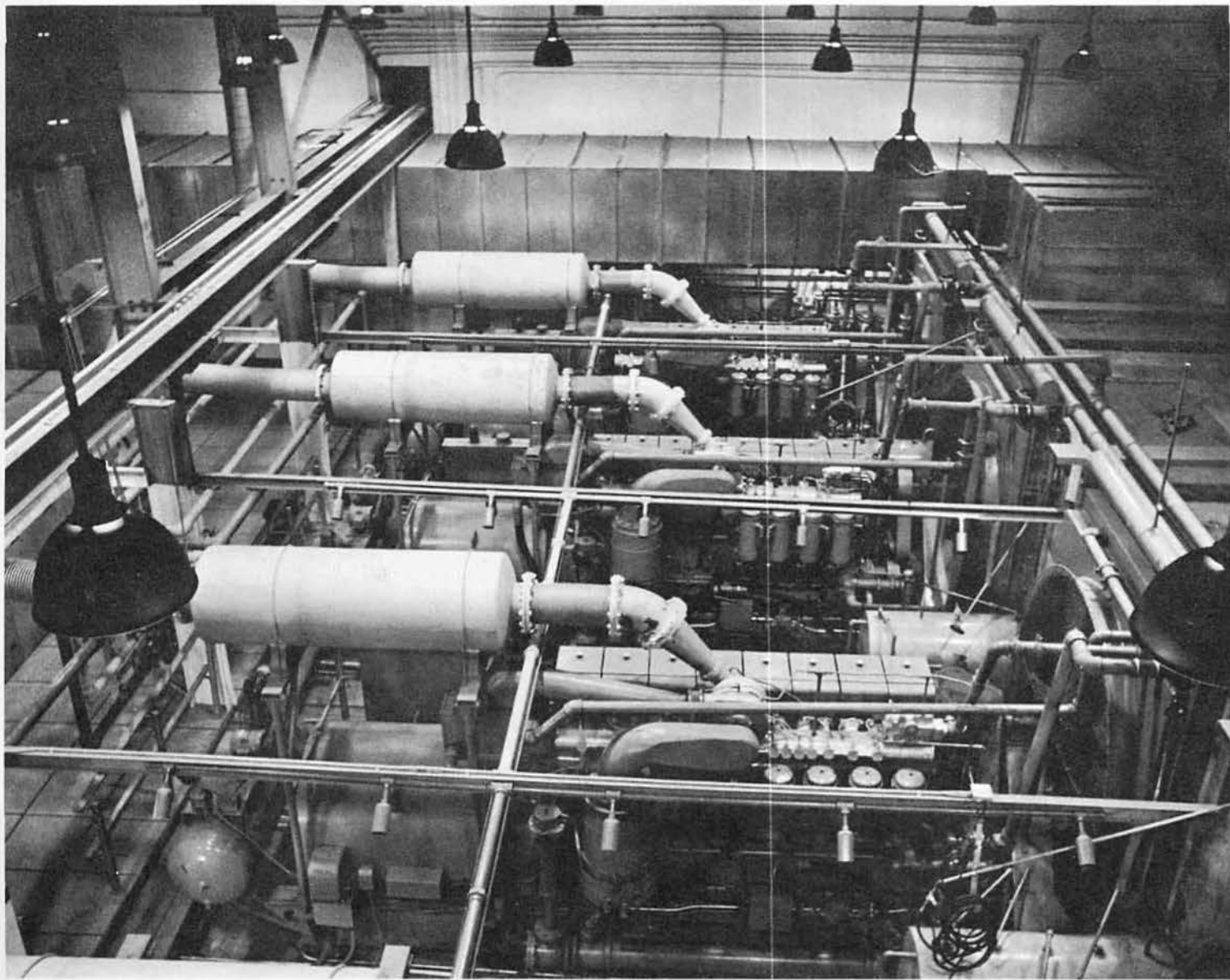
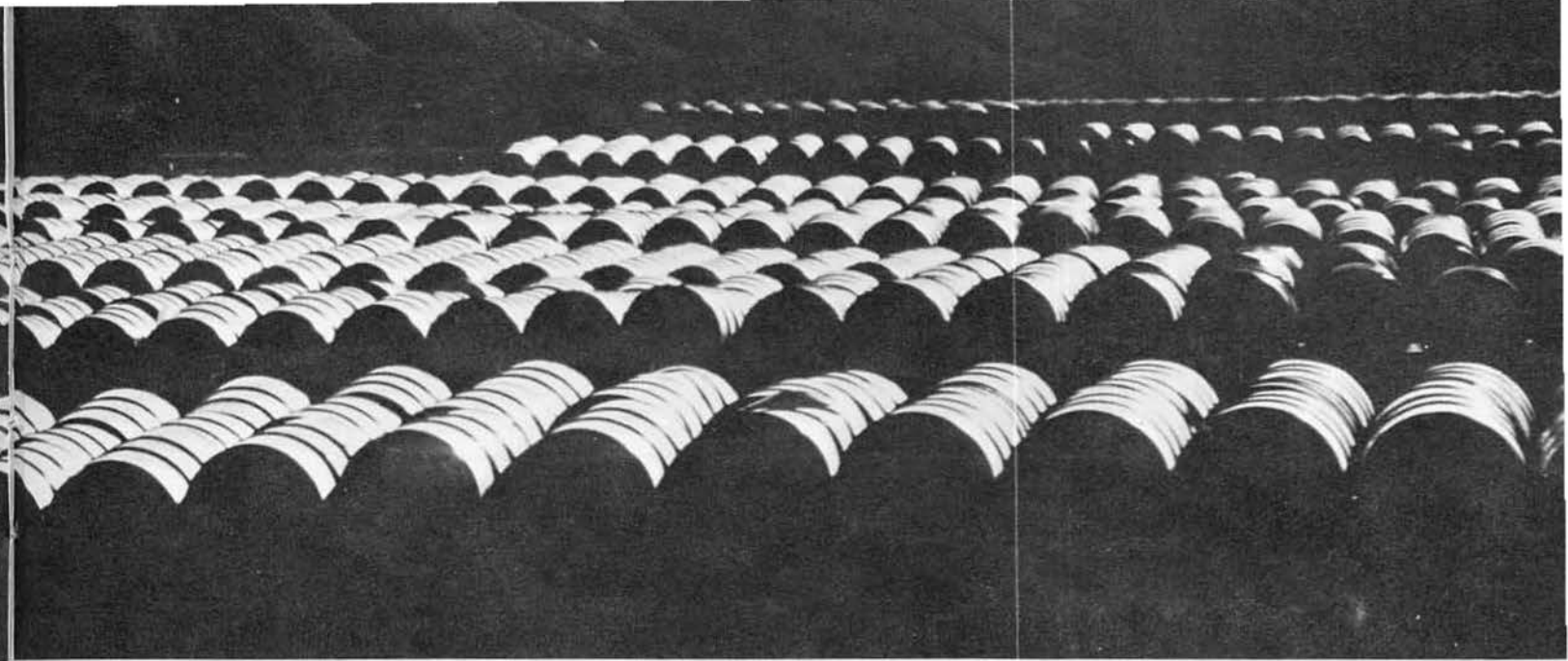
A helicopter is visible on the flight deck of *Atka*, spending her sixth season in the Antarctic. The majority of equipment and supplies still arrives by ship. Left, Ltjg Jim Woods peers from his "horse" — the name given to *Glacier's* helicopters because of their former designation: HO4S. The choppers are painted a bright international orange for maximum visibility.

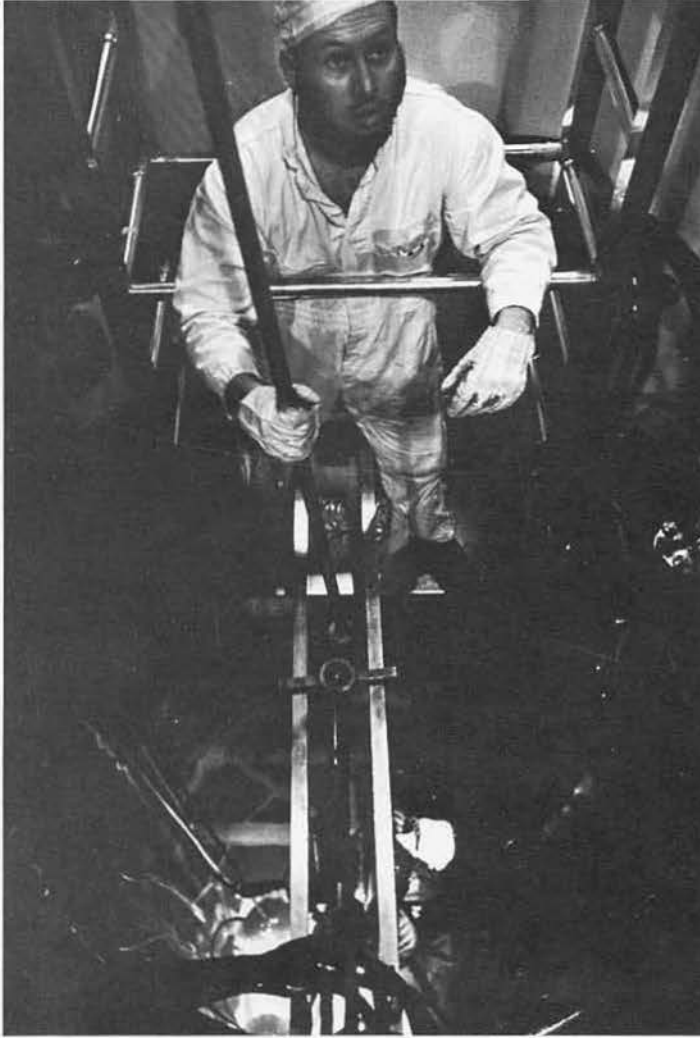


Approximately 40 percent of all tonnage flown to the inland stations consists of fuel. The Navy is constantly trying to find ways of cutting down on this requirement: by reducing consumption on the spot, by preventing leaks, by tightening inventory, and by planning flights carefully to consume fewer flying hours in support of scientific programs. Yet to supply the new Plateau Station, for instance, three 25,000-gallon fuel bladders had to be placed near the skiway at the South Pole. For the latest program in the Pensacola Mountains, the largest summer scientific party ever put into the field in Antarctica, fuel had to be flown 1,200 miles from McMurdo.

Sometimes it is so cold that the hoses break when they are coiled, like dry spaghetti. The bladders themselves are ordinarily used, in a normal climate, less than a year. On the ice, through necessity, they often serve for several years. They have a way of developing leaks, unseen, beneath the snow. Nevertheless, the bladders were, and are, a brilliant improvisation in a place where ordinary means of fuel storage did not exist.

Above: The 55-gallon drums are part of the emergency cache at McMurdo. There are 73,410 of them. The tank holds 250,000 gallons, and a number of these huge wafers surround the station, high on the hillsides. They are readily convertible from Diesel Fuel Arctic, which is used for heating, to JP4, which powers the turbo-prop Hercules. At right are some of the Diesel-electric generators that provide power for the station.





At left is Chief John Gannon, standing on an elevator of stainless steel, which is suspended by a 15-ton crane over a pool of brilliant water. He is removing one of the control rod actuators in the heart of the nuclear reactor at McMurdo. The actual fuel elements are contained in the walls of about 740 stainless steel tubes, half an inch in diameter. In case the power rises too quickly, the reactor has "period protection" from an automatic monitoring system. At 110 percent, an alarm sounds; at 115 the control rods are inserted at six inches per minute; at 120 the rods are put all the way down, in about 380 milliseconds.

Far below the surface of the water is a dolly that carries a hot or spent core into an adjacent tank where it can be stored until it cools off. These are two of the rare photographs, by an outsider, of the reactor with the cover off. Before he could enter the Primary Building, the photographer had to dress completely in white, put on special shoes, and carry a radiation-counter like a fountain pen. When he came out, he was inspected by a sensitive machine. "Rarely does a man go over one-sixth of his allowed quarterly dose," said Chief Jim Robertson, the senior electrician. The core, which is no larger than a single oil drum, replaces millions of gallons of Diesel fuel. It lasts two years.





"Stakes all day and steaks at night." Above, Tony Gow, of the U. S. Army Cold Regions Research and Engineering Laboratory at Hanover, N.H., cooks a steak at midnight. At this season the sun never sets, and its light pours through the thin, extremely strong cloth of his tent. The tent is a brilliant orange-red that can be spotted easily from the air. Gow, a glaciologist, has been measuring the angular shift between stakes that were driven into a glacier in the Dailey Islands several months before. The angular shift, measured with a surveyor's transit, yields information about glacial flow patterns. This area, across the Sound from McMurdo, receives a tremendous, although slow, discharge of the ice from the Koettlitz Glacier and the 500-mile sweep of the Ross Ice Shelf.



*At left:* Tony Gow and Steve Toth, also of CRREL, take an ice coring from the Ross Ice Shelf. It will be analyzed for any cosmic dust and trapped gases it may contain, and its crystalline structure will be examined as it varies with depth and temperature. This shelf, the size of France and as much as 1,000 feet thick, floats in the ocean although it is still attached to the land. From its seaward edge pieces break off, or "calve," to form huge flat-topped icebergs. Glaciologists have been trying to find out whether the ice shelf erodes on its underside or is built up by the freezing of sea water, but Gow discovered last year that at Little America V it is composed entirely of glacial ice. Fish found on top of the ice were thought to have been frozen to the bottom of the ice and later exposed by the wearing away of the surface. Gow now believes that seals brought the fish to tide cracks, where they became frozen.

*At right, top:* Jeff Bier of Roanoke College and Pete McCarthy of the North Star Research and Development Institute use an aluminum boat to set out a trap for marine animals. Most of their catches are in deep water; there is very little life around the shores because the ice prevents the sort of growth that marine animals need to feed on. A few of these creatures are found in other waters, but the majority are endemic to the Antarctic. The shells of crustaceans and mollusks here are actually thinner than in warmer waters. The best description of the food process is by the eminent Dr. Robert Cushman Murphy: "The red shrimplike crustacean commonly called krill . . . symbolizes life in the Antarctic more aptly than any penguin does. It is the key organism in the shortest food chain of one of the most abounding provinces of life on earth. Feeding directly on the one-celled plants of the sea, the krill in turn supports not only fish but also the penguins and vast populations of winged sea birds, seals and whales."

*Bottom:* Pete McCarthy (background) and Dr. Derry Koob in the Biological Laboratory at McMurdo. McCarthy wintered-over as manager of the BioLab, while Dr. Koob spent the summer studying algae, a project he had begun the year before. The BioLab is the largest fully equipped United States facility in the Antarctic for the support of a single discipline.







The Antarctic oceans are richer in life than any similar waters in the world. At left, reading down: a rather small octopus, with a total leg span of about four inches. A gate-legged sea spider, abundant in polar waters, which feeds on the sea anemone and other fleshy creatures. The legs of this one are about four inches long. A fancy-colored fish, collected at a depth of 830 meters, off McMurdo. A sea fan or sea lily, related to the starfish. If extended, its diameter would be about eight inches. All are in the BioLab at McMurdo, in salt water tanks, at a temperature slightly below freezing. Eventually salt water will be pumped to the aquarium from under the ice of McMurdo Sound.

## *The Center of the World*

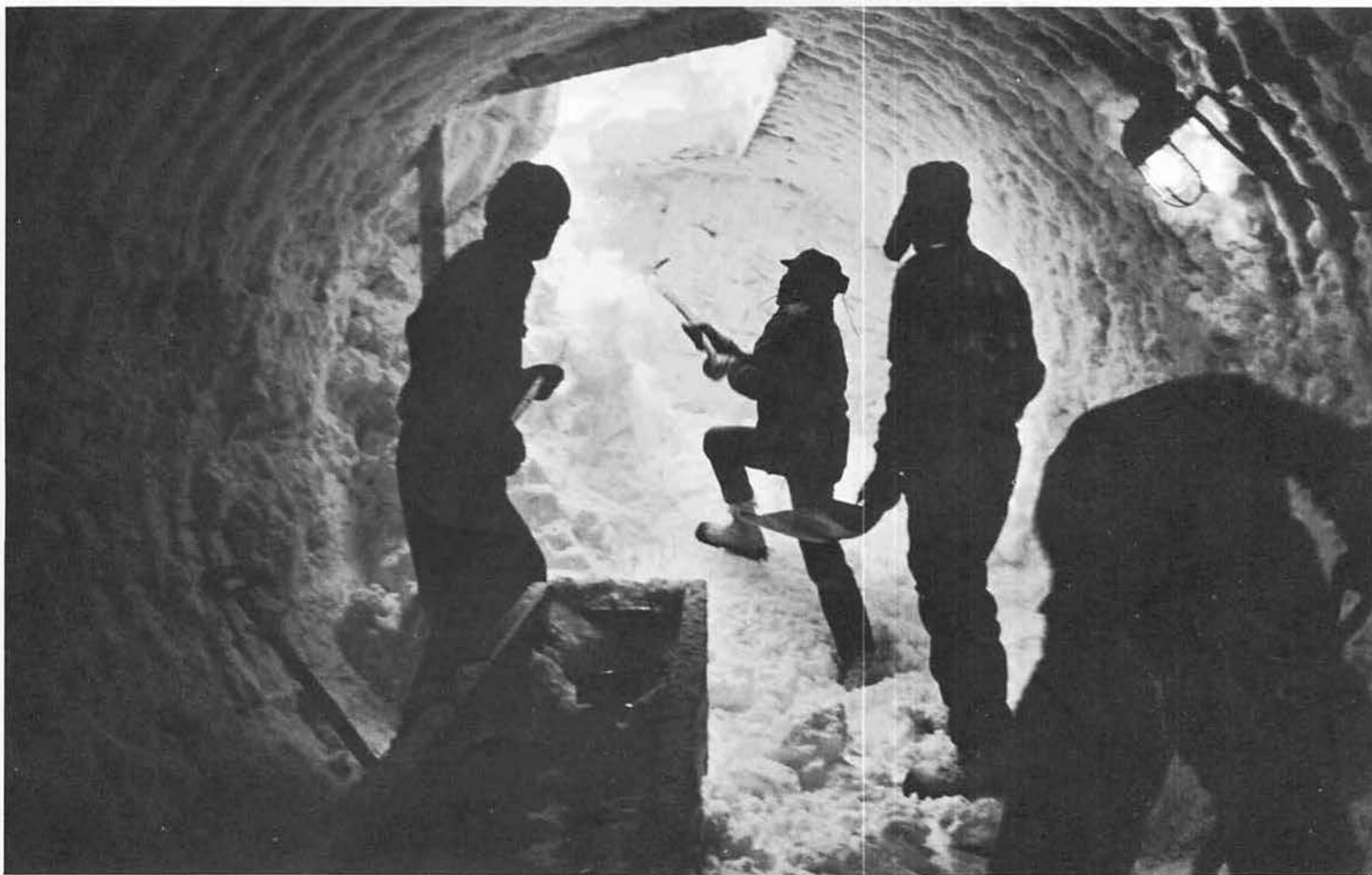
Madeira sits on a hummock of ice, gazing bleakly away from the slight wind. Atavistically, for she has not seen another dog since she was weaned, she adopts the pose of the husky at the end of Flaherty's film *Nanook of the North*.

The altitude makes the slow walk to the station exhausting. Four men are engaged in "outside Peggy," as Shackleton referred to chores. They are shoveling snow for the snow-melter, the method of getting water today as 50 years ago, and among them is a scientist who has spent the morning mapping the upper atmosphere.

Madeira trots ahead and plunges down steep, narrow, wooden steps covered with snow — the main entrance to the station at the South Pole. As soon as the sun is left behind, there is a dankness like the inside of a walk-in icebox. Through corridors lined with cases of canned food is an enormous room built of steel arches, containing three 25,000-gallon fuel bladders. Opposite is the mess hall, a rickety but well-insulated wooden building, self-contained, its door kept closed by heavy latches that drop into place on a steel shim.

The mess is like a small cafeteria, but it might as well be a European cafe. There are arguments on every subject and experts of every nationality. Discussion never stops, since even in the middle of the night (broad daylight) a couple of scientists may finish their observations and drop in for a cup of coffee. The

The snow mine at Byrd Station. A tractor outside pushes surface snow into this tunnel, and the conveyor belt in the foreground takes it to the snow-melter at the station. Every man at the station takes his turn at this work.





Above: Ramp for vehicles at the South Pole, showing the Wonder Arch that has made it possible to protect several stations far out on the ice from drifting snow.

At right: The storage tunnel at Byrd. Note ice crystals on the overhead.

small, brooding man with gray hair is Dr. Edgar Picciotto, who will lead the 1,000-mile overland traverse from the Pole of Inaccessibility to Plateau Station. Although he is Italian and represents Ohio State University, his base is the Free University of Brussels and he is talking to the Honorable Alfred van der Essen, Director of the Belgian Ministry of Foreign Affairs, who has just landed in the Herc.

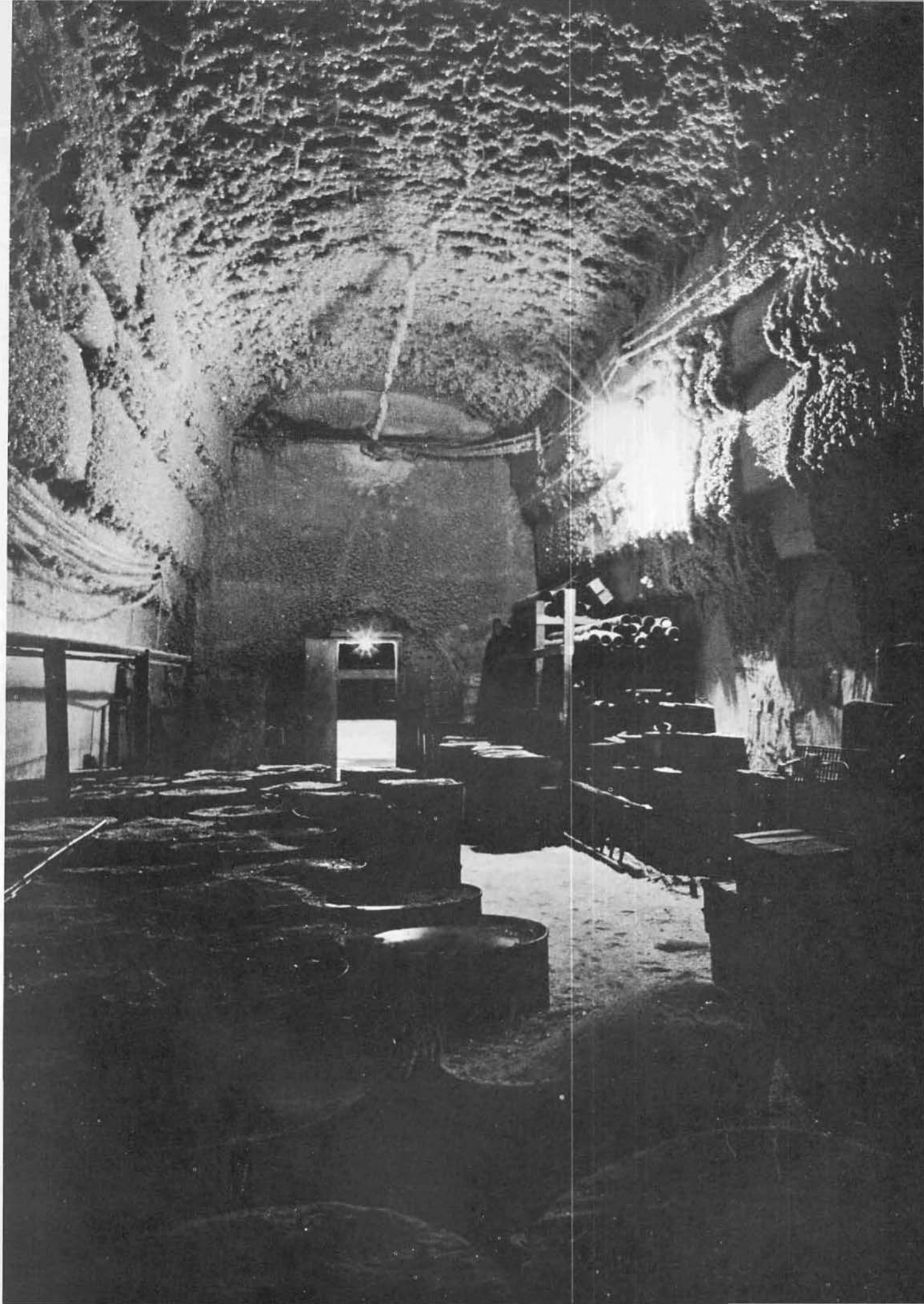
This is supposed to be the most isolated place on earth, but the most wretched Arab insists, "Where I stand is the center of the world." Sir Charles Wright says, "The upper atmosphere is a much livelier and more interesting place in the region of the poles." The magnetic lines of force extend straight outward here, and they act as funnels for charged particles from the sun. Also the pole is remote from large centers of man-made and natural radio disturbances, and it has the advantage of being stationary in space. There are now 45 people here, double the winter population. The number will drop as soon as the traverse party leaves, rising again when men arrive to get used to the altitude before going out to build the new Plateau Station.

A tall blond young man hands a large carton to Lcdr Brabec, the plane commander. Ronnie Stephen, meteorologist in charge at the Pole, is sending three Eppley pyrhelimeters back to McMurdo for calibration. They are on the order of 150-watt light bulbs but more delicate, and they measure the amount of radiation that comes directly from the sun. He notes any changes in what he calls "normal incidence," such as dust from the 1962 eruption of Mount Teal in the Philippines, which reached the Pole in about a year. When Krakatoa erupted in 1883, it threw off five cubic miles of volcanic ash, and Stephen says a mysterious cloud of "Agung dust" remains near the Equator.

Olav Orheim, a Norwegian glaciologist who is going on the traverse, sits across the table from a big man with a black beard. This is Major Jorge Raul Munoz of the Argentine Air Force, who piloted one of the tiny Beavers that flew here from the Argentine, against all sane advice. They landed first at their own General Belgrano base on the Filchner Ice Shelf and were supposed to return there after three days. The DC-3 that accompanied them — with an auxiliary jet engine installed in its tail — is now being repaired at McMurdo.

Munoz looks like a brigand. He speaks a little English and, with his flashing eyes and wicked smile, could be a character actor in the movies. Today is his anniversary, and he has telephoned a friend in Buenos Aires on the ham radio to send flowers to his wife, with a card he has previously signed: "Love, George." He got up at six o'clock this morning to call her. "She say, 'Where are you?' I say the South Pole. She say, 'How you send flowers?'"

On the left are several long tables and on the right is the galley, separated from the mess by a counter on which food is piled in what seems unnecessary quantity. Yet, at these temperatures, the body needs half again as many calories. The early explorers ate *hoosh*, a pemmican stew, although it is too rich and fatty to be eaten in a normal climate.





"Stew" is all the cook is ever called. Bobby Joe Davis talks like Texas and has the moustache of a riverboat gambler, but he is generous and witty. Some of the trusses in the overhead have buckled under the weight of the snow; he has removed certain panels in the ceiling and set empty food tins on the rafters to catch the drip. He keeps electric fans on the floor near the back door, to prevent the condensation from freezing. "Next year this place gonna catch hell," he says. The mess hall and the sick bay, the oldest buildings in the station, will be replaced. Since the air is pure, Dr. Bill Griffin, Officer in Charge of the station, has few patients. When someone wakes up with a sore throat, a scientist familiar with pyrhelimeters diagnoses it as Agung dust.

Stew instinctively heads off trouble by insulting the men before they can get around to complaining. Some of them are tense because they have not yet been relieved after a year on the ice, and some because "only 88 days till that last plane leaves." A worn-out Western is on the record player — its sad words the only reminder of life outside. When one of the men puts on something saccharine, Stew says to him, "I don't like to insult you, but your taste in music doesn't get to me, some way."

Saturday night at the Pole is time for a steam bath, and the men like to roll on the ice afterward. Terry Hardiman, who handled geomagnetism and seismology last winter for the U. S. Coast and Geodetic Survey, says the temperature set a record. For four days in July, it went to 113.4 degrees below zero. When they ran outside in the darkness, their bodies underwent a change of 253 degrees.

Sunday is the cook's day off, and everyone makes what he wants. Fresh eggs from New Zealand, magnificent bacon, homemade bread, steaks. . . . Over breakfast there is an easy dialogue going on between Dr. Picciotto and Ed Horton, a radioman who is waiting to go to Plateau around the middle of December.

It will take the SeaBees about three weeks to set up the buildings, but long before that the radio has to be operating. In the meantime, they will live in tents.

"It is much more comfortable in a tent than in the Sno-Cat," says Picciotto. "We use a Coleman stove, and I had my shirt off." He was on the same traverse last year; this is his sixth time in the Antarctic. In 1958 he wintered-over at Belgium's Roi Baudouin base, about where the four-year traverse will wind up in 1969, and made the first exploration of the interior. One group of his party got lost in the Belgica Mountains and was rescued by Russian DC-3s.

Warmth appeals to Horton, since he was born in Maine. He speaks nostalgically of Torremolinos where he spent two weeks while stationed in French Morocco, and he hopes to work his way back to Spain or Italy. Volunteers for Deep Freeze, whenever possible, are given preference in their next assignment. The shortest way to the Mediterranean may be by way of the South Pole.

Horton says the radio he will take to Plateau is a KWM-2A, basically the same as the one in the ham shack. "A few minutes ago, I was three-way with Byrd and Illinois. Byrd dropped out, but Illinois was loud and clear." Plateau makes everyone uneasy, simply because they don't know what they will find out there. Horton prefers action to uncertainty, and he concentrates on his

*At left, top: "Club 90" at the South Pole, named for the degree of latitude. Movies are shown here every night, and parties are held on Saturday or to celebrate a promotion. At one of these affairs, Madeira, the sled dog, grabbed the cook's hat and disappeared under a bench to chew on it. "Stew" refused to get angry: "I gotta keep in good with that dog - in case that plane don't come back."*

*Bottom: A resident at Pole reaches up to remove a panel in the galley so that he can empty a can placed there to catch the drip. This building leaks from the weight of the snow and is one of two scheduled to be replaced in Deep Freeze '67.*

*Below: "Stew," the cook. Bobby Joe Davis prepares an unlimited supply of good food for the men at the Pole, and his wisecracks keep them from feeling sorry for themselves. He belongs to Antarctic Support Activities, which does the "housekeeping" on the Continent. Aircraft have replaced the slow tractors that hauled supplies overland, but it takes a large ground force to maintain the planes, and ASA to maintain the ground force.*

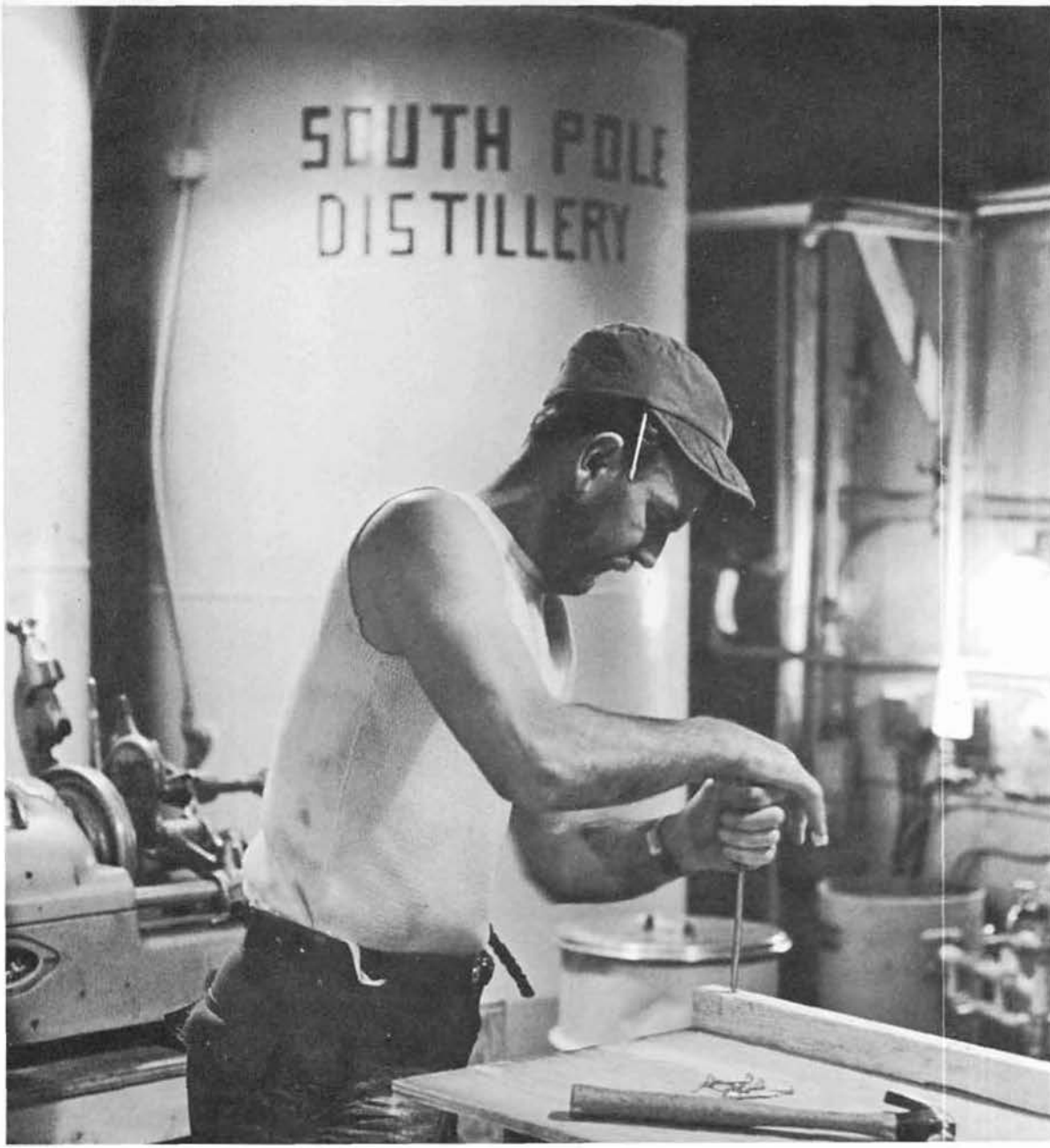


equipment, which is subject to his control. He believes the generator that powers the radio may give trouble in the thin air. "I'm going to have to get it up here and really adjust those carburetors."

"The biggest increase in altitude is between sea-level and the Pole," Picciotto points out to Horton. "There is only 10 percent between here and Plateau. So you just have to take it easy." They will meet at the same point on an endless sheet of ice. His experience is greater than Horton's, but the radio may save his life. This accounts for the intuitive respect between the USARPs and the Navy.

The "house mouse" for today, the man assigned to clean up, is Ambalada, a swarthy electrician's mate who is in charge of the generator room. At the moment he is washing dishes, but he spent a week recently in the nuclear power plant at McMurdo. Munoz comes in with the other two Argentine pilots. They put themselves out to be charming, since they feel they have stretched the Navy's hospitality — from three days to three weeks. Picciotto,

Bernie Pape in the carpenter's shop wintered-over at the Pole. It is so warm below the ice that he works in his undershirt. The tank stores the fresh water that comes from the snow-melter.



who is 45, compares his age with that of Munoz. "At 38, I was driving with dogs in the Belgica Mountains. . . ."

"I want to repeat the Amundsen-Scott journeys *with dogs*," says Munoz, his eyes glowing.

"In the future they will use Hovercraft," Picciotto answers gloomily.

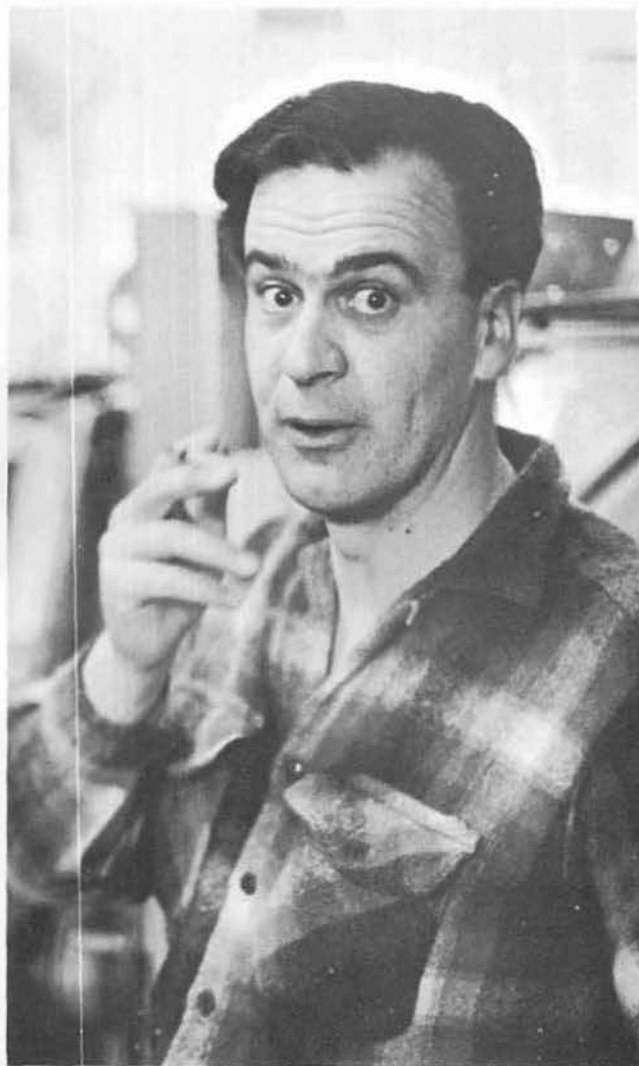
A hundred yards out on the ice is the cosmic ray hut, where Doug Thompson spent most of last winter counting things that are invisible. These are subatomic particles that come from somewhere in outer space and from the sun. They reach the Poles more easily because they can slide down the earth's lines of magnetic force instead of ramming through them. Their intensity, though, varies from minute to minute and from year to year, depending on the sun.

The International Geophysical Year, which was timed to take advantage of the sun's maximum activity, was the original reason for Operation Deep Freeze and produced an unprecedented exchange of data. With a new monitor that transmits information to high-speed computers, Thompson was able to detect infinitely more subtle variations in the neutrons, or low-energy cosmic rays, during the period of minimum solar activity (1964-5). Its name has a delightful Chinese sound: The International Year of the Quiet Sun.

This little hut is one of two high-altitude cosmic ray stations beyond 60 degrees; the other is at Vostok, the Russian base. Led by Madeira, Thompson walked back and forth every day during the six months of darkness to tend his instruments. He installed a hi-fi set, which brings him literally "the music of the spheres." At night he spends hours fiddling with the ham radio, gossiping on the most trivial subjects with people all over the globe. When a plane lands, he is invariably on hand to help with loading and unloading. The winter doesn't bother him. By the time he turns things over to Lars Andersson, he will have spent three years, altogether, in the Antarctic.

Teilhard de Chardin said that one cause of man's loneliness may be his awareness of the coldness and vastness of the universe, but Thompson is perfectly at home in the solar system. Far from being a mere technician, he sees an overall picture of the upper atmosphere as well as the stunning mosaic of related sciences. Instead of being made lonely by the cosmos, he is reassured by a series of cosmic coincidences. Byrd Station, for instance, is linked with the Great Whale River in Canada, since they are "conjugate points," or opposite ends of the same magnetic line of force.

In May, 1965, Carl Disch, an ionospheric physicist for the National Bureau of Standards, was visiting a fellow scientist at the radio-noise building, a mile and a half from Byrd. He headed back to the air station from the hut, exactly the size of Thompson's, and was never seen again. A search was made as far as the old Byrd station, six miles away, and around the 21-mile VLF antenna which lies on the ice, but the darkness and the cold and the wind made it futile.



Dr. Mike Gadsden of the National Bureau of Standards is one of two principal investigators on a grant from the National Science Foundation for the "Study of the Distribution of Sodium at High Latitudes, the Spectral Distribution of Polar Cap Aurora, and Auroral Luminosity Pulsations." The aurora is caused by particles from space that "slide" down the vertical and near-vertical lines of force around the geomagnetic pole, striking the upper atmosphere and causing it to glow (more or less like electrons striking a TV picture tube).





The main entrance at Byrd Station, for both men and vehicles. The monster on tracks is a Nodwell "Fire Boss," and the men riding in it are the two top Navy officers of the station: Lt Gordon W. Callender, Officer-in-Charge (left), and Lt Robert B. Hunt, the doctor.

"At Byrd the snow starts picking up at 20 knots, because there's so much of it," says Lt Norm Terrell in the weather central at McMurdo. "By the time you get to 30 knots visibility is almost invariably below minimum. For aircraft it's zero-zero, since blowing snow makes it even worse as you get closer to the ground."

Byrd, the largest inland station, ought to be a citadel, impervious to weather. It is entirely underground, but hand-lines are rigged outside for the men who have to reach the antennae, vents, or any of the four scientific towers. In "hand-line" weather, Brent Scudder, who will winter-over for the U. S. Weather Bureau, walks the 200 steps from his quarters to the galley — in shirtsleeves. "When the hurricane howls outside, you don't even know it," he says. "You can't hear it." The weather station picks it up, since all indicators inside are piped to instruments outside.

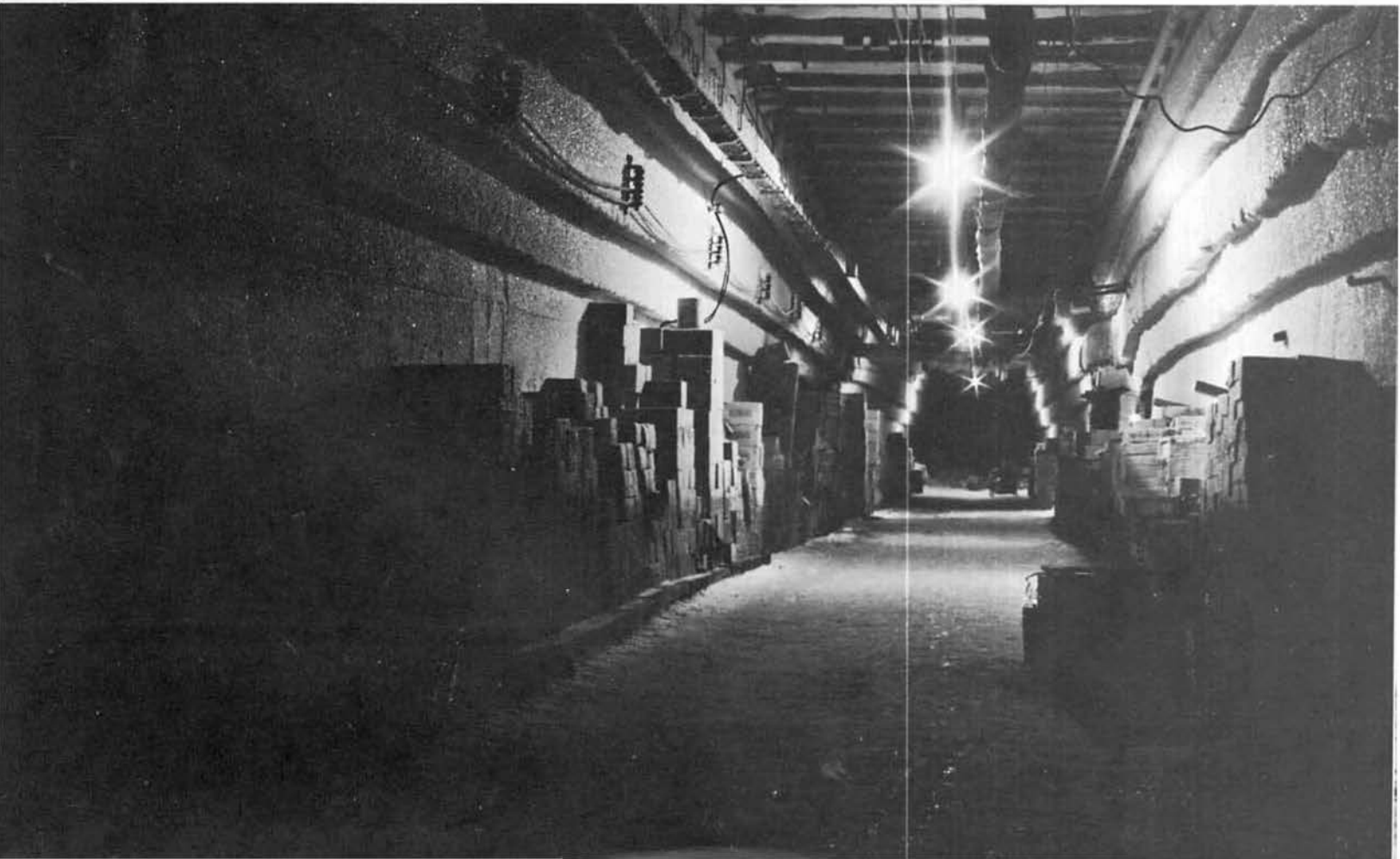
Scudder has charge of measuring ozone, a kind of super-oxygen whose movements can be used to trace air movements into the Antarctic from elsewhere. The ozone instruments are in the Aurora tower, so three times a day — in his shirtsleeves — he climbs a 62-foot ladder which is in a closed shaft. He has no fear of falling, as the shaft has shelves all the way up. When he gets tired, he just leans back.

"When there's a storm out there, you know it in the tower. It rocks with a steady motion. Certain measurements require a needle to stand still on a dial. Not only does the tower shake the needle but the generator voltage fluctuates as well, so the recorder makes a wavy line. At least it's never blown away. I've decided on a 50 mph rule, above which the ozone observations can go hang."



*Right:* Chino Cabrera, vehicle mechanic at Byrd.

*Bottom:* The main tunnel, with food stored along its sides. The men usually give the cook a hand by carrying a case with them when they go into the chow hall. The buildings are placed independently beneath the Wonder Arch, leaving enough space so that their heat won't melt the exterior walls.





The marvelous "Goony-Bird." For thirty years in civil aviation it has been called the DC-3, but the one shown here with skis is the Navy LC-47. Admiral George Dufek landed in a similar plane at the South Pole in 1956, the first man to set foot there since Scott left it in 1912. The "Goons" are used now for shorter flights, to place scientific parties in the field and to resupply them.

## Goony-Birds

The DC-3 has gone through as many changes as a moulting chick. In the early days of Deep Freeze it was called the R4D or "Dakota" or "Skytrain," and the survivors are the LC-117 and LC-47 or "Goony-Bird." The crews say this with affection, since they have to admire unpredictability. The LC-117 is a Super-Goon, configured with more power and other modifications. They used to fly to the Pole, but planes designed 30 years ago would have a hard time now, with their piston engines panting as they gain altitude. One of them was held for 17 days in Christchurch once, waiting for a fair wind.

In December a Goon was putting a field party in the Horlick Mountains, halfway between Byrd and the Pole, when it caught a ski in the *sastrugi* — violently contorted waves in the snow made by the wind. Fortunately, only two of the six scientists were aboard and, intentionally, they had enough supplies to be self-sufficient. Later, in the same area, a second Goon suffered strike damage; it was a total loss. For some reason, in these accidents, there are rarely any injuries.

When Cdr Jerry Driscoll was taking off on the second flight of the season, a propeller came off and sliced through the cockpit, missing him by inches. His mechanic was a tall, supple man with black hair and a two-day beard, named Dan Dompe. This curious name may be a contraction of Don Pedro. He was lucky to be sitting down, since ordinarily he is all over the plane, making adjustments with a pair of pump-pliers.

The Goon is a "do-it-yourself" airplane, and Dompe is constantly improvising, using everything but friction tape and baling wire. One moment he is aft, and the next he is squeezing past the radioman and the navigator, whose seats seem to have been added as an afterthought, to fix something between the two pilots.

The ice goes out, at Hallett Station, usually by the end of November. Since this is the only other runway for wheeled aircraft, the Air Force ends its supplementary flights from New Zealand as close to that date as possible. Once an aircraft passes PSR (the point of safe return), a little more than halfway from



Christchurch, it must land somewhere in the Antarctic. In the event of a white-out at McMurdo, a Herc on skis could land at Byrd or the Pole, but with wheels it could only circle until decreasing fuel forced it to land.

In a place where everything is upside-down, where the sun goes around counterclockwise, they call the region around Hallett, 400 miles to the north, the "Banana Belt." Compared to the rest of the Continent, it is rather like going to Miami Beach, and more than 100,000 tourists — Adelie penguins — spend the summer there. A visitor who chose to wait for the next flight, in November, might have to stay there until January when the icebreaker *Burton Island* comes with supplies. From day to day, no one knows exactly when the ice will go out.

Immediately after takeoff, Dompe goes to the after compartment where the generator is. He almost attacks the little door, thrusting himself into a space that was meant for a tiny stewardess. He turns off the generator, then goes to the windows, port and starboard, to see if the flames from the exhausts indicate the right mixture in the carburetors. On top of each engine, inboard, is an oil-cooler which is mounted there because, in its normal position, it would interfere with the skis. Just behind the cockpit, against the port bulkhead, is a two-burner electric stove and a large old-fashioned coffeepot.

"Turn the coffee on," says someone in the cockpit. Dompe fills the pot with water, throws in half a pound of coffee, and switches on the stove. Then he lies on the cold deck and fiddles with a valve on the after end of an auxiliary 200-gallon fuel tank in the cabin. Art Weber of the Navy's Bureau of Yards and Docks, and Major Jim Verlautz of the Admiral's staff are along to have an official look at the station. An aerial ice observer pulls out his charts and goes to the cockpit to have a better view of the frozen Sound. Whenever he sees a "lead" or open patch of water, or brash, or a change in color, he enters it on a list of symbols, with the time and position. The ice below is a mosaic far more subtle and far more exciting than an abstract painting. Ronnie Jankowski is very young but highly trained, and what he sees will affect future ship operations.



The biologists who study them have special terms for the characteristic movements the Adélies make during the mating season. Young birds give an "ecstatic display" by putting their heads straight up in the air. "It looks a bit like a New England church," says Dick Allison, of the University of California. When the adults are disturbed by humans, or when they bring a stone back to the nest, they rub their beaks together in a "mutual display." The "bow stare" is given by the female when she comes to a young bird to steal rocks. She pretends to flirt with him, but has left her mate on the nest and is really there only to get rocks and get out. The young bird, in any case, is not ready to mate. He cranes his neck in a sort of arch, and looks sideways at her. "It's comical," says Allison. "He's trying to see what she's doing."

Breeding places along the coast are scarce, so the Adélies concentrate in great numbers on the few stretches of bare ground, competing gently for the pebbles they need for their nests. At Hallett, for instance, there are anywhere from 100,000 to half a million in a single rookery.

Near Cape Royds, where Shackleton built a hut in 1908, the fast ice ends. An icebreaker appears below, surely too small to be *Glacier*, although she began breaking channel yesterday and is supposed to be joined today by *Burton Island*. Everything is dwarfed by Mount Erebus, which is abeam. The breaker seems to be standing still, but as the plane passes over she is backing down, and it can be seen that she has made another tiny cut towards McMurdo. It will take her almost three weeks to get there.

At noon the plane is flying blind, through a milky condition that is probably caused by glare and by the absence of recognizable objects. Tom Dunn, the radioman, says Hallett is still clear. Dompe keeps unscrewing the cap on the gas tank and peering inside with a flashlight. Somewhere off to port is Inexpressible Island, a name redolent of emotion, like many places in the Antarctic: Cape Longing, Cape Disappointment, *Pourquoi Pas* Island, Stygian Cove, Doubtful Point, Mislaid Rock, and Shambles Camp, the latter being the "slaughterhouse" where Scott had to shoot some ponies.

Near here, in 1909, Professor T. E. David's little party (with the Shackleton Expedition) was spotted on the beach with the greatest difficulty and picked up by the ship at the last possible moment. He had found the Magnetic Pole on the other side of the Prince Albert Mountains, although as Walter Sullivan writes, "It was already known, by then, that the Magnetic Pole was an ephemeral point which wandered from hour to hour as well as from century to century." By 1962 it had reached the coast of Adélie Land, near the French Dumont d'Urville station, sometimes called the windiest place in the world.

At the moment the outside temperature is 28 degrees Fahrenheit. "Just like summer," says Dompe. As the plane approaches Cape Hallett, the sun lights the land brilliantly and the shadows pick out the folds and crevasses. Rounding the headland opens a bay that is the equal of Italy and Switzerland combined, one of the most beautiful places on earth. It is a harbor in the true sense, after the open areas of the south, and the surrounding mountains seem to have been arranged aesthetically. The highest of these, about 12,000 feet, appears to be made of gesso, with bluish stretches of sheer ice, and near the bottom a patch of brown rock.

Icebergs of delightful shapes are trapped in the bay from the previous season. The ice is strewn with miniature bergs and hummocks, which may prevent the plane from landing. Yet, after Cdr Driscoll has brought the plane in gently, in spite of a strong crosswind, it can be seen that the area is enormous. The mountains merely alter the scale. Dompe jumps out and semaphores the plane to the Strip.

This consists of a single hut. The wind is vicious, and the passengers are picked up in a Weasel with "curtains" of plywood on one side by Chief Bob Partlow who is in charge of the station. As it bobs along, zigzagging to avoid bad spots, he points out a "working" crack. On the crest of a little hill, the Weasel surprises a solitary penguin that runs along for a time in front of the vehicle, then suddenly gives up and takes to the ice, tobogganing on

its belly. "These queer people," as they were called by an early explorer, look as if they belong in a painting by Hieronymus Bosch. Today the wind is blowing directly from the rookery into the station, with a fearful stench.

The chow hall is warm and snug, and the huge bearded cook, Charlie Bowin, points to slabs of meat left over from lunch. He is steaming knockwurst in a cauldron of beer, for supper. The men who drift in to pick up their mail are not particularly excited by visitors; they are absorbed in their own routine. Fred Kinsky, once a European nobleman, is now a New Zealand ornithologist. John Cranfield, a New Zealand biologist, spent 24 hours on the side of the steep, bare mountain that rises directly behind the station, to have a better look at the penguins, although he had been warned of avalanches. Later he pitched a tent in the middle of the rookery, right in the guano, painting the penguins different colors to trace their movements. A colleague is studying juvenile delinquency among penguins at Cape Crozier; in the grant it is called "Parent-Chick Relationships."

Roy Mangold, a Navy surveyor, with an Adelle penguin at Cape Royds. The penguin is an ideal bird for scientific investigation because it cannot fly. What it lacks in the way of self-defense, it makes up for with charm. These clowns of the Antarctic have fascinated everyone since the early explorers.

Edward A. Wilson, who perished with Scott while they were returning from the Pole, wrote in his diary in 1910: "They have lost none of their attractiveness, and are most comical and interesting; as curious as ever, they will always come up at a trot when we sing to them, and you may often see a group of explorers on the poop singing 'For she's got bells on her fingers and rings on her toes, elephants to ride upon wherever she goes,' and so on at the top of their voices to an admiring group of Adelle penguins. Meares is the greatest attraction; he has a full voice which is musical but always very flat. He declares that 'God Save the King,' will always send them to the water, and certainly it is often successful."



Lt Hal Morris, of VX-6, pilot of the LC-47 that crashed on the Ross Ice Shelf in poor visibility and with some evidence of icing. All six men aboard lost their lives. An accident such as this one calls attention to the precariousness of life in the Antarctic, and to the personal courage of the men who go out on these flights day after day.



Chief Partlow, who has been taking ice-corings, examines them in the Sick Bay to decide how much longer the runway will last. "We'll have to close it by the 28th," he guesses. "The crack is between the station and the Strip. You can still land your aircraft, but we wouldn't have any way of getting back and forth. We're taking the Wannigan off the Strip two days from now." He says both the machines for making fresh water broke down, and there was no water in the Sick Bay. They needed it all for the galley and the head. But a small glacier on the hillside is beginning to trickle, which will produce plenty of water.

The wind on the Strip is so strong that it tears some papers out of Major Verlautz's hands. They are notes he made on the operation of the station, and they go flapping off to leeward. When the plane is ready to take off, Dompe suddenly throws open the door and jumps to the ice. He has the pump, pliers in his hand, and disappears under the port wing. Cdr Driscoll tries to taxi, but something, perhaps a wheel or a ski, is stuck.

Dompe crouches under the wing, repeatedly, with bare hands in the 25-knot wind, and then steps back to watch the pilot try once more. As it gets colder, the passengers contemplate staying overnight at the station, but the only repair facilities are in the head of the big, expressionless man out on the ice. After a long time, the plane moves. When Dompe comes aboard, he says the brake was frozen. Cdr Driscoll taxis to the north end of the runway and takes off into the throat of the mountains before banking, at the last second, and flying out of the bay.

John Cranfield, after his smelly labors among the penguins, is enjoying a large cigar. Dompe stretches out like a cat on a few seats and reads a paperback, resting on one elbow. He is limp as an animal, oblivious to the bad light. The copilot, Lt Hal Morris, comes aft and says he and Lt Bill Fordell, another Goon pilot, are scheduled to winter-over.

"A few VX-6 people are kept over, to be on hand for early spring operations. We reactivate Hallett early; it's important for weather reporting. The Goons spend the winter on the ice. They take the control surfaces off and tie them down. It takes about a week to make them fly." Someone wonders about blowing snow. Morris smiles sympathetically. "Those poor Goons."

"After three years," says Dompe, "these things aren't safe to fly back for overhaul, so they take 'em apart and send 'em by ship. Next season they fly 'em down from the West Coast to Pearl to Canton to Fiji to New Zealand. "853" was two months flying down from the States. She was one of the original Goons in Deep Freeze One (1955) and she's still here."

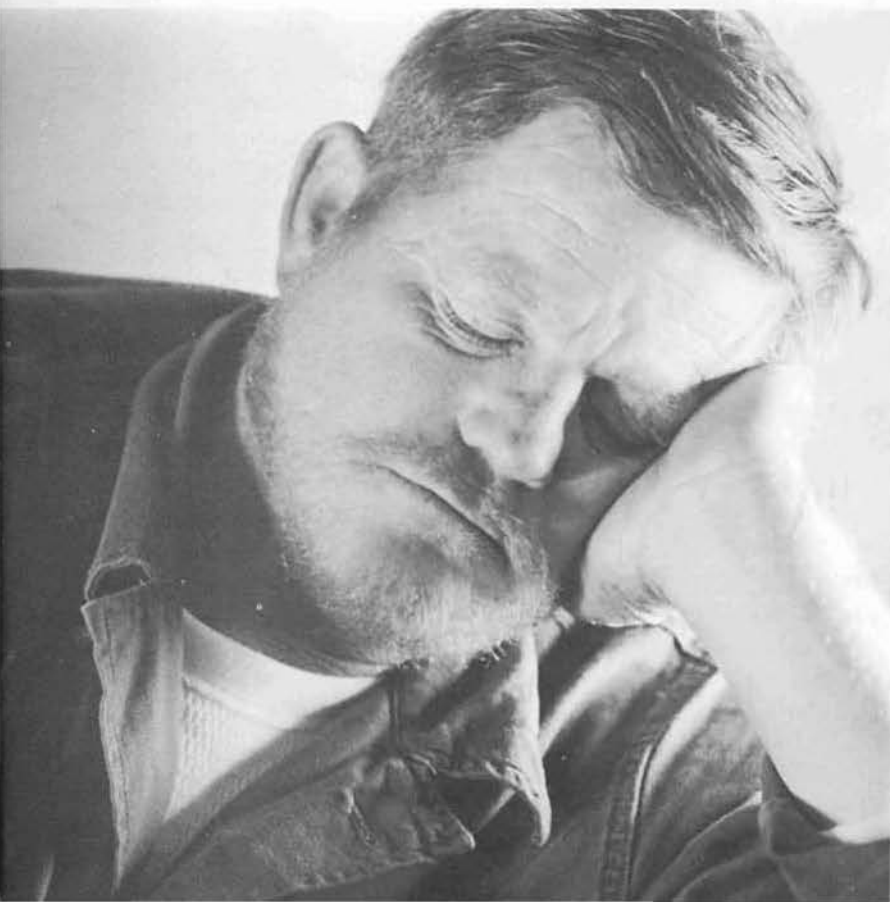
A few days later, Lt Morris is taking off for the Beardmore Glacier as copilot of "832," when they discover a bad magneto. As they taxi back to the gas pits, someone says a team of mechanics will spot the trouble. After chow, the New Zealand field party walks out to the plane where "Red" Auxford is working on the engine. It is wide open to the wind, and one of the New Zealanders is sympathetic: "They said a team of mechanics from the Strip would fix it." Auxford, a huge man with a husky voice,



U. S. Navy

Above: Hallett Station.

Left: "Red" Auxford, mechanic and plane captain of a Goon that flew out to resupply a party of scientists on the Ross Ice Shelf. He is responsible for any mechanical problems, in flight or on the ground. Work that would be routine at home is complicated in the Antarctic by the absence of hangars and, above all, by the cold.







Putting JATO bottles in place.

a green jacket, and a red "belly-clapper" on his head, points to his radioman, Dick Simmons, and says, "That's the team — him and me."

At the end of the day, Auxford walks into the Strip Coordinator's Office, muttering, "Sick, sick Goon." He has found a leak in the gas line. The next day he discovers a bad piston, which he plans to replace with one cannibalized from the "stricken" LC-47 that nearly got Cdr Driscoll. A blizzard intervenes. Then another piston is found to be defective. A second blizzard. Finally, the New Zealanders are dropped off by a Herc on its way back from the Pole, in an admirably-planned maneuver by the VX-6 logistics specialists. And so 832 is reprieved.

If the Goon were dangerous the crews would not speak of it sentimentally, nor would they be expected to fly it. Unlike the Herc, it was not made for this austere continent. The three accidents so far have not been due to mechanical failure but to unusual ice surfaces beyond the control of the most skillful and courageous pilots in the world. When they can afford it, the Navy will come up with a new type of aircraft to serve field parties, such as a longer-range version of the turbine-powered UH-1B helicopter now being used by the Army in the Pensacola Mountains.

On Sunday, Hal Morris is wandering in the ship's store and gazing thoughtfully at some jewelry for his wife. He asks "J.B." Cunningham the price of something and turns to a friend who is looking at the magnificent snow outside. They discuss the minimum visibility in which you could get a plane down and walk away from it. "Five hundred feet," says Morris. "That would be the *living* factor."

On February 2, Morris files as plane commander of 832. His copilot is Lt Bill Fordell and the navigator is Lcdr Ron Rosenthal. He carries two mechanics, ADJ3 Charles Kelley and Wayne Shattuck, with Kelley serving as plane captain. His radioman is Dick Simmons. They take off to pick up a group of topographic engineers from the U. S. Geological Survey, who have been measuring the movement of the Ross Ice Shelf near Roosevelt Island.

On February 3, at 0942 hours, zulu time, the teletype begins: THE ACCIDENT OCCURRED DURING OPEN FIELD LANDING IN PARTIAL WHITE-OUT CONDITIONS WITH RESULTING POOR SNOW SURFACE DEFINITION. THE AIRCRAFT WAS OBSERVED, BY PERSONNEL IN AN LC-117 WHICH HAD PREVIOUSLY LANDED, TO ENTER A STALL AND THEN MAKE CONTACT WITH THE SNOW IN A NEARLY VERTICAL, NOSE DOWN POSITION. THE AIRCRAFT EXCEPT FOR THE TAIL SECTION WAS TOTALLY DESTROYED BY FIRE AND EXPLODING JATO BOTTLES. THERE WERE NO SIGNS OF LIFE OBSERVED BY PERSONNEL WHO REACHED THE SCENE ALMOST IMMEDIATELY. FIRE CHARRED JATO BOTTLES CONTINUED TO EXPLODE FOR SEVERAL HOURS AFTER THE ACCIDENT DELAYING IMMEDIATE INVESTIGATION.

Auxford with the leader (right) of a party of glaciologists from Grand Valley State College in Michigan. They re-surveyed a line of stakes that was laid out in 1963 near the northern edge of the Ross Ice Shelf, from Ross Island to Roosevelt Island, about 350 miles away. A tellurometer, a radio distance-measuring device, was used for the survey. The resultant data, compared to the earlier survey, showed the speed and direction of movement of the ice shelf. The party also measured snow densities and accumulation. Inside the plane is ADJ2 Bruce Benson. Note rack for JATO bottles, just forward of the door.

This party had been out on the ice for almost two months and was glad to receive mail. They told the plane's crew that they didn't have enough water for washing. One of their four motor toboggans broke down in November, when they were 125 miles out of McMurdo, and had to be abandoned. For a week they were unreported, since their radio failed, but they were found safe by a SAR Herc that was on its way to refuel the Brockton summer weather station. Coming back, it spotted them and gave their position to Air Operations at McMurdo. During this period they were pinned down by a blizzard for several days, with winds as high as 65 knots.



## Breaking Ice

*Glacier* sends a "horse" ashore to pick up Cdr Jim Newman, the ship operations officer at McMurdo. The helicopter takes its name from the letters HO4S, as it used to be called, and when Lt Bill Lucas sets it down on the helo pad the large window in the port side of the cockpit is missing. It blew out as they were coming from the ship; they dropped a smoke flare to mark its position and landed on the ice to pick it up. "We only have one spare on the ship," says Lucas.

There is a raw wind in a blue sky. The horse hovers, slides off across the VX-6 warehouses, and sets a course for *Glacier*, which is out of sight to the north. In a few minutes, Lucas spots some seals and begins banking and circling while a grizzled Navy photographer in his fifties named Gallagher shoots them through the half-open door with a heavily-shielded camera. Lucas lands on the ice, and the man in the cabin opens the door wide. Gallagher sits clumsily on the sill and gets his pictures, as one seal flings its tail in the air and another slithers across the ice. He is so congealed by the cold that he has to be helped back to his seat. In less than a minute, the helicopter is off, with *Erebus* smoking to starboard.

The horse is exhilarating, since it can stop indefinitely to look at something, and then dart off in any direction. *Glacier* appears lifeless, as the plane captain puts a heavy strap on Gallagher, which is hooked into the opposite side of the cabin so that he won't fall through the open door. He shoots at a dizzying angle of bank, while *Glacier* backs down and waits for the chopper to land.

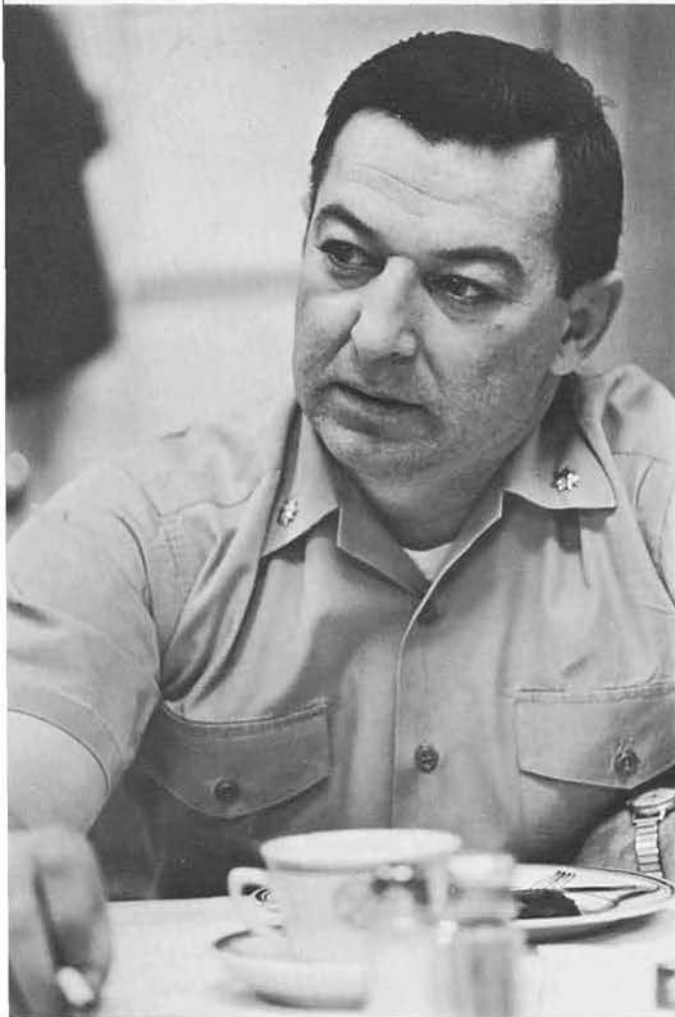
On the flight deck, Joe Strano, another pilot, reports that one of *Burton Island's* helicopters blew out a window this morning, in the same manner. The ship lives and breathes, with 280 officers and men going about their duties. Their combined skills are necessary so that she can go on making these same motions endlessly. She is the key that unlocks one of the doors of the Antarctic. Cdr Newman is quite at home, since he was the executive officer on the icebreaker *Staten Island* last year. He is greeted by the skipper, Cdr Frank Faughman, and taken up to lunch.

After the bitter cold, the captain's quarters are warm and luxurious. There are rugs and armchairs, and a steward brings plates of hot soup to a table set with silver on a white cloth. A book was written about a steward's mate named Amos Brown, who figured he ran the ship. "I give the captain a good breakfast, and when the captain's happy the ship's happy." These amenities are almost essential, since *Glacier* is sometimes at sea for seven months.

She is the only icebreaker never to miss a season in Deep Freeze and was the first one to penetrate McMurdo Sound where she helped establish the present station. She is a great pulsing brain that monitors almost everything in the Antarctic; besides being available for rescue and weather reporting, she can accommodate a scientific program or the commander of a task group.

Cdr Frank P. Faughman, skipper of the icebreaker *Glacier*. Toward the end of the season, the *Glacier* damaged her rudder and on February 20, 1966, left Antarctica for Wellington, New Zealand. In June she was transferred to the U. S. Coast Guard. She is expected to continue her annual Deep Freeze support.

Right: *Glacier* breaking ice.





Cdr Faughman was sent to M.I.T. by the Navy after World War II to study electrical engineering and is expert in command and control systems. In spite of the demanding nature of his technical duties, he is extremely well read, and he has the philosophical turn of mind that in Conrad's stories used to belong to the Chief Engineer. On the bulkhead, over the table, is a framed icepick.

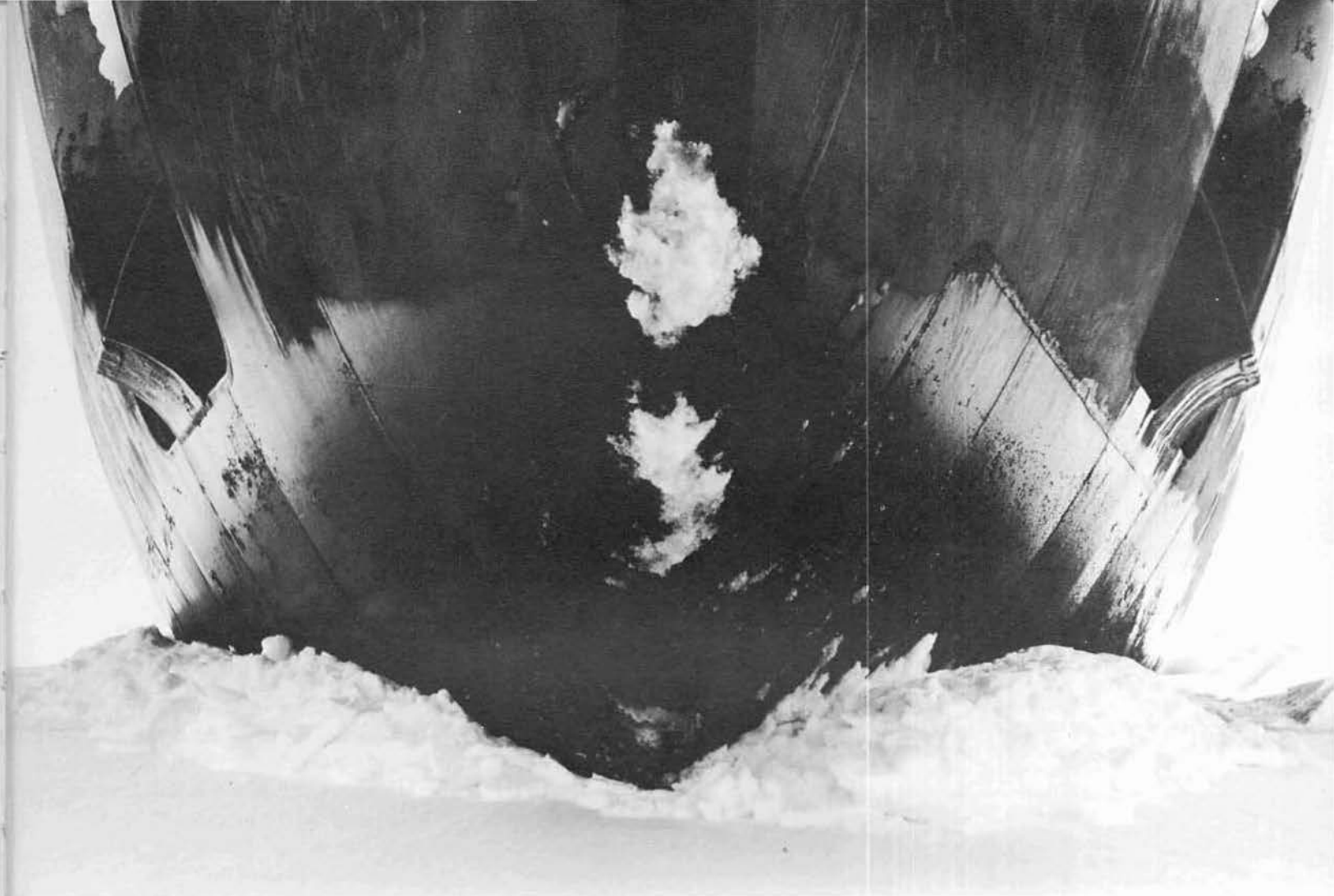
Lcdr Irving Voyer, *Glacier's* executive officer, comes in, wearing suntans and "street" shoes. Except for the four pilots and the eight men who maintain the horses, the ship is too warm for the heavy clothes worn on shore. He leads the way up the mast, which these days is climbed *inside*, on 50 or so icy iron rungs. If he has had an extra piece of celery at lunch, he can't make it. At the top is "Loft-Conn," a sunny, enclosed space where two officers are breaking ice. One handles the throttles and the other the helm, which is a small brass tube the size of an inverted dice cup.

It is hard to imagine the fishermen's monument at Gloucester — with a man at the "tube" of a schooner. By turning this cursed thing, Mike McDonald controls upward of 8,500 tons, a 310-ft. vessel with hundreds of men in it, and the second largest Diesel electric propulsion plant afloat, crushing 26 miles of six-foot ice — which would take a long time with an icepick. The tube flips some switches that transmit hydraulic power to a couple of "rams" that push the rudder. Lt McDonald has to keep the rudder precisely amidships when backing down, or it will be caught in the loose ice and jammed over, breaking a "pin" or preventer.

Even here, where the whipping effect of the mast would be noticed most, they are not knocked down when *Glacier* hits the ice. The vibration increases as she reaches full power, but ramming doesn't disturb the glasses on the table in the wardroom. Below the waterline, the bow slants aft at such an angle that the ship rides up on the ice and crushes it with her weight. Art Morison cuts the throttles just before she loses way, to avoid being hung-up and having to "sally" the ship. In the old days, this was done by men rushing back and forth across the deck, but *Glacier* can be rolled ten degrees by pumping 140,000 gallons of water from side to side. "We got hung-up seven times," says the XO. "The same as last year." But that was an unusually light ice-year, with only 17 miles to break.

*Burton Island, shoving the brash or loose ice in the channel. The huge iceberg that blocked the entrance to the channel can be seen here. Even after ten days of being worn away by the wind and the sun, it was still estimated to cover an area of nine square miles.*





*Glacier's* bow, breaking ice. The plating on a normal ship is an inch and a half thick; *Glacier*, in addition, has a two and three-eighths inch sheathing of high tensile steel that runs from three feet above her waterline to twelve feet below it. Each of her two propellers weighs over thirty tons. Snow on the sea ice muffles it and makes it that much harder to break through. An ice-breaker is rarely seen from this angle. Despite its enormous bulk, it is insignificant when seen in the Antarctic, between Mount Erebus and the Royal Society Range.

Here, the photographer was in danger of having the ice splinter ahead of the ship and deliver him to the killer whales. Another photographer set up a pair of "Panavision" motion picture cameras about four miles ahead. He said he was waiting for the ship to reach him. The men pointed out that, since *Glacier* advances no more than two miles a day, he might be there all night.

On a window near the ladder, each four-hour watch uses a grease pencil to boast of its progress and to disparage the distance gained by competing watches. It takes the tension out of a painstaking job; the score is being analyzed more profoundly than a ball game by the people on shore. The first supply ship has on board a number of vans that are urgently needed to set up Plateau Station, and fuel everywhere is running low. According to Cdr Mel Scott of ASA, "We're measuring fuel at McMurdo with an eyedropper." The timing of everything down the line may rest on *Glacier's* arrival one day early, so the season can be completed, and the aircraft fly out one day before a blizzard.

Lt McDonald makes a cut to starboard, another 40 degrees to port, and one in the center; about 40 cuts per watch. It is hard to achieve what he intends, since he can't tell how the ice is going to split, and the bow may be forced one way or the other. Lcdr Voyer says, "Near Beaufort Island it was so bad we had to go around, between there and Cape Bird. You can't force your way . . . Nature decides your channel." *Glacier* is making about a mile and a half every 24 hours, and the channel is being widened by *Burton Island*, astern, so the loose ice can escape.

Loft-Conn is a peaceful place, with a stunning view of Erebus and Cape Royds abeam, where Shackleton wintered before his try for the Pole. The early ships frequently were frozen in for a year at a time, but *Glacier* creates her own harbor. She will roll fearfully, however, in the open sea all the way home to Boston. It is fascinating to watch the infinite variety of the splintering ice. The bottoms of the fragments are brownish from microscopic plant life, since the Antarctic Ocean is richer in food than any other body of water in the world. "We saw some Adelies and Emperors at the edge of the ice," says Voyer, "and killer whales waiting for them."

Yet the most important part of *Glacier* is her engines, because they turn the two 17-foot propellers. An American Indian named Doran is in charge of the engine room, which actually is a series of compartments reached by ladders as slippery as a fire escape. "I can run down here quicker than a voice can get here from the bridge," he says proudly and half seriously. He puts his hand on

*Below:* The real villain of Antarctic waters is the killer whale. Its length is about thirty feet. It will come up under an ice floe and fling it in the air, in order to make a meal out of a bunch of penguins, a dog, a seal — or a man. This could have been the last photograph that Warren Krupsaw ever took.

*Top right:* A group of men is silhouetted against the sky. They are boarding the ship after a party on the ice. McMurdo Station is in the background, at the foot of Observation Hill.

*Bottom:* Men playing touch football on the ice. *Glacier* continues to break ice, around the clock. Because the work they do is so perilous, the men in Deep Freeze are given frequent opportunities to relax. Yet the tempo quickens as the date approaches when the summer support forces must leave, since everybody is trying to complete a job. "Near the end of the season, if you get in some guy's way — watch out."







one of the ten Diesel generators that supply power to two 10,500 horsepower electric motors driving the shafts. "This one is sand-bagging," he says, meaning it's resting. The evaporators can distill 16,000 gallons of fresh water a day, and last year they supplied McMurdo with water for ten days, when the last snow had been scraped off the brown hillsides.

There is no resemblance between this scene and the old time cursing and coal-heaving. Several "snipes," as the enginemen are called, stand attentively in front of a bank of relays that control the governors which prevent the rams from oversteering. Others follow each change in revolutions as the ship charges the ice, idles, and backs down. They seem dignified, because of their absorption, and because they are astute enough to see how their own machinery affects the functioning of the whole ship.

Suddenly a man comes up to Ens Doran and tells him that one of the pins has let go in the steering mechanism. A snipe in the control room says it was the same watch that let it happen before, but later they find out that a remote telltale in Loft-Conn didn't show the rudder's position accurately. The ship must stop breaking ice while the pin is replaced.

The Exec sits at the head of the long table in the wardroom, which offers excellent food served by a pair of stewards. The drink is sometimes iced tea, and sometimes an ersatz liquid that appears each day in a new color. Lcdr Voyer, a Naval Academy graduate with submarine experience, is basically a merry man, considering that he has an entire ship on his mind. Yet he thinks nothing of stopping someone in a passageway, reminding him of a hairline breach of discipline, answering a technical question, and heading off a morale problem — at one stroke. An AG2 waits at the XO's elbow until he has finished a joke, then hands him the evening weather report. "Ballard takes pride in working up the weather like a professional," Voyer confides later. "He is becoming a bit of an analyst himself."

At breakfast the XO receives a message: ATKA AT 52°. This odd little fact means something to someone everywhere on the ice. The third breaker has remained behind to escort the tanker *Alatna* through the pack, but even though she has scarcely left New Zealand there begins a sensitive listening-process which, much later, picks up the routine remark that she is having trouble with one of her main propulsion generators.

*Eastwind*, under the Coast Guard, takes a wintering-over party in January to Palmer Station on Anvers Island, near the tip of the Antarctic Peninsula, and while she is there she serves as another weather-reporting station. She may be called to free one of the thin-skinned cargo ships or pick a few men off an untenable place on the coast.

The big difference between Deep Freeze and the early Antarctic expeditions is that the smallest party in the most remote part of the Continent is in radio contact with someone. VX-6 once flew a Herc from Rhode Island to Byrd, in April, after the station had been buttoned-up for the winter, to bring out a Russian exchange scientist who became ill. The isolation experienced by Cherry-Garrard, only 50 miles from McMurdo, is a thing of the past.

This photograph shows the beauty of brash, a mosaic that is first noticed when approaching the Antarctic in an aircraft, over pack ice. *Atka*, *Burton Island*, and *Glacier* are near the entrance to the channel, which is blocked by the giant berg at right. The open water here is in the vicinity of Cape Royds. The nearest ship is not breaking ice, but moored so that work can be done on the hull. A shore party is barely visible.



The icebreaker *Eastwind* is a formidable ship, but she is dwarfed by one of the numerous smaller ice shelves along the western side of the Antarctic Peninsula. The helicopter about to land on her flight deck is the HH-52A, the first turbine-powered model to be used by any icebreaker in Deep Freeze. Conventional choppers would have taken much longer in the re-supply of Palmer Station, on Anvers Island, which was *Eastwind's* principal mission this season. The ship also served as a floating laboratory for a party of biologists studying arthropods and fungi, and trapping airborne insects.

At right, top: is a glimpse of the self-contained world of the nuclear reactor at McMurdo. These men took a year's training course at Fort Belvoir, Virginia, and then spent from one to two years learning operations and maintenance in an operational, pressurized-water plant. Outside this thin shed is the starkest environment in the world, where man has lived regularly for only ten years.

Bottom: some of the water distillation equipment. These mechanical details are part of a chain that makes possible the scientific work far out on the ice.

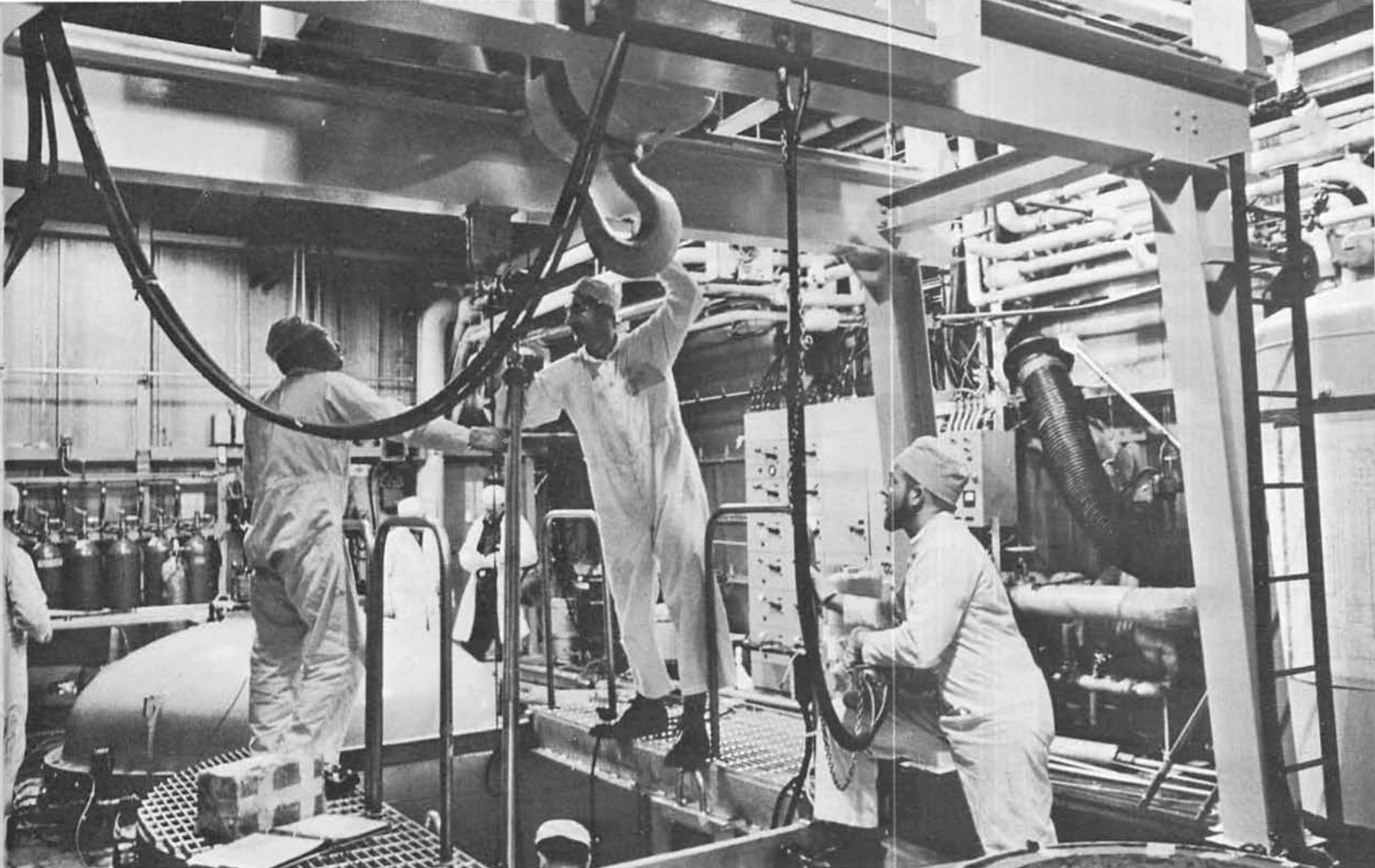
*Eastwind* made a unique contribution to Deep Freeze this season. On January 4 she arrived at Palmer Station, the only U. S. station to be supplied entirely by sea. After taking the previous wintering-over party to Punta Arenas, Chile, where she picked up some scientists, she met the freighter *Wyandot* at sea and escorted her to Anvers Island. *Wyandot* was to resupply Palmer for the winter, but the ice was so thick that she had to lie about a mile offshore.

*Eastwind* carried two turbine-powered helicopters — the first time they had been used in the Antarctic by an icebreaker. They are much larger than the choppers that usually search out "leads" or open water in the pack ice, and in two days they carried *Wyandot's* cargo ashore. One of *Eastwind's* officers said, "It would have taken ordinary helos a week." This saved so much time that they were able to go around into the Weddell Sea on an oceanographic cruise, and to allow the fourteen scientists aboard more time for their observations. In the Weddell Sea they encountered heavier ice, trapped there by the long arm of the peninsula.

The new turbine-powered helicopters are good for garbage, too. When the scientists asked that the ship's garbage not be dumped overboard, lest it affect the delicate balance of life in the waters where they were taking measurements, the choppers obligingly carried it far out to sea.

U. S. Coast Guard



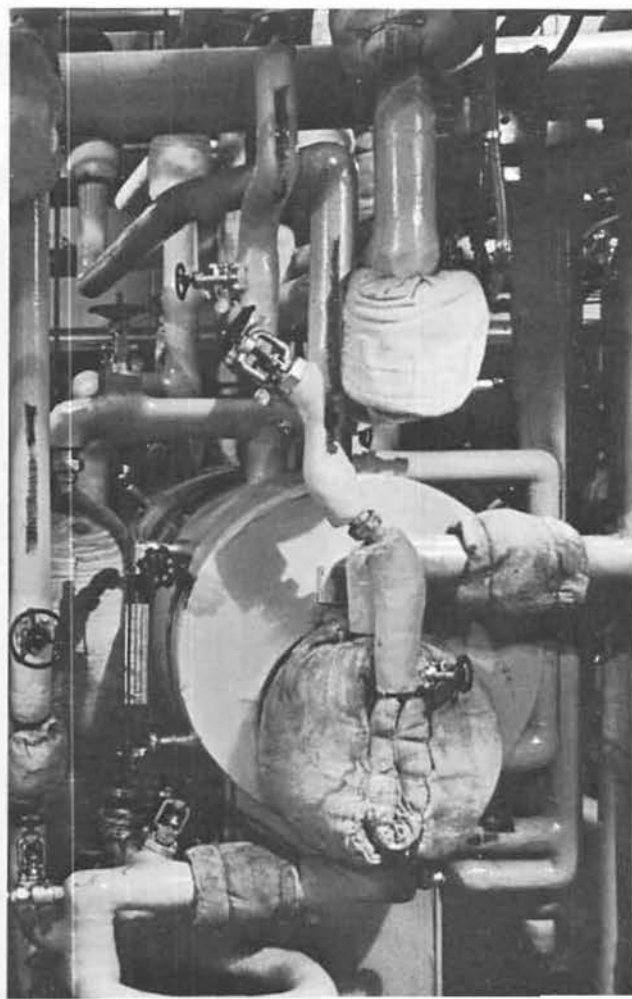


## *Summer Support Wraps Up*

Occasionally someone asks whether "the tail is wagging the dog" — whether the support force will overwhelm the scientific program. On the contrary, according to a senior officer who inspected the nuclear power plant at McMurdo, "the tendency is to cut down." The nuclear plant itself is an attempt to reduce the consumption of oil, which is the biggest single item that must be transported to Antarctica. When the plant is operating, it saves about 1,500 gallons a day.

Since it went critical in March, 1962, the reactor has not been in operation as steadily as was originally expected. This is because of the unusual safety precautions that have to be taken so far from home. "Containment is the big thing," says Lt Tom Boennighausen, Officer in Charge of the plant. "We're super-safe — we can't get our rods off the bottom." The Antarctic Treaty, furthermore, prohibits the disposal of radioactive wastes of any kind on the Continent.

One of the main benefits of nuclear power at McMurdo is the production of steam for the salt water distillation plant that went into part-time operation at the end of this season. It takes about ten gallons of sea water to make a gallon of fresh water, but this is far better than relying on snow, which begins to disappear from the hillsides in December.





“Nukie-Pu,” as it is called from its Navy letters NNPU, is the only place on the ice where there are more chiefs than Indians — thirteen Chief Petty Officers in a total of twenty-three enlisted men. When the plant is running, Lt Boennighausen wears red shoelaces.

In the McMurdo office of Lt Carl Ripa, Officer in Charge of Detachment W, Mobile Construction Battalion Six (MCB-6), the SeaBee detachment, was a diagram showing the “critical path” on which materials must travel to meet construction dates. Lt Ripa knows how many hours or days each job ought to take, and he fits this in with the weather and the arrival of ships, to make sure that it proceeds in the right order.

The day when a man nailed up his own bunk with left-over crating materials is gone. Now that Deep Freeze is recognized to be a continuing operation, the trend is toward larger buildings, to conserve heat, to avoid fires and freezeups, and for economy of maintenance. A new building, to be financed in 1969, will berth 250 men and feed 500. To prepare the site, the SeaBees had to bring in 4,300 cubic yards of fill this season. The only way it could be obtained was by sending a couple of D-8 bulldozers up to scrape the rock off a hill which has a slope of 60 degrees.

“From the cab, you think you’re looking straight down,” said

Lt Ripa. "I'm going up the hill tonight, after supper, to run one of them." He graduated from the Naval Academy in 1960 and is a member of the Civil Engineer Corps; he is so dedicated that he qualified to drive every piece of heavy equipment in his detachment. Outside the new Sick Bay that was being finished inside, he pointed to a transformer platform, which had been assembled on the spot, and said the man responsible for it was his chief electrician, John Hansen. "That's as good as the work done by any big utility company at home."

The average age of the 99 enlisted men in MCB-6 was 19 to 20 years. Seven of them graded the site for the personnel building in 23 days, bringing 1,800 cubic yards of rock down from the hill, with one bucket loader, two D-8s, and three dump trucks. "I get 70 percent utilization on any truck they give me," said Lt Ripa.

SeaBees with jackhammers were digging a trench for the lines that would carry water from the new desalination plant. Because of the extreme cold, it is not possible to lay the pipe below the freezing level. However, the pipe can be electrically heated by covering it with a special wrapping containing two thin, flat, copper wires which keeps the water from freezing. Other men, under Ens Steve Warwick, constructed a VLF substation 14 miles from Byrd, using three modular vans inside a 100-foot tunnel covered with steel arches to keep off drifting snow.

*Below: Constructionman Henry Moore, of the SeaBees, cuts scrap iron at McMurdo. The skeleton of this phased-out building will be used for repairs to other structures. As many buildings as possible are prefabricated before being shipped to the Antarctic, but, even so, the work of assembling them is considerable. A sign near here reads: "URBAN RENEWAL PROGRAM. Building for a better, more comfortable McMurdo Station. USN MCB-6, Detachment Whiskey." At left: Cargo is unloaded from the hold of one of the supply ships.*





At Byrd Station, 10,000-gallon fuel bladders are coupled together in a side tunnel to feed DFA to the generators. Although Byrd is below the ice, some of the men must go outside to reach several of the scientific buildings. In Deep Freeze '66, to reduce the chance of their being lost, new poles were placed to support the lifelines, and the flags were set at shorter intervals.

The SeaBees, with Ltjg Dave Ramsey and Chief Builder Gerson Hyatt in charge, set up Plateau Station in about two weeks. A phrase from the *Antarctic Journal* dryly sums up that hazardous operation: "Most of the problems encountered had been anticipated by the designers and planners. . . ."

On December 13, Cdr "Moe" Morris set his Herc down on the polar plateau. There was over a foot of soft snow, but no dangerous *sastrugi*. With almost no wind and a temperature of 18 degrees below zero, he described the weather as "pleasant." The altitude was 11,900 feet, and the "ridge" was at 79° 28'S, 40° 35'E.

The first persons to leave the aircraft were Capt Bursik and Dr. Gowan. They were followed by Ken Moulton, the USARP representative; Bob Flint, the station scientific leader; and meteorologist Paul Dalrymple. From Dr. Dalrymple's weather observations the station was oriented with regard to the prevailing wind. The Herc tried seven times to take off before it reached enough speed so that a burst from eight JATO bottles allowed it to become airborne.

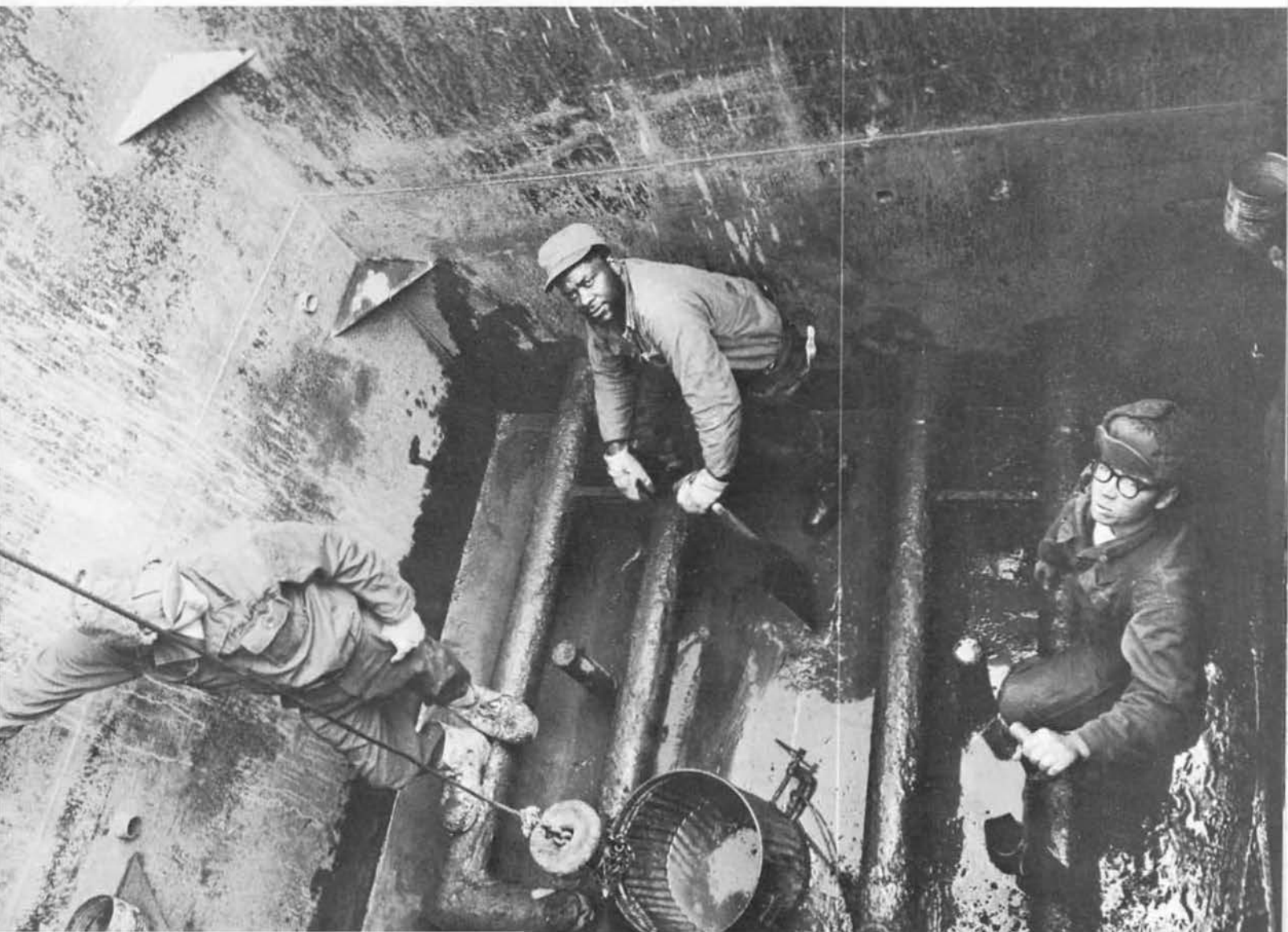
By January 7 there were twenty-seven men at work on the buildings. Two of the vans were placed end-to-end, the other two opposite, and the SeaBees roofed and floored the space in between. The Diesel generators that make electricity for the station use the "total energy concept" — their water jackets heat the vans and warm the fuel bladders. Their exhausts heat the snow-melter that provides fresh water. It was a triumph for the logistics staff that nothing was omitted. As Lcdr John Bell had said at the briefing, "That's a long way to fly an airplane with something left out of it." (In 1911, Amundsen forgot to bring snow shovels to the South Pole.) In spite of all the hearts behind it, the operation was so contingent upon unknown conditions that Admiral Bakutis had been prepared to postpone it until next season.

The people who went out there without having been acclimatized at the Pole found themselves in difficulties for a few days. The men were further slowed down by snow that turned out to be soft as far down as ten feet. Dr. Gowan reported only a few cases of altitude sickness, but the men had to pace themselves carefully. Ken Moulton said, "The more I see of these small air-transportable facilities, the more I am convinced that this is the way we must go."

Plateau Station was completed in time to house the ten members of the Queen Maud Land traverse party, who arrived January 29. They had "exceptional success" and covered 830 miles, although they almost lost one of the Sno-Cats in a crevasse. Dr. Picciotto said the radio ice-sounding mechanism worked perfectly and should give a reliable picture of the land structure below the ice.

They made very precise gravity and radio-sounding measurements to find out how far above solid earth the top of the icecap was situated. Sir Charles Wright says, "Fifty years ago a gravity reading took us five hours of observation daily for three days . . . Today the whole affair is accomplished in five minutes." The traverse won't be resumed until 1967, since the vehicles had to be flown back to McMurdo for a complete overhaul. The traverse is expected to reach the Princess Ragnhild Coast in 1969.

In the center of this photograph is Bob Mayfield, who was flown out for emergency medical treatment in the middle of the Antarctic winter (see pages 98-99). During the summer, he had been in charge of all outside work for SWI Jim Starr, otherwise known as the "water king." Mayfield, here, is cleaning out the snow-melter behind the mess hall at McMurdo. This is one of the vital sources of fresh water for the station, and mud and rocks tend to get mixed in with the snow.





In the Pensacola Mountains, the largest scientific party of the season found evidence that Antarctica, which may have been linked to South America long ago, according to geological similarities in the Andes and the Trans-Antarctic Range, may also have been a part of India. Tillites — glacial debris — from the carboniferous period, about 300 million years ago, occur at almost the same levels in Antarctica, South Africa, South America, and India. Fossils in the Horlick Mountains, such as *brachiopoda*, an early form of scallop, show that the Antarctic was much warmer once and had a lush vegetation. After ten years of investigation, supported by Operation Deep Freeze, the geologists are beginning a new era of detailed analyses, in which they will write the complicated geological history of Antarctica.

Toward the end of February, the Continent prepared to shut down for the winter. After the last aircraft flew out, a ship or two, engaged in scientific work, prowled around the coasts, but after the last letters departed, the men at the five lonely stations had only radio contact with the rest of the world.

Here, the true heroes remained, almost all of them members of Antarctic Support Activities, to keep the stations running for the next seven months. They perform many humble jobs, but the clue to the vitality of Deep Freeze is the patience with which the men of ASA back up the often invisible work of the scientists.

Even the penguins disappeared. The sun stood lower and lower above the horizon, and soon there was ordinary sunrise and sunset, before the final curtain of night, on April 22. It requires an unusual determination to remain — in total darkness — on the ice.



The leader of a scientific party on the Ross Ice Shelf reads his Christmas mail. Since the Goon that flew out to resupply them couldn't get to them for a few days because of bad weather, they were happy to see visitors.

*Opposite:* Adelie penguins in an Agnes DeMille ballet.



On June 1, 1966, when the Continent was dark, UTP2 Robert L. Mayfield fell at McMurdo and suffered serious internal injuries. His condition was reported to Washington by radio, and Admiral Bakutis ordered a Herc to take off from Quonset. It was fitted with the same interior fuel tank that is used to supply inland stations on the ice, containing 35,000 pounds of JP4 and assuring at least fourteen extra flying hours. The plane carried almost three crews and was flown by Cdr "Moe" Morris, skipper of VX-6, just before he relinquished command of the squadron. In Washington, they picked up the Admiral and his staff doctor and staff meteorologists. *Below:* Cdr Morris reported a bright moon as he brought the plane in very high over the Continent. At about 4,500 feet he found cloud cover, but when he dropped below it he saw the blazing oil drums on the Strip.

U. S. Navy





U. S. Navy

*Right:* The Strip at McMurdo had to be cleared of four months' snow, and the GCA equipment reactivated. It took the wintering-over party six days to make a skiway 6,000 feet long, lined with oil drums, and in the middle of this labor they were interrupted by a storm. Although a temperature of 38 degrees below zero and winds of 86 knots had been recorded at McMurdo in the month of June, the plane landed in a 15-knot wind with a minus 14 degree temperature. Only once before in history had an aircraft landed in the Antarctic in darkness. In June, 1964, a second Herc went along for possible search and rescue duty, but this year a second plane was not available at Quonset. The New Zealanders responded magnificently, holding two planes ready for SAR at Invercargill, the southernmost city in New Zealand, and sending a picket ship halfway to Antarctica for weather information.

*Above:* Admiral Bakutis stands aside as Mayfield is put aboard the Herc, which also brought mail and fresh fruit and vegetables for the lonely men at McMurdo. After less than three hours on the ground, the plane was on its way back to Christchurch where Mayfield's ruptured bladder was operated on successfully.





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## Some facts about the book

The body copy in ON THE ICE is set 25 picas wide 11 point American Type Founders Baskerville. The captions are set 16 picas wide 9 point American Type Founders Spartan Medium. The stock is 80 pound machined finished book stock. The entire volume, including the four-color process pages, was printed by the photo-lithographic process.

The layout was by Melinda Harris. The book was conceived and developed by Theodore Thomte.

# USS BURTON ISLAND

AGB-1



DEEP FREEZE '66



Commander Charles L. Gott enlisted in the Navy on 10 March 1942 and served aboard the *USS Lavallette*, a destroyer, until November 1943 as a sonarman. At this time he was selected as a naval reserve officer candidate and received training in the then-R-12 program at Park College and the University of Minnesota which led to his being commissioned Ensign in 1946.

As a young officer Commander Gott served aboard the *USS Vogelgesang*, a destroyer, and *USS Foss*, a destroyer escort, as Anti-Submarine Officer. He later was assigned duty as anti-submarine warfare instructor with the Fleet Training Group based at Guantanamo Bay, Cuba. Upon completion of these duties he became Executive Officer of the *USS Wilett*. November 1954 he was ordered to the Nato Anti-Submarine School, Londonderry, North Ireland as an exchange instructor in which duty he remained until October 1957 when he was promoted to Lieutenant Commander and assumed duty as Commanding Officer of the *USS Exploit*, a minesweeper. Here he commanded until July 1960 when he reported to the Naval War College for a year of advanced studies and was then assigned to the staff of the Chief of Naval Operations in connection with international research and development programs and received a promotion to Commander in June 1962.

Commander Gott's most recent duty was Executive Officer of *USS Monticello* on which he served from September 1963 to May 1965.

LCDR Ralph G. Reid enlisted in the Navy in July 1944 and served as an electrician on the submarine chaser, PC-486, in the Pacific area until the end of WWII. He was transferred to LST-245 and then *USS Xanthus* (AR-8) where he participated in a Pacific-wide survey of salvagable equipment on U.S. controlled islands. Upon being released to inactive duty in 1946, he returned to his home in Birmingham, Alabama where he worked and attended school until he reenlisted in the regular Navy in August 1948. Between 1948 and receiving his commission as Ensign in 1956, Mr. Reid advanced to EMC and served in the Florida Group, Atlantic Reserve Fleet, *USS Hollis* (APD-86) and Beach Jumper Unit Two.

From OCS, Newport, Rhode Island, Mr. Reid reported to *USS Washburn* (ADA-108) in October 1956 where he served successively as Assistant First Lieutenant; Boat Group Commander; Communications Officer and Navigator until November 1959. From December 1959 to June 1961 he served as Assistant Staff Communications Officer, Staff Commander Amphibious Group Three, and was promoted to Lieutenant in June 1960. In July 1961, Mr. Reid was ordered to shore duty at U. S. Naval Communications Station, San Diego as Communications Plans and Frequency Officer under the District Communications Officer.

Prior to reporting to *Burton Island*, LCDR Reid served as Operations Officer and Navigator of the *USS Dixie* (AD-14).





So long, Pier 91.



Welcome HC-1.



Land ho! Diamond Head, Hawaii



King Kamehameha I greets B.I. sailors.



Hawaiian scenery was magnificent.



Especially on Waikiki Beach

FROM POLLYWOG . . . .



TO SHELLBACK



# LIBERTY TO WORK



Sydney Harbor Bridge



Sydney sweethearts



Port Lyttleton, N.Z.



ComNavSuppForce Antarctica, arriving



Well done, B.I.



Icy greetings from south of sixties

# X DIVISION



ENS J. Schmidt, "Mr. X"



1st class executives



"What do you mean, that's too much to pay for protection?"



Busy mail clerks



Mama hen and chicks



"When I'm Postmaster General . . . ."



# MEDICAL



LT(MC) J. Scardapane "Fourth for Bridge?"



R. Fisk, HMC spears victim



W. Johnson, HMSN "Any visible birthmarks?"

# AIR DETACHMENT



"Zoomies Three"



Dodge, AMSI and his bell



"Alright, who let the air out?"



HC-1, Det. 41

# NAVIGATION



Stubby and sextant



"Well, which pub will it be tonight?"



"It's this pub here."



Abandon ship?



"Now, in the old Navy . . ."

# AG'S



"It won't be like this in '67."



"Please don't leave."



"It all started in Boston."



"It was here a minute ago."

## OPERATIONS



"Reverend", "Good ole", "Speedkey", "Skates"



"Are you cleared?"

## RADIO GANG



"CQ Seattle, CQ Seattle"



The ears of the B.I.



"Hey, it's KJR!"

## PHOTO/PIO



"This ought to be good for some fruit cake."



"Say, how do you spell Texas?"



"But Captain, this won't look good in your cabin."

## OPS ADMIN



"Dear SecNav"

## RADAR GANG



"Was that your fruit cake, Johnson?"



"Range to Kings X. . . ."



"Bogey who?"

## ET GANG



"Where's the plug?"



"What gold pen?"



"So, we'll see ya payday."

# DECK



1st Lieutenant and 2nd Lieutenant



"You shoot him, I'll tie him up."



"Tow an iceberg?"



"How many coffee cups?"





"So you wanna be a Bosn's Mate!"



"Bridge. Foc'sle. Did you hear the one about . . . ."



"Who said we're barred from the 'Plainsman'?"



"Now if she gives you a hard time . . . ."



Holiday routine



A steel-driving man

## ENGINEERING



"What do you mean, No. 5 threw a rod?"

## 'a' & 'R' DIVISION



"Not Mitch, it's Tony."



"Smile, you guys will be Chief some day."



"We don't make stereo cabinets."



Wise-men



"The first step in engraving cigarette lighters."

## 'E' DIVISION



"Electricity is the key to modern living."



"I'd like 100 wallet size, please."



"The ship is alive with the sound of music."



"Which one hit you, son?"



"Shorty's waltz's"

# 'M' DIVISION



CWO 4 Gene Lacy. "You mean we have liners for No. 5?"



"Yes, sir. We have liners for No. 5."



B1. "We have the best crew."



B2. "No, we do."



"If I press this button, maybe it will squeeze oranges."



"I knew it would work if I shined it."



B3. "No doubt about it, we are the best."



"This emergency lighting is for the birds."

## SUPPLY



"You mean he wanted it without a chit?"



"We don't move until we get a working party."



"We're on strike. Do your own dishes."



"Mister C won't like this."



"Add the 10 I won from Mr. C at bridge."



"Don't sweat it, you've got another ear."



"You want me to mix rum with it?"





"Put in a chit like everyone else."



"God, those socks smell."



"About that letter in Grass Roots."

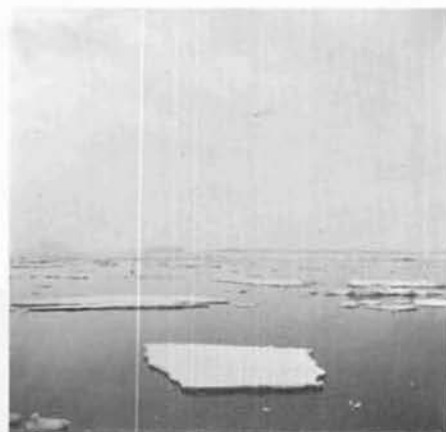


"What letter?"

## LIFE ON THE ICE

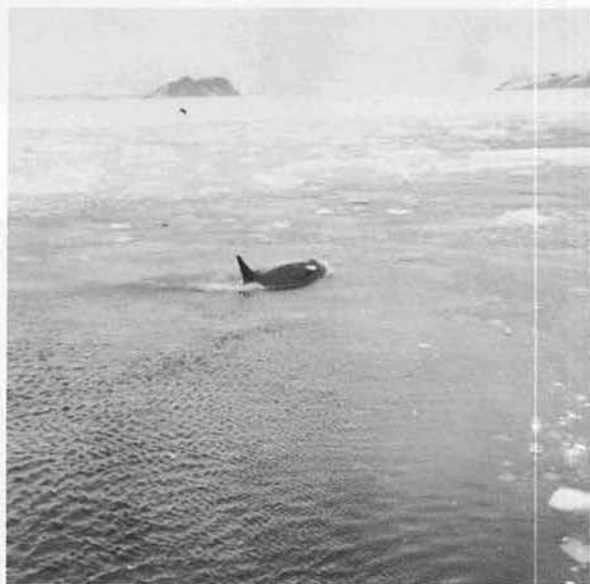


Sale of razor blades in the Ships Store went down: while hobby items and the quality of scenery went up.





THE NATIVES  
WERE FRIENDLY . . .

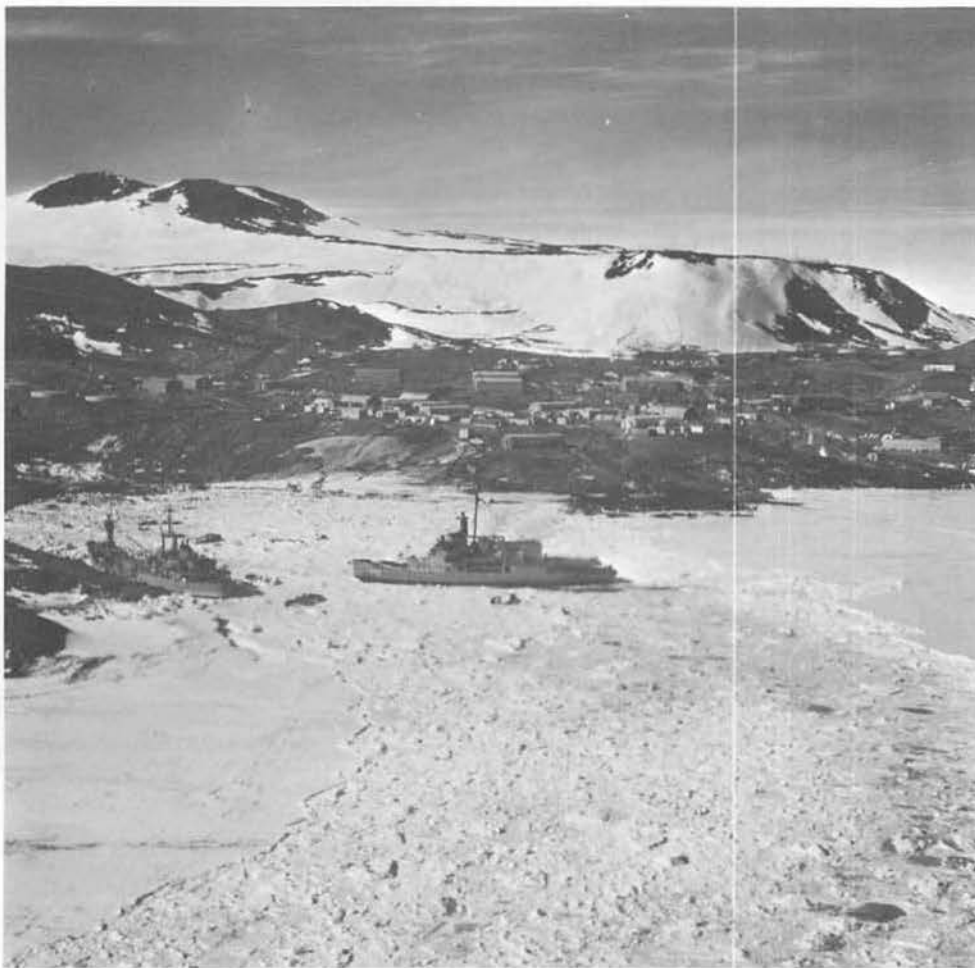


WITH ONE  
EXCEPTION:





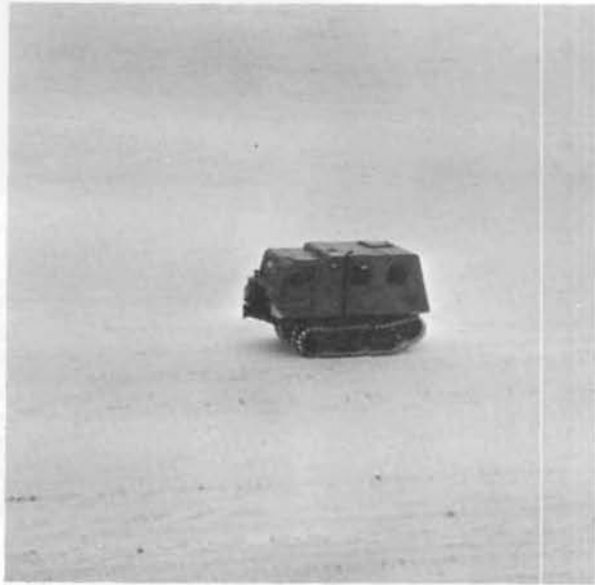
THE ROAD TO McMURDO  
WAS LONG AND HARD:



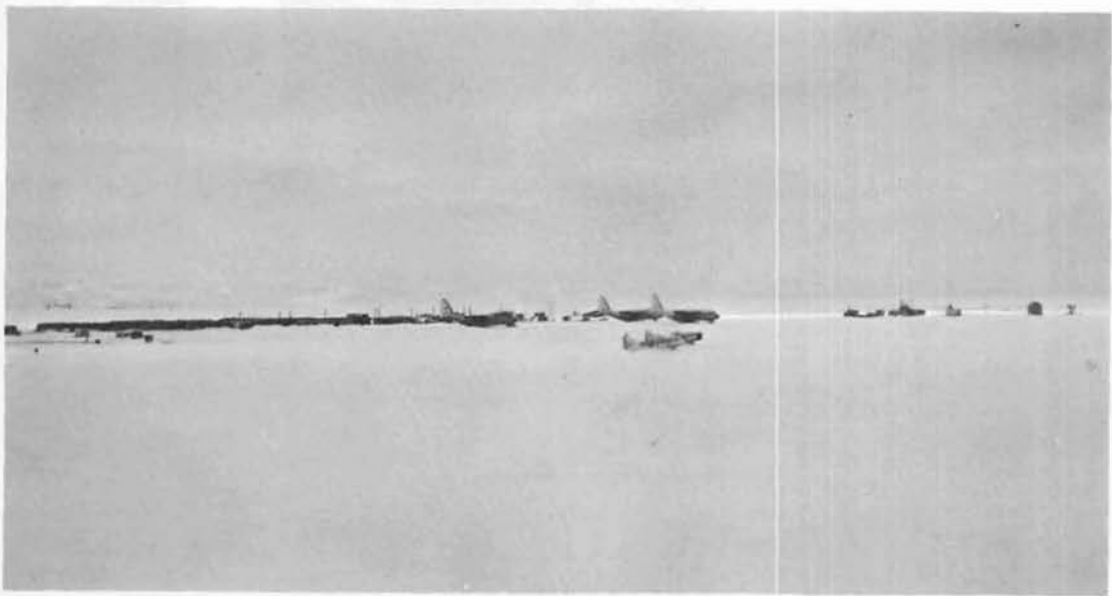
But we finally reached the metropolis called McMurdo —



and visited the smaller city of Hallett Station.



Transportation was readily available —

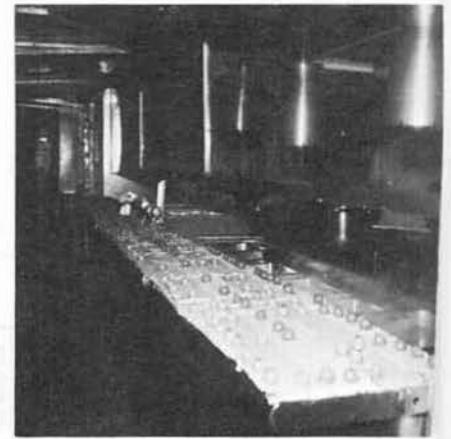


so some visited the modern airport.



*Burton Island* did most of the work, so we let it be known.

## "BUT THE TRIP WASN'T ALL WORK"



There wasn't much liberty, but chow was good.



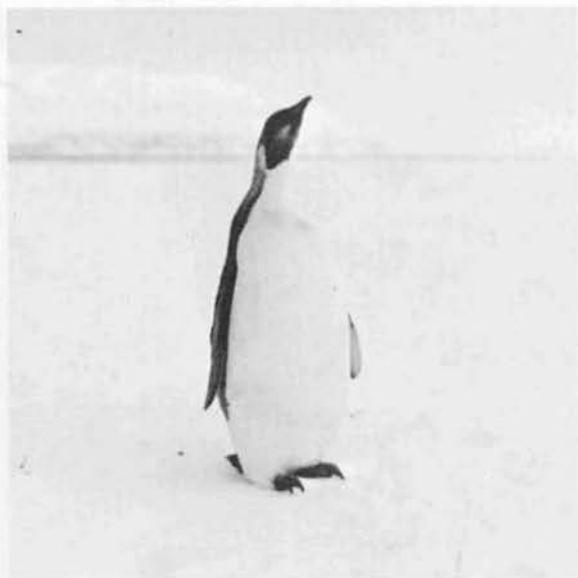
Several lawn parties were held.



Crew meets natives . . . .



Natives say, "Go home, Yank."



"Awfully good of you to come, old man."





"Keep your wings out, I'll spin your propellor."



"Wot hoppen?"



"Twinkle, twinkle, little star."



"It won't be like this in Saigon."

To  
Public Info  
Staff  
And all the Men!  
Edward the USS Benton Island...

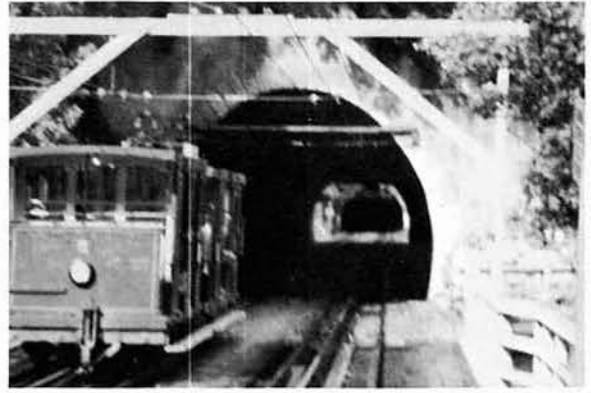


With You  
All The Way!

Love  
Jane Wood  
D. "ICE"



It's the end of another tough day.



Wellington tramway



"It's the next best thing to . . . ."

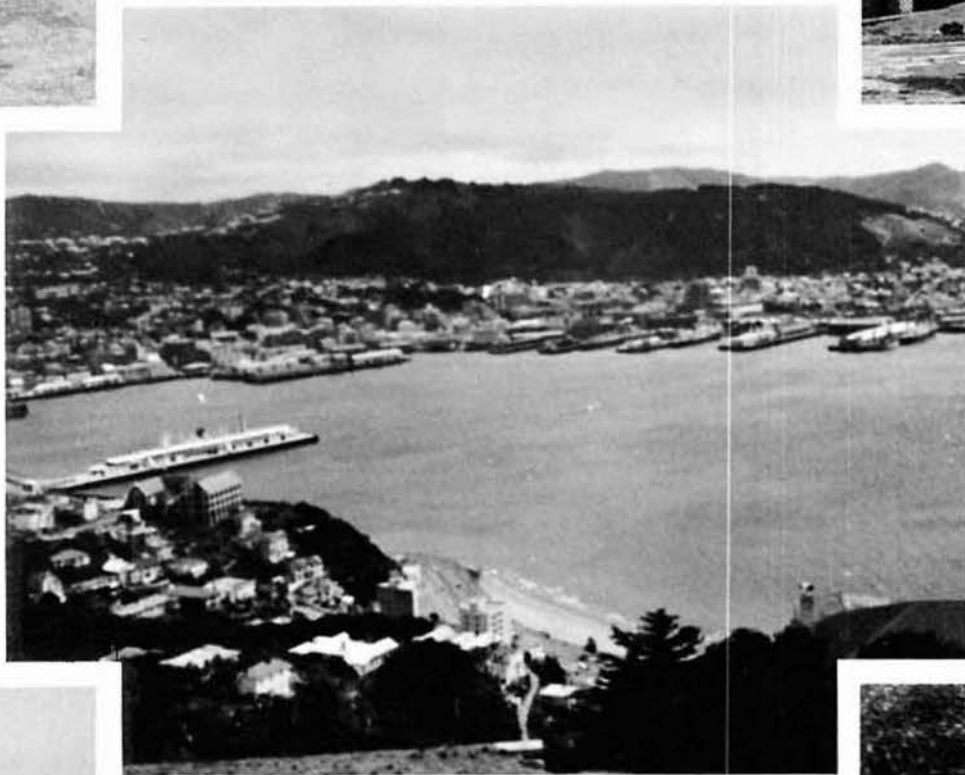


"This way guys."



"Liberty in sight!"

# R & R IN WELLINGTON





# HOME!



