SUPPLEMENT: ATLAS MAP OF ALASKA, THE 49TH STATE

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THE NATIONAL GEOGRAPHIC MAGAZINE

Up Through the Ice of the North Pole

By COMDR. JAMES F. CALVERT, USN

On March 17, 1959, the U. S. nuclear submarine *Skate* broke through the ice at the North Pole from below, and men again stood at the top of the world—50 years after Robert E. Peary.

Skate's captain, Comdr. James F. Calvert, USN, long a National Geographic Society member, here contributes to its magazine the first complete account of his two great Arctic exploring voyages. The Society is proud to add his brilliant name and narrative to those of such explorers as Peary, Byrd, and Siple, Stefansson, Shackleton, and Fuchs, whose memorable firsthand accounts have appeared in the NATIONAL GEOGRAPHIC.—*The Editor.*

ON A BRIGHT, sunny morning in June of 1955, I was sitting in a small Washington, D. C., office looking out on busy Constitution Avenue when a tall, vigorous young naval officer came striding through the open door.

"Hey, you really look like a student!" he laughed, seeing the textbooks on my desk.

"That's what I am, all right; I don't know what half the words mean, let alone the sentences," I grinned in reply. Having finished my first submarine command, I had been assigned to Rear Adm. (now Vice Adm.) Hyman G. Rickover's group in the Atomic Energy Commission, with the ultimate purpose, I hoped, of being designated a nuclear submarine commander.

My visitor was Comdr. Eugene P. Wilkinson, first such commander in the world as captain of the *Nautilus*.

"Seriously, how's it going?" he asked. "It's important, you know. The admiral is a bear on this studying."

"He's made that fairly clear to me," I answered wryly. "What's on your mind?"

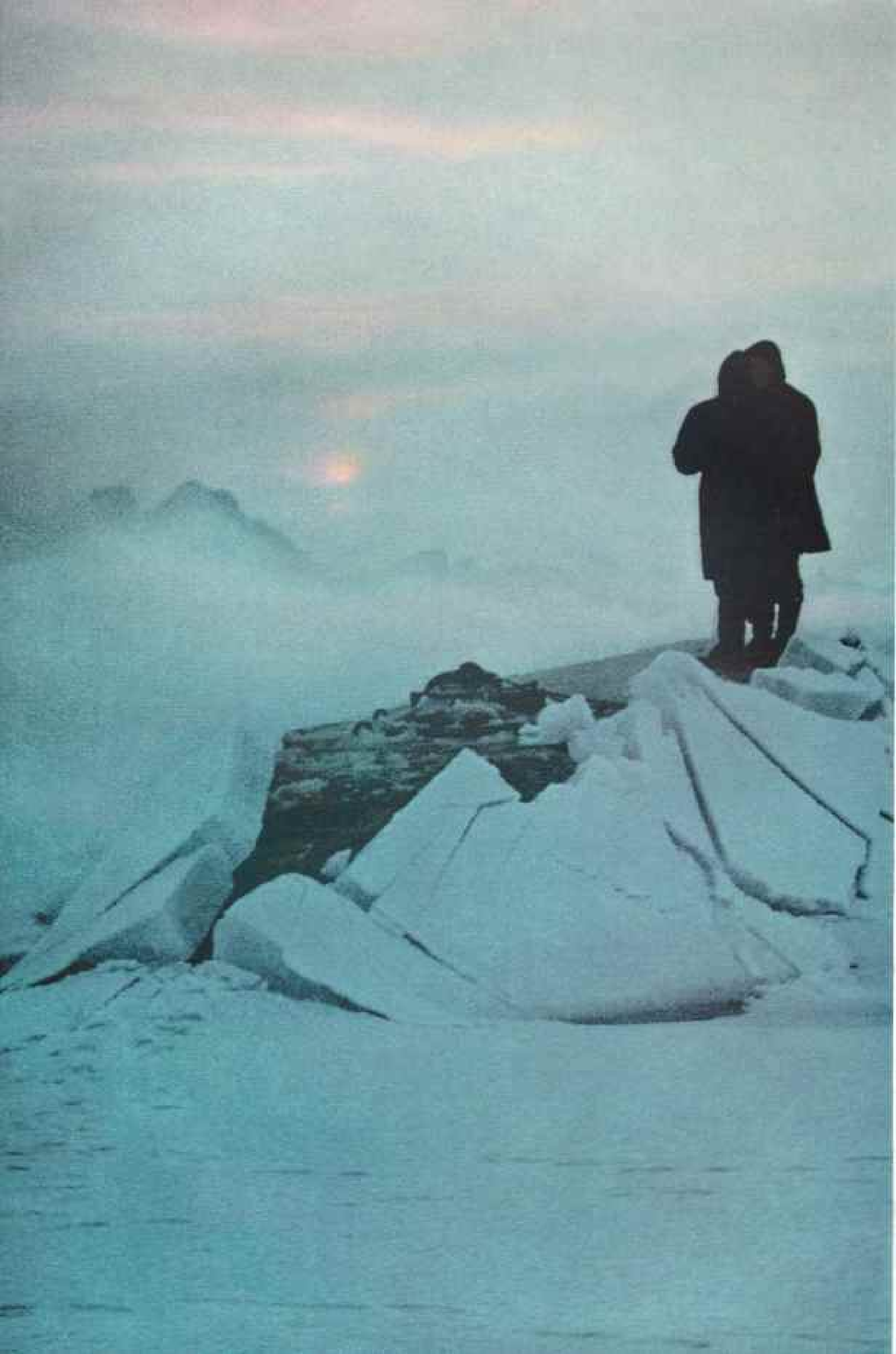
"The Arctic. I want to take the *Nautilus* up there," Wilkinson said, sitting down.

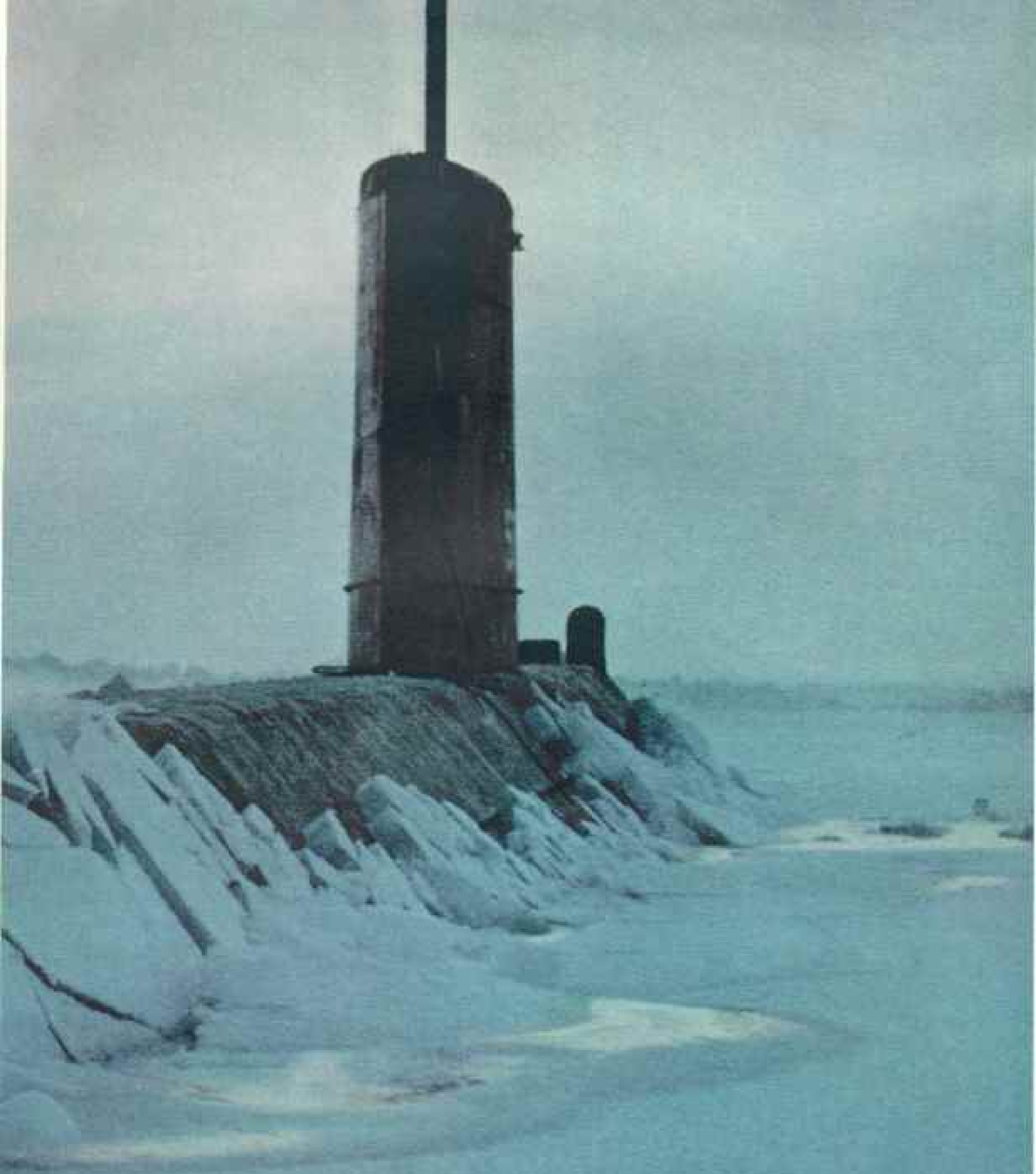
"Under the ice?" I asked, laughing.

"Just part of the time," he replied, reaching for an atlas. "Take a look at this chart." He turned to a view of the world that put the North Pole in the center.

"The Soviet Union essentially fronts on one ocean—the Arctic," he went on. "Oceans are

Shattering a "skylight" of thinner ice between 10-foot-thick floes of the polar pack in winter, *Skate* rises into an Arctic world of eerie silence and incredible beauty (next two pages). On March 22, 1959, Comdr. Calvert made this remarkable Kodachrome 300 miles from the Pole, at Skylight No. 6. A few hours later—at this very spot—*Skate* narrowly escaped being crushed by "crashing, groaning, and shrieking" ice.





NATIONAL GEOGRAPHIC PHOTOGRAPHER J. BAYLOR ROBERTS

***Skate*'s captain,** Comdr. James F. Calvert, was born 38 years ago in Cleveland, Ohio. A 1942 graduate of the U. S. Naval Academy, he served as executive officer of the submarine *Jack* in World War II, and was twice awarded Silver Star and Bronze Star medals for conspicuous gallantry in action. After commanding *Trigger*, he was selected at 34 for training in atomic submarines.

Under his command, the nuclear submarine *Skate* revolutionized Arctic exploration and strategy by surfacing nine times—three times within 50 miles of the Pole—in small open-water lakes, or *polynyas*, in the polar ice in August, 1958. Last winter, finding no open water except a single two-foot puddle, she crunched to the surface 10 times—once squarely at the Pole—through new ice that freezes six inches thick in 24 hours.

For these history-making expeditions, Comdr. Calvert twice received the Legion of Merit and *Skate* won Navy Unit Commendations. This August he takes command of Submarine Division 102, comprising *Skate*, *Nautilus*, and three others.

our business in the Navy, and here's the most strategically located one in the world; yet no one uses it."

"Well, it's a little obstructed," I smiled, thinking of the huge ice pack that covers it.

"But not to a nuclear submarine!" he said. "We'll go under the ice at any speed we want. Most of the water up there is thousands of feet deep."

"But you can't accomplish anything while you're under the ice. There's nothing strategic about that," I objected.

"Look, I've talked to dozens of aviators. They tell me there are always openings in the ice," Wilkinson said. "The wind makes the ice shift around, and these lakes come and go. You know some of our diesel submarines surfaced in these lakes at the edge of the pack years ago. What they can do at the fringe, the *Nautilus* can do at the North Pole!"

World's Ice Hat Worn at an Angle

From that day forward I thought a lot about submarines and the Arctic and began to study the charts. Although it has more area than the United States, the Arctic Ocean is nearly landlocked, with only two main entrances: the Bering Strait between Alaska and Siberia, and the Greenland Sea between Spitsbergen and Greenland. This Atlantic entrance to the east of Greenland is broad and deep, while the Bering Strait entrance is narrow and less than 150 feet in depth.

The world's ice hat is worn slightly over one ear; in summer it extends down some 1,200 miles from the Pole on the Pacific side, but only about half that distance toward the Atlantic. The difference is caused by the warming fingers of the Gulf Stream reaching northward on the Atlantic side of the globe.

There was considerable information on Arctic ice thickness, most of it dating back to Fridtjof Nansen's brilliant Arctic expedition of 1893-96. I was surprised at what I found in the reference material. The ice pack ranges in thickness from 9 feet in summer to 13 feet in winter. In an ocean more than 12,000 feet in depth, that's not much ice!

Waste of Ice or Navigable Ocean?

Studying the Arctic emphasized Wilkinson's comments. The two heartlands of the world face each other across this brooding waste of ice. But if, instead of a waste of ice, it is actually a navigable ocean whose surface can be reached by missile-carrying submarines—then the Arctic Ocean could become one of the most important military areas in the world.

As I read more about the Arctic, I began to see what a struggle it had been for men like Nansen, Peary, Amundsen, Stefansson, and Wilkins to ferret out what information we have. I began to realize how much scientific knowledge was still to be obtained—and what a marvelous vehicle for such work a submarine would be.

It was not until much later that I learned that both Vilhjalmur Stefansson and Sir Hubert Wilkins had had these same ideas as early as 1914. Stefansson had made the striking observation that if you want to study a botanical garden, you don't fly over it in an airplane, you get down in it; similarly, if you want to study the Arctic, you had best get down in it in a submarine.

The end of 1956 saw the completion of my training at the AEC in Washington and my assignment as prospective commanding officer

Ice Drapes the Submarine's Stern. A Crewman Ropes Down the Side

Except for a few minor dents in the sail, or conning tower, *Skate* escaped damage from her brushes with Arctic ice. "Security forbids disclosing the exact thickness that we penetrated," says the author, "because it is something other nations would like to know, something that cost us time and money to learn." Here, 220 miles from the North Pole, Seaman John Kirkpatrick inches down the sub's hull.

of the *Skate*, the Navy's third nuclear submarine, then under construction at Groton, Connecticut. By the end of 1957 the *Skate* was a ship at sea in the United States Navy, and we were making plans to go to the Arctic in the summer of 1958.

Much remained to be done before we could go, however. *Nautilus* had made an exploratory cruise under the ice pack in the fall of 1957 and discovered that there were problems. Her gyrocompasses had failed, and she had found it more difficult than had been expected to locate and surface in one of the ice lakes, or *polynyas*. The ice pack apparently was not going to yield easily.

In January, 1958, we appointed Lt. David Boyd as the *Skate*'s polar-project officer, and a February trip to Washington put him on the trail of a new device—inertial navigation—originally devised for a now-defunct guided missile project.

Instruments Sense Earth's Rotation

At once we realized that this could be the solution to our problems of navigation under the ice pack. Since these delicate instruments can feel the direction of motion resulting from the earth's eastward rotation, they know which way is east. They sense speed as well as direction, and since the speed of rotation of a point

JAMES F. CALVERT

on the earth's surface decreases as one goes toward the Poles, the inertial machines can sense their distance from the Pole.

With a big assist from the Navy's Bureau of Ships, we soon had the satisfaction of knowing that the *Skate* would have this remarkable equipment before sailing for the Arctic.

By late July, near the time of loosest ice in the Arctic, our departure date was approaching. Zane Sandusky and his assistant Roger E. Schmidt, from the Autonetics Division of North American Aviation, Inc., supervised installation of our inertial navigation system. Half a room was turned over to Zane and his black magic—and getting that much space on a modern submarine is like getting permission to build a private parking lot in Times Square (page 12).

Of the scientists who would be going with us, the next arrivals were Walt Wittmann, the Navy's senior ice forecaster, and Dr. Eugene C. LaFond, of San Diego, our oceanographer. Five other civilians were assigned to assist in the charting and exploration of the new parts of the Arctic we hoped to reach.

With 10 officers, 9 civilian scientists, and 87 crew members, we added up to 106 men for a total of 90 installed bunks. Obviously we were going to have to observe the time-honored practice of alternating hours in the bunks—"hot-bunking," as we call it.

At two o'clock in the morning of July 30, 1958, we slipped out of Connecticut's Thames River with only my friend Wilkinson—now a captain and division commander of all Atlantic Fleet nuclear submarines—to bid us farewell. The *Skate* was Arctic bound.

We had 3,800 sea miles to go before we would see ice. Lazing along at some 360 miles a day, *Skate* would travel at a depth of about 300 feet—far below the effect of any but the roughest weather.

As the days passed, I read and reread the first objective of my operation order:

> ITEM 1. DEVELOP TECHNIQUES FOR SURFACING IN PACK ICE AREAS. . . . ALL OTHER ITEMS ARE SUBORDINATE TO THIS ONE. . . . IF NUCLEAR SUBMARINES ARE TO BE USEFUL IN THE ARCTIC THEY MUST HAVE ACCESS TO THE SURFACE.

But how? I was pondering this for the hundredth time when Lt. Cmdr. John Nicholson, the executive officer, came in with a grave look. "The underwater speed log is out, and we can't repair it. The spare part we need to fix it isn't available," Nick said.

"How'd we come away without that?" I asked incredulously.

Like Spacemen on Another Planet, *Skate*'s Explorers Range over the Ice

Observed Comdr. Calvert: "It is not every day a skipper can walk away from his ship and contemplate it from a distance while it is a hundred miles from land, in water more than a mile deep."

A wan sun peeps above the horizon for the first time in nearly six months, heralding spring in the Arctic. Pressure ridges litter the ice at Skylight No. 6.

"I walked among hummocks at least twice my height," says the 6-foot-3-inch author.

The barrel-like tube projecting from *Skate*'s deck houses a television camera.

North Pole

Drifting Station Alpha
August, 1954

Lomonosov Ridge

ARCTIC OCEAN BOTTOM

Cape Columbia

Cape Sheridan

United States Range

Axel Heiberg Island

Ellesmere Island

DRAWN BY WILLIAM PALMSTROM, NATIONAL GEOGRAPHIC STAFF © N. G. S.

Color map shows route of *Skate*'s first historic voyage in 1958. As to this year's route, the Department of Defense announced only that *Skate* had surfaced precisely at the North Pole and remained in international waters, never running closer than 100 miles to any land mass except Spitsbergen.

"We didn't. We had two spares and we've used them both," was the reply.

Now the speed you are making is of great interest in a submarine, where you are always, so to speak, flying on instruments; but for navigating under the ice, where so much depends on dead reckoning, it is vital. This was a serious matter.

We were about two days from the ice. To turn back was unthinkable.

"Nick, we'll just have to estimate the speed. You can do that from shaft r.p.m., can't you?" I asked.

"I'll do my best."

Nick's best is usually something special, and our navigation never suffered from his speed estimates based solely on our shafts' revolutions per minute.

On the 9th of August, as we were approaching the ice pack, *Skate* was at periscope depth, and Nick was shooting the sun with the specially built sextant contained in the periscope. We put up a radio antenna to see if there was any news, and heard a voice saying in a clipped British accent:

"The entire civilized world thrilled today to the announcement that the American atomic submarine *Nautilus* has crossed from the Pacific to the Atlantic under the Arctic ice pack, sailing under the North Pole en route. . . ."

A gasp of incredulity went up from everyone in range of the radio. I was the only one on board who had been authorized to know in advance of the ultra-top-secret voyage of the *Nautilus*. Our primary missions were quite

***Skate* pokes only her sail** up through newly frozen ice at Skylight No. 8 on March 24, 1959. Crewmen bundle against minus 34° cold and bone-chilling winds.

ENGRAVING BY JAMES F. CALLERY © NATIONAL GEOGRAPHIC SOCIETY

Crewmen Off Duty Enjoy a Songfest in the Forward Torpedo Room

Though confining, life aboard an atomic submarine can hardly be classed as Spartan. *Skate* carries refrigerators, electric ranges, radio, and record players. Movies in the messroom drew packed houses during Arctic cruises.

Nineteen crew members, most of them torpedomen, bunk in these quarters, side by side with the big steel projectiles. Engineman Theodore Archambault, leading the harmony, has a film badge on his belt. The matchbook-sized device measures exposure to radioactivity; every man wears one at all times.

different—*Skate*'s to learn surfacing in the ice, *Nautilus*'s to pass from Pacific to Atlantic beneath it. But there was no escaping the fact: *Nautilus* had beaten us to the Pole.*

I could never describe that day and shall not try. The pride a Navy crew feels in its ship, the good-natured but intense competition, the sensitive feeling a submarine captain has for his crew's pride and their competitive spirit—all these things were tied up in our emotions of August 9.

We felt as the ill-fated Robert Falcon Scott must have felt when he found to his crushing disappointment that Amundsen in 1911 had preceded him to the South Pole by a month.

"The Norwegians have forestalled us and are first at the Pole," he wrote in the diary later found by his body. "It is a terrible disappointment and I am very sorry for my loyal companions..... All the daydreams must go; it will be a wearisome return."†

At four in the morning of Sunday, August 10, we took a quick radar bearing from Spitsbergen and fixed our position. Seeing the white line of the Arctic pack ahead, we went deep and were soon under the ice.

There were several alternatives. We could spend a few days going in and out of the ice, getting used to the idea. We could practice surfacing in the edge of the pack. Or we could head for the North Pole, 600 sea miles away. The mood of my crew was much on my mind. It was time for the *Skate* to *do* something, not pussyfoot about. We set course for the Pole at 16 knots.

Life in a Steel Bubble Under the Ice

What is it like, these first hours under the ice? I shall attempt to describe it. There is no sense of motion: the ship is still, with only slight machinery vibration. Lighted instruments show angle, course, and speed—no, we are missing that one on this trip.

We are in uncharted waters, and the depth is of great interest. Our bathymetry expert, Art Molloy, from the Navy's Hydrographic Office, is bending over his precision depth recorder and watching the trace. Its anguished whine rings through the control room, and back comes the faint echo from the ocean floor 5,000 feet below.

"Beautiful trace, beautiful trace," Art says lovingly, as he watches the machine record its profile of the bottom.

"And to think that Nansen's party got only 62 soundings in three years," he mutters to no one in particular. Art is clearly pleased.

But we are sending sound impulses out in more directions than one. In the after end of our control room, ice expert Walt Wittmann watches his upward-beam ice detector with deep interest. His machine makes a rapid

* See "Submarine Through the North Pole," by Lt. William G. Lalor, Jr., USN; and "The Arctic as a Sea Route of the Future," by Comdr. William R. Anderson, USN. NATIONAL GEOGRAPHIC, January, 1959.

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NATIONAL GEOGRAPHIC PHOTOGRAPHER J. BAYLOR ROBERTS

whish, whish, whish as it draws its detailed picture of the ice overhead, showing clearly the varying thickness. Most of it now is about seven feet thick. Occasionally the trace shows only a thin black line, indicating open water. This is the key to the Arctic Ocean for us, and we watch it intently.

Sometimes the machine draws what looks like an immense bulge hanging down from our ice ceiling. These are all that we can see of the pressure ridges that are forced upward and downward when the ice floes are pressed together by the enormous momentum of the drifting ice fields. We measure the depth of these pressure ridges carefully, for we must keep submerged deep enough not to strike them. So far we see none deeper than 60 feet or so.

Still another pulsing electronic voice is probing the icy water ahead and to the side for these pressure ridges. We also hope it may help locate the all-important polynyas.

Over in the forward corner the three men of the diving control party sit relaxed, expertly holding *Skate* on course and depth.

Aft by the ice detection machine, navigator Nicholson works quietly over his charts, drawing our projected course along the 10th meridian of east longitude. He has a private talk-back circuit to his friend Zane Sandusky in the black-magic chamber down below.

In the after end of the ship another world exists. Here the nuclear plant supplies the power for the lights, air conditioning, galley, sonars, navigation equipment, atmosphere replenishment—in short, for the life of the ship. Here the power surges into the turbines to drive the propellers and send the *Skate* farther and farther under the pack. And here the engineers stand this morning, tending this incredibly complex machine in matter-of-fact fashion as it uses the energy stored in uranium atoms eons ago when the very stars were formed.

Yes, nuclear power, inertial guidance, digital computers, complex electronics—many of the most glamorous technical products of the 20th century are sealed up in this small bubble of air beneath the ice this Sunday morning in August. I am sure that when the first space


U.S.S. SKATE

ship roars off on its great mission, the scene inside will be much the same—objective and quiet groups of men, each working efficiently on its particular task.

A Sunday Morning Decision

When the *Skate* is at sea on Sunday, we usually have informal church services at ten in the morning in the crew's mess hall. We have no chaplain on board. However, we assemble, read a few passages from the Scriptures and the Book of Common Prayer, and it feels more like Sunday morning to us.

As we were gathering this Sunday morning, I stopped by the ice detecting machine. For two hours we had had nothing but solid ice overhead, with an occasional very small opening. As Walt and I stood looking at the trace, the familiar thin black line indicating open water began to show. It stretched on and on—a sizable lake! Then, as suddenly as it had appeared, the thin black line was gone and heavy ice was overhead.

By now we were 70 miles or so into the solid ice pack. This was a real ice lake, not just an opening in the fringe. Should we try to surface in this one? Wouldn't it be better to reach the Pole first, before we tried this admittedly risky and unfamiliar maneuver? After all, to reach the Pole we had only to continue. Attempting to surface, we might damage the ship enough to hazard the entire mission before we had accomplished anything.

But Item One flashed through my mind again: ALL OTHER ITEMS ARE SUBORDINATE TO THIS ONE.

The time to face this issue was now. "We'll have church later; right full rudder; station the plotting party," I said.

Lt. Al Kelln, *Skate*'s gunnery officer, was in charge of the plotting. Watching the trace on Walt's ice detector, he called out "Clear overhead" or "Ice overhead," as we passed under the boundaries of the lake.

Finally we had a fairly good picture of the lake, and the *Skate* stopped underneath it. This required some delicate control by Lt. Bill Cowhill, diving officer. Bill's job is to keep us perfectly stationary until I tell him to bring her up slowly.

We are coming up very slowly now but are still more than 100 feet down. I raise the periscope. The water is incredibly clear. I can see many jellyfish and other bits of marine life, but as I roll the prism to look upward, I see only a blurred aquamarine color.

One of the dangers in this maneuver is that the ice lake may be covered with a sheet of new ice as much as six or eight inches thick. This may not show up on our ice detector, and yet could severely damage the *Skate*'s delicate "sail," with its collection of periscopes, antennas, and ventilation piping. I raise one of the vertical buggy-whip antennas so that it sticks straight up into the water above the sail. I can see the tip of the buggy whip as clearly as though I were looking through air, so transparent is this Arctic water.

Jellyfish Serves as Speed Indicator

The *Skate* continues to come up slowly, foot by foot. It is essential to keep the ship absolutely free of forward or aft motion, else it may drift away from the center of our polynya and strike the encircling ice.

Even if our log speed indicator were in order, it would probably be of little help here, such fine control is needed. I roll the prism down and look a huge jellyfish squarely in the eye. Here is the perfect speed indicator! If the jellyfish is still, the *Skate* is stopped. I look again; my friend the jellyfish has not moved an inch.

By now we are getting close to the surface.

Tracings of an Ice Detector Guide *Skate* to Gaps in the Frozen Surface

By bouncing electronic pulses off the ice above the submarine, the instrument sketched a detailed picture of the "ceiling." During the August, 1958, cruise the detector occasionally showed only a thin black line—open water. Then the ship sailed back and forth to measure the breach for possible surfacing. This plotting party includes (left to right) Quartermaster 1/c Jerry L. Taylor, Commander Calvert, Sonarman 1/c Louis E. Kleinlein, and Lt. George A. Barunas.

Inertial guidance system, developed by North American Aviation, Inc., senses earth's rotation and charts its speed. This extraordinary device enabled *Skate* to plot her precise position at all times. Designed for the Navaho missile nine years ago, the equipment was tested on surface ships in 1957 and installed on *Skate* and *Nautilus*. Zane Sandusky, an engineer with North American, rode aboard *Skate* on both cruises.

Skate **officers** affix an American flag on a cairn containing a record of the visit. A face mask protects Lt. David Boyd (left) from the cold. Lt. Richard Boyle wraps a towel across mouth and chin.

A Dramatic, Torchlit Ceremony at the Pole: Men Scatter the Ashes of an Arctic Pioneer

The winter sun still hid below the horizon last March 17 when *Skate* crunched up through the ice at 90° N.—first ship in history ever to surface at the Pole.

"It was 24 below; the wind strong, and the light poor," Commander Calvert recalls. "We could see but a few hundred yards in the blowing snow."

More than two dozen of the ship's company filed onto the ice and formed a semicircle around a small table covered with green cloth. In the center of the table sat a bronze urn containing the ashes of Sir Hubert Wilkins, veteran Arctic explorer, who died last December. By the flickering light of a red torch, Commander Calvert read the Episcopal service for burial at sea:

Unto Almighty God we commend
the soul of our brother departed,
and we commit his ashes to the deep.

A rifle squad on *Skate*'s deck fired three volleys as the ashes vanished in the wind.

For years Sir Hubert tried in vain to reach the Pole. A pioneer in Arctic aviation, he was knighted in 1928 for a flight from Point Barrow, Alaska, to Spitsbergen, 400 miles north of Norway. In 1931 he anticipated the feats of *Skate* and *Nautilus* when he made an unsuccessful attempt to take a conventional submarine under the ice pack.

The United States Navy, at the suggestion of Sir Hubert's widow, gave the valiant Australian a final resting place in the northland he loved.

Stars and Stripes and the United Kingdom's White Ensign flap in the 30-knot wind that swept the ice during the service. Crewmen on the bridge prepare to hoist the Australian flag.

EASTMAN COLOR (LEFT) BY U. S. NAVY, OFFICIAL; SUPER ANSCOCHROMES BY JAMES P. CALVERT © NATIONAL GEOGRAPHIC SOCIETY

Bill Cowhill calls out the depth a foot at a time as we come up. Suddenly the antenna tip disappears, and I see a tiny circle of ripples made as our harbinger pierces this quiet pool. Open water, no doubt about it!

Now for the test of patience. I lower the periscope and buggy whip within the sail to protect them from being damaged by drifting ice as we break water. Bill continues to bring the *Skate* up carefully. Now the sail is just out of water, and it is safe to raise the periscope.

My first impression is that we are completely surrounded by ice—much too close. We are not used to seeing such short distances at sea through our periscopes. A more careful look reveals that we are almost precisely in the center of a lake of just about the dimensions determined by the plotting party.

"Prepare to surface," I say to Bill. He blows the tanks with high-pressure air, and the ship rises quickly to her normal surface draft.

On the bridge I look around at an endless expanse of white. Once more I have the feeling we are in much too small a place. But we are safely on the surface—farther north than any submarine has ever surfaced before. I look at my watch; the whole business has taken a little more than an hour and a quarter.

White Welcomer to the Arctic

"Captain, do you see the polar bear?" It was John Medaglia, *Skate*'s quartermaster, talking to me over the loudspeaker to the bridge. I had never been in the Arctic before, but I knew that to see a polar bear is a rare experience: you just don't come up here and see one the first day.

"No time for jokes, quartermaster. Let's stay with business right now," I said firmly. I was too pleased with the surfacing to be angry, but I didn't think it the appropriate time for such obvious tomfoolery.

In a few seconds my bridge lookout said, "Medaglia wasn't kidding, captain. Look! There's the bear now, climbing out of the water!"

I glanced to port just in time to see a full-grown polar bear pull himself out of the water, shake himself off, and stare very solemnly at what was undoubtedly his first atomic submarine.

"Medaglia, I'm sorry. Come up here and take a look at your polar bear," I called down on the loudspeaker. Soon our good-natured quartermaster was on the bridge with us, watching the bear he had seen through the periscope lumber away across the ice. It was gone before anyone thought of a picture.

The weather was surprisingly warm, about 32° F. Our strange world of Space Age gadgets and complex machinery was gone. We were just another ship sitting quietly on the sea, breathing natural fresh air and feeling very relaxed. But I looked around me again and saw the vast stretches of ice reaching in all directions to the horizon and realized that without our gadgets and machinery we would never see home again. Our reliance upon the *Skate* was still absolute.

The Uttermost Parts of the Sea

After a quiet lunch we submerged and left our friendly lake. Once more we were in the unknown. The pulsing of the sonars, ice machines, and Fathometers started up again. We set course for the North Pole.

We gathered for our delayed church services now, and the familiar and comforting words of the 139th Psalm filled the room:

> . . . behold, thou art there.
> If I take the wings of the morning, and dwell in the uttermost parts of the sea;
> Even there shall thy hand lead me, and thy right hand shall hold me.
> If I say, Surely the darkness shall cover me; even the night shall be light about me.
> Yea, the darkness hideth not from thee . . .

Never had the grand old Psalm meant so much to us before.

By the next afternoon we were within 150 miles of the Pole, and our regular gyrocompasses could no longer tell us which direction was north. Now our reliance on the inertial navigation set was almost complete. Its delicately precise mechanisms could sense the earth's rotation even at this point where the amount of motion was becoming so small. Here a point on the earth's surface moves only 1,000 miles in 24 hours, compared to 25,000 miles for a point at the Equator. However, our inertial machine not only could sense this motion but also could feel its direction and thus tell us which way was east.

At 1:47 a.m., Greenwich meridian time, on August 12, 1958, the earth's rotational force had settled to a single point, and we knew we had attained the North Pole.

Only a brief announcement and a joke or two marked our arrival. We were all too much aware that we had been preceded the week before to feel much jubilation, and we all had

In Bathrobe and Beret, the "Bailiff" Initiates a Blindfolded Pole Cat

In *Skate*'s lexicon, a pole cat is a man who crosses the Pole for the first time. At this off-duty session, the victim sits in a puddle of water. When his arm touches the metal table, he will get a slight electric shock.

something else on our minds now. If we could reach the surface at the Pole, or near it, then we might begin to show what we were all beginning to feel: that the Arctic Ocean can become a usable ocean for the United States.

With all directions south, we turned toward Canada and started along the 90th meridian of west longitude, slowly examining every possibility of a lake. No luck.

Over a Submerged Mountain Range

By noon our sonic sounding machine is beginning to show signs of one of the most interesting features of the Arctic Ocean, a lofty ridge of submerged mountains, in places more than two miles high, that roughly divides the ocean's floor into two parts, the North Eurasian Basin and the North Canadian Basin. The ridge was discovered in 1948 by Russians taking soundings from drifting ice stations and was named the Lomonosov after their famous 18th-century scientist of that name.

As we forge toward the Canadian side of the Arctic, our Fathometer feels the steady rise of the slope of this scantily charted range —a rise from the 14,000 feet of the North Eurasian Basin up to less than 8,000 feet.

"Look at this one, captain."

It is Walt calling from the ice detector. The thin black line of open water shows for a short distance. We'll investigate. "Station the plotting party" goes out on the ship's announcing system.

This is a small one, much smaller than our first on August 10—but we are anxious to get up: This is the top of the world. We are stopped under it now, still quite deep. I raise the periscope to look around. It goes up slowly as it strains against the sea pressure pushing it down. Instinctively I roll the prism to look straight up. The familiar blurred aquamarine, nothing else. Looking nearly straight out, however, I see the cobalt blue of heavy ice startlingly close aboard. I suppress a desire to cry out.

"One-twenty, one-nineteen, one-eighteen."

Bill Cowhill's quiet voice ticks off the depth as we rise slowly into this canyon of ice. I swing the periscope astern and look straight into an immense pressure ridge hanging down like a giant theater curtain.

"How close is that pressure ridge astern?" I ask. I try to keep a calm voice, but there's a lump in my throat.

"Plenty of room there, captain," says Louis Kleinlein, our senior sonarman. "It's a heavy ridge, all right, but clear of the stern."

The buggy whip goes up, and I watch its tip intently as it goes through the surface. I can see ripples all over the water now; must be a little breeze here.

"Captain, we're being set over to port. We're getting too close to that side." It's Nick's voice, sounding a little anxious.

I glance over there with the periscope. "Too close" is putting it gently. But what to do? We are nearly at the surface now. We may not find another opening this near the Pole.

"Keep her coming up, Bill."

Surfaced Forty Miles from the Pole

After what seems like an hour but must be only a few seconds, the sail is out, and I raise the periscope. The ice to port is close, all right—just a few yards away—and we are drifting very slowly toward it. There isn't much to do; we'll just let the sail touch and see if she will stay in that position.

A Tiny Outboard Circling the Surface Guides *Skate* to "Arctic Civilization"

With twin screws turning at slow speed, *Skate* nears Drifting Station Alpha during her August cruise. Her visit to this IGY camp, some 300 miles beyond the Pole, demonstrated that nuclear-submarines could support bases in the so-called Area of Inaccessibility.

As the motorboat churns the sunlit lake, its steady *put-put-put* registers on *Skate*'s sonar (page 26). Marine artist Hervey Garrett Smith has re-created the dramatic moment in this painting for the NATIONAL GEOGRAPHIC.

Torpedo tubes on the flukelike fin suggest a jet plane's afterburners. Curved guards protect the screws.

I look around the lake. It's small—too small for complete surfacing. It is surrounded by pressure ridges formed when the giant ice floes press together.

We ventilate the *Skate* through her snorkel piping and take a sun shot through our sextant periscope. Our position is 89° 20′ N. and 95° 00′ W.—forty miles from the Pole. No ship of any kind has ever been at the surface of the sea so far north.

The nervous strain of getting the *Skate* up in such tight quarters seems well repaid when we hear the radio operator at Manila, in the Philippines, answer our call loud and clear as we peer from the top of the world to talk to him. The Manila radio operator is having doubts: he can't understand why he is being called by the *Skate*. That's an Atlantic submarine and he has no notice she has shifted to the Pacific. We can almost see him shrug as he copies our report to the Navy Department in Washington.

We have wired a thermometer on the sail so we can look at it through the periscope. It shows 30° F.—still not cold. The wind is a very light breeze, judging from the ripples on the water. There is no sign of any life.

New Target, Exact Location Unknown

With the regular cruising watches manned and everything ready should trouble arise, we remained at Polynya No. 2, as we called it, a total of some 19 hours.

Our next goal was Drifting Station Alpha, one of two camps the United States had established on the drifting Arctic pack to take soundings and get oceanographic, meteorologic, and other data in connection with the International Geophysical Year.

Skate's operation order included the following laconic paragraph:

> . . . AND IF THE POLE HAS BEEN GAINED BY 14 AUGUST, SKATE IS FURTHER AUTHORIZED TO PROCEED AS FAR AS DRIFT STATION ALFA.

The date was August 13, and we had been at the Pole on the 12th. So at 9:30 a.m. on August 13 navigator Nicholson laid his course for a target that was moving several miles a day, and whose location we knew only approximately.

At Polynya No. 2 we had radioed the men at Station Alpha and asked for their exact position. They answered that clouds had been obscuring the sun and they'd had no sun fixes for several days, but as far as they knew, they

were near 85° N. and 136° W. We were all mildly amused at the prospects of finding this tiny place from underneath the ice when the exact location was not known even to the scientists of the station itself.

As I looked at the chart with Nick, I could see that the approximate Alpha position was close to what Arctic explorers had come to call the Area of Inaccessibility—that part of the ice pack most difficult of access by dog sled, airplane, or any other land-based device.

Nick's idea is to surface in any available lake and see if we can get some more accurate data on the whereabouts of the station. Sounds good. Almost as though to order, Walt Wittmann's ice detector serves up a thin black line and in a few minutes we are on the surface.

We inflate our rubber boat and send Walt Wittmann and Dr. LaFond "ashore" for ice and water samples.

From the bridge I look down at a dozen or so of the crew who have come on deck for fresh air and a look around. Joking and back-slapping are going on. The sense of grimness at the task ahead and the bitter disappointment of August 9 are dropping behind us now. I think of the words of Robert E. Peary as he came back from the North Pole in 1909:

"We returned from the Pole to Cape Columbia in only sixteen days . . . the exhilaration of success lent wings to our sorely battered feet."

I can see that the exhilaration of success is lending wings to the crew's battered spirits.

Submarine Homes on Outboard Motor

Nick comes suddenly to the bridge with his infectious grin, and I am called back to reality.

"We have a good radio bearing on Alpha now, and they've given us a better position. I don't think they're more than seven or eight miles away, and they say they have a good-sized lake right in their front yard!"

"We'll have lunch and then have a go at it," I say, as we leave the bridge.

While we are eating lunch, a messenger brings another radio message from Alpha:

WILL RUN JOHNSON IN OUR FRONT YARD POLYNYA.

"Now there's a good idea; why didn't we think of that?" asks Nick. He is thinking that if our sonar can hear the station's Johnson outboard motor running, it may help to guide us into the proper lake.

Soon after lunch we close up the ship, drop out of Polynya No. 3, set our best known course for Alpha, and start to listen carefully for the sound of the outboard motor.

A smile spreads over sonarman Kleinlein's face as he hands the earphones over to me. The soft *put-put-put-put* is unmistakable!

Before long we are too close to the outboard motor to obtain any direction from it. It becomes obvious that we have passed it, and we double back. Again the soft *put-put-put-put* seems to be all around us. Occasionally we see a small lake but none that looks big enough.

Suddenly Al Kelln says he has a line long enough to be the right one—or at least big enough to use. We'll try it.

Up we come a foot at a time, using our regular procedure. The buggy whip goes up, and again there is Cowhill's quiet chanting of depth as we rise slowly into our fourth lake.

Drifting Settlement Supplied by Air

The periscope breaks water on as remarkable a sight as I suppose I shall ever see through one. Again we are in the precise center of a nice-sized polynya—but round and round this one goes a small outboard motorboat with the occupant madly waving his hat!

As I swing the periscope around, I can see huts, a flagpole, radio antennas. We are in the midst of Arctic civilization (page 26).

"We're there, Nick," I mutter almost disbelievingly as I continue to look around. We are soon on the surface, safely moored, and talking to the occupant of the small boat. He is Maj. Joseph P. Bilotta of the United States Air Force, the station military commander.

"We have 29 men here, all told," he said, as we chatted in the submarine. "Thirteen of us are U. S. Air Force personnel, and our task is to operate the camp. The other 16, all civilians, make up the scientific party."

"How do supplies come in?" asked Nick.

"All by plane. The entire camp and all its material were originally brought in by plane. We have a landing strip which is usable during the winter months. During the summer our supplies are just dropped."

This had been a busy day for the *Skate* and I saw it was getting late—past 6 p.m.

"Well, I'd like to remain here tomorrow, and perhaps we can set up tours so some of your people can see the *Skate* and we can visit the station," I said. "Let's get a good night's sleep and start something about 8 a.m."

The major looked at his watch quizzically. "It's a bit late for that good night's sleep,

Huge Mounds of Tortured Ice Tower Above a Submariner

Walking among the pressure ridges bordering Skylight No. 6, Commander Calvert and his men pictured the indomitable Robert E. Peary sledging over and around such obstacles on his dash to the Pole 50 years earlier. Shifting floes, grinding together with tremendous pressure, raised these giant hummocks above the pack.

commander. It's 8 a.m. right now!" he said.

Suddenly I realized what was wrong. *Skate* had been keeping Greenwich, England, time to avoid the constantly changing time zones, but the drifting station was keeping Alaska time—10 hours earlier than Greenwich!

"Major, we have a problem here," I said, laughing.

"Well," replied our friend, with a smile, "my people are used to odd hours. We'll just take it easy today and have the visiting schedule tonight. We'll turn our night into day for you."

What more can a host do?

As we toured the station the next day, Dr. Norbert Untersteiner, the senior scientist at Alpha, pointed out what looked like dressed beef hanging from a pole.

"The boys shot a couple of polar bears," he told me, and added: "The meat seems pretty strong."

Later we were to realize what an understatement that was.

The midsummer melt season was at its height and shallow pools lay on the floes in every direction. This water is usually fresh enough to drink, and the clear, penetrating blue of these pools is unforgettable. On the other hand, they made life at Alpha in summer like living in a swamp.

"You know," said Dr. Untersteiner, "there hasn't been an airplane in here in weeks because of the melt. Your visit was a welcome break in our isolated life.

"But I don't know whether I like it or not," he sighed. "The Arctic has always had a beautiful privacy. Now it's gone. You people will be popping up all over this ocean before long."

Major Bilotta, Dr. Untersteiner, and I decided that a festive farewell meal was in order, and after the plans were made, I returned to the ship for a nap before dinner. I had no more than fallen asleep when the officer of the deck called me. The wind had shifted and the shape of our polynya was changing.

NATIONAL GEOGRAPHIC PHOTOGRAPHER J. BAYLOR ROBERTS

Skipper signs a sea of affidavits. Each man on *Skate*'s first Arctic voyage earned three certificates: Realm of the Arctic Circle, for crossing the Circle; Ancient Order of Magellan, for the round-the-world tour at the Pole; and Domain of the Golden Dragon, for appearing on the threshold of the Far East. Charter members of the crew received Plank Owner parchments.

The submarine service of the Royal Dutch Navy awarded the plaque to *Skate* men.

Just then Lt. Comdr. Bill Layman, *Skate*'s engineer officer, returned to the ship from the station.

"Captain, there's something funny going on with the ice," he said. "In the last hour or two a hummock 15 feet or so high has appeared. Look, you can see it from here."

Shifting Ice Threatens the Submarine

The wind was still less than five knots and the temperature only 31° or 32° F. However, it was apparent that ice motion transmitted from another area was making itself felt here at Alpha. The new ridge was a big one.

"Better call the people back, Bill," I said. "We're going to be forced to cancel the dinner, I'm afraid."

I was interested in watching what was happening. In the discussion of the past year, there had been conjecture that if a submarine was lucky enough to surface in one of the ice lakes, it wouldn't mean much because of their transitory nature. "In an hour or two the lake will change shape and force you to submerge," the skeptics had said.

Our experience to date had indicated quite the contrary. There had been no sign of deformation in three hours at Polynya No. 1, in 19 hours at No. 2, or in eight hours at No. 3. We had now been at Polynya No. 4 (Alpha) nearly 24 hours and were finally seeing our first polynya deformation. Thus far it was slow and gave adequate warning, but I fully realized that this might not always be the case and that the danger of the submarine's being caught and damaged in the ice was a real one.

I sent my regrets to Major Bilotta and Dr. Untersteiner about the dinner, and the *Skate* maneuvered into the center of the now

noticeably smaller lake. One of the last boat trips took 15 gallons of *Skate* ice cream to the station and brought back polar bear steaks in exchange.

About eight in the evening *Skate* slowly dropped out of sight as our new friends stood on the edge of the polynya and waved a farewell—a dedicated group of men for whom we had great respect and admiration. Living up there in complete isolation and with considerable privation, they well exemplified Fridtjof Nansen's famous words: "Man wants to know, and when he ceases to do so he is no longer man."

Back to the Pole—for Practice

Our operation order allowed us eleven days in the Arctic. We had now been in the ice pack six days and had accomplished two of our missions—the attainment of the North Pole and the visit to Drifting Station Alpha. We had made much progress toward the accomplishment of Item One, but we knew there was more work to be done on reaching the surface routinely.

We decided to return to the Lomonosov Ridge, intersect it somewhere between the Pole and Greenland, then zigzag over it back to the Pole. The more complex and radical our maneuvers near the Pole, the more we would demonstrate the effectiveness of the inertial navigation system at high latitudes.

One thing we still needed was a routine method of detecting suitable ice lakes as we proceeded at high speed, and returning to them without difficulty. When you pass under a small ice opening at 16 knots in a 3,000-ton submarine, you are well past it before you can slow down and turn around.

At this point we devised a system whereby the officer of the deck, noting a thin black line of sufficient length on the ice detector, would immediately offset his course to the right, reverse his rudder to swing completely around, and head back down his old track on a reverse course. Thus the opening could be relocated and plotted.

About the time we reached the 78th meridian of west longitude—roughly the longitude of Niagara Falls—our polynya-hunting system worked, and we felt the *Skate* heel over as the officer of the deck swung into his maneuver.

"Station the plotting party," came Bill Cowhill's voice on the ship's announcing system. In less than an hour *Skate* was surfaced in Polynya No. 5, a lake very similar to No. 3. In a few minutes the rubber boat was inflated, and our scientific party was out on the ice floes, gathering samples. The entire operation had been reasonably routine.

While we were on the surface, we received a message from the Navy Department telling us we were scheduled to be in Bergen, Norway, the 23d of August—just a week away. But right now our job was the Arctic. That evening and most of Sunday, the 17th, we drove northward at 17 knots. We were essentially going along the backbone of the Lomonosov and drawing a more and more accurate picture of the majestic mountain range hitherto so well hidden by its mantle of ice-covered ocean.

By two in the afternoon *Skate* was within 50 miles of the Pole and working her way up into what looked like a small but usable lake.

From the time I got the periscope up, however, I began to have my doubts. The ice looked too close on every side. When I finally got the periscope out of the water, I could see that the stern was under the ice and the port side very close to it. An attempt to move the *Skate* resulted in a rubbing noise; the deck aft was apparently touching the ice.

After a stay of only six minutes we dropped out of Polynya No. 6. It was just too small.

However, this was apparently a loose ice area because in less than an hour we were maneuvering under another lake, this one of very good size. In short order we were on the surface in latitude 89° 16′ N., 44 nautical miles from the Pole. This was the largest polynya we found in the Arctic. The rubber boat was again inflated, and this time I accompanied the scientific party to the ice for a walk.

Here again was that feeling of lonesomeness, of utter separation from the world of reality. The absence of any noise or sign of life combined to give an eerie other-world feeling. I was glad to get back to the *Skate* with its light, warmth, noise, and banter.

Sea Rejects Polar Bear Steak

Shortly before the evening meal *Skate* submerged from Polynya No. 7 and set course directly for the Pole. By eleven we were there again. We took exhaustively careful soundings, gravity measurements, and navigation readings to ensure that we had attained the precise navigational Pole and had as much data as possible from the famous spot.

By August 18 we had made our eighth surfacing in nine days, and we felt Item One was

getting into the "mission accomplished" class.

Taking water samples at various depths in this polynya, some 250 miles from the Pole, Dr. LaFond found that the top 12 feet or so was fresh water, with a very sharp boundary between fresh and salt.

During this stay we tried cooking the polar bear steak given to us at Alpha, but it proved to be so oily and smelly that the cooks wouldn't allow it to stay in the galley. Medaglia dutifully brought it on deck and threw it over the side. It sank like a stone through the fresh water but stopped abruptly at the layer of salt water with its greater buoyancy.

"Look at that!" grinned our quartermaster. "Even the ocean won't have the stuff!"

Our time was now getting short and after one more successful surfacing, we headed for the edge of the pack. By late in the afternoon of the 20th the *Skate* was in open water for the first time in 11 days. In that period we had covered 2,405 nautical miles, surfaced nine times, obtained more than 652,000 recorded soundings in previously uncharted waters, and discovered enough submarine canyons, peaks, and ridges to name one after every man in the crew.

In Norway *Skate* was visited by the gracious King, Olaf V. Equally wonderful visits to the Netherlands, France, and Belgium followed, and at the end of September we were in New London again.

But Could It Be Done in Winter?

Life is seldom so sweet as for the sailor freshly home from the sea. But once the glow of home-coming and the round of luncheons, dinners, and receptions were over, there remained the cold facts of the matter—the business end, so to speak. What had our cruise really accomplished? Had we truly shown that the Arctic Ocean could be freely used by the Navy? What about the winter months?

Every submarine operation ever attempted in the Arctic had been conducted in the summer and almost every one in August. Even the first attempt at under-ice submarining, by Sir Hubert Wilkins in his own *Nautilus* in 1931, had been an August adventure.

On October 18, 1958, Sir Hubert spent a day with us in the *Skate*. His answers to our questions about openings in the ice in winter were not very encouraging.

"Oh, you'll probably find some open water in the winter, but it's scarce," he said. "Most of the great over-ice treks have been made in March and April. Those are the months when the ice pack has the least open water and thus the least hindrance to over-ice travel."

"Yes, that's when Peary made it to the Pole. Wasn't it April?" I asked.

"Yes, indeed," Sir Hubert said. "April 6, 1909—just 50 years next spring. You ought to go back on his anniversary!"

"Not much good to do that if we can't get to the surface," I laughed.

"How about boring a hole? That was one of my schemes in 1931, you know. You don't necessarily have to surface," Sir Hubert said.

"Yes, we do—for our purposes. Unless the submarine can get all the way to the surface in every season, we haven't really opened a new ocean for the Navy; we've just shown that a submarine can operate under the ice. That's not enough," I answered.

Why Not Do as the Whales Do?

January, 1959, brought a visit to Hanover, New Hampshire, to speak at Dartmouth College—and an opportunity to chat with Dr. Vilhjalmur Stefansson, the famous explorer who is on the faculty there.

"The air temperatures are about the same in January, February, and March," he remarked. "But by March the ice has just about reached its maximum. That's as poor a month as any to find open water."

"But there's some open water all winter, isn't there?" I asked.

"Some, all right, but I think it will be pretty hard to find. Any open water you find in winter will have to be mighty new."

"What do you mean?" I asked.

"As you know, the average winter temperature is about 30 below," he replied, "and at that temperature salt water freezes six inches thick the first 24 hours!"

That was something I hadn't known, and it answered a lot of questions. New leads might form, but unless we could find them promptly they would soon be thickly frozen over.

"But I don't see why you need open water anyway. You can break through the thin ice, can't you?" Dr. Stefansson asked.

"Depends on how thin," I answered.

"I've seen the whales break ice six or eight inches thick in the frozen leads—with their backs," he said.

"Yes, I remember now. You mentioned that in your book *The Friendly Arctic*," I mused. If the whales could do it, why not the *Skate*?

(*Continued on page 33*)

PHOTOGRAPHS BY NATIONAL GEOGRAPHIC PHOTOGRAPHER J. BAYLOR ROBERTS © N.G.S.

A Tunnel Floored with Lead Permits Safe Passage atop the Reactor Space

Six inches of glass shields officers inspecting *Skate*'s atomic heart. Crewmen enter the reactor compartment only when engines are shut down; even then they must wear protective clothing. Amber bulbs light the reactor space especially for this picture, made while the submarine lay in her berth at New London, Connecticut.


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KODACHROMES BY JAMES P. CALEMY AND (NEXT PAGE) R. T. ARNOTT © N. G. S.

Shore Leave Ended, Liberty Party Paddles Shipward from Station Alpha

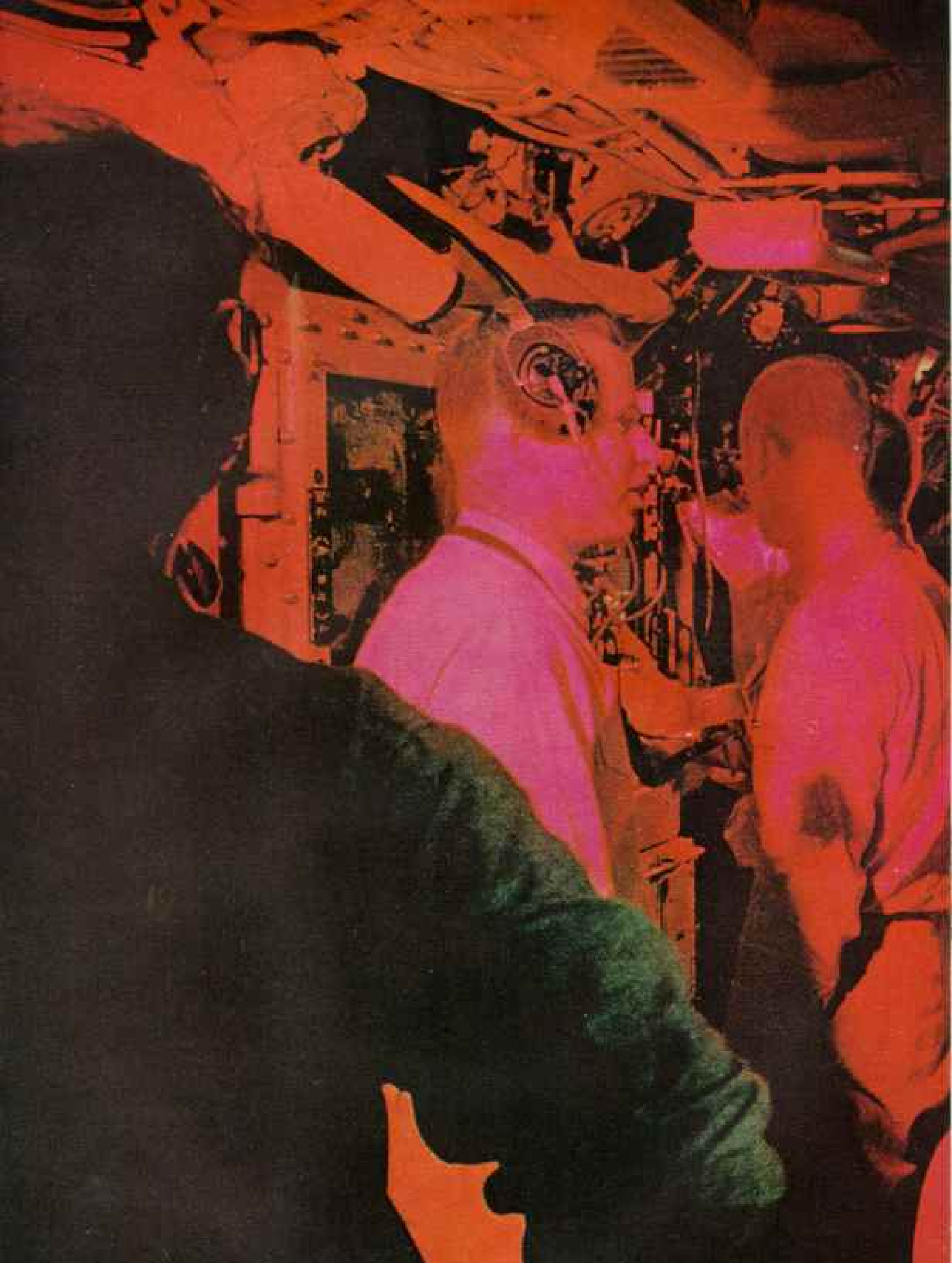
Summer sun, wind, and above-freezing temperatures combined to produce this large lake, or *polynya*, in Alpha's front yard—a perfect surfacing spot for *Skate*. Mooring to the edge of the ice, the crew inflated a rubber boat and took turns ashore.

Twenty-four hours later the wind shifted, and the ice appeared to be closing in. Hurriedly pulling stakes and stowing lines, the sailors maneuvered *Skate* into the center of the narrowing polynya. One of the last boat trips saw 15 gallons of ice cream leave the sub in exchange for polar bear steaks.

An outboard runabout speeds across the lake toward *Skate*. In the bow Maj. Joseph P. Bilotta, Alpha's military commander, calls a welcome on behalf of his visitor-starved camp. A few minutes earlier the sound of the boat's motor had guided *Skate* to the polynya.

Alpha's Jamesway huts, radome, and radio towers dot the white plain.

Climbing steeply, Skate *shakes free of the Atlantic*
during maneuvers off the Virginia capes. Water cascades
from the winglike bow planes and decktop sonar domes.



On Target . . . Fire Torpedoes. **Unearthly Red Light Bathes Attackers on a Night Run** Special lights cast a cherry glow through the attack center as *Skate* cruises under dark Atlantic waters. Unlike ordinary lighting, which

impairs night vision, the red light makes it possible for submariners to see enemy ships through the periscope. Attack coordinator Layman, wearing earphones, relays target bearing and speed to skipper Calvert (right). Shadowed crewman at left signals the torpedo room on this practice mission.

KODACHROME BY NATIONAL GEOGRAPHIC PHOTOGRAPHER J. BAYLOR ROBERTS © N. G. S.

Skate Bursts Up and Out of the Depths. No. 1 Periscope Lances the Sky

Projecting bow planes, which control up-and-down motion, fold into side slots for surface travel. Photographer Roberts and Lt. R. T. Arnest balanced in a raft on the choppy Atlantic to make this striking photograph and the one on pages 28 and 29.

While I had been talking and reading, the Navy Department had been working, and I soon learned that *Skate* was indeed going to learn about the Arctic in wintertime. She was scheduled to leave New London in early March for another exploratory venture into the Arctic Basin. We would be accompanied by a staff of civilian scientists again, and our Arctic equipment would be brought up to date to include all the latest devices, notably an underwater television set.

With most of our veterans from last August still on board, we were ready to go. Our only major change was the loss of Lieutenant Commander Nicholson. He had gone to Honolulu in December to command his own submarine. Bill Layman, our old engineer officer, had moved up to be the new exec and navigator. Dave Boyd was the new engineer.

Our civilian staff was to be headed by Dr. Waldo K. Lyon, of the San Diego Naval Electronics Laboratory. Dr. Lyon had been on every Arctic submarine cruise made by the Navy except the *Skate*'s 1958 venture—and he missed that only because he was embarked in *Nautilus* for her transpolar cruise. Walt Wittmann was to be with us again, as was Zane Sandusky, the inertial navigation expert.

To the Arctic at Its Wintry Worst

March 3 saw us leaving New London for the Arctic with our new equipment and 107 men on board.

Eleven days later, after a routine 4,000-mile submerged cruise, we went deep and headed north. By eight in the evening our ice detector was showing large floes overhead, although still much open water.

Our winter of reading had brought out a new fact that added nothing to our peace of mind. Last summer we had assumed there were no icebergs—chunks of glaciers that have fallen into the sea and have drafts that may exceed 1,000 feet—in the polar ice pack itself. A more careful search of the literature had revealed that the Russians had found icebergs within the pack as far back as 1938. Although we knew the chances of hitting one were remote, the possibility added suspense.

By ten in the evening the ice above us was fairly solid as *Skate* steamed for the Pole at 16 knots. In the morning we were some 120 miles inside the pack, and the ice was showing solid overhead. Our new television stared straight upward with its single eye and watched the ice glide by. It was equipped with two monitoring screens in the control room, so the crew could gather around and watch the scenery.

By 9:30 on that Sunday morning we were hovering underneath what we had hoped would be a stretch of open water, but it was apparent that it had a coating of ice. Judging from the light coming through from above—which I could see through the periscope—it was relatively thin.

Should we go on and look for open water? After all, we were at the start of our cruise. Why risk banging up the ship the first day? On the other hand, if we were going to break through the ice, we ought to get some experience here—about 500 nautical miles from the Pole—where the going might be easier.

The first Sunday in the ice had been a good day last August. We'd try it again!

Strengthened Sail Breaks the Ice

Positioning is not difficult, and we start the *Skate* up slowly after she is completely stopped. Again the jellyfish are a help, but they are not as numerous as last summer.

Lt. Guy Shaffer is the new diving officer, and he brings the ship up carefully. The periscope goes down, as we are now only 40 feet or so from the ice. We swing the Cyclops eye of the TV aft so that it sees the top of *Skate*'s sail—the part of the ship that will take the shock when we hit the ice.

As the sail comes into sharp focus on the TV screen, I think of all the important equipment packed into this 6-by-20-foot container: the periscopes, the radar, our radio antennas, all built so that they can be raised and lowered by hydraulic pressure. They are all lowered now, but if the sail is crushed or deformed by hitting the ice, perhaps none can be raised again—making it almost impossible to operate the ship.

Of course the sail has been strengthened. Its top looks humped and, all in all, strangely like one of Dr. Stefansson's whales. But still it is with more than mild anxiety that we stare at the TV screen and watch the sail come closer and closer to the ice.

Carefully Guy Shaffer allows the nearly 3,000-ton mass of the *Skate* to bump against the ice. We rebound gently away. Too cautious, but that's all right for the first try. We bring her up again, this time a little faster.

All eyes are on the TV screen when suddenly the image disintegrates into splashing water and breaking ice. I glance at the depth gauge:

the ship is so close to the surface that the sail must be above the ice. We have broken through!

Quartermaster Medaglia soon opened the hatch, but getting to the bridge was another matter. Our way was blocked with huge chunks of ice. We had to use a crowbar to break up and move these pieces before we could get up the ladder to the bridge.

Low Sun Lights a Magic Scene

Once up there we had a breath-taking sight. Contrasted with last summer's Arctic world of pale-blue melt ponds atop the ice floes, and almost black lakes of open water, this was a world of stark, frozen whiteness.

Skate lay near the center of a polynya similar in size and shape to those she surfaced in during August—but it was frozen solid with a flat sheet of snow-covered ice. The submarine had poked a hole for herself in this billiard table of smooth ice. Now she sat there, looking like the confectioner's prize decoration on a new white cake.

The edges of the frozen polynya were bordered by the usual pressure ridges. Everything was white with a thin snow cover. The wind was light, the temperature crisp and not immediately unpleasant, though later measured at 20° below zero F. The sun hung low over the southern horizon, and a gossamer overcast shrouded the scene. There was no sound or any sign of life. The effect was one of ethereal, cold, almost fragile beauty.

After a moment's fascination with our surroundings, Medaglia and I turned to more practical matters. We cleared some of the ice from the bridge and attempted to talk to the control room through the waterproof electrical speakers. They were frozen and useless. We rigged headset telephones for the purpose, and they worked very well.

The polar water, usually thought of as frigid, is by far the warmest part of this winter environment. It remains near 30° F., while the air temperature is 50 to 70 degrees lower. *Skate* had undergone a drastic temperature drop in coming to the surface here, and a complex series of procedures—worked out before we left port—were put into effect to protect her vulnerable parts from freezing.

It was easy to step from *Skate*'s low deck to the ice, and I took a walk around her to check for damage. She seemed to have broken through with no difficulty. It is not every day a skipper can walk away from his ship and contemplate it from a distance while it is a hundred miles from land, in water more than a mile deep.

To learn something about the way ice breaks when battered from below, Dr. Lyon was eager to get motion pictures of *Skate* actually breaking through the ice. This was a roomy polynya. Why not put our motion-picture man on the ice, submerge, move to a different part of the lake, and break through again?

We decided to do it. Our ice party included our ship's doctor, Dick Arnest; Chief Torpedoman's Mate Paul Dornberg, and Quartermaster Alexander Martin. (Martin still claims he was not aware of what was planned when he glibly joined this group.) I waved them a farewell as we prepared to submerge.

We were soon dropping back into the sea, and by TV we could see a coating of ice form on the sail as the intensely cold metal struck the warm water. The TV also showed the cigar-shaped hole we had made in the ice, and with this as a reference point, we moved to an area where the ice was unbroken. Here we stopped and came up as before.

The ice broken, I went to the bridge and was relieved to see our party intact and in good photographing position.

"Did you get some good ones?" I shouted expectantly.

The silence was eloquent. Their cameras had frozen, and they had gotten nothing. We were beginning to learn the hard way.

Television Captures Undersea Drama

By five in the evening we were ready to move on. Reassured by our ability to break through the winter ice, we dropped down and set course for the Pole.

Our first day under the ice had again been Sunday—and again successful. There was a full room as we met for our necessarily postponed church service. We used the order for Evening Prayer, closing with the lovely words of the Nunc Dimittis: "Lord, now lettest thou thy servant depart in peace. . . ."

Everyone felt the beauty of these ancient phrases. The practical young men whose business for the next few days must be machinery and ice could also feel the meaning behind less tangible things. The day had been a full one, and this was a fitting close.

For this cruise *Skate* had been equipped with upward-beamed lights in her superstructure on the chance they might be of

some value. On Monday the television engineer, Cramer Bacque, of Baltimore, turned on one of these lights for use in adjusting his television, and soon the screen showed a school of small fish darting in and out of the rays. Quite a crowd had gathered around the screen in the control room when suddenly a fish—three or four feet long—shot through the television picture, mouth wide open, and scooped up a few of our small companions.

"Better than Channel 8 back home!" laughed the irrepressible Medaglia.

Monday afternoon brought another stretch of thin ice—we were beginning to call them "skylights"—and by four o'clock we had broken through the ice and reached the surface again. The scene was similar to that of the day before, with perhaps a heavier overcast. The sun was low and red in the southwest. We were 220 miles from the Pole.

I walked out on the ice to examine the ship carefully and snap a few pictures. Taking off my heavy mittens to operate the camera, I soon found that I could no longer feel the levers and knobs. At once I hurried back to the ship, but the pain I experienced with these frost-nipped fingers over the next few days was a lasting lesson.

In the evening we submerged for the run to the Pole, which we reached next morning.

At this point I had an announcement to make to the crew. Sir Hubert Wilkins had died on December 1, 1958—little more than a month after his visit to the *Skate*. One of his last requests had been to have his ashes left at the North Pole by one of the nuclear submarines that he knew would surely someday return there. It was with no knowledge of our projected trip, but merely with the suggestion that this

Ice blocks strew *Skate*'s deck after a break-through. A member of the crew walks through mist rising from the relatively warm sea water.

"Stand By for Surfacing!" Tension Grips the Watch in the Maneuvering Room

The power plant which propels *Skate* is a further development and refinement of that installed in *Nautilus*, the world's first nuclear-powered vessel.

Electrician's Mate 1/c E. L. Mauk, seated at right, adjusts the loads on the generators as the vessel rises toward a skylight. Lt. Richard J. Boyle stands behind him.

be done "when the opportunity arose" that Lady Wilkins left the ashes with Rear Adm. Frederick B. Warder, Commander of Atlantic Submarines, in New London.

I had not discussed the matter with my crew en route to the Arctic—partly because I wasn't sure we could surface at the Pole. It would be a poor ceremony if held submerged.

But now it began to appear as though our chances of bringing the *Skate* up at the Pole were at least worth discussion. I told the crew of our assignment, using the ship's announcing system. All respected and admired Sir Hubert. The task of surfacing the next day at the Pole took on more immediate meaning.

Skate Surfaces Squarely at the Pole

By 10:54 Greenwich time on March 17, the *Skate* had returned to the North Pole. But we were hundreds of feet below the surface and might as well have been cruising in the friendly waters of the Caribbean for all we could see. The surface was the thing.

We commenced our search at slow speed, looking with every means at our disposal for the thin ice which would give us our opportunity. But everywhere ice of 10 feet or more created a black ceiling for our icy world. No skylight. Hours went by.

Of course the ice cover at the Pole—as in almost all parts of the Arctic Ocean—is on the move. As we remained near the Pole, this ponderous canopy was slowly changing. We determined to stick to our task.

As the afternoon wore on, Lt. Al Kelln found a small skylight worth examining. As we hovered under it, looking through the periscope, the faint emerald green of a long narrow crack—a lead, not a polynya—appeared. It was not very big, but worth a try.

Again and again we patiently maneuvered *Skate* into position, only to find that as we neared the ice, the lead had drifted away. Finally, about 4:30, our sail crunched into the ice where we wanted it. We watched the TV with anxious eyes: it showed us going through! The ice was heavier here than we had broken before, but we were breaking it.

Climbing eagerly to the bridge, I saw a sight different from those of the two previous days. The sun was still just below the horizon, and a very heavy overcast made for late twilight darkness. But the major difference was the wind. It was roaring around us at about 30 knots, blowing the snow until one could see no more than a quarter of a mile.

We were on the edge of a narrow, winding lead that disappeared into the hazy distance.

BRUCE MEADER

Both sides of the lead were piled with the heaviest and ruggedest hummocks I had yet seen in the Arctic. It was a wild and forbidding scene, but it did little to dampen the joy we all felt in accomplishing what we had set out to do.

The *Skate* was the first ship in the history of the world to be on the surface at the geographic North Pole.

But more important than that for us at the time was the fact that now we could do what Sir Hubert had asked.

With this strong wind there was certainly danger of ice movement and resultant damage to the ship. I was anxious to get on with the task. We decided to have the service on the ice beside the ship, using it for a windbreak. For extra light we would burn red torches, like the ones truck drivers burn when making night repairs. We flew the Australian, British, and American flags to honor the lands of Sir Hubert's birth, service, and last residence.

The scene was impressive. The officers and crew, in their heavy Arctic clothing, were in

JAMES F. FOLVENT

Aqua-Lung Divers Explore a Frigid Sea

Wearing foam-rubber suits, crewmen plunged into the Arctic Ocean at two spots.

Standing on the submarine's submerged stern, Lt. David Boyd and Lt. Richard Arnest prepare for a 40-minute exploratory swim.

Though the water tested 30° above zero, "it felt like a hot bath compared to the minus-30° air," said Boyd.

After diving 30 feet to fill bottles with water samples, Sonarman James Hall and Hospitalman Richard Brown rest on the ice.

ranks both on the ice and on deck. The swirling snow loomed around the red torches held on either side of the small table on which the container with Sir Hubert's ashes rested. I read the service and a short prayer Sir Hubert had written.

Dave Boyd and I, accompanied by the torchbearers, walked to a place away from the group. There, as I read the committal sentences, the ashes of this great man were spread to the strong winds across the frozen surface of the sea (pages 14-15).

A rifle squad cracked a last salute, and it was over. We silently returned to the ship.

After dinner we made a small cairn of ice blocks and placed within it a waterproof container with the record of our visit and Sir Hubert's committal. Atop the cairn we left an American flag on a steel shaft. It is not inconceivable that the ice which was at the Pole that day may, in time, drift out of the polar sea and allow the container—which will float—to drift onto the shores of Greenland or Iceland. Its return to *Skate* would be of great historic and scientific value.

About 8:30 in the evening, as *Skate* submerged, I took a last look through the periscope. As the submarine sank lower in the sea, the hummocked ice along the edges of our narrow lead took on the appearance of a rocky canyon into which we were slowly sinking. I could still see the cairn with its flag whipping proudly in the wind.

Thicker Ice Gives *Skate* a Nasty Jolt

As we left the Pole, we followed the spine of the mighty Lomonosov Ridge southward. On the 19th of March we found what appeared to be a usable skylight, and after working into position, we were soon watching the sail approach the ice.

As the sail struck, we felt a sensation like the jolt one feels when an inexperienced elevator operator stops too suddenly on the way up. The television confirmed that we had not broken through—our first failure.

"Well, you're still three for four, captain," grinned my friend Medaglia.

The disappointment of this failure was not deep, but when several more identical failures followed, we began to worry. Had we just been lucky on our first three tries?

Finally on the 20th we worked the *Skate* under a narrow lead that showed some promise. It was near midnight, local time, in the eastern longitudes we were exploring, and in the relative darkness we turned on the light atop our sail so that on our television screen we could watch it approach the ice. The cone of upward light against the underside of the ice made a dramatic picture as we came up.

We fully expected the slightly sickening sensation of another sudden stop—when suddenly the light went out! Baffled for a moment, we soon realized why we could no longer see the light; it was shining up into thin air. We were through again!

It was with a real feeling of relief that I climbed to the bridge for the first time in nearly three days. The awaiting view was worth the effort. It was virtually dark, and all the stars were out—the first we had seen in the Arctic. The sky was cloudless, and a gibbous moon lighted the surrounding ice with a beauty I cannot describe. The *Skate* was in a narrow lead winding through lightly hummocked ice. I'm sure that when the first men step out on the moon they will not see a more unearthly or delicately beautiful vista.

Divers Explore Under the Ice

It was time to give our Scuba divers a chance. (The initials stand for Self Contained Underwater Breathing Apparatus.) In an air temperature of about 30° below zero, Lt. Dave Boyd and Lt. Dick Arnest were soon on the deck in black rubber "wet suits" and Aqua-Lungs. There was a small hole in the ice near *Skate*'s rudder and in they went (opposite).

I must admit I watched them with some misgivings. But underwater examination of the Arctic ice is one of the requirements for learning all we need to know about its structure—notably the huge underwater pressure ridges, some of which go more than 100 feet down below the mean ice level.

Far from a stunt, *Skate*'s use of divers was an attempt to blaze the trail in this area—to see whether wintertime Aqua-Lung operations from a submarine in the ice pack are practical. They are.

Our fifth surfacing was noteworthy mainly for the fact that on the way up we saw a two-foot puddle of open water, the first and last open water we saw on the entire cruise.

Sunday evening, the 22d, saw *Skate* on the surface for the sixth time, in a long and narrow lead. The air temperature was 31° below—cold enough to crystallize the salt out of the ice on the lead. It seemed covered with giant snowflakes half an inch or more in diameter.

We had begun to develop trouble with part of our engine-room machinery: not the nuclear part, but still vital to the ship. Repair would be a major job, including lifting heavy weights and opening watertight connections.

At 10:30 Dave Boyd's engineers started their repair work in the engine room. I went out on the ice to make my usual inspection of the ship and its surroundings. The estimated time for the repair was 15 hours; so we would be in this lead longer than in any this cruise. Our longest so far had been about 10½ hours at No. 4, where the Scuba divers had worked.

Crippled Ship Menaced by Groaning Ice

About 11 p.m. Lt. Al Kelln, the officer of the deck, called me to the bridge. He pointed out ice movement along the edge of the lead. It made an occasional crack or groan.

This was the first ice movement of any sort we had seen, and although it did not look serious, it was unwelcome. Once the repair work was started, it was necessary not only to stop but also to undo some of it before *Skate* could safely submerge. Even then submergence was distinctly not desirable.

Al and I watched the ice from the bridge anxiously. We called back all the crewmen walking on the ice and got them below.

There was no question now; the movement was becoming much worse. The hummocked ice to our portside was noticeably closer. The ice of the frozen lead surface was beginning to crawl up the sides of the ship in most alarming fashion. Most disturbing of all was the noise. The crashing, groaning, and shrieking from the ice defied description. So loud was it that Al Kelln and I, standing two feet apart, had to shout to make each other hear.

I went below, and the noise was nearly as audible there. It resembled the sound one might hear if one were inside a steel drum being dragged over gravel.

I went briefly to the engine room, where the machinery was laid open. The men were working as quickly as they could, but this was a job to be measured in hours, not minutes.

Back on the bridge, I could see that the ice movement was much worse. Heavy vibrations could be felt through the ship, and we were taking a considerable list.

All I had ever read about ships being caught and crushed in the ice flashed through my mind. I had talked to many Arctic-wise men about this very situation. Their advice had all boiled down to one sentence: When ice starts to move, don't stay around to argue with it. Now it was easier said than done.

Home! The Ship Sails up the Thames River Toward New London

Traveling in an engineering marvel, the submariners made a comfortable 36-day voyage, enjoying movies, hot showers, 22,400 cups of coffee, and 160 gallons of ice cream in the wintry North.

On April 7, 1959, soon after this picture was taken from a helicopter, *Skate* pulled into her home berth, ending her Arctic voyage.

"Could you draw up a little closer to the newsreel cameras?" a Navy official asked. "It's easier than parking in the ice," said the submarine's captain with a grin.

Relatives carried placards reading "Welcome Home North Pole Sitters," and a band blared "I'm Sitting on Top of the World."

Still, there was no other solution. I told Dave Boyd to undo what he had done in the engine room and get ready to submerge.

By 11:50 we were ready. As Al Kelln was leaving the bridge, he noticed the movement diminishing somewhat. He held up the dive and called me to the bridge. Somewhat annoyed, I went up. This was no time to be shilly-shallying back and forth about a decision. But there was no doubt: the movement was distinctly diminished. I waited; by midnight it had stopped completely.

Skate Escapes an Icy Trap

Although I was well aware that the vise could start closing again, I told Dave to reverse the signals and start to work. Was this just indecision or was I prudent? I didn't know. By three in the morning the repair job was well along; the men were doing a wonderful job. Still no ice movement. There was no point in pacing about. I took a nap.

At 6:30 Dave called me and said he was ready to answer bells—the engineer's way of saying his work is completed and tested. Only eight hours—counting the backtracking I made them do—for a 15-hour job! How can you go wrong with a crew like that?

There had been no sign of ice movement since midnight. At 6:39 a.m., with no regret at all, we submerged from Skylight No. 6—a part of the Arctic none of us will forget.

On the 24th we gave our Scuba divers another workout, and they came back with stories of six-foot-long stalactites hanging down from the flat ice of the lead. The photographers got another chance at filming *Skate* rising through the ice; this time they took along a blanket to keep their movie cameras warm—and got the pictures.

On March 27 we left the ice pack, with 10 surfacings and 3,090 sea miles of under-ice cruising accomplished.

As we set our course for home, we cleared messages to New London and Washington summarizing our experiences. Before long we had received a message from Admiral Warder. In part it said, with a bit of parental hyperbole: THE ENTIRE SUBMARINE FORCE JOINS ME IN SALUTING ONE OF THE GREAT SHIPS OF THE AGE.

Upon opening my mail at New London, I found a small gift from Admiral Rickover. It was a bronze paperweight upon which was inscribed: "O, GOD, THY SEA IS SO GREAT AND MY BOAT IS SO SMALL."

I thought of Skylight No. 6 and the roaring vise of ice that somehow failed to close.

Twice the size of Texas, the new 49th State touches fingers with Siberia and extends the United States north to the shore of the Arctic Ocean

Alaska Proudly Joins the Union

By ERNEST GRUENING
United States Senator from Alaska

Illustrations by National Geographic Photographer
THOMAS J. ABERCROMBIE

FOR six days the august chamber of the United States Senate had rung to spirited debate. Now, at eight o'clock on the evening of June 30, 1958, it ended with a vote and five simple, momentous words:

"So the bill has passed."

The supporters of statehood for Alaska, crowding the Senate galleries, burst into a tumultuous ovation, despite Senate custom—and my own hands ached from their part in it.

An open telephone line flashed the news to Fairbanks, where jubilant citizens launched weather balloons towing aloft a 15-foot golden star, symbolic of the 49th State. Others tried to dye the Chena River, flowing through the city, gold; no one seemed to mind when its waters turned green instead.

As word spread through Alaska, stores closed, bonfires blazed, church bells pealed, sirens wailed. Parades, parties, and festival gaiety unmatched in the Territory's history enlivened the night—a daylit night, for Alaska knows little darkness at this time of year.

Our first flash of rejoicing over, we Alaskans in Washington repaired to the Senate chapel for prayer. It was a prayer of thanksgiving; a humble supplication for the successful voyage of this newly launched ship of state.

Well, of course, there were a few formalities remaining before Alaska could officially join her 48 sister States: a Presidential signature and proclamation, a vote of approval by the Territory's people, an election to fill new State offices. I will not deny that I was very happy to be chosen one of Alaska's two United States Senators. But to me the real climax of this American drama will always be the simple finality of those five words uttered by the Senate's presiding officer at that historic moment, Senator Richard Neuberger: "So the bill has passed."

It had been a long struggle—91 years. It began on March 30, 1867, when William Henry Seward, Secretary of State in President Andrew Johnson's administration, signed the treaty which legalized his bargain with Baron Edward de Stoeckel of Russia.

Gold Strike Ends 30 Years of Neglect

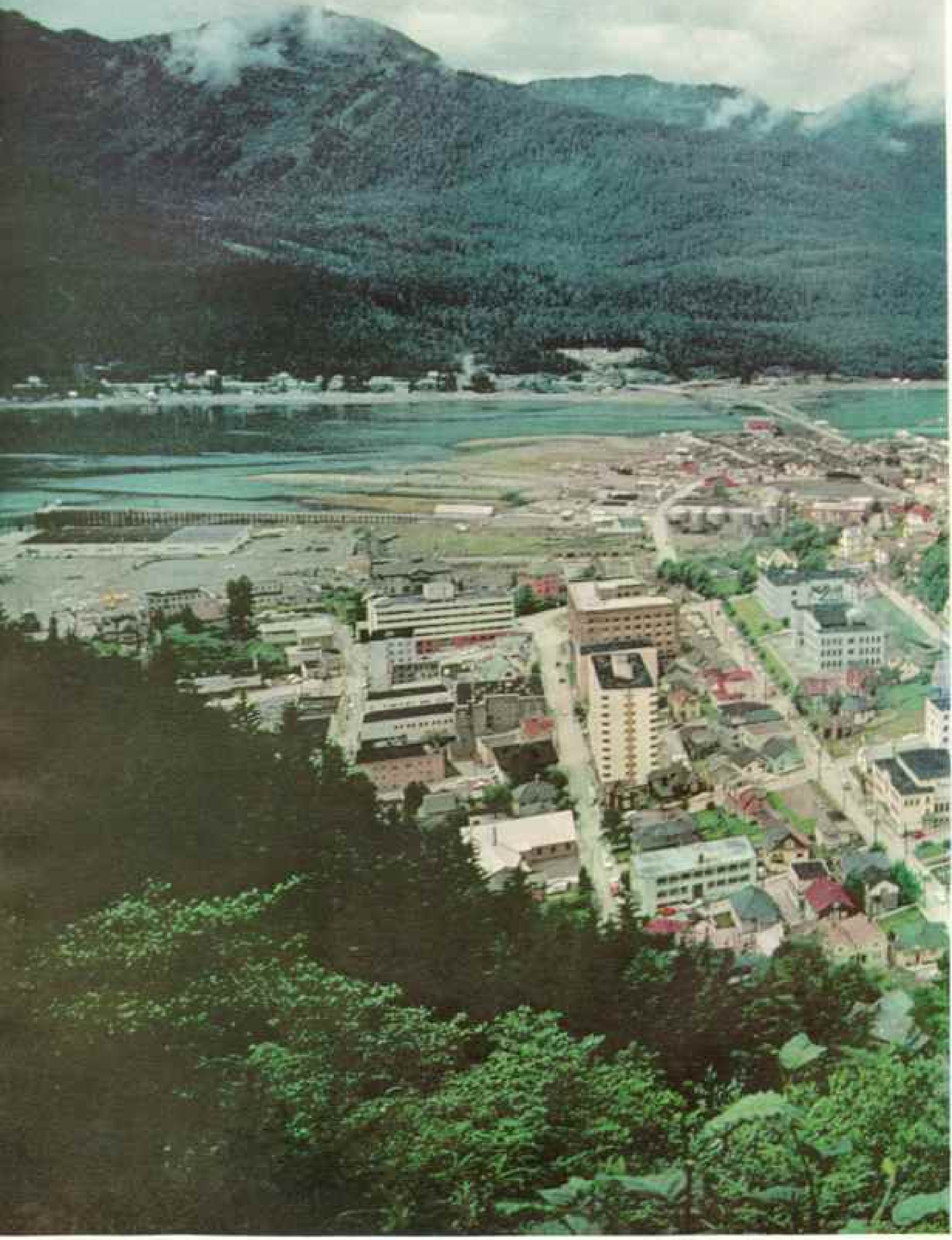
A year later when the House of Representatives was called upon to pay the bill—$7,200,000—a lot of skeptical Congressmen scornfully labeled Alaska "Icebergia," "Walrussia," "Seward's Icebox," and "Johnson's Polar Bear Garden." If American forces had not already raised the Stars and Stripes in Sitka, capital of Russian America, the House might have refused to pick up the tab.

Three decades of oblivion followed. Alaska, mistakenly regarded as a worthless expanse of ice and snow fit only for walruses and polar bears, was forgotten. The young United States was occupied with the epic task of spanning the continent and winning the West.

Then a Seattle newspaper headline in 1897 shrieked, "A Ton of Gold," and Alaska was rediscovered. The S.S. *Portland* had docked with early dividends of the fabulous Klondike strike in Canada's Yukon Territory. The West was pretty well settled now, and adventure-

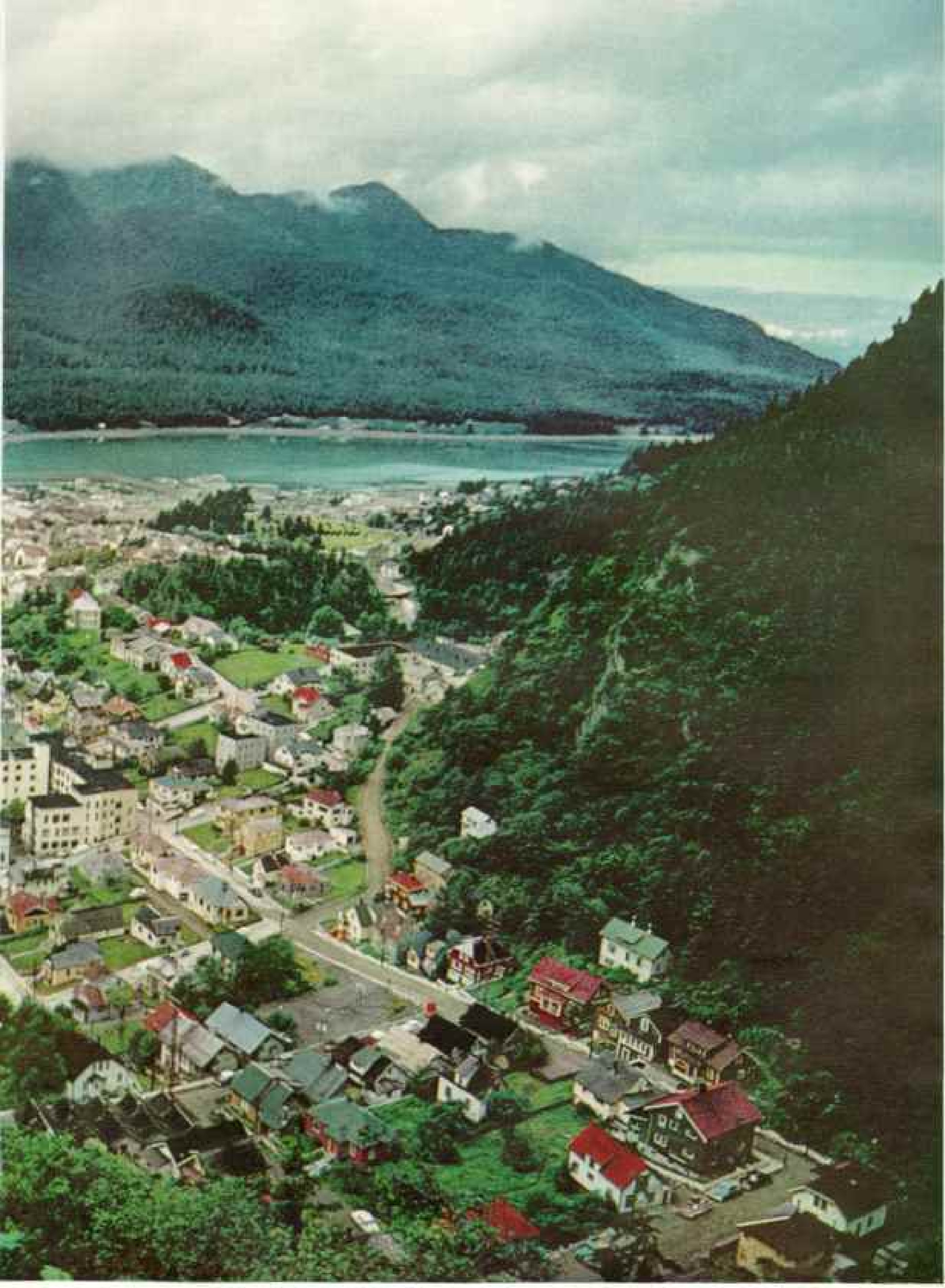
Puckish Eyes Peer over the Rim of an Expressionless Eskimo Mask

Alaska's population of 211,000 includes some 40,000 Eskimos and Indians, descendants of prehistoric immigrants from Asia. This Nunamiut Eskimo boy at Anaktuvuk Pass belongs to the last of the new State's nomads. He plays with a caribou-hide face, a toy counterpart of tribal spirit masks. Wolverine fur fringes the parka.



Fiord and Mountains Squeeze Juneau, Sheltered Port and State Capital

Alaska's fourth largest city—after Anchorage, Fairbanks, and Ketchikan—began as a 19th-century gold camp, and took its name from Joe



Juneau, who with a partner made the first strike. Scant profits have closed the mines. This mountainside view looks across Gastineau Channel, which connects the port with the Inside Passage. Distant bridge leaps the channel to the sister community of Douglas.

some eyes turned north to a new frontier. Thousands of gold seekers boarded any craft that would float, bound for the romance and riches—or disillusionment, even death—of places named Dawson, Skagway, and Nome.

The excitement leaped cross-country to New York. There I, too, had a touch of gold fever. My parents took a dim view of a prospecting career for an 11-year-old, and that career died aborning. I was to see Alaska, but not until a medical education and a newspaper career had put nearly 40 more years behind me. Nor did I dream that it would be my privilege one day to serve the Territory as Governor.

Sourdoughs, Scenery, and Supermarkets

In the interim, Alaska sank once more into obscurity. It was not until Japanese troops filed ashore on fog-shrouded Attu and Kiska in the Aleutian Islands during World War II that the United States took much notice again of its northern outpost.

So three times in less than a century Alaska has been "discovered." Today it enjoys its fourth and final recognition—as a State.

Yet Alaska is a State less known to most Americans than any of the others—less familiar to many, in fact, than much of Europe. Though the number of tourist visitors increases each year—some 80,000 in 1958—most Americans have never seen their 49th State.*

It is not surprising, therefore, that some old misconceptions survive: that Alaska is an empty icebox, a frozen waste of worn-out gold mines and ghost towns, a land of igloos and dog sleds, saloons and sourdoughs.

Alaska is all these things, to some degree. But it is much more. It is a land of incredible beauty, of friendly people, of fantastic wealth, still largely untapped—of oil, minerals, hydroelectric power, natural gas, and vast forests of prize timber and pulpwood.

It does have glaciers and frozen wastes. But in so big a place—almost one-fifth as big as the rest of the United States—there is room for these and people too. And portions of civilized Alaska have warmer winters (and cooler summers) than many of the other States; here farms produce rich crops of lush fruits and giant vegetables, and cattle grow fat (page 60). Flowers, wild and garden, grow as they do nowhere else.

Moreover, Alaska's snows, as they melt, turn into sparkling rivers and sapphire lakes which offer some of the world's finest fishing. And scenery. And swimming, sailing, and camping. Alaska's greatest potential of all, I think, may be as a vacationland.

But most important, Alaska is a State of people—enterprising, vigorous, warmhearted, modern. In the larger communities they shop in supermarkets and neon-lighted drugstores, read everything from comics to classics, and watch television. They see the World Series on film, a week late, and try to pretend they don't know who's going to win.

Mosquitoes Fly on High Octane

They fly planes—more per capita than any other State. So many are the small private planes, in fact, that one imaginative businessman has started a helicopter tow-truck service. When your plane won't run, he flies out in a powerful helicopter, picks it up (after removing the wings), and hauls it to the shop for repairs.

The new giant in the national family immediately became a favorite theme of cartoonists and the source of many jokes at the

* See, in the National Geographic: "Alaska's Warmer Side," by Elsie May Bell Grosvenor; "Alaska, the Big Land," by W. Robert Moore; and "Photographing Northern Wild Flowers," by Virginia L. Wells, all in June, 1956. For many other articles on Alaska, consult the National Geographic Cumulative Index.

A Tent Town That Became a Metropolis Highlights Alaska's Growth

Once a railroad camp in the midst of a wilderness, Anchorage boasts 30,000 residents, one-seventh of Alaska's population. Modern apartments and office buildings rise beside log cabins. An international airport, a crossroads of Arctic air travel, welcomes flights from Stockholm, Edmonton, and Tokyo to the State's largest city.

The camera peers east along broad 4th Avenue to the snowy Chugach Mountains (page 74). Overhead sign commemorates a 1957 national award for civic work.

Luxuriant lawn gets a trim in Juneau. Warmed by Pacific currents and long hours of sunlight, this Alaska panhandle city enjoys a July as warm as that of San Francisco. Homeowners raise spectacular flowers and thick crops of grass. "The stuff grows so fast it runs away from you," a resident remarked to the photographer.


ANCHORAGE
ALL-AMERICA CITY
SOUVENIR SHOP

expense of the now second largest State. A new definition of "claustrophobia" emerged: "How an Alaskan feels in the heart of Texas."

Alaskans vied with Texans in tall tales. A sample: "When the Air Force first established Ladd Field near Fairbanks, the crew rushed out to service a transient plane. They pumped 50 gallons of gas into it before realizing that it was an Alaskan mosquito."

Fiction and fantasy aside, the 49th *is* a State of superlatives. It is more than twice as large as Texas; 21 smaller States would fit within it. Its seacoast is longer than that of all the other States combined. (See the Atlas Map, **State of Alaska,** distributed to members with this issue of their magazine.)

It is the only State that juts into the Eastern Hemisphere, and extends above the Arctic Circle. Alaska's outermost Aleutian island, Attu, lies as far west as New Zealand. On Little Diomede Island the United States now has a State border within view of Soviet Russia, 2½ miles away. It includes four time zones, and would include a fifth, except that one time-zone boundary and the international date line are deliberately bent to avoid it.

Nor does Alaska lack record vertical dimension. Its Mount McKinley, 20,320 feet in height, is the North American Continent's loftiest peak (page 80). Indians call it Denali —the Great One. Eleven other Alaskan mountains soar higher than California's Mount Whitney, previously the Nation's summit.

Moreover, Alaskans claim that their highest mountains look taller than any other peaks on earth, since they rise from near sea level. I have often seen Mount McKinley on a clear day all the way from Anchorage and Fairbanks, 130 and 160 miles away.

Egg-crate ballot box at Anchorage records votes in the August 26, 1958, referendum. Five out of six Alaskans voted for statehood.

Park Shelters Alaska Wildlife

This sounds as if I am implying that Alaska's scenery is superb, and so I am. A galaxy of nature lovers from John Muir on have agreed. To preserve the scenery and the State's fantastic abundance of wildlife, the Federal Government has established here a national park and three national monuments.

Mount McKinley National Park alone spreads over nearly two million acres. Often I have wandered its spruce-flanked trails, relishing its grandeur and enjoying glimpses of its animal life. Grizzly bear, moose, and caribou thrive here, as well as Dall sheep, wolf, wolverine, coyote, fox, and lynx.

Glacier Bay National Monument, in southeastern Alaska, is an enormous outdoor museum of glaciers—some advancing, others receding. They may be observed from the safety and comfort of a boat.

In 1912 an incredible volcanic explosion created the Valley of Ten Thousand Smokes. Largely through the efforts of the National Geographic Society, this land of steaming fumaroles and ponderous glaciers was set aside as Katmai National Monument. Its expanse of 2,697,590 acres makes it the largest unit in the National Park System.

Sitka National Monument, 54 acres, marks the site where the Tlingit Indians finally succumbed to Russian invaders in 1804. Appropriately, it preserves some of the finest examples of Indian totem pole carvings.

My first visit to Alaska began with a voyage up the unique Inside Passage—a thousand miles of sheltered waterway from Puget Sound to Skagway. This was in May, 1936, when I was director of the Division of Territories and Island Possessions. And in those days no airline or highway yet linked the Territory with the 48 States.

NATIONAL GEOGRAPHIC PHOTOGRAPHER THOMAS NEBBIA

President Eisenhower Creates the First New State in Half a Century

Alaska became the 49th State January 3, 1959, when the President signed the proclamation. His act, first of its kind since Arizona's admission in 1912, ended what the author describes as "Alaska's history of remote control." Vice President Richard Nixon (left) and House Speaker Sam Rayburn sit beside the President. Alaska's Representative Ralph J. Rivers and Senators Ernest Gruening and E. L. Bartlett stand at left.

Despite all I had read, I was unprepared for the majestic loneliness. Our steamer wound through silent deepwater channels, past mile after mile of steep forested slopes, sparkling cascades, and massive glaciers. Only an occasional thread of smoke from a cabin betrayed human life. I felt as if I had stepped back fifty years into American history.

My first look at an Alaskan city came at Ketchikan, the southernmost port. Then, as now, it stretched for miles along the northeast shore of Tongass Narrows.

Ketchikan's houses cling tier on tier to the hillside, and long flights of wooden steps lead up from the city's streets. Behind them towers forest-clad Deer Mountain.

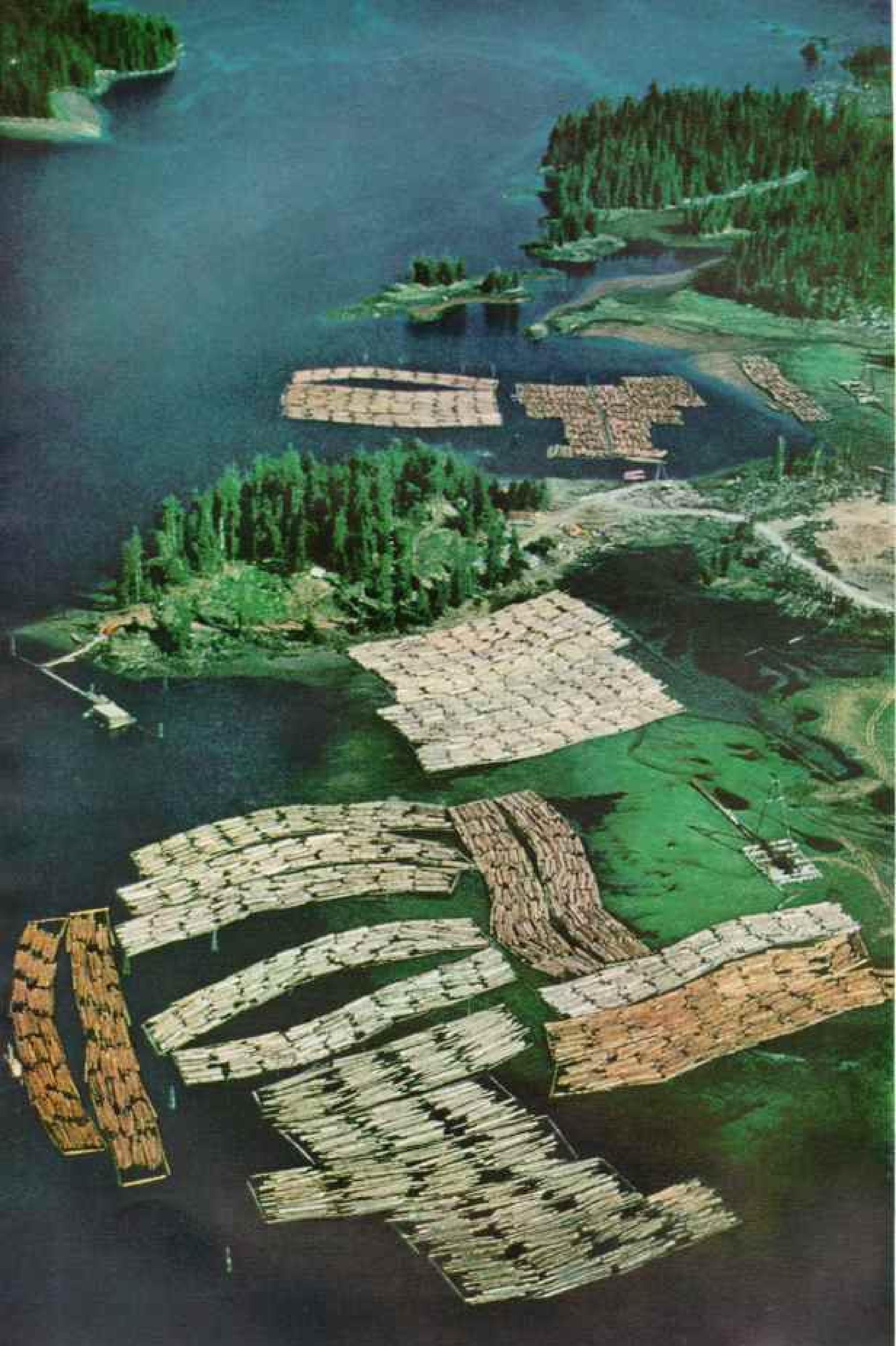
Called the salmon capital of the world, Ketchikan long has lived by fishing. So have most towns of the "panhandle," as many call southeastern Alaska—Wrangell, Petersburg, Sitka, Haines, and the Indian villages.

Once the salmon, struggling up Alaska's streams to spawn, were the Nation's most abundant fishery resource. But now the salmon have dwindled alarmingly. Fishermen hope to see the annual runs restored to their former profusion, under State management. Meanwhile, brighter prospects lie in such species as halibut, flounder, and cod, as well as the shrimp and crab fisheries.

Pulp Mills Thrive as Salmon Dwindle

As the salmon have declined, however, a new industry has come to the panhandle. Today the coastal forests echo to the petulant whine of chain saws and the ring of the logger's ax. Alaska's first pulp mill, one of the world's biggest, can spew out 500 tons a day. It is fed by part of the Tongass National Forest's 16,000,000 acres (page 50).

You'll find signs of former tsarist occupation in Sitka, which nestles between steeply rising mountains and a magnificent, island-studded bay. As the capital of Russian America in the first half of the 19th century, the city bustled with social life and flourished



on furs. The Cathedral of St. Michael, Alaska's outstanding monument of the Russian era, lifts its weathered, carrot-shaped spire above the town. Inside is one of the world's finest collections of icons (page 62).

Crumbling gravestones in a cemetery at Sitka bear many Russian names. Some who lie beneath them, no doubt, sadly watched the imperial Russian standard lowered and the Stars and Stripes raised in its place on October 18, 1867. Sitkans celebrate the date, Alaska Day, with more elaborate pageantry each year.

Later history lives on in the massive brownstone Pioneers' Home, whose cheerful red-tiled roof is the first thing visitors see when they arrive by boat or plane. It was built by the first Territorial legislatures for those prospectors whose hopes did not "pan out." It is Alaska's way of showing respect and affection for the gold-seeking pioneers who opened up the land.

Here I have heard many tales of fortunes narrowly missed, or wrested from the earth and lost. Yet hope springs eternal in a sourdough's heart. One, perhaps, spoke for all as he confided: "I know a little creek up north of Ruby that shows real 'color.' One of these days I'll get back there. . . ."

Logger rests by a blazed tree on Prince of Wales Island. Advance crews marked it to spare it from cutting teams. Alaska timbermen, far from depleting forest reserves, improve stands by thinning.

A page of Alaska's future history may be written here in Sitka, too. Not long ago I watched chuffing bulldozers level the landscape for a new pulp mill capable of churning out a daily 300 tons. Financed partly by Japanese capital and scheduled to open this year, the mill will furnish Sitka with a sorely needed year-round industry. More than that, it will mark the new State's first big venture in international trade. The pulp is destined principally for Japan's rayon and paper industries. The Japanese, who already import lumber from Wrangell, have recently shown great interest in Alaska's deposits of coking coal, iron, and chrome ore. All this foreshadows a two-way exchange of raw materials and manufactured goods with the Orient.

The State needs this new trade, for as its salmon catch has declined, so has gold mining. Alaskans mined $26,500,000 worth of gold in 1940, but only $7,500,000 in 1958.

Today Juneau, the State capital, once a center of hard-rock mining, relies on government payrolls, Federal and now State. And despite the new constitution which fixes the city as Alaska's capital, some local residents fear it may one day be moved. Already government employees in Anchorage far outnumber those in Juneau.

Capital Holds Riches in Scenery

Yet Juneau possesses another resource which may eventually bring it more wealth than either gold or government. Its superb natural setting makes it a potential paradise for vacationers and sightseers.

The city lies cradled in a small, triangular valley sloping gently to the Gastineau Channel, an arm of the Inside Passage. The towering walls of Mount Juneau and Mount Roberts

Log Rafts, Marshaled Like Freight Cars, Will Be Ground for Pulp

Alaska's forest products rank second only to its fisheries. Hemmed by floating booms, these spruce, hemlock, and cedar logs from Tongass National Forest jam coves in Prince of Wales Island. They wait a turn at near-by Ketchikan Pulp Mill, a $64,000,000 plant that can produce 500 tons a day, destined chiefly for rayon manufacture.

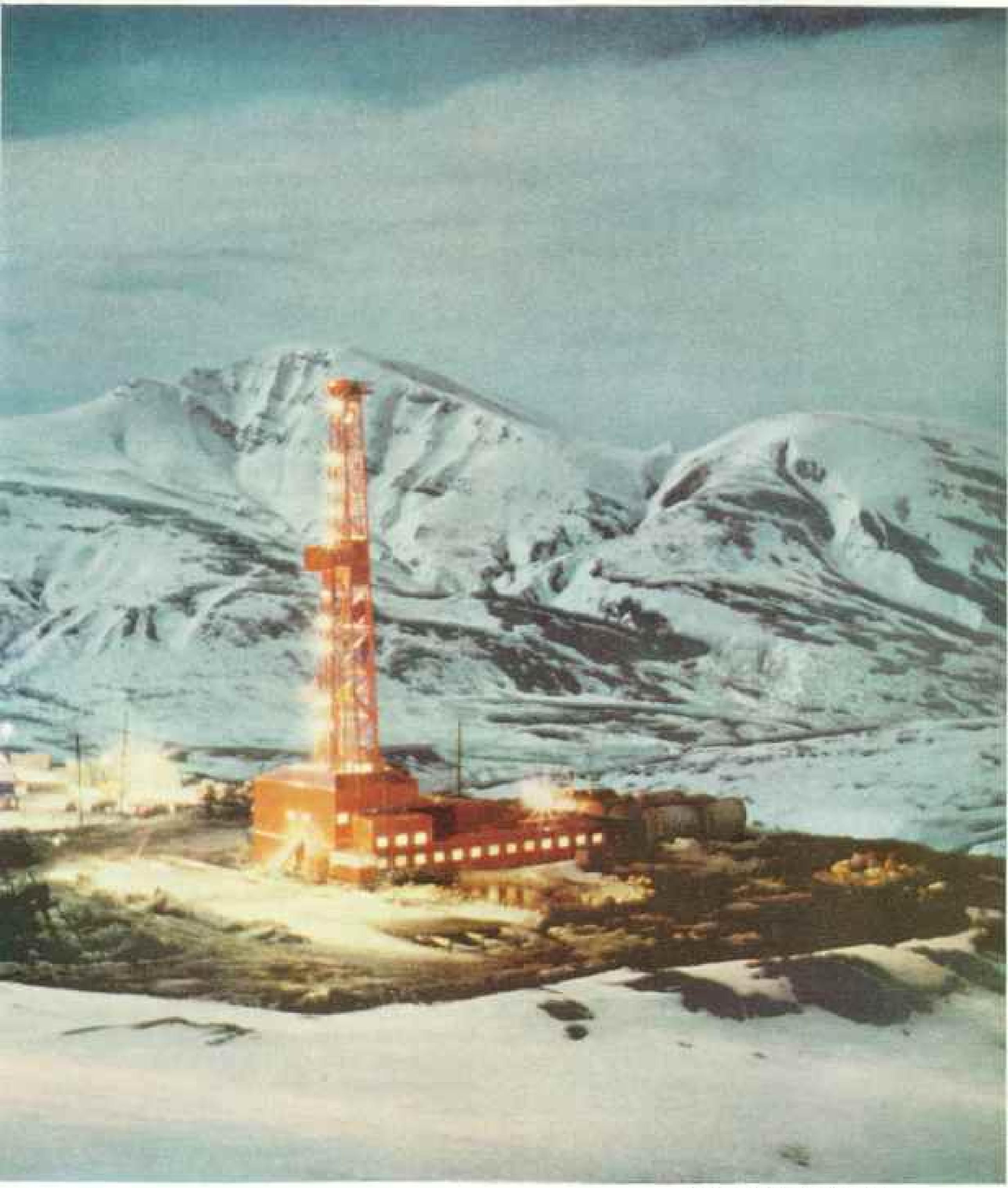
Grease-spattered "roughneck," his grin suggesting the hoped-for oil strike, leans against a tool shack at Wasilla, near Anchorage.

SUPER AEROCHROME BY THOMAS J. ABERCROMBIE, NATIONAL GEOGRAPHIC STAFF © N.G.S.

Floodlit Oil Derrick Lifts a Gleaming Shaft Above Frozen Wasteland

Oil today lures more prospectors to Alaska than does gold. Neither subzero temperatures nor the seemingly endless night of Alaskan winters halts exploration and drilling. Construction crews thaw the rock-hard soil with steam hoses. Some isolated camps receive supplies by helicopter.

This wildcat rig on the Alaska Peninsula rises in a forlorn landscape of snow-swathed mountains and treeless terrain. Moonlight, not the midnight sun, bathes the lonely scene.



ASSOCIATED BY SONNY CLARK © U.A.A.

Pouring gold, a worker in Fairbanks rights the kettlelike crucible after filling a mold with metal heated to 2,000° F.

form the land sides of the triangle. Through the narrow canyon between them rushes Gold Creek, whose gold-bearing gravel gave birth to Juneau in 1880. Unspoiled wilderness lies within a 20-minute stroll (page 44).

Often after a day at my desk in the Federal-Territorial Building I would find mental relaxation and exercise on one of the steep mountainside trails behind the city. Within a few minutes' climb I could look out over splendid vistas of mountain and sea. From above the spruce and hemlock timber line I could see the lofty Fairweather Range lifting its spires to the northwest. At my feet alpine meadows stretched riotous with flowers.

Ahead lay the great Juneau icecap, shining with beauty and mystery. Its protruding rock pinnacles—Devils Paw, Gabriel's Sword, and others—challenged mountaineers younger and more intrepid than I.

Here is an empire of scenic splendor and a matchless playground. The countryside abounds with ptarmigan, mountain goat, and deer; the rivers and lakes teem with trout. In no other capital that I know can such natural bounty be enjoyed so easily.

To the northwest lies Glacier Bay; to the southeast the breath-taking fiords of Tracy Arm and Fords Terror. Beyond Taku Inlet, magnificent Turner and Twin Glacier Lakes beckon visitors. Juneau might well be called the American Vale of Kashmir.

"Canals" Made by Nature

The Inside Passage ends in a 60-mile-long fiord, Lynn Canal, which cuts straight and deep into the continent. It is one of several natural waterways in southeastern Alaska called "canals": Portland Canal, separating the southeast shore of the panhandle from British Columbia; Behm Canal, near Ketchikan; Seymour and Duncan Canals, cutting into Admiralty and Kupreanof Islands.

All these have parallel shores that look as if they were made—or at least straightened—by men and machines. I have always enjoyed the story of a Congressman who was making his first tour of Alaska on a Coast Guard cutter. Upon being told, "We are now entering Lynn Canal," the lawmaker harrumphed: "Yes, I helped put that through Congress for you!"

From Juneau you can take a ferry up Lynn Canal to Haines and Skagway, famous names from gold-rush days. From Haines prospectors moved inland over the Dalton Trail, where they sometimes encountered warlike Chilkat Indians. Now a road, the "Haines Cutoff," crosses into Canada to link up with the Alaska Highway.

Site of an early Presbyterian mission which continues to this day, Haines had the only United States Army post in Alaska when World War II erupted. After the war a few enterprising veterans bought Chilkoot Barracks, renamed it Port Chilkoot, and started a tourist trade in native arts and crafts.

Broad Wake of Tailings Marks the Track of a Gold-mining Dredge

Heavy machinery today replaces the sourdough's pan and sluice box in Alaska's gold-mining industry. This dredge of the United States Smelting Refining and Mining Company works a creek bed near Fairbanks. Floating on a man-made lake, the machine claws up gravels from as deep as 72 feet, washes and screens them, and discards the waste in rippled mounds. Such dredges can process 15,000 tons of earth a day.

From Skagway and neighboring Dyea, now deserted, some 28,000 gold rushers trudged over the White and Chilkoot Passes during the winter of 1897-98. For months, night and day, an unbroken line of men wound its way to the summit of Chilkoot and down its far slope into Canada. There many built crude scows and skiffs to float downstream to the gold fields of Dawson in Yukon Territory.

The White Pass and Yukon Route, completed early in the century, still threads over the mountains from Skagway to Whitehorse, on the Yukon River. Alaskan wags claim the railroad's initials stand for "Wait Patiently and You'll Ride!" But the jibe is an affectionate one. Skagway still awaits a highway link with the interior.

Pacific Swells Harass Gulf Shipping

Sailing westward from the Inside Passage, the sea traveler must cross the Gulf of Alaska. It is frequently a mean piece of water, for here the Pacific's swells have had a 5,000-mile running start. I've heard it said that the gulf waves heave so high they leave the ocean floor bone-dry between them; on some crossings I could almost believe it.

Finally, however, the ship finds shelter in Prince William Sound, a gigantic amphitheater formed by the Chugach Mountains. From a jagged shoreline the peaks rise as high as 13,000 feet; their toes push tidewater glaciers into a bay of forested islands.

Cordova, close to the Copper River Delta, appeared to have a rosy future early in the century as the ocean terminus of a railway to the famous Kennecott copper mines, 195 miles inland. The construction of the Copper River and Northwestern Railway was a saga of engineering skill and daring, immortalized in Rex Beach's novel *The Iron Trail*.

Unfortunately, the rich copper ores played out. Both railway and mines shut down in 1938, and Cordovans returned to fishing.

The town displayed its undaunted spirit a few years ago during the annual salmon run on the Copper River. A small catch was expected, and only a few canneries were open. The runs proved to be the largest in a quarter century. Merchants closed their shops; men, women, and children donned oilskins; even the local banker led his employees to a cannery to help pack the silvery bonanza.

A highway is projected over the water-level railway route to link Cordova with the interior. Already it has pushed 49 miles to where a 50-year-old "million-dollar bridge" spans the broad Copper River. Beyond this lie the great Abercrombie and Wood Canyons through which the railway led to the climax of Alaskan scenery, the Chitina Valley.

The Chitina River is a tributary of the Copper; its Indian name means "copper river."

I first succumbed to the Chitina Valley's spell while inspecting the abandoned railway 20 years ago. I still feel sure that it is destined to become one of the world's great recreation areas. Some of the mightiest mountains on the continent wall this Olympian coliseum along its 100-mile length. Lakes alive with fish dot the valley floor; wildlife, from lynx to Dall sheep, abounds everywhere. Once I chanced upon two sets of locked antlers where bull moose adversaries had fought to a fatal draw.

At the end of Valdez Arm, a 30-mile fiord in Prince William Sound, lies Valdez. Northernmost ice-free port on the continent, it offers entry by highway to interior Alaska. The road dates back to 1899, when gold seekers wore a trail from Valdez to the Yukon.

The War Department expanded the trail into a wagon road, later to become the Richardson Highway. It now meets the Alaska Highway on its way north to Fairbanks.

Alaska Railroad Starts at Seward

Valdez's historic rival, Seward, lies 130 miles southwestward at the head of long, deep Resurrection Bay. It, too, was born as a gateway to the interior, and is a bustling community today, despite an unhappy start.

In the early 1900's private capital built a railroad 71 miles northward from Seward. Business was bad; the company went broke.

Later, when the Federal Government decided to build a railway, it faced the alternatives of buying the Alaska Northern Railway's right of way out of Seward, or buying the Copper River and Northwestern, leading north from Cordova. It chose the former, and Seward expected a glorious future.

But alas for the best laid plans! The defunct railway's promoters—shrewdly, they thought—had secured the greater part of the Seward townsite and sought to exact their price. The Federal Government refused to buy; instead it moved 80 miles north and at Ship Creek founded a town to be the headquarters of the Alaska Railroad. Popular

(*Continued on page 65*)

KODACHROMES BY THOMAS J. ABERCROMBIE, NATIONAL GEOGRAPHIC STAFF © N.G.S.

Knee-deep in Salmon, a Fisherman Crams the Hold with a Glistening Catch

"Salmon and Alaska have been as closely intertwined as cotton and the South," says the author. Salmon fishing, the State's leading industry, earns some $60,000,000 yearly, more than eight times the price paid for Alaska by the United States in 1867. In a good year the catch approaches 300 million pounds.

This crew member of a purse seiner stows the catch with a barbed stick called a pew.

Netted salmon flop aboard a seiner near Ketchikan (next page). Men use a huge dip net to lift the fish. ▶

Like a pendant on a necklace, a boat appears suspended from its purse seine, a huge net flung around a school of fish and drawn shut below the surface.

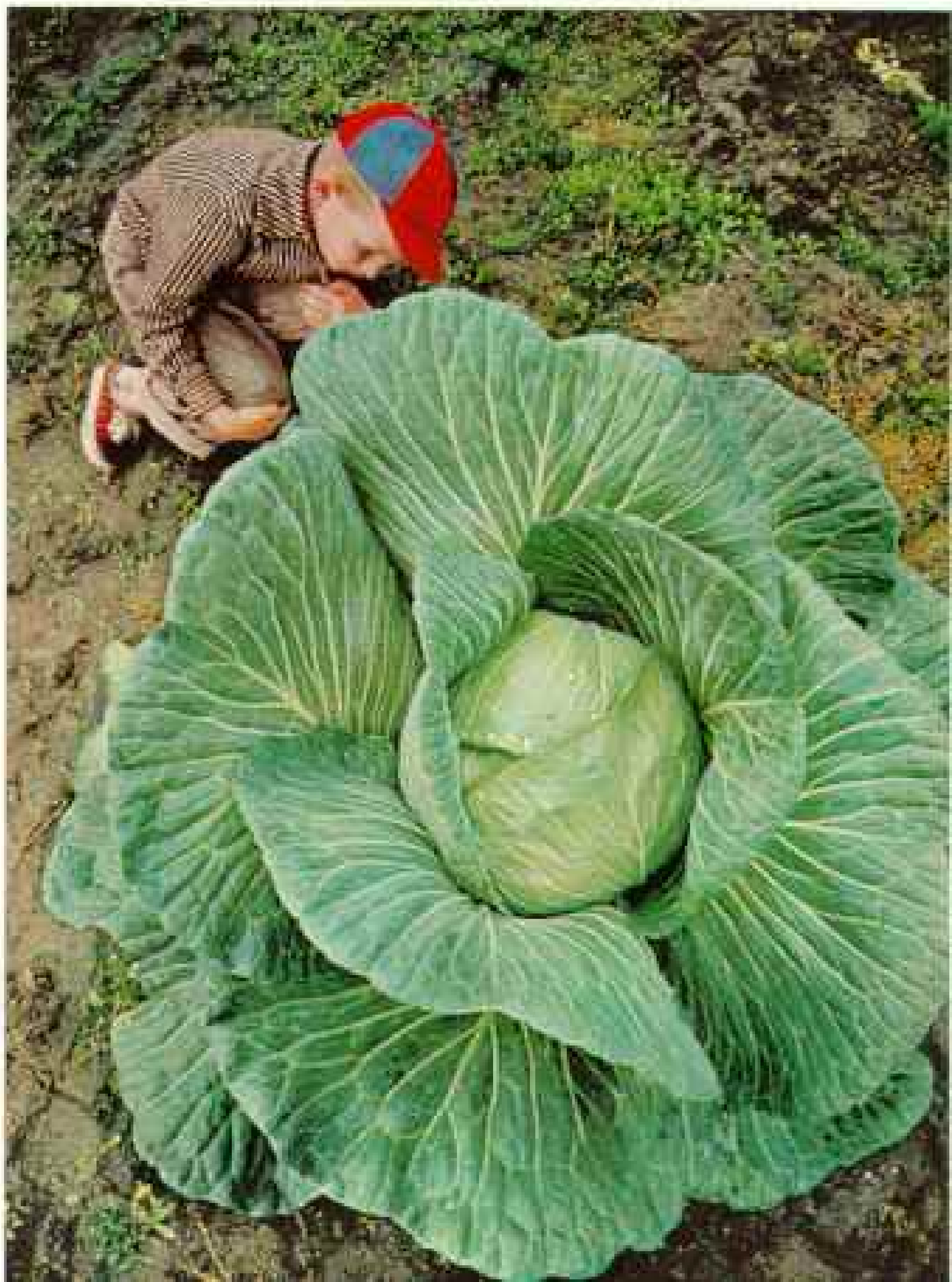
Farmer pauses from harrowing his fields in Matanuska Valley, Alaska's richest farm area and producer of half the State's crops. Homesteaders from the Midwest colonized the valley in the 1930's, laboriously carving fields from dense Alaskan forests.

Long hours of summer sunlight offset Matanuska's short growing season. Days as long as 19 hours produce crops in record time. This tractor driver prepares his soil for potatoes, a Matanuska specialty.

Tanana Valley Dairy Cattle Bask in the Endless Summer Sun

Newcomers, known to Alaskans as "cheechakos," stare in disbelief at dairy cows grazing less than 120 miles outside the Arctic Circle. Despite short grazing seasons and long barn-bound winters, Alaskan cows yield more milk per head than the national average. Few pests plague the animals. Brown bears (page 80) raid farms on rare occasions, mauling but seldom killing the cows.

This Holstein herd near Fairbanks belongs to Creamer's Dairy, one of Alaska's largest milk producers. The cyclist's banner announces the annual Tanana Valley Fair.



Outsize cabbage dwarfs a Matanuska boy. Rich soil and superb growing weather produced this giant. Residents glibly call it an Alaska Brussels sprout.

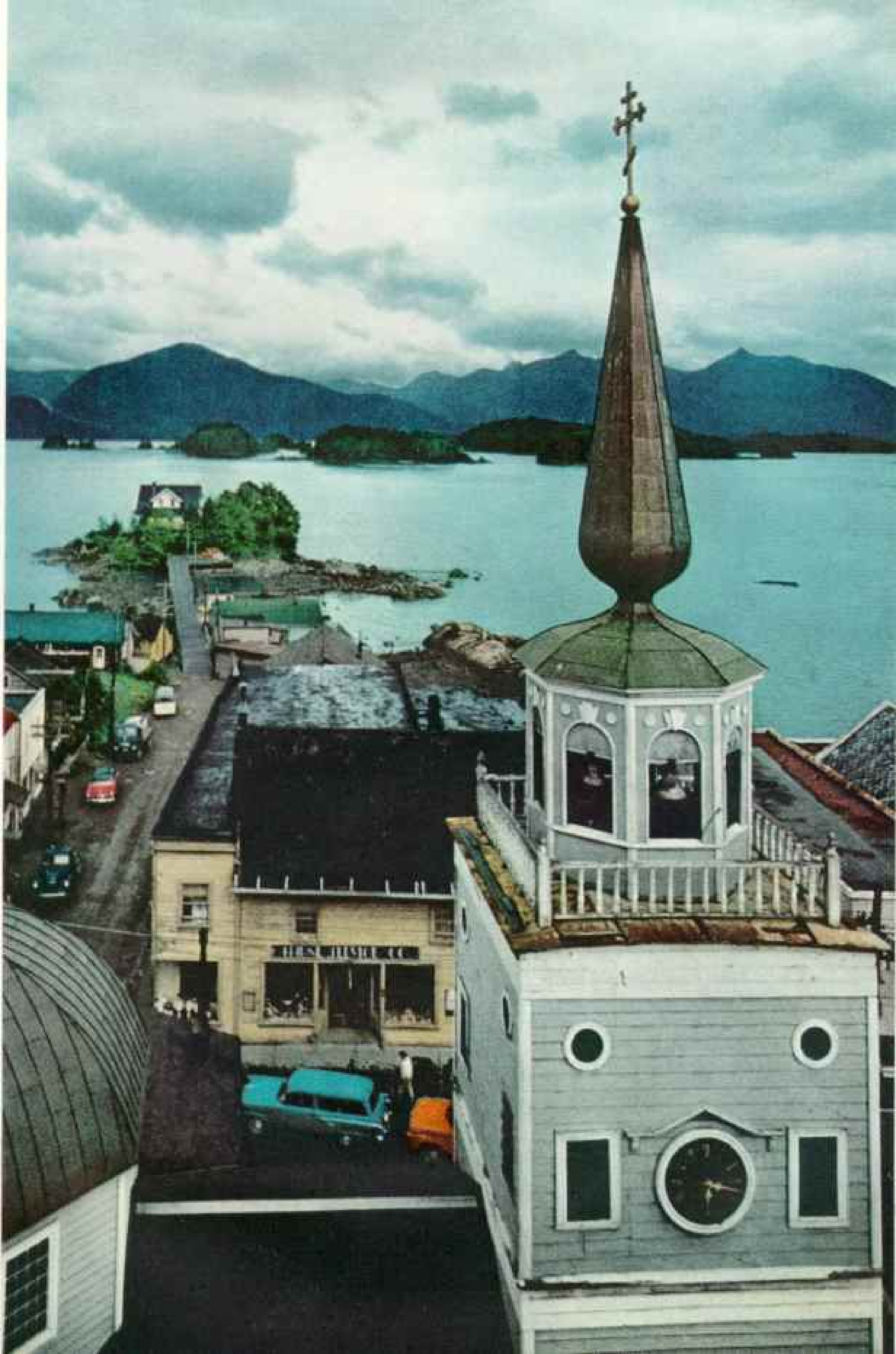
Russian Cathedral's Weathered Spire Endures Above Sitka, Alaska's Early Capital

Explorers from Siberia who founded the outpost in 1804 made it the capital of Russian America. When the United States bought Alaska from the Tsar in 1867, Americans took possession at Sitka. The town remained the capital until 1906, when the Territorial Government moved to Juneau.

Sitkans, bemoaning their long rainy winters, tell visitors, "If you've lived through one of our summers, you won't mind the other 364 days."

Beyond the Orthodox Cathedral of St. Michael lie the cloud-draped islands of Sitka Sound.

Communicant admires an icon, Madonna and Child, from the cathedral's world-famous collection.



Study Period Absorbs a High School Class

The State's educational system ranks among the best in the Union. Few students drop out before graduation from high school.

These girls study in Kenai.

Aleut artist paints a toothy marshal of the old West at a school in Nikolski, Umnak Island. Alaska's three indigenous groups, Eskimo, Indian, and Aleut, study side by side with white pupils.

vote gave this new community its name: Anchorage.

Seward, in one of the most favored of nature's locations, has struggled valiantly for 45 years to overcome the handicap. It is an ocean terminus of the Alaska Railroad, if not its headquarters, and defense needs connected it with Alaska's interior by highway. But defense also created a formidable competitor on the upper east coast of the Kenai Peninsula: the port of Whittier, through which most of the State's military freight moves.

Racers Climb a Mountain

Seward now attracts tourists with its annual Salmon Derby and its trout fishing. Each July 4 the city also stages a unique sporting event: the grueling Mount Marathon race, inaugurated in 1915. Entrants start downtown, dash three-fourths of a mile to the mountain's base, scale its steep 3,022-foot peak, and return. Contestants from Scandinavia, as well as Hawaii and the 48 other States, have sought the cash prize—as much as $2,500—and trophy. The record was set in 1957 by Alaska's Sven Johansson, who made the round trip in 51 minutes 40.7 seconds.

Seward—all of Alaska, in fact—hummed with excitement two years ago when a well on the Kenai Peninsula began spouting 900 barrels of crude oil daily. The strike was not unexpected. Travelers discovered surface-oil seeps in Alaska a century ago, and some geologists believe the State is potentially one of the world's greatest petroleum producers.

But oil prospecting on Alaska's forested ridges and trackless tundra is a rugged, costly enterprise. Geologists reach many remote prospects only by helicopter. Drilling rigs have been beached by landing craft and laboriously hauled inland. Even so, more than a score of oil companies plan to spend up to $300,000,000 in the next decade searching for black gold (page 52).

Already nearly 40 million Alaskan acres have been leased, and I am no longer startled

Forests Yield to a Growing Campus at the University of Alaska

The world's northernmost university began in 1922 as a land-grant college. This view shows the domed observatory (left) of the Geophysical Institute, a laboratory for study of magnetism, the aurora, and other phenomena. The campus and surrounding community of College lie near Fairbanks.

Darkness at Noon: Floodlights Bathe a Construction Project

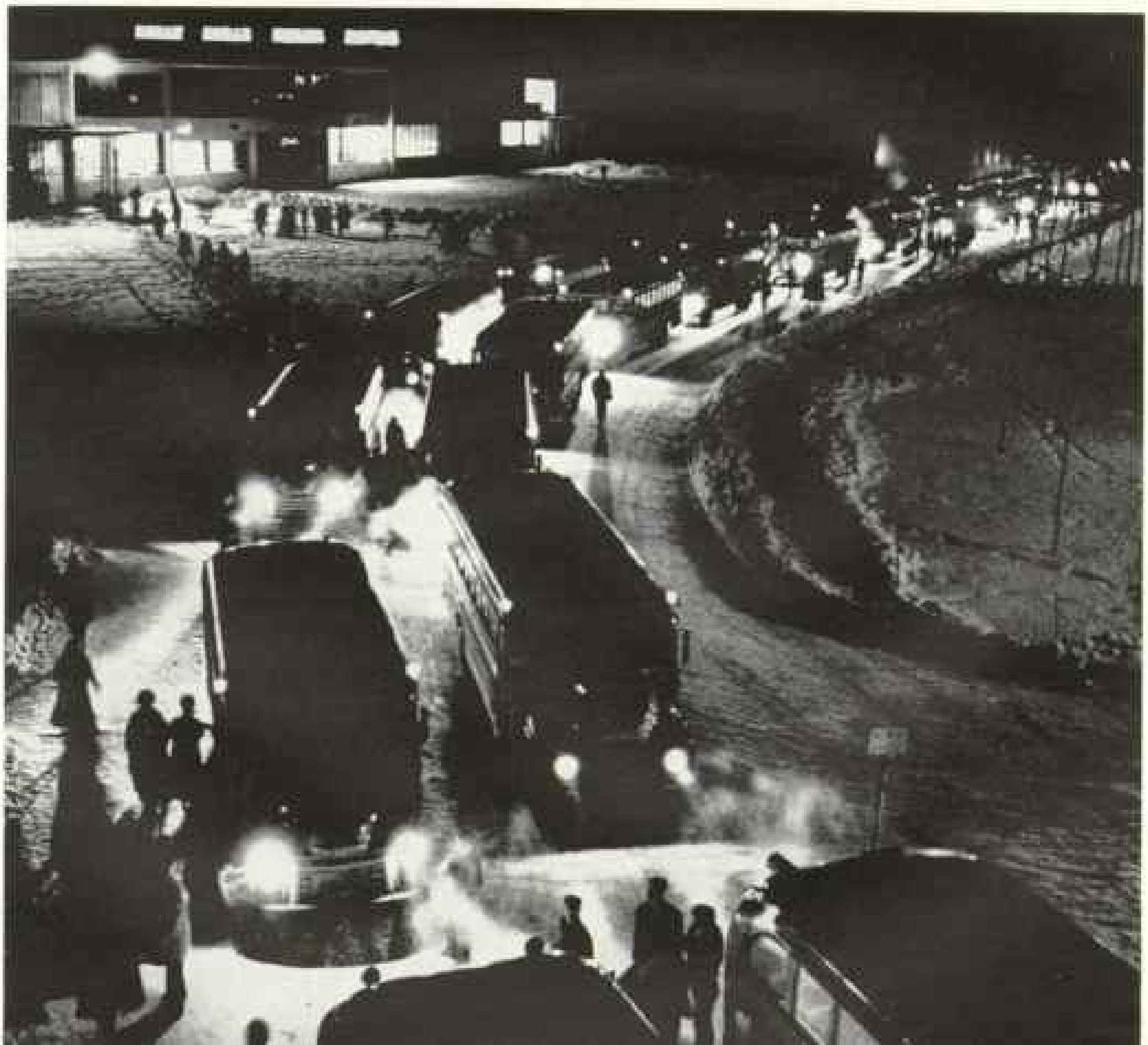
Winter in Fairbanks brings four-hour days and temperatures as low as minus 60° F. Mailmen use flashlights for daytime deliveries, and street lights blaze in midafternoon. One wit described his Alaska as "the only State I know where a drive-in movie could have matinees."

These crews on a winter day rush completion of a warehouse at an Air Force missile warning base near Fairbanks. Most construction halts between October freeze and May thaw.

Frost rimes power poles and lines at Fairbanks in the gloom of late afternoon. To climb a pole, linemen must often pierce an inch-thick crust.

Bus lights wink through the darkness during afternoon pickup at Anchorage High School. Relays of teachers use the building 16 hours a day for high school, junior high, and college classes. Buses, required to transport students who live more than a mile and a half away, run a shuttle service.

GORDON TENNET, ALASKA STAR



when I hear the twang of Texas on the broad streets of Anchorage. "Fire a rifle in any direction," says former Mayor Ken Hinchey, "and you'll likely hit an oil crew."

The oil rush is but the latest of many bonanzas to favor this miracle city of Alaska. Anchorage is the State's metropolis, its economic dynamo, its transportation hub, its medical and cultural center (page 47).

In 1935 two hundred families from the drought-seared Midwest colonized the fertile Matanuska Valley northeast of the city (page 60). Although some left discouraged, more than 5,000 inhabitants now dwell in this richest of Alaska's agricultural areas. Prolonged summer sunlight sprouts vegetables of incredible size—40-pound cabbages, 30-pound turnips.

Anchorage Boom Still Grows

In 1940 Anchorage became the headquarters of the Alaska Defense Command. The city's air and infantry installations at Elmendorf Air Force Base and Fort Richardson house the largest concentration of troops in the State. Here also are the regional offices of the Federal Aviation Agency. French, Dutch, and Scandinavian airliners now touch down at Anchorage on transpolar flights between Europe and the Orient.

Already the State's railroad center, Anchorage is also the hub of Alaska's highway system, such as it is. The city is now reaching out into a fourth field of transportation with a plan to dredge the shallow harbor and build docks to cope with Cook Inlet's 36-foot tides.

Many who work in Anchorage vacation in remote lakeside homes and commute by air. Once, accepting a dinner invitation, I boarded one of the scores of private float planes parked around near-by Lake Hood. A canal joining the lake to Lake Spenard, a popular bathing spot, served as our watery runway (page 76). In twenty minutes, during which I counted eight startled moose and three bears lumbering away from our plane's flitting shadow, we touched down on a tiny, gemlike lake in virgin wilderness.

"I hope I never have to walk home," grinned my host in his lakeside cabin. "I figure it would take about four days!"

South of Anchorage stretches the Kenai Peninsula, a region of natural beauty and mild climate, with rugged mountains, glaciers, forests, and hundreds of lakes. Much of it is part of the Chugach National Forest and the Kenai National Moose Range. Human habitation, except for Seward and Whittier, clings chiefly to a strip along Cook Inlet.

New Road Borders Cook Inlet

In 1950 I cut the ribbon on a highway that threads the peninsula, giving new life to communities which include some early Russian settlements. Homesteaders in this area combine farming with fishing, replenish their larders with moose during the fall, and gather plentiful coal along the beaches for fuel.

The highway ends at the village of Homer, which faces Cook Inlet and beautiful Kachemak Bay. Homer, growing as a tourist resort, also has a prosperous local industry: It cans Alaska's great variety of berries into jams and jellies and ships them, as well as seafoods, to many parts of the world. The cannery owner prospects wild berry patches from the air—occasionally to find on landing that a sweet-toothed bear has jumped his claim.

To the southwest 125 miles lies Kodiak Island, bigger than Puerto Rico. It was the first part of Alaska settled by the Russians, in the 1780's. Kodiak village derives its livelihood from fisheries, especially from the grotesque king crab, which sometimes spans six feet from claw tip to claw tip. The island is famed for its huge Alaska brown bears, and many a hunting party starts here.

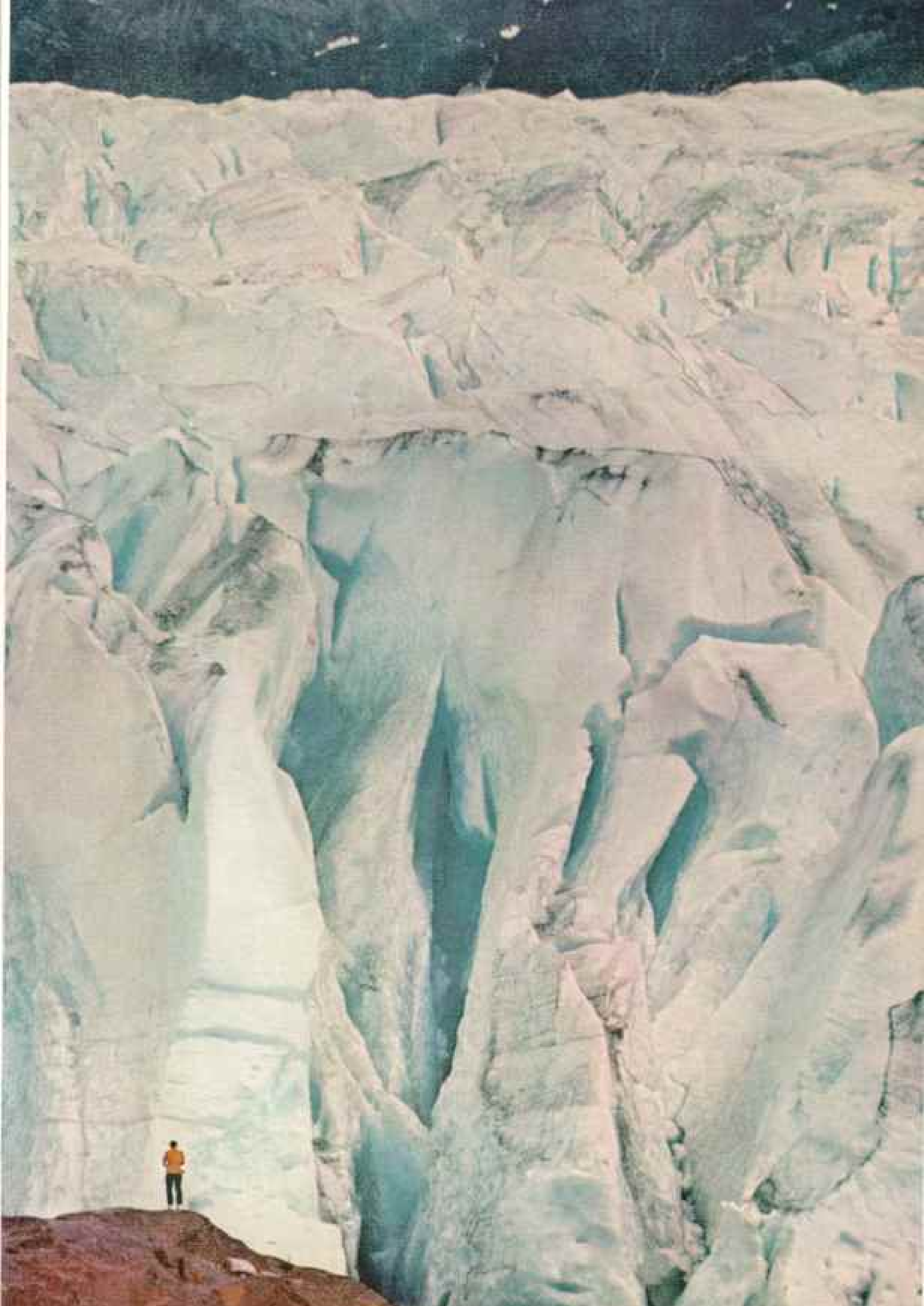
Kodiak is a point of monthly departure of the Aleutian mail boat, the M.V. *Expansion*. Passengers who take the cruise get glimpses of the remotest and least-known portions of the State all the way down the Alaska Peninsula to Unmak Island in the Aleutians.

Some 80 volcanoes, many of them occasionally active, punctuate the half-drowned mountain chain that forms this island-peninsula arc. Iliamna Volcano spurts a perpetual plume of white steam; others continue south-

(*Continued on page 77*)

Mendenhall Glacier, a Frozen Cascade, Ends Life in a Placid Lake

Motorists drive almost to the face of the glacier, a two-mile-wide arm of the Juneau icefield. In summer, ice slabs as big as six-story buildings calve from Mendenhall's face—here tinted pink by the sun—and melt in a lake at the base. Hardy residents turn neighboring pools into summer swimming holes and winter ice rinks.



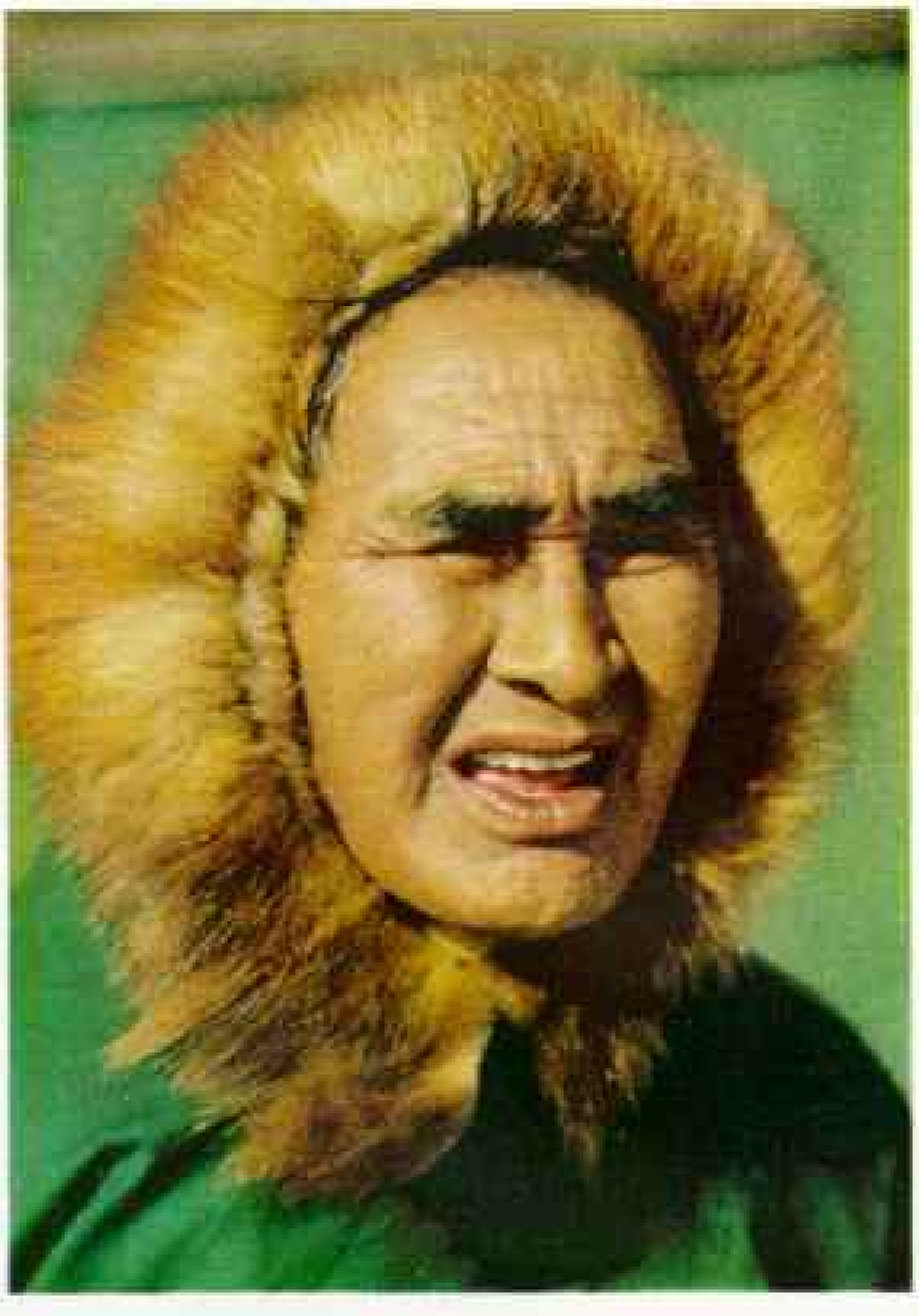
Drying Hides and Sun-blackened Steaks Festoon an Outdoor Rack

Caribou, the nomadic Eskimos' chief source of livelihood, furnish meat for food, horn for implements, and hides for tents, rope, and clothing.

This woman at Anaktuvuk Pass cures supplies alongside freshly laundered trousers.

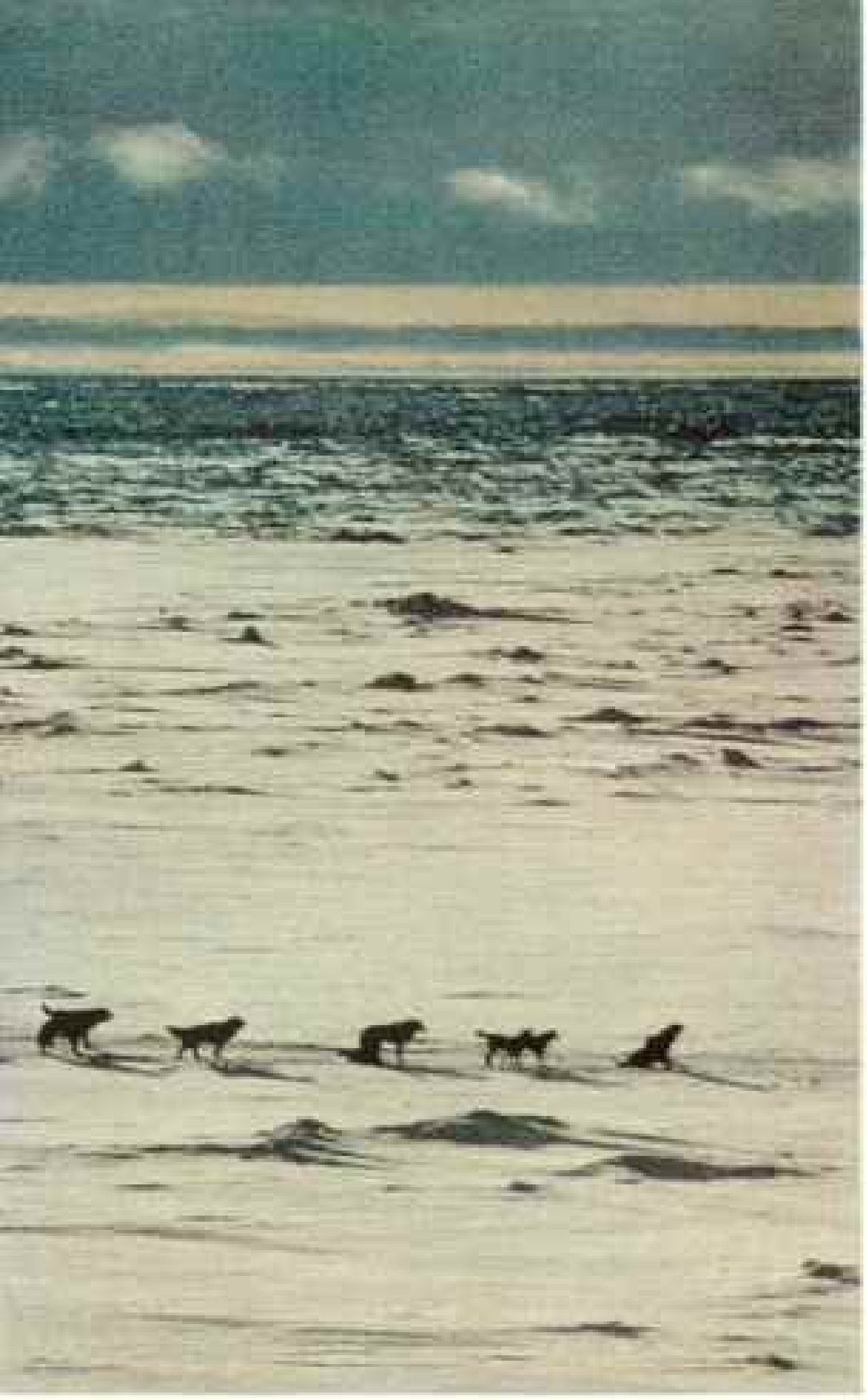
Spoils of the Arctic Hunt Equip a Grizzled Elder of the Nunamiut Tribe

Young Eskimos fill such highly skilled jobs as pilot, nurse, and radar operator, but villagers and nomads of the remote north still earn their living by hunting and fishing. This 78-year-old veteran at Anaktuvuk Pass rests after a grueling 20-mile hunt across the trackless tundra. His equipment includes caribou-hide gun case and telescope pouch, sealskin mukluks, and a parka trimmed with fur.



Eskimo dance leader, Chester Seveck, directs festivals at the northern village of Kotzebue. For nearly half a century he acted as chief herder of government-owned reindeer, domesticated caribou imported from Siberia. In summer Chester conducts Arctic tours for an Alaskan airline.

Empty sled indicates a race across a frozen lake near Anchorage. The contest, prelude to an Arctic-style Mardi Gras called the Anchorage Fur Rendezvous, sends more than a dozen drivers and teams over a punishing 18-mile course. Driver Number 11, nearing the finish line, mushes behind his sled. The leader of his seven-dog team trots just out of camera range. Lakeside trees bow under winter's weight of snow.



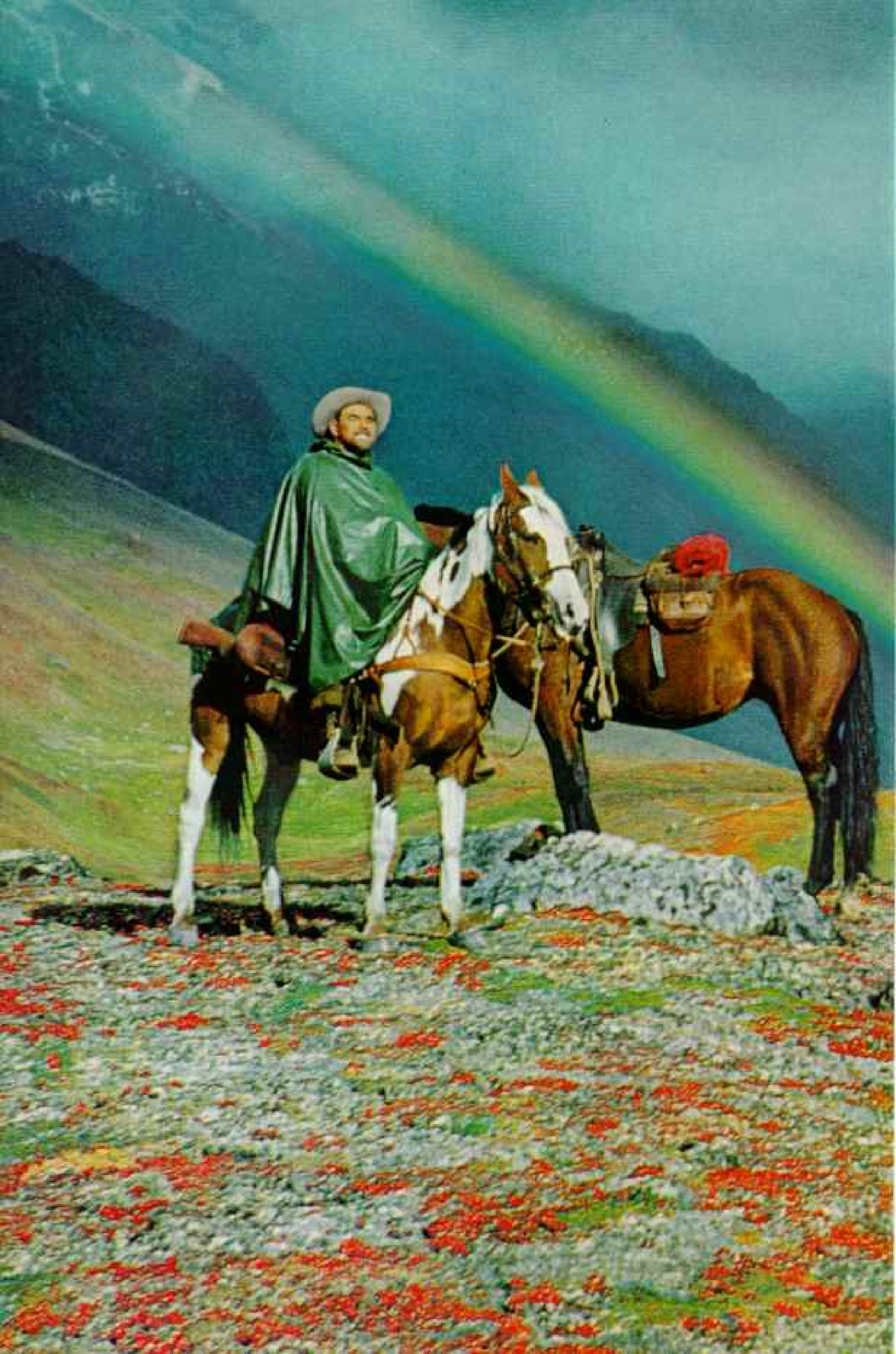
Eskimo Skin Boats Portaging Sea Ice Ride Sledges Behind a Dog Team

In early spring Eskimos pack their walrus-hide boats, called umiaks, across miles of offshore ice to hunt whales and seals. Dogs drag the craft and hundreds of pounds of supplies to water's edge; on frequent voyages between floes the animals take their turns as passengers.

This party near Little Diomede Island treks across a desolate stretch of the Bering Strait. Drivers steer a course around wavelike *sastrugi*, ridges of snow formed by the Arctic wind.

Big Diomede Island, a Soviet possession, lies 2½ miles to the west, across the international date line.

Nature's brilliance overwhelms visitors in the Chugach Mountains (next page). Blinding sunlight arching through clouds casts a rainbow above slopes fantastically dyed with wild flowers. Patches of snow on the heights lend a summer-within-winter aspect.

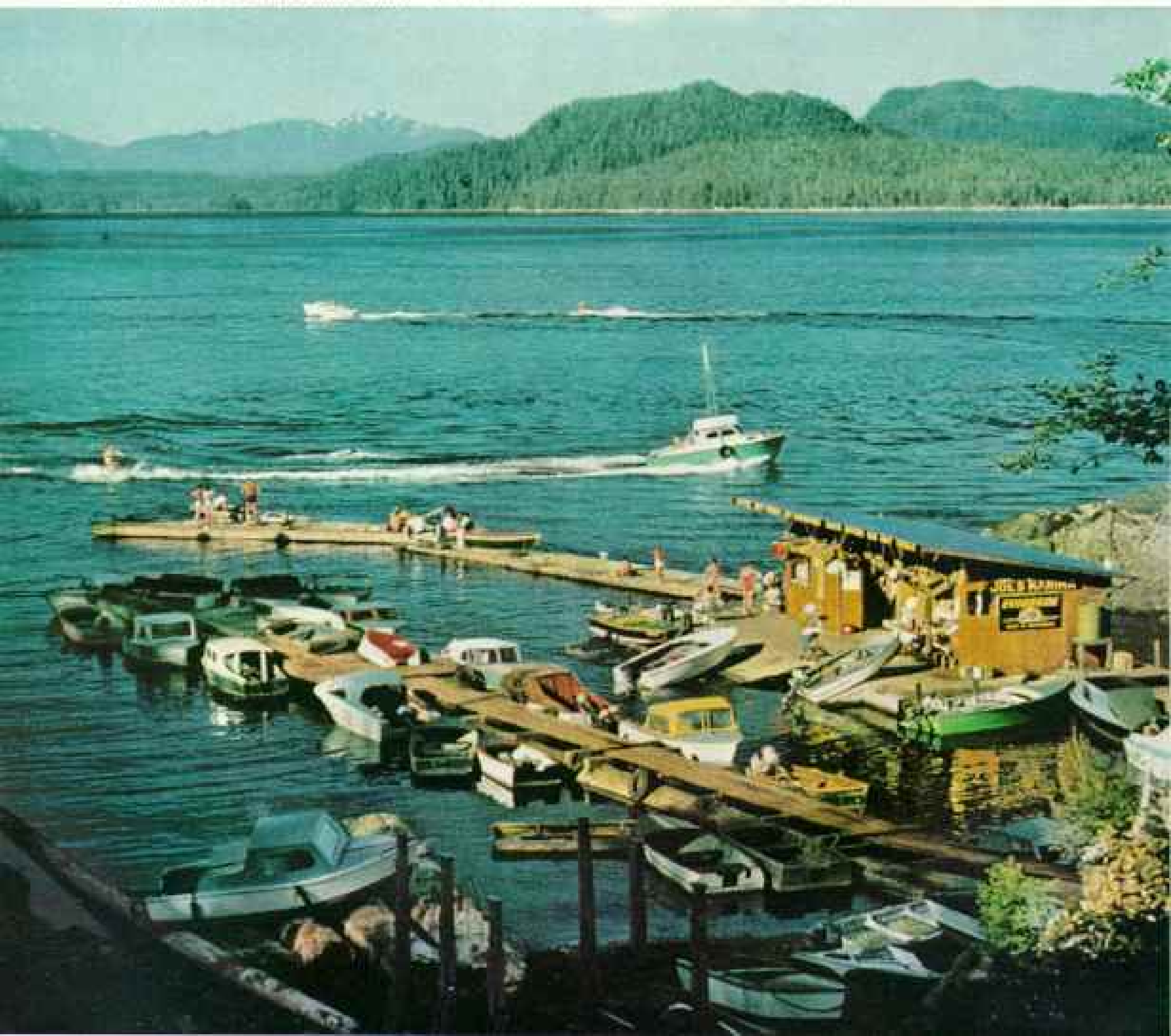


Bathers at Lake Spenard Make the Most of Summer

Temperatures at this resort near Anchorage reach the 80's while snow still caps surrounding mountains. In winter the frozen lake becomes a ski-plane parking lot.

Paper sun hats in the crowd suggest a Florida beach scene.

Water skier churns the surface of Herring Cove, an arm of the Inside Passage near Ketchikan. Boats moored at the marina contend with 20-foot tides.



westerly through the great volcanic laboratory surrounding Mount Katmai.

A World War II story grew up about 8,215-foot Pavlof Volcano, which gives up alternate puffs of black smoke and white steam. The "top-secret" rumor: the Army had harnessed it to give a dot-dash-dot signal warning of enemy approach!

The Aleutian Islands bristled with air and naval stations during World War II. The level island of Shemya, a spearhead for the attack on Japanese-held Kiska, is used as a station for flights to the Orient. A village on Atka, midway in the chain, is now the westernmost permanent civilian community. Its people live by fishing, whaling, reindeer raising, basketry, and trapping.

Bristol Bay, indenting the mainland just north of the peninsula, has for years been the great fishing area for red salmon, most highly prized of several varieties. In recent years its runs have been sadly depleted by Japanese fishermen. A 1952 treaty permits them to fish up to the 175th meridian, west longitude, but American-spawned salmon migrate 20 degrees or more west of that line.

North of Fairbanks: Empty Expanses

At the northern end of the 470-mile Alaska Railroad lies Fairbanks, affectionately called by its residents "The Golden Heart of Alaska." Founded on gold in 1902, it is today the State's second largest city and the distribution center for northern Alaska. Near-by Ladd Air Force Base is the northernmost United States defense bastion on the continent.

Four miles west of Fairbanks, on a knoll overlooking the wide Tanana Valley, is the world's farthest north university. The University of Alaska opened with six students in 1922; today some 850 study arts, sciences, agriculture, engineering, business, and education (page 65).

Fairbanks is Alaska's northernmost city. Yet almost half of Alaska's expanse lies north of it, empty but for scattered communities along the Yukon River, occasional Indian settlements, and Eskimo villages scattered all the way to the Arctic coast.

One community on the Bering Sea coast—Nome—survives in the shadow of its past. In 1900 its population approached 20,000. Gold dredging persists today, though it is diminishing; the present city of 1,900 supplies the miners of the vast Seward Peninsula.

Nearly 200 miles north "the Eskimo capital" of Kotzebue, with a population of almost 1,000, attracts many tourists with its Eskimo dances, kayak rides, whale and walrus hunts, and other activities. Visitors come by plane; there is no road within a hundred miles.

Barrow, Uncle Sam's farthest north, numbers more than 1,400 Eskimos. Here the Navy established an oil-drilling venture which uncovered a vast natural gas field. Barrow also benefited by the building of the Distant Early Warning system (DEW Line), the chain of radar stations which I proposed ten years ago.*

Ocean Current Keeps Winters Mild

As Alaska's people, an estimated 211,000 including the military, undertake the responsibilities of statehood, they welcome the interest their fellow citizens are displaying.

Impressions Alaskans would like to correct, however, include those concerning the State's climate. Alaska has not one climate but several—some mild, and few, if any, hard to bear.

True, Nome lies locked behind sea ice seven months or more of the year, and Fairbanks uses antifreeze in its fire hydrants. But where many Alaskans dwell, winds warmed by the Alaska Current push winter temperatures higher than those of northern States a thousand miles to the south. A summer swim near my cabin at Eagle River Landing is as comfortable as a dip in New England surf.

This Pacific Ocean "Gulf Stream" delivers more rain, however. Warm, moist air from the sea, striking the mountain ramparts, drops 150 inches of rain a year in Ketchikan; more than 80 in Sitka and Juneau.

As one moves inland, winters are colder, summers warmer, precipitation less. Fort Yukon, just above the Arctic Circle, has recorded temperatures ranging from 100° F. in June to 71° below zero in December. Spring and fall are brief all over Alaska.

The real difference in Alaska's seasons is the varying daylight. Long summer days pleasantly affect the lives of Alaskans. On June 21, the longest day of the year, Fairbanksans annually play a midnight baseball game. On that night the sun is below the horizon only two hours and 11 minutes. Conversely, on December 21, dawn-to-dusk lasts only from 9:59 in the morning until 1:41 in the afternoon.

What of Alaska's people? Approximately

* See "DEW Line, Sentry of the Far North," by Howard LaFay, NATIONAL GEOGRAPHIC, July, 1958.

five-sixths of them came from the other States —either they or their parents or grandparents. Most hail from the northern tier of States, from Wisconsin westward. Many were born in Scandinavia and find much that recalls the lands of their birth.

About 40,000 Alaskans are of aboriginal stock—Indian, Eskimo, and Aleut. Southeastern Alaska has some 8,000 Indians, chiefly Tlingits; another 8,000 or so of Athabascan stock live in the interior. The 1,500 Aleuts, an Eskimauan people, are spread over Kodiak, the Alaska Peninsula, and the Aleutians. Along the Bering Sea and Arctic coasts, and along the rivers for considerable distances inland, dwell some 20,000 Eskimos.

Eskimo Elected Senate President

All these aboriginal peoples are in varying degree being absorbed into the white man's civilization. Indians and Eskimos serve in Alaska legislatures. Frank Peratrovich, a Tlingit from Klawak, was president of the Territorial Senate in 1949 and in 1955 was elected first vice president of the Constitutional Convention. An Eskimo carpenter, William E. Beltz of Unalakleet, served for ten years in the Territorial Legislature before being elected president of the first State Senate.

Eskimos, extraordinarily adept and adaptable, are pilots as well as mechanics on Alaska's airlines. They also work on DEW Line stations. Remoter villages still live by hunting whale, walrus, seal, and caribou; furs and handicrafts help as "cash crops."

Nearly all Alaskans hunt and fish, both for sport and for food. Salmon derbies held in most coastal communities attract increasing numbers of anglers from other States.

Alaska's fishing potential is so good, in fact, that it led to what I regard, at times, as my narrowest escape.

Totem Carver's Mallet and Chisel Fashion a Legend in Wood

Northwest Coast Indians hewed the cedar shafts as banners, coats of arms, storybooks, and tombs—even as notices of unpaid debts.

Casper Mather, a Tsimshian Indian living at Ketchikan, chisels through a rough block. Garishly painted pole at left shows eagle, bear, and a woman with an eyelike shoulder socket.

Grimacing men and beasts peer from a pole at Sitka. Well-carved totems, $10 a foot before the war, have tripled in price.

Tranquil Waters Mirror Mount McKinley, the Monarch of Alaska

Highest in North America, the 20,320-foot peak far overshadows California's 14,495-foot Mount Whitney, which ranked as the loftiest in the United States until Alaska's admission.

Indians call the peak Denali—the Great One—and recount how a warrior with magic powers created the mountain from an enormous wave to deflect the spear of a pursuer.

This view from the south looks across a lily-strewn lake to Ruth Glacier at the base of the mountain. On clear days the peak may be seen from Anchorage, 130 miles away.

Brown Bears Breast a Flood for a Feast of Salmon

Alaska's assortment of bears, among the world's most varied, includes grizzly, cinnamon, black, glacier, polar, and the great Alaska brown, or Kodiak, largest of land carnivores. Eskimos fear to boast in the bear's vicinity lest the beast hear and kill the braggart. These three wade the McNeil River near Kamishak Bay.

Pincushion muzzle and frightful tusks give the clam-hunting walrus an undeserved air of fierceness. The ponderous beasts owe their name to the Norse word *hvalross*, meaning "whale horse."

Eskimos, wasting nothing, turn the walrus's tusks into carvings, stomach into knapsacks, and intestines into windows and raincoats. This herd lolls in Bristol Bay.

While enjoying the beauties of one of the many placid sloughs off the Stikine River from a flat-bottomed skiff, I was startled by the sudden leap of a 15-inch rainbow trout. The fish struck the gunwale and hung there, balanced, for a precarious moment.

To my relief it slid back into the water. Had fortune's finger tipped that trout into the boat, my reputation for truthfulness would have been shattered beyond repair!

An outdoor people for much of the year, Alaskans have developed the characteristics of friendliness, helpfulness, generosity. Neither caste nor class exists here; no work is considered menial. If you order a cup of coffee in an Alaskan cafe, do not be surprised if the waitress steps around the counter to join you with a cup of her own. The "Alaska tuxedo"—whipcord trousers and hunting jacket—is not improper male attire at a dinner party.

State's No. 1 Need: More Roads

As Alaskans enter statehood, they face problems resulting from long neglect. These are principally in the field of transportation. During the first 40 years of Federal aid for highway improvements, from 1916 to 1956, Alaska's share was negligible—though Alaskans paid all Federal taxes.

In consequence, Alaska has only 4,100 miles of road. Few of its communities are connected by highway. Its one major railway extends only 470 miles, from Seward to Fairbanks. Passenger service on the only American steamship line offering it between Seattle and Alaskan ports was suspended in 1954.

As a result, Alaska depends almost wholly on air transportation.

In this respect the 49th State is unique. A dozen airlines and some 300 airfields have sprung from the bush-pilot operations of past decades. Then, and to some extent even now, frozen lakes, winding rivers, mud flats, and gravel bars served as landing fields. Modern aids to navigation were nonexistent. And when one flew from, say, Fairbanks to Nome, one prudently wore "walking-out" clothes.

Twice in years past I have gone down in forced landings in single-engined bush planes. Once we skidded to a halt on sea ice only six feet from open water, off Little Diomede Island in the Bering Strait. On the second occasion, between Wainwright and Point Lay on the Arctic coast, a search plane found us stalking a herd of caribou, preparing to "live off the land" until rescued.

Even so, I would feel as safe flying from Ketchikan to Kotzebue with a skilled Alaskan bush pilot as crossing Chicago in a taxicab.

Alaskans Face Future Confidently

High among Alaska's past problems has been legislation, passed in 1920, which imposed the highest maritime freight rates in the world. This, in turn, brought high living costs and related handicaps which Alaskans now hope gradually to correct.

Some of Alaska's greatest potential remains to be developed. Besides pulp and petroleum, the State has the largest undeveloped water-power resources on the continent; less than one-quarter of one percent have been harnessed. Valuable resources of natural gas and critical minerals are little tapped, for lack of transportation.

As they embrace statehood, Alaskans are imbued with two desires which they hope are not in conflict.

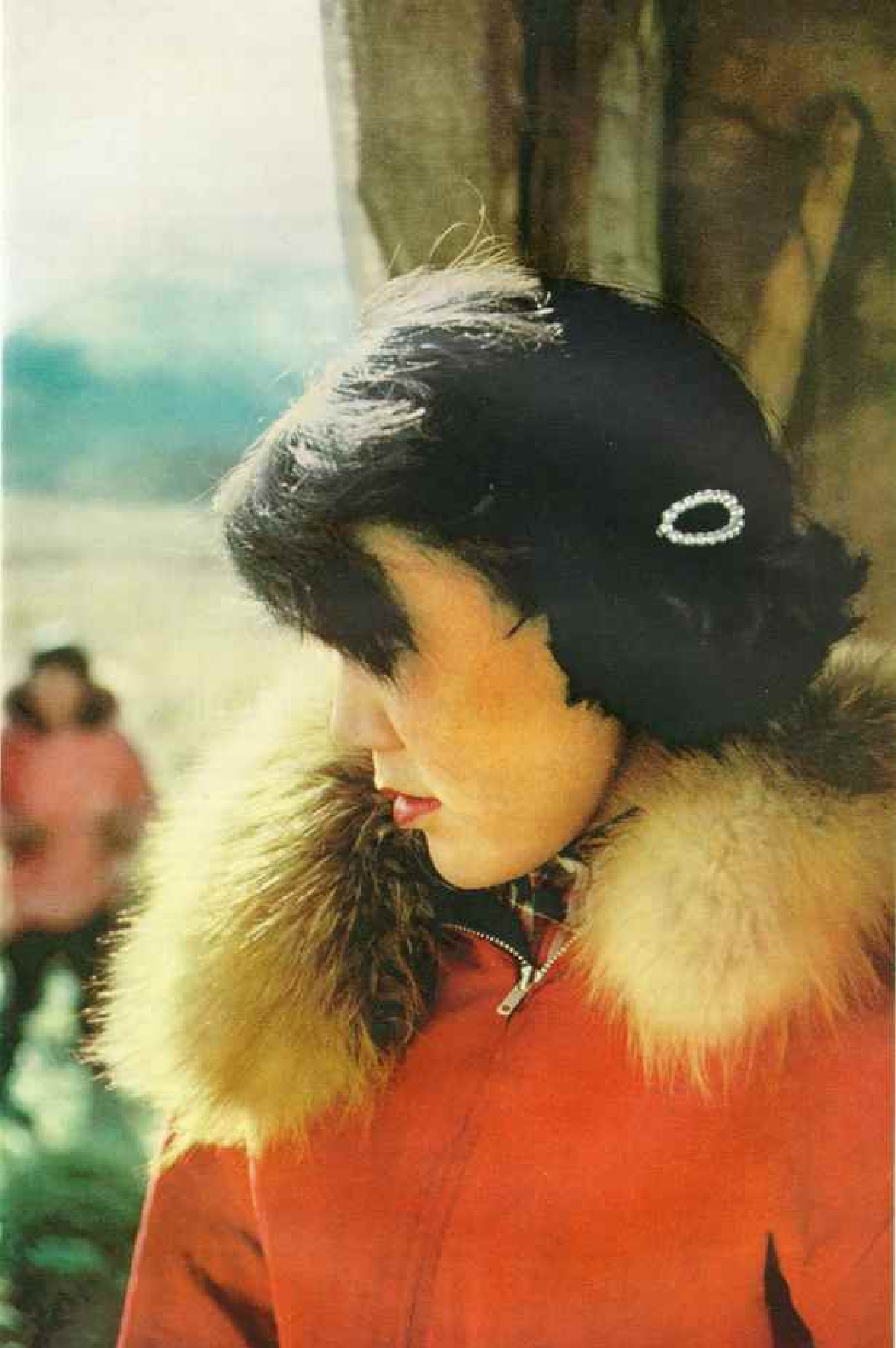
One is to develop Alaska. They want to diversify its economy and place it on a firm and enduring foundation. They want to secure for themselves and their children all that is best in the American way of life. They want to increase the cultural content of their society, to forego none of the blessings of modern civilization. They want to enlist newcomers to Alaska in this great adventure.

At the same time Alaskans cherish their wilderness, with its beauty, abundance, and mystery. They appreciate that it is one of nature's last great strongholds on the continent. They want to preserve it.

Most of us believe we can do both. We do not expect to achieve these twin goals without hard work, devotion, public spirit, sacrifice, and applied intelligence. I am confident that Alaskans are ready and eager to accept the challenge, that they can and will succeed.

Winter's Brief Sun Warms an Eskimo Girl at the Door of Her Sod Home

At autumn's chill warning, Eskimos of Anaktuvuk Pass fold their caribou-hide tents and retreat to winter quarters. This girl, not yet at the marriageable age of 18, shares her parents' house. Her pearl hair clip, printed shirt, and zippered jacket exemplify the trend from homemade clothes to trading-post garments.



Primitive path crosses modern in Alaska's mingling cultures; here, Eskimos and dog

Atlas Map Provides a Full-length

TO INTRODUCE the great State which has brought a 49th star into the United States constellation, the NATIONAL GEOGRAPHIC presents as a supplement to this issue the eleventh map in its Atlas Series—the **State of Alaska.***

Deftly portrayed in the foregoing article by Alaska's distinguished Senator Ernest Gruening, the Union's new member emerges as a too-long-neglected wilderness in transition. But this vigorous young giant daily draws closer to its sister States, becoming more familiar with every news dispatch from Fairbanks, each weather report from Anchorage.

The new 10-color Atlas plate graphically confirms the frontier character of Alaska's 586,400-square-mile area. Most of its 2,679 names identify natural features, not settlements. They also teach a lesson in history: Mitliktavik, Chakachamna Lake, Point Romanof, and Goodnews Bay echo the State's Eskimo-Indian-Russian-American heritage.

Today's more than 210,000 Alaskans, their numbers grown 64 percent since 1950, still have elbow room aplenty—2.8 square miles per person. Their State, stretching across 20 degrees of latitude, ranges from pond-pocked Arctic tundra to lush valleys of the panhandle bordering British Columbia. And beneath their feet lies vast mineral wealth: almost $730,000,000 in gold alone has already poured out of Alaska.

While exploring near Dillingham, one oil company has discovered what seems to be a huge deposit of iron ore. The United States Navy has uncovered a vast reservoir of natural gas in the vicinity of Umiat. The map's tiny derrick symbols on the Kenai Peninsula testify to an embryonic but vastly promising petroleum industry.

Atomic Blast Would Dig a Harbor

Nuclear energy, too, may affect the new State's future. The Atomic Energy Commission is contracting for a reactor at Anchorage, the State's largest city, and also is studying a possible nuclear explosion to blast out a harbor on the coast of the Chukchi Sea southeast of Point Hope. Such a port might open rich beds of copper and coal in the hinterland

team lope past bush planes lashed down against the northland's fierce winter winds.

Portrait of the Union's Largest State

and serve as a terminal for a pipeline to the Arctic oil fields southeast of Barrow.

Alaska's proximity to Asian markets is exerting a growing influence. The thriving Japanese steel industry now imports coking coal from faraway Virginia. But if Alaska-mined coal—worth some $6,000,000 in 1958—proves suitable, the Virginia suppliers plan a mammoth installation in the Bering River area.

New roads probe the wilderness; the map shows the Denali Highway that opens Mount McKinley National Park to motor traffic. But Alaska still conquers its immense distances by air; red stars mark the 217 communities with scheduled air passenger service.

A line of red trees indicates the limits of the State's wooded areas. National Geographic cartographers have learned from bush pilots that the forests are marching steadily toward the sea in the north and west; in some places, spruce and hemlock thrive 50 miles nearer the coast than was true a few decades ago.

Spectacular ice sheets stud the wild coastline of the Gulf of Alaska. One, Malaspina Glacier, could cover all of Rhode Island.

The metamorphosis of the 49th State is strikingly evident at Chirikof Island, southwest of Kodiak. Cowboys now ride the range on what was once a tsarist prison isle. A cattle company has leased the entire island and hopes eventually to supply a large proportion of Alaska's beef.

A glance at the inset in the map's upper right corner will identify regions of Arctic tundra, mountain tundra and alpine vegetation, forest, and farmland. Other insets complete the Aleutian chain on the same large scale as the main map, and show the Diomede Islands, where a scant 2½ miles of water separates the United States from Soviet territory.

* A convenient Folio to hold Atlas Maps is available for $4.85; a packet of the seven maps issued in 1958 for $3; individual maps for 50¢. Write to National Geographic Society, Dept. 17, Washington 6, D. C.

This map is Atlas Folio Plate No. 18. Plates previously issued: Northeastern United States (No. 6), Southeastern United States (8), North Central United States (9), U.S.-Canadian National Parks (13), Southern South America (28), British Isles (31), Germany (35), Poland and Czechoslovakia (38), Greece and the Aegean (40), and Lands of the Eastern Mediterranean (47).

By LONNELLE AIKMAN

New Stars for

The United States flag—182 years old—has changed with the Nation, reflected its achievements, and shared its sorrows

HIGH ABOVE the White House, against Washington's bright-blue January sky, fluttered a flag that was fast being outmoded by events taking place inside.

In the stately green-draped Cabinet Room, I stood with a battery of reporters and cameramen facing President Eisenhower, seated between Vice President Nixon and Speaker of the House Sam Rayburn. Lined up behind them was a group of distinguished Alaska officials. Near by stood two flags of the United States—the familiar 48-star version, and a furled mystery.

As the gold mantel clock ticked past the hour of noon, the President, using six souvenir pens, signed the proclamation admitting Alaska to the Union. Then, with six more pens, he signed an executive order adding the 49th star to the Nation's flag. Finally, revealing the Capital's best-kept secret, he unfurled America's latest constellation.

It was not destined to last long. Scarcely two months later the United States Congress voted Hawaii into the Union. The formal addition of a 50th star for Uncle Sam's great island group became only a matter of time.

Even Benjamin Franklin, philosopher and tamer of lightning, could never have imagined that the flag he helped establish would fly one day on the Arctic Ocean's shore and above the tropical blue waters of the mid-Pacific.

In the anxious month of June, 1777, when the original Stars and Stripes was adopted by the Continental Congress meeting in Philadelphia, it was by no means certain that either flag or independence had a future.

Philadelphia, where the Declaration of Independence had been hopefully signed a year earlier, still echoed the brave words of the Revolution's leaders—Jefferson, Franklin, Adams, and their fellows. But the Congressional delegates, sitting on the edge of their chairs in the handsomely Georgian Independence Hall, were literally poised between flights. Six months before, they had fled to Baltimore on reports of advancing British troops. In the fall they would again abandon their quarters as General Howe's men marched in for a nine months' occupation of the rebel capital.

So it was hardly surprising that the first formal flag of the United States was handled in a distinctly offhand manner.

The bill was sandwiched casually between others dealing with routine naval matters; so it is assumed that the Marine Committee reported it. But there is no record of deliberations preceding the vote on that 14th day of June, 182 years ago.

Congress failed to specify the proportions or arrangement of the stars and stripes: many designs were possible, all of them valid. Handed down to posterity were only these laconic words: "Resolved That the Flag of the united states be 13 stripes alternate red and white, that the Union be 13 stars white in a blue field representing a new constellation."

The curious spelling of United States with small letters is just as it appears in the handwritten resolution prepared by Congressional Secretary Charles Thomson. To him, apparently, the States were not yet a nation. He was "a gentleman of Family, Fortune and Character," as one of his colleagues described him. But "confoundedly Headstrong," added others. The fact that no further documentation has been uncovered has done more than frustrate flag historians. It has given rise to legends and romantic traditions that still color the thinking and beliefs of Americans.

Old Glory

Did Betsy Ross make the first flag or didn't she? Everybody knows the story, but nobody can prove it.

It was first publicly told in 1870, 34 years after Mrs. Ross's death. At that time her grandson, William J. Canby, read a paper before the Historical Society of Pennsylvania. Its gist, later supported by affidavits from family friends and relatives, was to the effect that George Washington, Robert Morris, and Col. George Ross (an uncle of Betsy's first husband) had called at the Ross upholstery shop in Philadelphia shortly before the Declaration of Independence. With them they brought the design for

PAINTING BY E. PERCY MORAN, COURTESY PEALE MUSEUM

"'Tis the Star-Spangled Banner!" Francis Scott Key, detained by a British fleet bombarding Baltimore's Fort McHenry in the War of 1812, sees his country's flag still "gallantly streaming" after 25 hours of cannonading.

PHOTOGRAPHS BY SOLOMON WEBSTEL © N. G. S.

"Broad stripes and bright stars" are now proudly hailed at the Smithsonian Institution. The flag of the United States, whether the first makeshift of a valiant band fighting for freedom or the 50-starred banner of a world power, has ever mirrored the Nation's growth and glory. Countless hearts have been lifted at the sight of it; countless lives have been offered in defense of it. This series traces the development of the most cherished symbol of the American people.

Star-Spangled Banner Shows Ravages of Time

This drawing of the famed flag outlines the 42-by-30-foot original. Decay has nibbled away a fourth. Displayed in the Smithsonian Institution (page 88), the banner has only one face. Linen covers the reverse to prevent further deterioration. By 1962 the museum expects to have a magnificent new building with a ceiling high enough for the relic to be hung properly. Baltimore's Star-Spangled Banner Flag House preserves several pieces.

a 13-stripe, 13-star flag which they commissioned her to copy.

The attractive young widow (she was married three times) agreed to make the sample flag, the story goes. But first the pattern was changed, at her suggestion, to use five-pointed instead of six-pointed stars.

Today flag scholars rule out the Betsy Ross legend, charming and popular though it is. It has the fatal time defect that the Nation's independence was yet to be proclaimed, and that the Stars and Stripes was not approved by Congress until a year later. Moreover, decades of research through revolutionary documents—including George Washington's voluminous writings—have failed to yield a single notation of such an occurrence.

Said President Woodrow Wilson when he was asked for an opinion on the matter: "Would that it were true!"

Designer Asks Reward in Wine

Better evidence supports another claim to participation in the starry flag's birth.

Francis Hopkinson—a signer of the Declaration of Independence and member of the Continental Navy Board—wrote a letter to the Navy in 1780 asking recognition for his work in designing, among other devices, "the flag of the United States of America."

As "a reasonable Reward for these Labours of Fancy," he thought that "a Quarter Cask of the public Wine" might be about right.

Later, when required to restate his case before a succession of Government authorities, Hopkinson put a substantial money value on his services. Arguments followed, and eventually, after congressional investigation, the claim was disallowed. But not, it should be noted, on grounds that the work had not been done. Rather it was felt that Hopkinson "was not the only person consulted on these exhibitions of Fancy," and that the public should not have to pay "for these little assistances, given by gentlemen who enjoy a very considerable Salary under Congress."

Grand Union Before Stars and Stripes

Actually, the life story of the American flag had already begun, and with a quite different design, at least a year and a half before Congress adopted the Stars and Stripes.

During the uncertain period that followed the first clashes with British troops at Lexington and Concord,* the rebellious colonists dreamed up a national standard that was both a compromise and a hope.

Called the Grand (or Great) Union flag, it displayed 13 red and white stripes in honor of the 13 Colonies instead of the solid red field of the British flag. At the same time it retained Great Britain's Union Jack in its upper left-hand corner, or canton.

The British flag—carrying England's red Cross of St. George overlying Scotland's white Cross of St. Andrew—already was intimately associated with the colonists' lives, both in battle and maritime trade. Under it New England sailors and soldiers had won a great victory for Britain at the 1745 siege of French-held Louisbourg in Nova Scotia (opposite).

Thus it was quite natural that the United Colonies' first national flag should present the "English colours, but more Striped," as a contemporary writer described the new Grand

* See "History and Beauty Blend in a Concord Iris Garden," by Robert T. Cochran, Jr., NATIONAL GEOGRAPHIC, May, 1959.

MABEL BRADY GARVAN COLLECTION, YALE UNIVERSITY ART GALLERY © N. C. C.

Yankee Troops Battle for the British Ensign at the Siege of Louisbourg

For nearly two centuries the English settlers accepted as their own the flags of Britain—the Union Jack, with its Crosses of St. George and St. Andrew, and the Meteor (above), Red Ensign of the Royal Navy. In 1745, as on many other occasions, these flags flew over colonials in war. Sailing north from New England, 4,300 citizen soldiers stormed the French fortress of Louisbourg on Cape Breton Island and won its surrender.

PAINTING BY CLYDE O. DELAND

Rousing Cheers Send Aloft the First Flag of a People in Revolt

At the beginning of the American Revolution, the colonists hoped not so much to gain independence as to right the wrongs done them under the reign of George III. Thus, in the Grand Union flag, they kept the British Jack out of loyalty to the Crown but added 13 stripes to bespeak their own unity. Here, atop Prospect Hill near Boston, the flag makes its appearance at the birth of the Continental Army, January 1, 1776. "We ... hoisted the Union flag in compliment to the United Colonies," said Washington.

Union. It was also natural that misunderstanding should arise.

On January 1, 1776, while laying siege to British-held Boston, George Washington raised this standard over near-by Prospect Hill (above). Waving from a 76-foot pole (a salvaged ship's mast), it had the look of conciliation. It didn't mean, however, that the rebels had abandoned their grievances against George III, as British observers in Boston optimistically concluded.

Washington set the record straight in a sardonic letter written soon after, when he finally received copies of the King's address to Parliament rejecting the colonists' petitions. "We are at length favourd," Washington observed, "with a sight of his Majesty's most gracious Speech, breathing sentiments of tenderness & compassion for his deluded American Subjects. . . . Farcical enough, we gave great Joy to them (the Red Coats I mean) without knowing or intending it, for . . . we had hoisted the Union Flag in compliment to the United Colonies, but behold! it was receivd in Boston . . . as a signal of Submission. . . . By this time I presume they begin to think it strange that we have not made a formal surrender of our Lines."

Meanwhile, the Colonies' infant Navy was being outfitted to take the Grand Union to sea and make clearer the lack of submission.

About the time General Washington sent his flag aloft, America's first fleet rode at anchor in the Delaware's ice-caked waters off Philadelphia. Among former merchantmen converted to gun-bristling sloops, brigs, and

ships of war was the flagship *Alfred*, scrubbed down, "spit 'n polished" to greet the Navy's commander in chief, Esek Hopkins.

As Commodore Hopkins came aboard on a still-disputed wintry day, an ambitious unknown named John Paul Jones hoisted the "Flag of America" to the roar of guns and the cheers of spectators.

The then young officer later wrote that, because it had been his fortune as senior lieutenant to raise this flag, he felt all the more "for its Honor."

Jones, unhappily, did not say what he meant by the Flag of America; witnesses of the time described several emblems over the *Alfred*. The answer, many historians agree, is that the Grand Union flew with other ship banners, including the commodore's personal flag—a coiled rattlesnake in a yellow field bearing the warning, "Don't Tread on Me."

In that spring of 1776 the Grand Union sailed south into Britain's Bahamas and underscored the warning with a notable victory.

Storming ashore at New Providence Island, American marines and sailors captured a desperately needed store of gunpowder, shot, and cannon. In addition, the colonials took the Bahamas governor as hostage—a bold gesture of defiance from the world's youngest navy to the world's leading sea power.

Shortly after the Bahamas raid a Yankee skipper displayed subtler audacity by winning the first foreign recognition of American independence—a salute to the national flag.

Dutch Guns Honor U. S. Independence

Capt. Isaiah Robinson flew the Grand Union over his brigantine *Andrew Doria*. (Americans commonly ignored her official name, *Andrea Doria*, which honored a Genoese admiral.) He sailed under secret congressional orders to take on supplies for the Continental Army at the neutral island of St. Eustatius in the Dutch West Indies. As extra credentials, he carried a copy of the Declaration of Independence for the attention of Governor Johannes de Graaff.

St. Eustatius, or "Statia" as it was more familiarly known, was then a booming trade center where cargoes from Europe could be

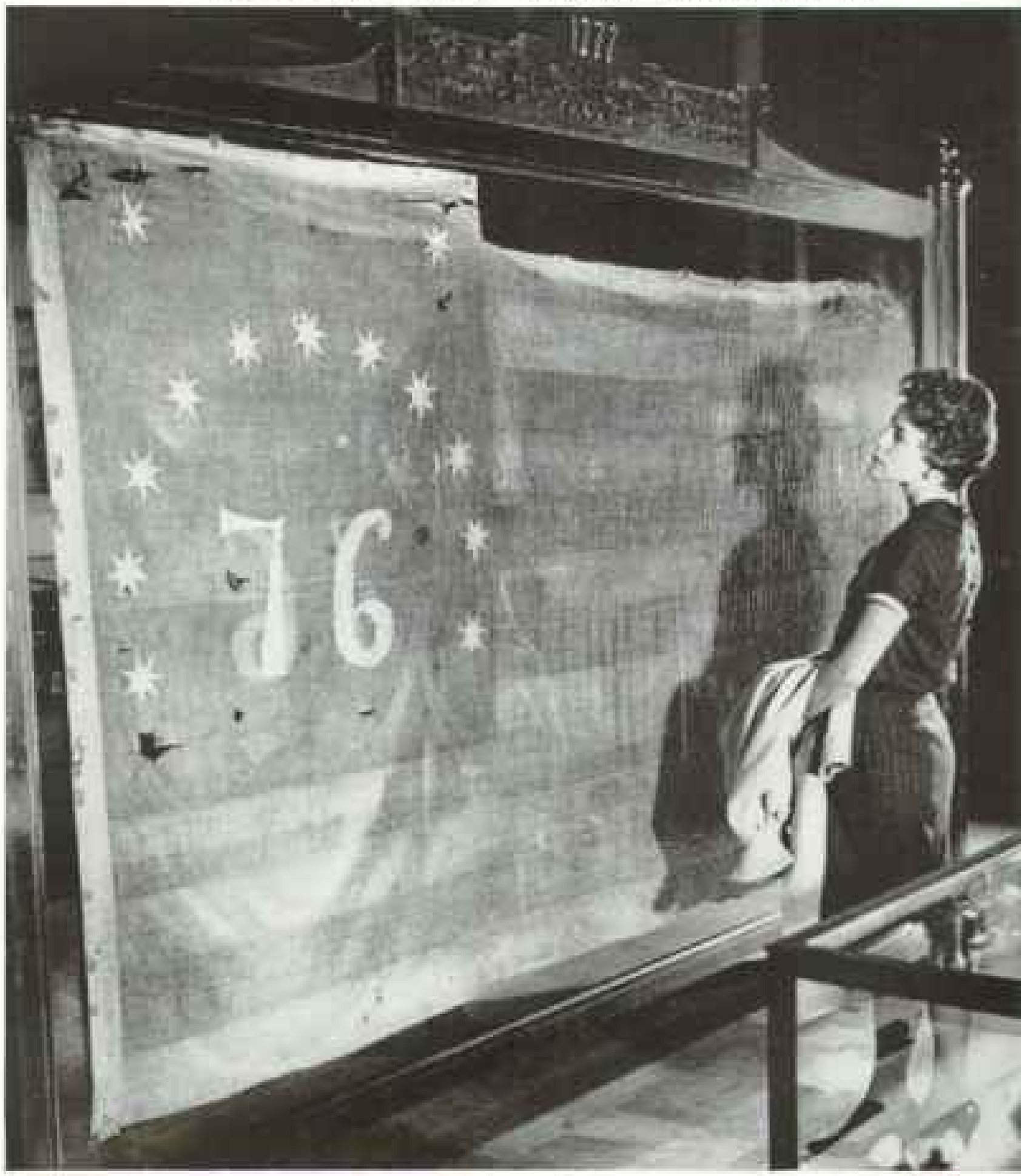
Starry Union Proclaims the Fight for Freedom

The breach with Britain beyond repair, the Continental Congress on June 14, 1777, adopted a brief resolution: "Resolved That the Flag of the united states be 13 stripes alternate red and white, that the Union be 13 stars white in a blue field representing a new constellation."

Revolutionary flagmakers set the stars variously and even changed the colors, as banners still surviving reveal (pages 94 and 97).

Vermonters say this faded flag flew near Bennington when a brigade from New Hampshire under Gen. John Stark defeated a foraging detachment sent by British General Burgoyne. The battle—"one continued clap of thunder"—hastened Burgoyne's surrender two months later, in October, 1777.

FLAG PRESERVED IN BENNINGTON HISTORICAL MUSEUM, BENNINGTON, VERMONT



NATIONAL GEOGRAPHIC PHOTOGRAPHER THOMAS NEBBIA

FLAG PRESERVED IN NORTH CAROLINA HALL OF HISTORY, RALEIGH

Blue Stars and Stripes Joined the Battle at Guilford Court House

Leaders of the Revolution considered the Stars and Stripes a naval ensign. Nevertheless, a few land units did carry starred flags into the roar of conflict.

At North Carolina's Guilford Court House, in 1781, this banner saw the Americans lose the field. But their enemy fared worse. As Horace Walpole put it, "Lord Cornwallis has conquered his troops out of shoes and provisions and himself out of troops."

Thus weakened in the south, Cornwallis moved northward into Virginia and to his final stand at Yorktown (page 100).

PAINTING BY EDWARD MORAN

U. S. NAVAL ACADEMY MUSEUM © N. G. S.

"American Stars" Aboard the *Ranger* Take Their First Salute from a World Power

Revolutionary flags went to sea in such bewildering variety as to confuse even Benjamin Franklin, abroad to win support for the Continental cause. Describing the United States flag in an official letter, Franklin wrote that its stripes were red, white, and blue.

It remained for John Paul Jones to win recognition for the Stars and Stripes "in the fullest and completest manner." On February 14, 1778, the captain ran his sloop into Quiberon Bay, on the coast of Brittany. A thundering salute from the French fleet formally recognized the Colonies as a new, independent nation.

Dutch Guns at St. Eustatius, West Indies, Boom in Honor of the Grand Union

When the British fleet harried European shipping to the Colonies, goods poured into this free port in the Leeward Islands to await revolutionary blockade-runners.

In November, 1776, the *Andrew Doria*, a Continental brigantine named for a Genoese admiral, dropped anchor and fired a 13-gun salute to Holland's flag. Returning 11 "honor shots," the governor became the first foreign official to acknowledge American independence.

transferred to American craft running the British blockade. For the Dutch this profitable business was further sweetened by sympathy for the American cause, based on their own earlier hard-won independence from Spain.

In such a favorable climate, Captain Robinson sailed into Statia's roadstead on November 16, 1776. Maneuvering into a prominent spot opposite Fort Oranje, he ran up the appropriate Dutch and American colors and fired a 13-gun salute (page 94).

Eleven shots—held off, some say, until Governor de Graaff had read the Declaration of Independence—thundered in reply, with obvious Dutch realization of their meaning.

Though De Graaff was eventually called home by his government to answer British charges that his salute had violated Dutch neutrality, the Americans had scored a valuable psychological point in the New World.

Hero and Flag Were Twins

Seven months later the Stars and Stripes replaced the Grand Union as a flag of full independence. Rippling at the masts of the colonists' naval and privateering vessels, it soon sailed across the Atlantic to broader fields of recognition and battle.

"That flag and I are twins," is a sentimental declaration often attributed to John Paul Jones, born seaman and man of destiny. Whether or not he put it that way, the statement rings true in one sense. The Continental Congress gave Captain Jones command of the fighting ship *Ranger* on the same day it adopted the Stars and Stripes.

In raising the new ensign over the *Ranger*, Jones believed that he was first to attach the 13-star, 13-stripe emblem to an American man-of-war, as he had been first with the Grand Union over the *Alfred*. Many historians agree with him. But where that flag came from is lost in clouds of romance.

A popular tale claims that a group of admiring ladies of Portsmouth, New Hampshire, cut up their best silk gowns to make the dashing young captain's ensign. Unhappily, the evidence belies this charming tale.

More to the point is what Jones accomplished for flag and country after sailing for France in the fall of 1777. In Quiberon Bay, Brittany, February 14 and 15, 1778, he requested and received salutes for the "American Stars" from the fleet of Admiral La Motte-Picquet (page 95).

Then Jones sailed out into British waters to write an unforgettable chapter in naval history. Warming up by capturing or sinking half a dozen merchantmen, he led a short, successful raid on the English coast. He next took on His Majesty's man-of-war, the *Drake*. After 64 minutes of furious combat—during which the starry flag fluttered over the nimble *Ranger* like a dancer's scarf—the outmaneuvered *Drake* struck her colors, and was taken as a war prize into the French port of Brest.

But Jones's—and the Revolution's—most spectacular sea victory was still to come.

In September, 1779, while commanding a French-American squadron under American colors, Jones came across a British convoy in the North Sea off Flamborough Head. Closing in for action against the warship escort, he pitted his unwieldy, patched-up East Indiaman, *Bonhomme Richard*, against Britain's brand-new 50-gun frigate *Serapis*.

A murderous, incessant fire soon reduced both ships to a pandemonium of flames, smoke, and wounded and dying men. Jones finally managed to lash together the two battered hulks, bow to stern, hampering the superior gun power of the *Serapis*. By that time the *Richard's* flag spar had been blasted down, and with it her colors.

"Have you struck?" Captain Pearson of the *Serapis* shouted hopefully to Jones.

"Struck, sir?" came the famous defiant answer. "I have not yet begun to fight!"

Army Flew Varied Banners

If it appears at this point that the Navy held a virtual monopoly on the Stars and Stripes during the Revolution, the impression is well founded.

The Navy's ensign was a practical necessity to identify the Colonies' far-flung warships and swarms of privateers. The Army, on the other hand, did not officially adopt the Stars and Stripes as its colors until more than half a century after the Revolution, though it did use this flag for garrison duty and special occasions.

So—despite the many stories and historic paintings depicting the Stars and Stripes carried in battles of the Revolution—the land forces of that time usually bore their own state, regimental, and other devices. These were made up in various colors and patterns, including such heraldic symbols as a mailed arm, crescent moon, tiger, minuteman, liberty tree, and coiled or gliding rattlesnakes.

True, some regimental flags followed the

PAINTING BY FREDERICK KEMMELMEYER, MERRILL ROAST GARVAN COLLECTION, YALE UNIVERSITY © N.G.S.

Sabers Sing Beneath Old Glory in the Revolutionary Battle of Cowpens

America's Morgan fought Britain's Tarleton in South Carolina on January 17, 1781, with hit-and-run tactics. As Tarleton charged, Morgan faded. When he finally turned, he trapped the British. Maryland's State House preserves tradition's battle flag (below).

REPRODUCING BY NATIONAL GEOGRAPHIC PHOTOGRAPHER THOMAS NEBBIA © N.G.S.

NATIONAL GEOGRAPHIC PHOTOGRAPHER J. BAYLOR ROBERTS

The flag holds a place of honor in the United States House of Representatives. When displayed flat, whether horizontally or vertically, the stars always lie to the observer's left. President Dwight D. Eisenhower reports to Congress on the state of the Union: January 9, 1959.

Congress's vague stars-and-stripes directive. But designs differed sharply. How sharply can be seen by flags displayed as battle relics of Bennington, Guilford Court House, and Cowpens (pages 93, 94, and 97).

To present-day Americans, whose flag has come to be the fixed and secure symbol of their country, such confusions and contradictions seem almost incomprehensible. The clue lies in the attitudes of a time when neither flag nor Nation was fixed or secure.

After Vermont and Kentucky joined the thirteen original States in 1791 and 1792, Congress was forced to consider a new law.

The Senate quietly passed a bill at the end of 1793 providing for two more stripes and two more stars. But when the measure came before the House, debate soon showed that some members, at least, regarded the flag's alteration as a bore and a bother.

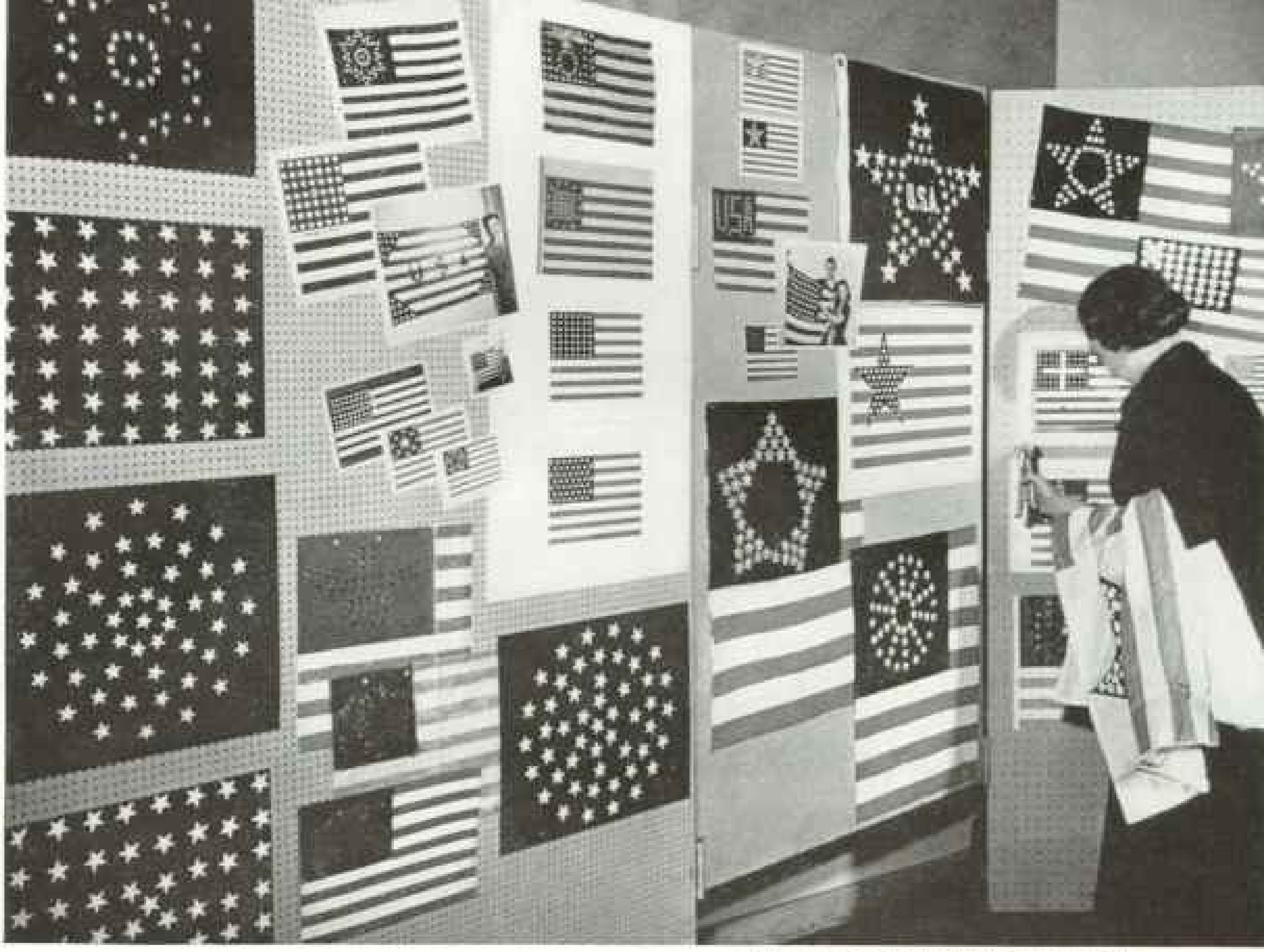
"A trifling business," observed one Representative. "A consummate specimen of frivolity," said another sternly. If the bill had to be dealt with, it was suggested that it be passed quickly, so as to get on with more important affairs. But "for the honor of the House," warned the opposition, let it not appear upon the minutes that such an act was the first passed at the session.

"O Say Can You See?"

The resolution as finally approved was brief enough. It ordered simply "That from and after the first day of May Anno Domini one thousand seven hundred and ninety five, the Flag of the United States, be fifteen Stripes alternate red and white. That the Union be fifteen Stars, white in a blue field."

As it turned out, this "consummate specimen of frivolity" produced Francis Scott Key's Star-Spangled Banner.

"I had no idea it was so *big*," said my companion as we stared at a mammoth, partly folded flag hung in a display case at Washington's Smithsonian Institution.



NATIONAL GEOGRAPHIC PHOTOGRAPHER BATES LITTLEHALES

Suggested Patterns for the New Flag's Stars Resemble Fireworks Displays

The Flag Act of 1818 established the permanent design of 13 stripes and provided for addition of a star for each new State. But the law made no provision for an enduring arrangement of stars. These designs represent a few of the hundreds submitted when Alaska and Hawaii stars loomed into view.

We were looking at the tattered, mended remains of the original 42-by-30-foot flag that inspired Key to write "The Star-Spangled Banner" (page 88).

Anxiously watched in the rockets' red glare, this was the beleaguered banner that flew over Fort McHenry when the British attacked Baltimore after capturing Washington during the War of 1812.

The barest outline recalls one of America's favorite stories: How Key, a young District of Columbia lawyer, and Col. John Skinner, a Federal agent, boarded the British flagship to plead with Admiral Cockburn to release a captured American. How they won their point, but were later detained lest they reveal the campaign about to be launched. And, finally, after a night of furious bombardment, how they saw by the dawn's early light . . . that our flag was still there.

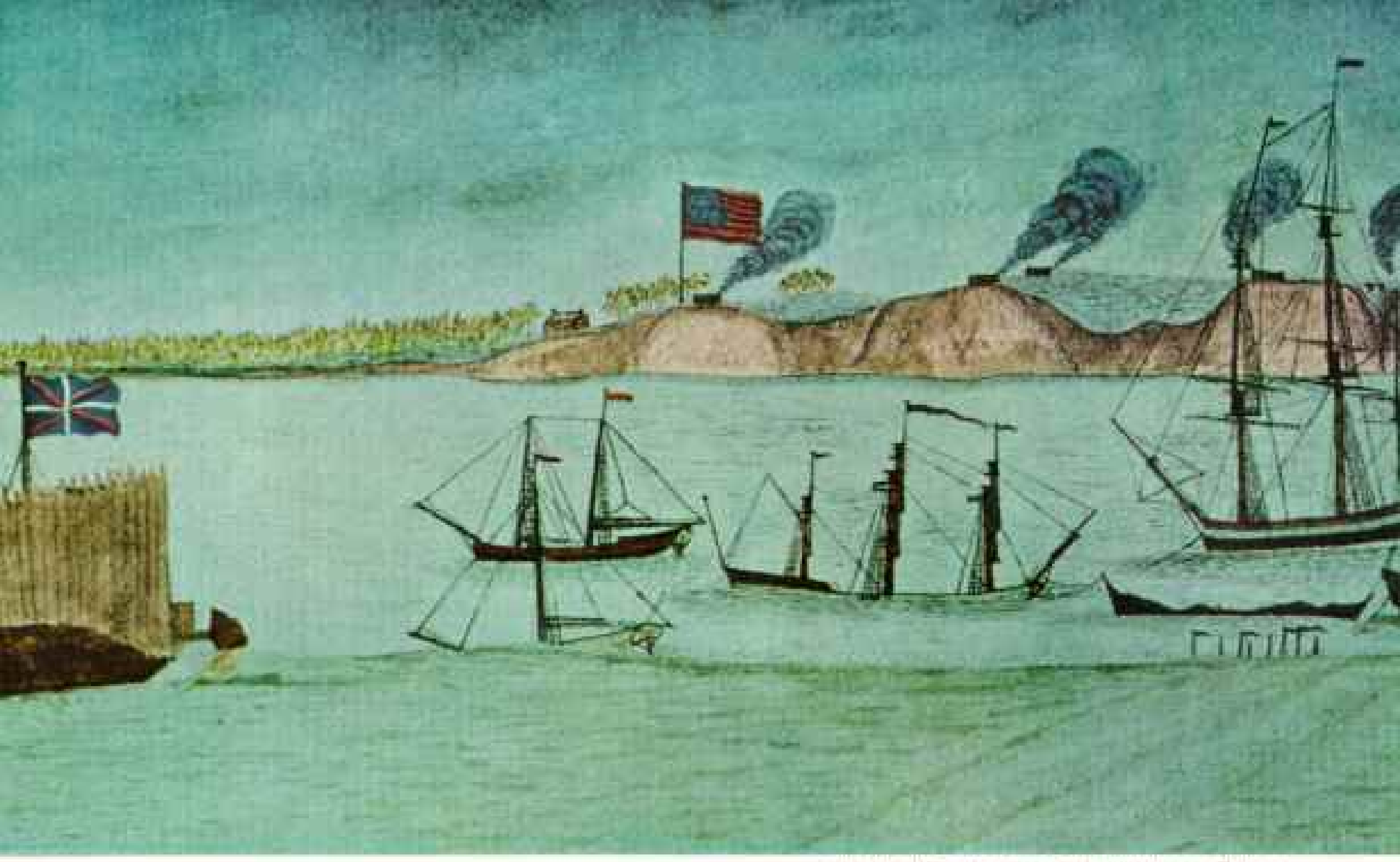
Just where the flag stood on that morning of September 14, 1814, was a mystery for nearly a century and a half. Then last fall came new light. A team of National Park Service archeologists and historians was carrying out research excavations on a proposed project to restore the original installations at Fort McHenry, now a national monument and historic shrine.

Following an 1803 map, workmen dug seven feet down in the old parade ground outside post headquarters. They found a massive brace of hand-hewn oak timbers preserved in mud.

Here was the long-sought base of the towering pole from which the Star-Spangled Banner waved its memorable message.

Rockets and bombs could not accomplish it in 1814, but high winds sweeping across the peninsula's tip regularly force replacement of today's smaller, lighter banners.

"A flag lasts about ten days," said Park Historian George C. Mackenzie, as we shivered in blasts that whipped at my skirt and set the fort's flag snapping high above our heads. "Of course, McHenry's flags take unusual



FROM THE SIEGE PAPERS, COLONIAL WILLIAMSBURG © R. & S.

Yorktown Cannon Herald Revolution's End; the Flag Waves Free at Last

In this painting, preserved by a British officer who fought at Yorktown, the Stars and Stripes looms nearly as large as battle-torn British ships in the York River. Beneath the banner, American guns duel with the enemy. When the French bottled up Gloucester Point (foreground), Cornwallis faced the end. His drummer, signaling for parley, made "the most delightful music" to American ears.

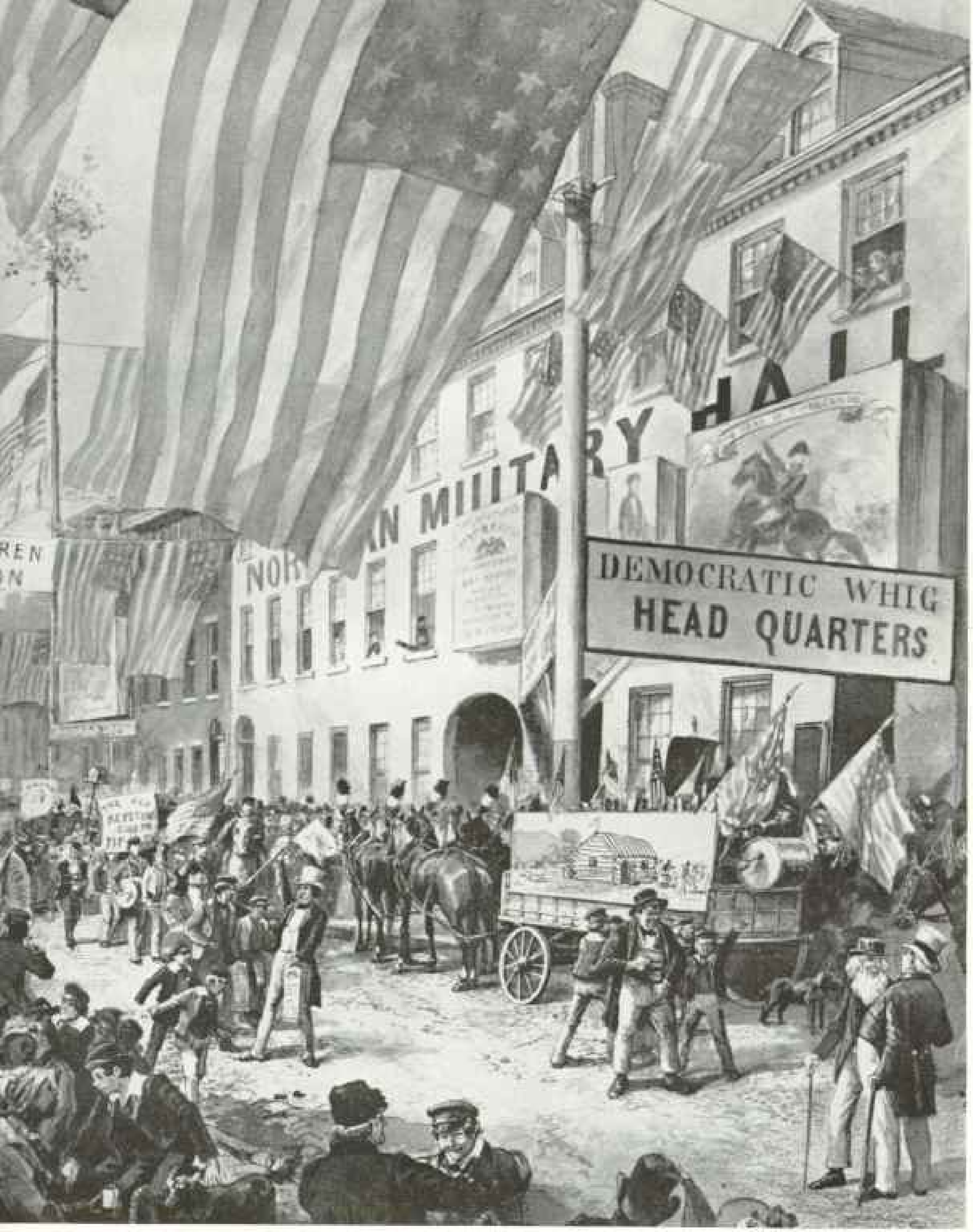
Washington and his officers (right) and French commanders (left) met shortly after, on October 19, 1781, to watch deputies enact the ceremony of surrender. "The play, sir, is over," wrote Lafayette,

PAINTING BY JOHN TRUMBULL, COURTESY YALE UNIVERSITY ART GALLERY

PAINTING BY DE THULSTRUP, COURTESY LOUISIANA HISTORICAL SOCIETY © N. G. S.

At New Orleans, the Flag Claims an Empire and a Parade of Stars Begins

The second flag of the United States, whose 15 stars and 15 stripes represent the addition of Vermont and Kentucky, rises over the Place d'Armes as the French flag descends. Thus on December 20, 1803, the Nation took possession of the Louisiana Territory and nearly doubled in size. In time this continental heartland, carved into States, added 17 new stars.



PRINTING BY FRANCIS H. SCHELL, CURRIER MARSHALL & DAVIDSON

The Banner of a Lusty, Growing Nation Dominates an 1840 Election Scene

Bursting with energy, young America sent canals crisscrossing the East, railroads rolling to the West. Factories boomed in New England; cotton built pillared palaces in the South. But the wilderness still challenged. Presidential campaign strategy, as demonstrated here at Whig headquarters in Philadelphia, presented William Henry Harrison as a homespun, log-cabin hero. In the decade that followed Harrison's election, the flag corralled the Lone Star of Texas and three others. With its territories, the American domain then swept to the shores of the Pacific.

punishment, since we fly them day and night, by special Presidential proclamation.

"Soon we'll be flying nylon flags, however," he added. "We tested one recently and found it lasted about three times as long as the cotton hunting."

Before the War of 1812 the United States had fought and won two struggles under the 15-star, 15-stripe flag. One was an almost forgotten contest with France over shipping rights soon after the Revolution.

The second was the war with Tripoli that checked the Barbary pirates' raids on Mediterranean shipping. On April 27, 1805, a combined land and naval force overwhelmed the Tripolitan town of Derna. Over its captured fortress they raised the first American flag to fly in victory over Old World soil.

But such adventures were mere muscle flexing by the young Republic. The most far-reaching event of the Star-Spangled Banner era was the Louisiana Purchase (page 101).

Overnight in 1803 the purchase nearly doubled United States territory and flung open to settlement a continental interior of fantastic wealth and opportunity.

A decade and a half later, as the human tide poured over the eastern mountains, America's family of States numbered 20. Obviously, if each rated another stripe and star, stripes soon would overrun the flag.

March of the Stars Begins

Even without additions the flag situation in 1818 was chaotic. In Washington, Congressman Peter H. Wendover of New York called his colleagues' attention to three flags of 18, 13, and 9 stripes which in the past two years had floated over Federal buildings within sight of Congress. None, he pointed out, conformed to the then-prescribed 15 stripes.

Wendover made his point. On April 4, 1818, Congress passed the third, and last, major flag act.

It provided for a permanent return to the 13 original stripes, and for the first time required that they be horizontal. It also specified that a new star be added to the blue field whenever another State formally joined the Union, and that such stars should appear on the Fourth of July following the accession.

This law has governed all national flags since. Yet curiously it failed to designate a star arrangement—an omission that left the problem of design to be solved afresh each time the flag has changed (page 99).

As the Nation expanded during the 19th century, it became harder than ever to keep up with the march of stars symbolizing United States growth. By the end of 1845 there were 28 stars for 28 States, reaching from Maine to Florida, deep into the central prairies, and across the broad plains of Texas.

Annexation of Texas touched off the Mexican War. When peace was signed in 1848, the Red, White, and Blue stretched across the Southwest and California.

Already, by peaceful agreement with Great Britain, Oregon Territory extended northward to the 49th parallel. It wasn't quite up to the "Fifty-four Forty or Fight" of President Polk's catchy campaign slogan, but the coast-to-coast spread marked a startling advance for a national emblem that had stopped at the Mississippi River less than 30 years before.

Stars and Stripes Follows Yankee Trade

While the pioneers' flag rode prairie schooners toward "manifest destiny," the Stars and Stripes at sea saw the world from the masts of the American merchant marine.

As early as 1790 the 13-star, 13-stripe flag had first circled the globe over the sturdy merchantman *Columbia*, out of Boston. Rounding the Horn, the *Columbia* took on a cargo of Indian furs in the far Northwest, exchanged it for China tea, and then sailed home by way of the Cape of Good Hope to a rousing welcome in her home port.

Already, shrewd and daring Yankee businessmen were carrying on a flourishing trade with the Orient, India, and the pepper and spice isles of the East Indies. In time the American ensign became a familiar sight in the world's remotest ports.

Flung to the breeze over fleets of trading schooners, whalers by the hundreds, and, finally, the fast and graceful clippers, the starry flag stood for American leadership in a saga of sail that for sheer adventure and romance has never been surpassed.*

Steam was beginning to push sail from the seas when Commodore Perry opened up long-isolated Japan in a theatrical performance with overtones of comic opera (pages 104-5).†

Matthew Calbraith Perry, an enthusiast for the Navy's recently introduced steamships, based his strategy on two factors: Japanese

* See "American Pathfinders in the Pacific," by William H. Nicholas, NATIONAL GEOGRAPHIC, May, 1946.

† See "The Yankee Sailor Who Opened Japan," by Ferdinand Kuhn, NATIONAL GEOGRAPHIC, July, 1953.

JAPANESE PRINTS FROM THE HARRISSE COLLECTION, LIBRARY OF CONGRESS © N. G. S.

With Colors Flying, Perry Opens Japan to the World

As the flag pushed across the continent at home, it met rebuff abroad. Japan, a nation closed to outsiders for more than two centuries, denied American ships refuge and imprisoned shipwrecked sailors.

In 1853 Commodore Matthew C. Perry arrived to crack the islands' closed door. With a grand show of strength and pageantry, he persuaded the Japanese to sign a treaty of friendship and commerce.

Setting out for the final negotiations, Perry and his officers marched through Yokohama as the band blared "The Star-Spangled Banner." The carefully contrived splendor of the procession, seen in all its glory by an American (right), escaped the frugal eye of a local artist (upper left). The Japanese woodcut shows a single stubby banner of seven broad stripes. Another Japanese, portraying Perry's "black ships of evil mien," drew the ensign with 17 stripes, and blossoms in place of the stars.

The commodore's flag (left), preserved at the Naval Academy Museum, was again to witness the end of hostility between Japan and the United States. It flew aboard the *Missouri* when Japan surrendered after World War II.

thinking and Western know- and show-how.

Perry's squadron of smoke-belching, steam-powered warships made an impressive display of might as the mission sailed against wind and tide into Japan's Tokyo Bay on July 8, 1853. Still more impressive was his campaign to out-Mikado the Mikado in a show of rank, dignity, and ceremony.

Remaining mysteriously aloof in his cabin —a "Lord of the Forbidden Interior"—the commodore refused to meet minor officials sent out from shore. He communicated through subordinates, who, with Oriental pomp and straight faces, announced that the secluded dignitary carried a message from the United States President, Millard Fillmore, to the Emperor of Japan. Moreover, only the highest authority could touch it.

Eventually, the Emperor designated a personal emissary considered by Perry to be of sufficient rank to receive the President's letter. The missive was then brought ashore under full-dress escort of several hundred men, who, with bands playing and flags flying, delivered it to the waiting authorities.

Afterward the expedition sailed away, while the Japanese considered the Americans' formal request for friendly trade and coaling facilities.

On his return Perry found the Japanese ready to negotiate and to exchange gifts to bind the bargain. As a final gesture, the commodore presented a United States flag to Japan's chief treaty commissioner. It was, he pointed out, "the highest expression of national courtesy and friendship" possible.

Back home, the flag was taking part in a grimmer drama. As State after State emerged from the western frontier, an ominous question brooded over each new star. Did it stand for slave or free territory?

When 1861 opened, there were 33 stars on a flag divided against itself. "Bleeding Kansas," admitted January 29 after a bitter struggle between pro- and antislavery factions, made the 34th a symbol of the irrepressible conflict to come.

Tattered Banner Raised Funds for Union

On April 12 the big guns of the Confederacy opened fire on Fort Sumter in Charleston Harbor (page 109). The Civil War was on.

In today's national monument at the fort site, you can still see the riddled remnants of the Union flag that flew through the two-day bombardment and continued to serve even after it was lowered.

Taken to New York by the evacuating Federalists, the Sumter banner was unfurled before a roaring, cheering crowd at a great rally in New York City (page 108), where it won money and recruits for the North.

Four years later that same flag came back

BY AN UNKNOWN CHINESE ARTIST, COURTESY PEABODY MUSEUM

106

PAINTING BY GEORGE ROPES, COURTESY PEABODY MUSEUM © M.S.M.

Scouring the World for Trade, Seamen Carry the Flag to China

Revolutionary guns had hardly cooled before ships set out to find the commerce which would stabilize the young Republic's chaotic economy. In 1784 the *Empress of China* pioneered the route to Canton; fleets of merchantmen followed. Once there, the Stars and Stripes joined flags of Denmark, Spain, France, Sweden, Britain, and Holland before warehouses where foreigners were required to trade. Yankees made fortunes exchanging furs and ginseng—a root prized by Chinese as a medicine—for teas, silks, and porcelain.

Voyages took Old Glory also to Mauritius, Calcutta, and European ports. By the end of the Napoleonic Wars, American bottoms were carrying the goods of the world.

Treasure from the Indies fills warehouses of the Crowninshield family at Salem. The darker flag at wharf's end has blue stripes as well as red and white ones, recalling Franklin's error (page 95).

to Fort Sumter. Its return symbolized the failure of the South's Stars and Bars to tear 13 stars from the Union galaxy.

On April 14, 1865, the Union flag was ceremoniously reraised over the fort. That night Abraham Lincoln was assassinated.

It was Good Friday. Later they would call it Black Friday. At Ford's Theatre in Washington, the audience was in high spirits, relieved and hopeful following General Lee's recent surrender. President and Mrs. Lincoln sat with guests in their flag-draped box, absorbed in the comedy *Our American Cousin*.

With gun and dagger gripped in either hand, John Wilkes Booth slipped unnoticed into the unguarded Presidential box. Creeping up behind Lincoln, he fired the fatal shot, slashed the man who tried to stop him, and vaulted over the rail. As he leaped to the stage, his spur caught in a flag. He landed off balance, breaking his leg, then staggered off into the darkness and temporary escape.

Two torn and worn flags now catch the visitor's eye in the Lincoln Museum, set up in the old Ford's Theatre.

"Everybody wants to see the flag that tripped up Booth," said Randle Truett, Chief of the History Section of the National Capital Parks System. "But it wasn't the United States flag draping the box, as was long thought. It was this blue banner of the Treasury Guard that hung next to it."

He pointed to a long tear at one side. "That's where Booth's spur snagged. The missing squares below were cut out by souvenir hunters on the night of the assassination. One was returned and fitted perfectly."

When the Civil War ended, there were two more stars on the Union flag—for West Virginia and Nevada. Significantly, each brought a token of the coming industrial revolution.

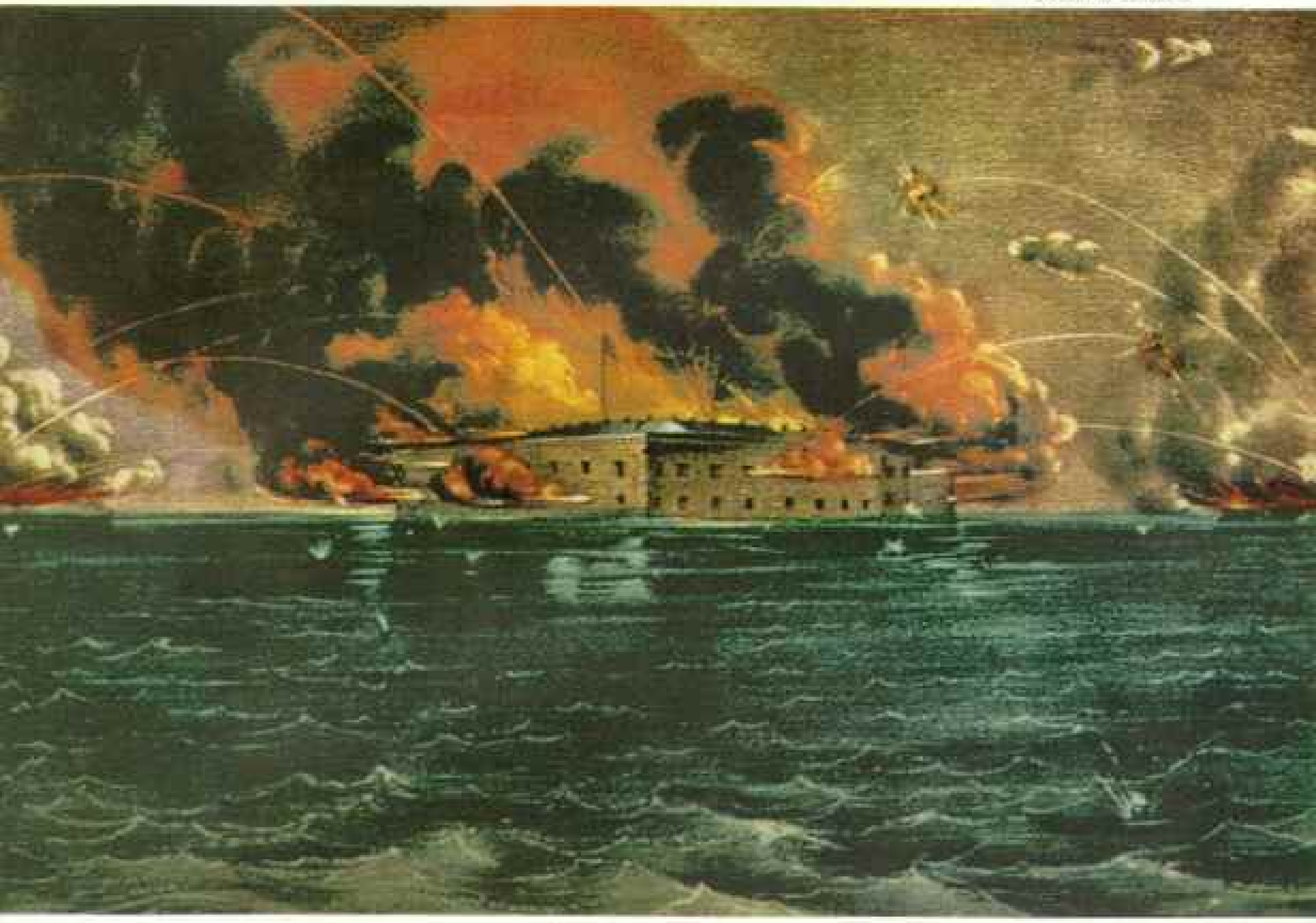
West Virginia, whose mountain farmers had broken with the Virginia secessionists to remain with the Union, nursed a lusty infant industry based on coal and iron.

Distant sagebrush Nevada contributed an even more welcome economic aid. Its Comstock Lode, discovered in 1859, yielded a silver bonanza that helped the Federal Government meet its wartime debts, lured settlers to the West, and created a new crop of millionaires with money to invest in development enterprises.

(*Continued on page 117*)

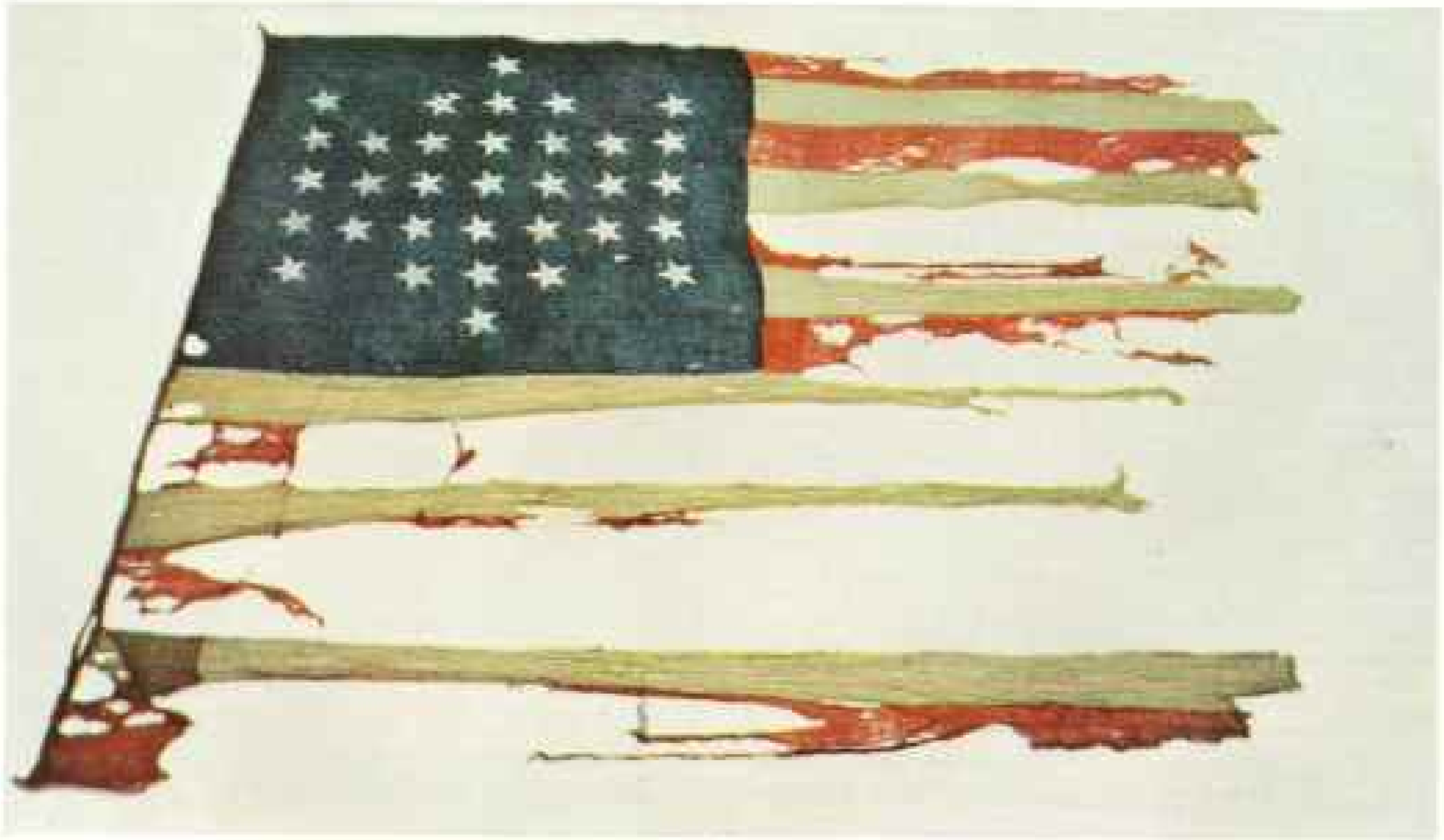
"A mighty uprising of people" rallies round the Fort Sumter flag in New York's Union Square. Washington's statue supports the severed staff two weeks after Southern guns knocked it to earth (opposite). The defeated garrison saved the banner.

NEW YORK HISTORICAL SOCIETY



Confederate Shellfire Riddles the Flag at Fort Sumter and Triggers the Civil War

As 1860 drew to a close, 33 stars composed the constellation of the flag; two months later, seven had fallen out and others were to follow. Seceding states now paid allegiance to a new flag, the Stars and Bars. Four bloody years after Confederate forces fired on this Federal fort in the harbor of Charleston, South Carolina, the Union gathered home its errant stars.



Picnickers on the Fourth of July, 1912, Welcome Stars of Arizona and New Mexico

This 48-star banner saw America through two world wars and the Korean conflict. It witnessed the dawn of the Atomic Age, the first

PAINTING BY IRVIN E. ALLEMAN, NATIONAL GEOGRAPHIC STAFF © N.G.S.

adventures into space. But in 1912 few dreamed of such a future; it was a time "of incredible innocence and security," said commentator Elmer Davis. War? Unthinkable! Social reform? Every man's duty! "Progress is . . . rampant," wrote George Fitch, a contemporary humorist.

In Peace or War, in Life or Death, the Flag Keeps Vigil over the Forces

Once hoisted above a U. S. Navy surface ship at sea, the Stars and Stripes must remain aloft until the vessel reaches port. This flag (right) watches gunnery practice aboard the U.S.S. *Yorktown*, with the Seventh Fleet north of the Philippine Islands. Antisubmarine aircraft wait with wings folded.

Aboard the U.S.S. *Canberra*, a Medal of Honor winner chooses a hero of World War II to rest at Arlington's Tomb of the Unknown Soldier. An unidentified casualty of the Korean war, in the center casket, will sleep with him. Warrior's body at left was buried at sea with full honors. Flags draped on caskets are arranged so that stars cover the left shoulders.

PHOTOGRAPHS BY THOMAS W. MCKNEW, EXECUTIVE VICE PRESIDENT, NATIONAL GEOGRAPHIC SOCIETY

Atop Mt. Suribachi, the Star-Spangled Banner flies day and night to honor the Marines who planted the flag there in World War II (left). On Iwo Jima, in the words of Fleet Admiral Chester A. Nimitz, "uncommon valor was a common virtue."

Congress in session: Whipped by the evening breeze, the Red, White, and Blue above the Capitol dome signifies a night debate. Down the Mall, floodlights pick out the Washington Monument.

NATIONAL GEOGRAPHIC PHOTOGRAPHERS B. ANTHONY STEWART AND JOHN E. FLETCHER

JOE ROSENTHAL

KODACHROME BY W. E. GARRETT, NATIONAL GEOGRAPHIC STAFF; AND EKTACOLOR (BELOW) U. S. NAVY. OFFICIAL © N.G.S.

Half-mast at the South Pole, the Flag Honors Admiral Byrd

The naval explorer took his country's colors to the ends of the earth on his historic first-time flights over the North and South Poles. On Admiral Byrd's death in March, 1957, this wind-frayed banner over man's first habitation at the South Pole dipped in mourning for 10 days. Soon thereafter, the flag came down for six months of night.

"Nailed to the Pole," wired Robert E. Peary of the Stars and Stripes after he reached the North Pole on April 6, 1909. Peary cut out six sections and left them at key points on his travels north; two have been recovered.

Stained and patched, Admiral Peary's silk flag now rests in Explorers Hall at the National Geographic Society. Marines (below) stand guard during ceremonies on May 6, 1955, when Mrs. Marie Peary Stafford presented the banner to The Society on behalf of her mother.

BOARDROOMS BY PAUL A. SIPLE (LEFT), AND NATIONAL GEOGRAPHIC PHOTOGRAPHER KOLBERT WENTZEL © N. G. S.

Sunset at Fort Myer Brings Old Glory Unhurriedly Down

As day ends and the bugle's echo dies away, a flag detail unsnaps the banner and folds it into tradition's cocked hat. Three stars must face outward as the escort marches off.

Stationed within sight of the Capital's monuments, these men carry on the tradition of the 175-year-old 3d Infantry, called the Old Guard for Mexican War gallantry. The Third keeps unceasing watch over America's Unknown Soldiers and serves as honor guard for Presidential ceremonies.

"**I pledge allegiance** to the flag of the United States of America and to the Republic for which it stands, one Nation under God, indivisible, with liberty and justice for all."

Despite the dislocations and distress of the postwar decade, it was then that the railroads, the binding force of America's future growth and industry, streaked out across the country.

Before the Nation was fully aware of what was happening, steam had pulled the center of population far to the west, and was helping to lay the foundation for a transcontinental civilization.

And once more the flag—in the shorthand of its stars—recorded the expansion.

Nebraska's star, the 37th, flashed out in 1867, two years before a gold spike drove home the final junction of Atlantic-to-Pacific rails. Colorado, admitted in 1876, made the 38th, and as the western plains and mountain country filled up, seven more States came in before the end of the century. Oklahoma in 1907, and New Mexico and Arizona in 1912 ended the West's last roundup.

Short-lived Flags—Ten Stars Apart

During the final rush for statehood, both Dakotas, Montana, and Washington were added within the single month of November, 1889; Idaho, some eight months later. And thereby hangs a tale of 39 stars and a flag that never was.

Before Congress acted, it seemed likely that the Dakotas would form one State, and that other applications for statehood would be deferred.

The flag manufacturers of the time, just as in 1959, found themselves in a quandary. Should they wait till they were sure of the new flag design and lose potential early sales? Or should they take a chance and guess?

At least one flagmaker gambled and lost. Harold L. Ruland, a member of the National Geographic Society and a teacher at Union, New Jersey, called recently at Society headquarters with a 39-star curiosity.

This flag, which belonged to Mr. Ruland's grandfather, legally never existed. It represented a 39-State Nation that lasted only for the few seconds between the signing, by President Benjamin Harrison, of the two Dakota statehood proclamations. Furthermore, the President juggled the twin documents so that it would never be known which Dakota was the 39th and which the 40th State.

Had Hawaii completed its elections in time for formal admission before this Fourth of July, the same anomalous status would have befallen the 49-star flag. At any rate, it seems destined to have a year's life at most.

When an American's heart lifts at the sight of his flag in some foreign port, his pride owes something to the American success story and to the protection he enjoys as a citizen of his rich and powerful homeland.

It also stems from the knowledge that success came hard, and that his security was won and rewon in a succession of wars symbolized by the flags under which they were fought.

Repaired and hung in academic halls and chapels, or displayed behind antiseptic museum glass, these flags of bygone wars look prosaic now. Yet around them cluster memories of musket fire and drawn sabers, bullet-raked hills and mud-slimed fields, flame throwers and crashing planes.

"We have the largest collection of military flags in the country," said Frederick P. Todd, Director of the West Point Museum. "Of a total of more than 700, probably a third are Stars and Stripes. Many saw battle action, from Canada to Korea."

Each banner enfolds its own story. Imaginative visitors can hear marching feet and crackling gunfire at the capture of Mexico City's Citadel, or the storming of Yangtsun during China's Boxer Rebellion. There is the World War I flag that flew over General Pershing's headquarters in Chaumont, France; and the World War II standard that reached Germany by way of Algeria, Tunisia, Sicily, France, and Belgium.

Prisoner Saves Relic of Corregidor

One small but priceless exhibit at the Academy is a two-by-three-inch piece of red bunting from the colors lowered at Corregidor after waving defiance at the Japanese for five months.

It was the unhappy duty of Col. Paul D. Bunker, then Seaward Defense Commander, to burn his flag before the enemy could reach it. But first he snipped out a fragment that he concealed under a patch in his shirt.

Taken to a Manila prison, Bunker kept the bit of bunting close to his heart till he fell ill of blood poisoning. Feeling death near, he secretly passed half of it to a fellow prisoner, Col. Delbert Ausmus. Perhaps Ausmus would be lucky enough to get home with it.

And so it happened. Colonel Bunker later died in a Formosa prison. Ausmus, transferred to Mukden, Manchuria, was freed by the Russians and returned to Washington. There he delivered his relic to the War Depart-

NATIONAL GEOGRAPHIC PHOTOGRAPHER JOHN E. FLETCHER

Myriad Stars Join Endless Stripes at the Nation's Biggest Flag Factory

Machines at the Verona, New Jersey, plant of Annin & Co. cut more than a hundred pieces for each flag. Seamstresses paste stars on one side of the cloth. Backing them with white squares on the other, they stitch both sets tight. Trimmers then shape the outsize pieces to match the stars opposite.

ment, which, at the request of Colonel Bunker's widow, presented it to West Point.

"It must have been hard for you to give it up to West Point," I said to Mrs. Bunker when I met her, by odd chance, in the Capital.

"On the contrary," she replied with spirit. "I guess I'm enough of an Army wife to want it to belong to my country."

For every storied flag that has gone with the moths in some forgotten attic trunk, others are carefully preserved among family treasures. Each has its own remembrance.

Such a flag once flew over the S.S. *Byron Darnton*, a merchant ship named in honor of a *New York Times* correspondent who lost his life during World War II while covering advance operations in the New Guinea jungle.

"The *Darnton* broke up in a storm off the coast of Scotland several years ago," the widowed Mrs. Darnton told me. "Sailors heroically saved her flag and sent it on to us. It's tattered and stained, but it is one of our boys' proudest possessions."

Public interest never seems to wane in the countless historic flags displayed in patriotic shrines and military establishments throughout the land.

"People come here from all over the country to see the famous flag raised on Iwo Jima," said Lt. Col. John H. Magruder III, Director of the U. S. Marine Corps Museum at Quantico, Virginia. "For years we loaned it to various qualified groups for special occasions: Marine reunions, Flag Day celebrations, and such. But we finally had to call a halt, for fear of wearing it out."

Flag Makes Two Trips to Japan

In the Naval Academy Museum at Annapolis young plebes can trace their service's fighting career in storm- and shot-battered ensigns that have found their last port there.

Now displayed safely folded, one flew over the *Monitor* during its historic battle with the ironclad *Merrimac* in Hampton Roads on March 8, 1862. Another fluttered from

Admiral Dewey's flagship *Olympia* at Manila Bay in 1898. A third survived Japanese bombs when its ship, the U.S.S. *Shaw*, lost her bow at Pearl Harbor. Fitted with a wooden bow, the destroyer sailed to the west coast, where repairs enabled her to fight again.

Perhaps most fascinating of all to Annapolis visitors is the doubly historic ensign that went along with Commodore Perry to Japan.

"After spending nearly a century here in the museum," said the director, Capt. Wade DeWeese, "Perry's flag was flown back to Japan in 1945 and raised over the *Missouri* while the Japanese signed surrender papers."

To the Ends of the Earth

Nobody needs a flag more than an explorer. Beating his way to the North Pole across Arctic wilds of snow and ice, Robert E. Peary wore his precious Stars and Stripes wrapped about his body for safekeeping.

Peary's flag was unique. Made of silk taffeta, it had been painstakingly sewed for him in 1898 by his wife.

When he "nailed" it to the North Pole on April 6, 1909, it lacked five fragments that he had cached at each farthest key point reached in a decade of pushing north.

At the top of the world, Peary slashed out a final diagonal strip. After depositing it, with the journey's record, in a bottle left on northernmost sea ice, he brought the remains of his flag home to his waiting wife.

Today the patched banner hangs in Explorers Hall at the National Geographic Society (page 114).* Two of the far-scattered fragments have been recovered and are in the possession of the Peary family. The flag itself was presented to The Society in 1954 in recognition of its long and friendly ties with Peary the explorer and the man.

At the opposite end of the earth, a tiny black speck of a plane landed amid white emptiness on October 31, 1956. Onto the South Polar plateau jumped a seven-man party of the United States Navy, led by Rear Adm. George J. Dufek.

At 58° below zero, the men of Operation Deep Freeze briskly chopped a hole in the packed snow, inserted a note recording their landing, and raised over it the flag of the United States. It promised that things would never be quite the same there again.

Soon after, fleets of planes began arriving at the South Pole with men and supplies to build a United States scientific station.†

Within its shelter researchers for the International Geophysical Year dug in with delicate

* See "The Peary Flag Comes to Rest," by Marie Peary Stafford, NATIONAL GEOGRAPHIC, October, 1954.

† See "We Are Living at the South Pole," NATIONAL GEOGRAPHIC, July, 1957; and "Man's First Winter at the South Pole," April, 1958, by Paul A. Siple.

This 39-star Banner Legally Never Existed

The maker of this 1889 flag gambled on the possibility of Dakota Territory's entering the Union without companions. He lost: Congress divided the Territory and admitted Montana, Washington, and Idaho as well. Senator Francis Case of South Dakota views a picture of the flag and its owner, Harold L. Ruland, a Union, New Jersey, teacher (page 117).

NATIONAL GEOGRAPHIC PHOTOGRAPHER WILLIAM W. CAMPBELL III

equipment to gather knowledge for the eventual conquest of the world's ice frontiers.

Last year other men with eyes on the future sailed northward in the nuclear-powered submarines *Nautilus* and *Skate*. With them, as they drove beneath the Arctic ice pack on the first sea voyages to the North Pole, rode the Stars and Stripes.*

Forty-eight Stars Still Fly

This Fourth of July, as America's latest star design becomes official, the spotlight falls less on the historic flags of the past than on needed millions of new ones.

To meet orders pouring in, the Nation's flagmakers rolled into high gear when President Eisenhower unveiled the 49-star design last January 3. Then Congress voted Hawaii statehood in March, and uncertainty gripped the industry. Would the official flag carry 49 or 50 stars on July 4?

"It was a tough situation," says Digby W. Chandler, President of Annin & Co. of New York, a firm that has been in the flag business 112 years. "Some of us already were stuck with large 48-star stocks. Now we were making forty-nines that might be outmoded before they could be used.

"On the other hand," he adds, "a new flag always means more orders. The industry usually produces between five million and six million flags of all types each year. This year the figure is running perhaps 20 percent higher."

Actually, while owners of the latest design have the satisfaction of being up to date, others can console themselves that old flags may fade but never officially die. It is proper to display any flag of the United States, regardless of the number of stars, as long as it is in reasonably good condition.

In fact, many people prize old flags as souvenirs. There is a small but steady sale to patriotic and historical societies, collectors, and theatrical producers for such items as 13-star, Civil War, and Spanish-American War flags.

Perennial big buyers are the military services and the various agencies of the Federal government. Last year they acquired more than 650,000 U. S. flags, ranging in size from 5-by-9 inches to 20-by-38 feet.

The small flags—mostly for memorial gravesite decoration—are inevitably lost to the elements. But the substantial 48-star flags owned by the military and the Government will continue in use, by Presidential directive, as long as they remain serviceable.

A major exception is Alaska, where, on July 4, our 49th State will officially begin to fly 49 stars in its skies.

At Annin's New Jersey plant, the country's largest single producer, I found an endless procession of new forty-nines in the making—from plain printed types to gold-fringed flags with embroidered stars.

I saw 2-by-3-inch miniatures and the mammoth 60-by-90-foot banner of the Port of New York Authority. Flown from George Washington Bridge on legal holidays, the port's flag was at Annin's for a new 49-star field.

"It weighs 250 pounds," a plant official told me as we stood by a small mountain of flag. "Each star is four feet across. We'll have to sew the new field in sections—it will take us 200 working hours."

Most of the U. S. flags made in this factory, however, are cut to sizes suitable for home and general display purposes—from 3-by-5 to 10-by-15 feet.

In a huge workroom I found long lines of women sitting at sewing machines amid billowing clouds of red, white, and blue. On near-by tables stood stacks of red and white stripes from the cutting room. Others held piles of blue fields, each spangled with 49 pasted-on stars ready for machine sewing.

Working briskly, the seamstresses turned and stitched, snipping off threads and bits of stars. Finished flags went to inspectors, then to messengers for boxing and shipping.

Capitol Flags in Demand

From such factories, year after year, pour the flags seen on America's public buildings, schools, shops, and ships; the flags that blossom out by hundreds at World Series and national conventions, and by millions on July 4 and Memorial and Flag Days.

On the balconied roof of the U. S. Capitol in Washington, a small ceremony now takes place a dozen or more times a day. On Memorial Day last year it was enacted a hundred times.

First a Capitol police officer hauls down the 8-by-12-foot flag that normally flies over the west entrance. Then, one after another, he runs up smaller flags, allowing each to flutter briefly. When he has completed the

* See, in this issue: "Up Through the Ice of the North Pole," by Comdr. James F. Calvert; and "Submarine Through the North Pole," by Lt. William G. Lalor, Jr., National Geographic, January, 1959.

NATIONAL GEOGRAPHIC PHOTOGRAPHER B. ANTHONY STEWART

America's 50th State Retains the Union Jack on Its Island Flag

During the War of 1812, Hawaii's King Kamehameha found himself buffeted between opposing forces: Yankee privateers demanded that he display the United States flag; British men-of-war threatened him for not flying the Union Jack. His advisers suggested combining the two flags, and the ensign seen here has been in use ever since.

day's quota, he again hoists the official banner.

This curious performance satisfies a continuing demand for flags that have flown over the Capitol. For constituents, Congressmen buy and fly new ones, thus providing a parade of flags over the seat of Government such as no other building in the country commands.

The desire for such emblems is a reminder of the intangible sense of history that is warp and woof of the Stars and Stripes. Interwoven in the shared national memory is the strength of America's great, the labors and dreams of her pioneers, the sacrifices of her war dead.

But the flag, like the Nation, belongs also to the living and to a future only dimly seen.

When, and if, an American spaceship floats down upon the pock-marked surface of the moon, the first order of the day doubtless will be to raise a red-white-and-blue rectangle against the airless lunar sky.

We smile at the face of adventure as we set out to span the Atlantic in a balloon. Colin Mudie (left) signed on as navigator for the voyage; his wife Rosemary as photographer; my son Tim as radioman; and I, Arnold "Bushy" Eiloart, as commander.

Braving the Atlantic by Balloon

By ARNOLD EILOART

TENERIFE, largest of the Canary Islands, has long been a jumping-off point for sailors plying the Atlantic from the Old World to the New. Christopher Columbus set an example by weighing anchor there when he headed his three caravels into the unknown Western Ocean. Tenerife's attraction is simple: off its coast one makes rendezvous with the friendly northeast trade winds that blow steadily toward America.

There was an element of the traditional, then, in the fact that we four British subjects —Colin Mudie, his wife Rosemary, my son Tim Eiloart, and I—started our voyage from the same island as Columbus and depended upon the same winds. Every other aspect of our trip, however, was a radical departure from custom. For our craft was a balloon.

Our attempt to cross the Atlantic in the 53,000-cubic-foot *Small World* had its inception, oddly enough, in a London flat. One January night in 1957 I was a dinner guest of the Mudies. After eating, we idly leafed through a book on ballooning. Then we fell to discussing transatlantic voyages. In 1953 Colin—a yacht designer by profession and one of the finest navigators in England—had crossed from the Canaries to the West Indies in a 20-foot sloop, *Sopranino*. In 1954 I had done the same in the 60-foot trawler *Revive*.

Sailing the Ocean of Air

"You know," Colin said, "I remember one day of heavy seas and driving rain. As I crouched at the helm, drenched to the skin, I thought, 'The real craft to cross the Atlantic in—particularly with those lovely trade winds behind you—is a balloon.'"

"Surely someone must have done it by now," I said.

***Small World* Slaps the Sea on a Wind-rucked Take-off by Night**

We plotted our course along the path of the trade winds, from the Canary Islands to the West Indies. If we stayed aloft, the wind could waft us across the ocean in about eight days. If forced to ditch, our gondola would double as a boat. During the heat of day, the bag's silver dome and white skirt reflected the sun's rays. Circular patches atop the bag mark a rip panel for deflating in an emergency.

PHOTOGRAPHS FROM KING FEATURES SYNDICATE

"No. An American, John Wise, planned a west-to-east flight in 1873, but his balloon blew apart during inflation. After repairs, another pilot took it up but crashed in Connecticut. There's no other try on record."

I began to think. From a sailor's point of view the trades are an ideal ally. They scud along at an unflagging 10 to 15 miles an hour, astern of a westbound craft.

Abruptly I made up my mind. "How much do you think such a trip would cost?" I asked Colin.

"Oh," he said, doubtless sharing my own vision of packing a few suitcases and a cylinder of gas, "about 2,000 pounds."

If I had known that Colin's margin of error would eventually prove to be 1,100 percent, I should have fled the premises without another word. Instead, I said, "Let's do it!"

Scientists Give Their Support

Suddenly we were all talking at once. And before the night was over, Rosemary had drawn a list of tasks that each of us was to perform. Shortly thereafter we also recruited a fourth crew member—my son Tim, who was studying chemical engineering at Cambridge University.

Since none of us knew the first thing about ballooning, we feared that those we approached for guidance would think us utterly mad. But C. H. Gibbs-Smith, England's leading writer on the subject, heard us out with interest and referred us to the University of Bristol. There Prof. C. F. Powell, a Nobel laureate, uses balloons in his extensive research on cosmic rays. Powell not only considered our plan feasible but provided us with valuable advice on construction.

Eventually we gained the assistance of the Ministry of Supply's Research and Development Establishment. The Air Ministry Meteorological Office generously provided us with a wealth of information on the weather we would face.

The Imperial College of Science and Technology in London, which has specialized in studies of the trade winds, also came to our support. Researchers at the college had no direct information on how temperature, humidity, and wind velocity change inside the moving trade-wind air mass. Prof. P. A. Sheppard saw in our projected flight an opportunity to obtain useful observations.

A free balloon travels at the same velocity as its propelling winds, encased in the air mass like a fly in amber. We would therefore be in an ideal position to make key meteorological observations of the trades. Professor Sheppard outfitted us with some 70 pounds of expensive lightweight instruments, and Tim spent two months studying meteorology in order to carry out an elaborate program of observations.

Wind movements across the Atlantic also intrigued the Institute of Navigation, and Colin was requested to provide pertinent information on navigational problems we might encounter.

Such widespread endorsement came as a tonic to our hopes. But just as confidence began to burgeon, we came a cropper. Our road led to the Government's lighter-than-air base at Cardington, 45 miles north of London.

HERBERT MUSIC

Maintained by the Ministry of Supply and the Royal Air Force, it is a research center for balloons of many types. Gerry Long, a balloonist of 45 years experience, was in charge of flying operations. Cardington had also housed the famous dirigible R-100, whose one-time skipper, Wing Commander Ralph Booth, later agreed to head our launching crew at Tenerife.

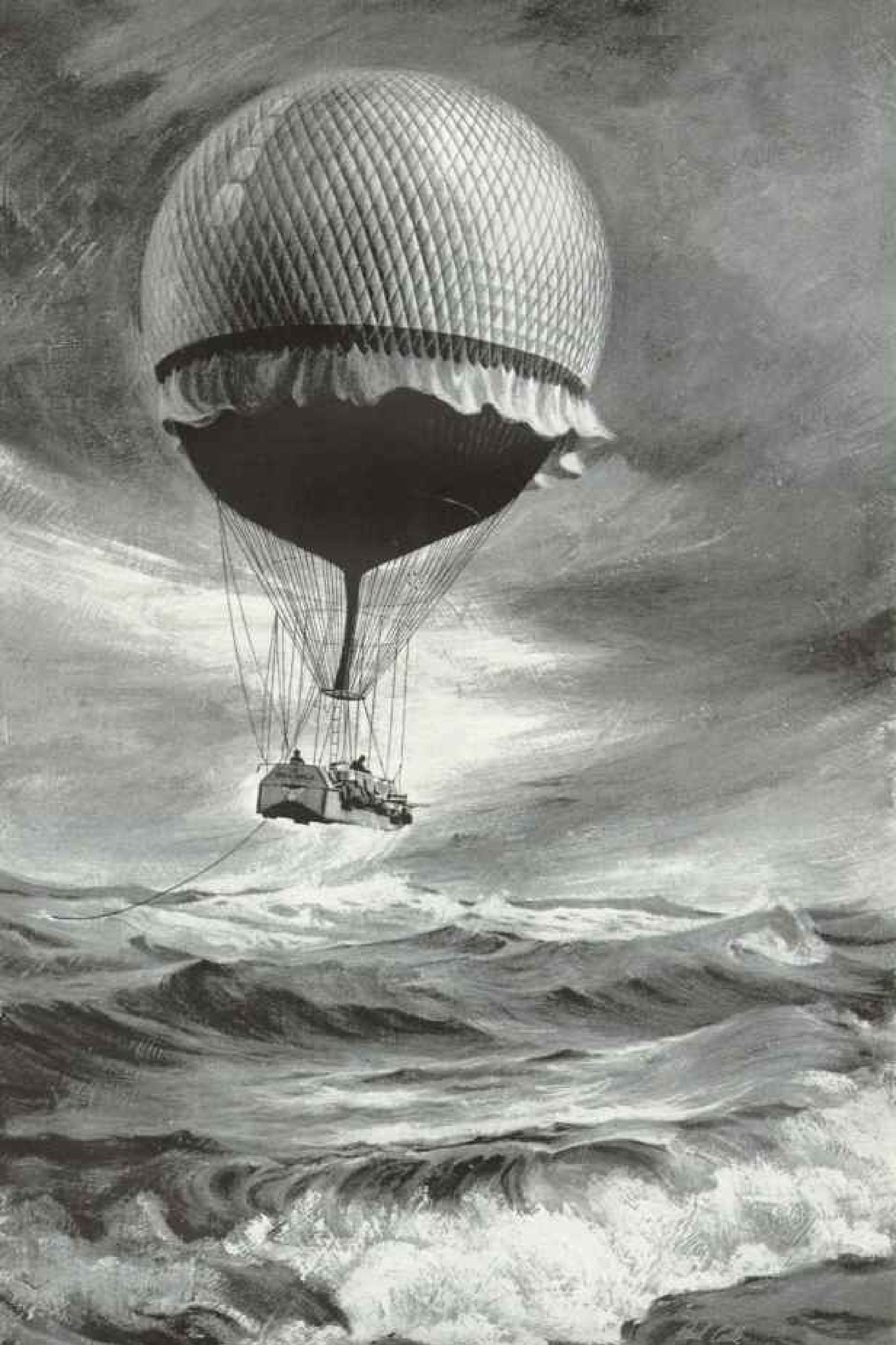
"A thoroughly sound idea," one of the Cardington authorities told me when I rang him up. "Of course, there are certain formalities. You'll need a Pilot's License, a Certificate of Registration, a Certificate of Airworthiness, a Radio Operator's License, a Transmitter License, and a Certificate of Approval of Aircraft Radio Installation. You will, I need hardly add, also require insurance."

Our Balloon Mushrooms in a Sand Storm

We elected to jump off from Tenerife in the Canary Islands, as did Columbus centuries earlier. Across this Spanish island, 180 miles off Africa, trade winds blow almost constantly southwest at 10 to 15 miles an hour. Arriving in December, 1958, we found the winds much too strong for take-off. When gusts finally abated, we raced to the launching beach in the dark of night. Working by automobile headlights, we set to inflating the 53,000-cubic-foot canopy with bottled hydrogen.

Here at dawn, wind and flying sand call a halt. Hours later, when we completed filling the bag, night had fallen once more.

Cutting free the surplus sandbags, the crew shackles balloon to gondola. In moments we were off, scraping across sand, dipping into the sea, and—at long last—soaring into the sky. Thus on December 12 began our duel with air and sea.



ROSEMARY MUSIC

Out of Control! The Balloon Rockets into a Bank of Angry Clouds

Suddenly, on the third morning aloft, a dreaded updraft shot us thousands of feet high. As we released hydrogen, our balloon contracted till it looked like an umbrella. At 3,400 feet we reversed and dashed wildly downward. Frantically we jettisoned ballast—radio, battery, generator—before crashing into the sea. We bounded up . . . down . . . up. Our next thermal updraft, on the fourth night, knocked us out of the sky.

Zigzagging Between Water and Sky, *Small World* Sails the Lonely Ocean

Because it was obviously impossible to photograph our balloon on its solitary course, the NATIONAL GEOGRAPHIC commissioned artist Paul Calle to paint this dramatic but authentic scene. The trail rope helped control *Small World*'s rises and dips (page 132).

"But," I said weakly, "we had nothing elaborate in mind. I rather fancied that we might leave from the Canary Islands. You know, a foreign land and all that. Then nobody would even see us."

"The law," he said coolly, "provides severe penalties for evasion."

With no alternative, we set out to provide ourselves with all necessary papers. Since I already held an airplane pilot's license, I was the logical candidate for a balloonist's permit. Tim volunteered to study for the radio operator's license. Colin was to design the balloon as well as the seagoing car to ride below it, and Rosemary would procure suitable food and prepare herself for the post of official photographer.

Meanwhile, Sylvia King, one of the University of Bristol's specialists, came up to London and, working in my drawing room, made us a balloon of polyethylene. Initially we intended to use this gasbag for our Atlantic flight. But researchers of Imperial Chemical Industries Limited found that their synthetic Terylene fiber, coated with neoprene plastic, would be far more durable. The company provided the fiber, and other firms, at considerable expense to themselves, agreed to coat it and construct the gasbag.

Another shortcoming of our original polyethylene balloon was its lack of a rip panel. This essential safety device enables the balloonist to release all his gas in a matter of seconds. Without it, he runs the risk of being dragged along the ground and dashed to death should he land in a high wind.

Colin soon quit his job to devote full time to designing a suitable canopy and car. With

patience and ingenuity he tested a series of models of the gondola-boat—a small one in his bathtub, a one-eighth size replica in the Round Pond at Kensington. Finally, to the amazement of strollers, he and Rosemary took to dumping a half-size model from various bridges into the Thames to test its resistance to impact. The final design, of reinforced polystyrene, could land undamaged at an angle of 30 degrees and at high speed.

I pressed a search for a practice balloon in which to qualify for my license. I had absolutely no luck in coaxing one away from the military.

In desperation Tim wrote to Prince Philip, the Duke of Edinburgh, asking him to intervene on our behalf. To our delight, the Duke evinced keen interest in our plans. Although he was unable to help us secure a balloon, His Royal Highness did consent to be the patron of our flight.

I decided on the risky course of using *Sylvia*, our rip-panelless polyethylene balloon, for my licensing flights. These were to be ten in number, each lasting two hours, six of them under the instruction of a licensed balloonist. Under the capable guidance of Gerry Long, who had held a license since 1913, I soon met the Government's requirements.

Sylvia Gives Author a Bad Moment

Sylvia's lack of a rip panel did give me one nasty moment when I came down in a field and was dragged helter-skelter across it by the wind. Although I was slammed about considerably within the basket, I escaped with minor cuts and bruises. Then, too, the abominable weather drove me across the North Sea to the Netherlands, where I made two of my required flights with The Hague Balloon Club.

Despite delays and difficulties we gradually accumulated our remaining papers. However,

before granting us a Certificate of Airworthiness, the authorities insisted that we place a "No Smoking" sign in *Small World*—this despite the fact that none of us smoked!

Finally, we sailed to our take-off point—Tenerife—in early December of 1958. According to our meteorological research, Tenerife would offer a northeast breeze sufficiently light to permit launching, but strong enough to drive us into the path of the unhindered trade winds.

We soon realized, however, that our weather reports had dealt only in average wind velocities. In actuality, we were faced with a choice between gentle but erratic breezes that might carry us in the wrong direction and a perilously strong trade wind blowing in exactly the right direction.

We established our launching base (page 124) on a beach near the fishing village of El Médano.* A large white cloth spread on the beach protected *Small World*'s canopy, or gasbag, from the gritty, volcanic sand.

Then we checked and rechecked the supplies that would have to sustain us across 2,700 sea miles: 200 pounds of concentrated food; 20 gallons of fresh water, plus solar stills and a chemical compound to make more from sea water, if necessary; calcium hydride which, when combined with sea water, could produce hydrogen; radio and meteorological instruments; assorted spare parts; even a bugle to serve as a foghorn.

All was in readiness. With our 690 cylinders of hydrogen stacked in place, we settled down to await a lull in the high wind that keened through the banana leaves.

The first favorable break in the wind came on the night of December 10. Although a night launching promised to be dangerous because of the inexperience of our volunteer ground crew, we decided to risk it.

All night long, hydrogen pumped into the canopy. Then, just before dawn, the wind picked up. Hope died within us as strong gusts buffeted the half-inflated gasbag and lashed its tender neoprene hide with driven sand. With no alternative, we partially deflated and snubbed down *Small World* to await the next lull.

* See "Spain's 'Fortunate Isles,' the Canaries," by Jean and Franc Shor, NATIONAL GEOGRAPHIC, April, 1955.

Flying Days Over, We Face the Threat of a Sullen, Storm-chopped Sea

I was on watch that last night aloft. When the thermal draft tossed us skyward, the gondola started swinging like a giant pendulum. In darkness and driving rain, Tim climbed up to the load ring and untied the balloon's neck. By allowing gas to escape, he saved the bag from bursting. Yet still we careened upward. Finally, to halt our terrifying passage, I grabbed the gas valve rope. Hanging onto it like a clapper in a bell, I loosed to the elements almost a fifth of our gas supply. I knew, then, it was ditch or die. Hurtling toward the sea, we cast off all remaining ballast. Three feet above the water I freed the now-useless balloon. As it sailed off to infinity, we plopped into the ocean. *Small World* was now a small boat, 15 feet long, 8 feet wide.

Here, after a harrowing first night in the Atlantic, I make ready to haul in the mast, attached to our trail rope. Behind us lay 1,200 nautical miles of flying; before us, 1,500 miles of sailing.

In the Air: the Luxury of Electricity for Shaving

Taking off from Tenerife, we had hoped to make a contribution to science. With some 70 pounds of equipment given us by the Imperial College of Science and Technology, we planned to make meteorological observations that might crack the secrets of a globe-circling air mass.

For our own safety we packed a radio receiver, a transmitter, and various navigational aids. A battery and electric generator provided light and powered our radio and instruments.

Unfortunately, the struggle to survive and stay airborne during the first four days saw most of our instruments sacrificed. To lighten the craft, we heaved them into the sea.

On the Sea: Slim Rations of Water for Drinking

Creeping across the Atlantic's vast expanse in slow-motion, we soon felt the discomfort of thirst. Anticipating such a problem, we had brought along plastic stills which, in theory, would use the sun's heat to distill fresh water from salt.

Here Rosemary inflates the apparatus while I rig it for trailing behind the boat.

Hours later (below) the still had yet to produce a drop of fresh liquid. Repeated failure convinced us that it required calm seas to function.

Eying the compass at center, I handle the tiller with my foot, an easy-enough task at our average three-knot speed.

We kept restless vigil all the following day, but it was not until just before sunset that the wind finally dropped again. Once more we swung into action with our gas cylinders. But in less than an hour we had to call a halt. Through eyes bleared by 48 tense, sleepless hours, the four of us watched the implacable wind worry the balloon. And we watched our dream dying.

Colin and Rosemary headed for a tent, while Tim and I made ourselves comfortable in *Small World*'s boatlike gondola, not yet attached to the gasbag. As I settled myself, I spotted Wing Commander Ralph Booth, chief of the launching team. Silhouetted in the wind-whipped dusk, he was poring over the latest meteorological report.

Midnight Gamble on the Wind

Although I was balloon commander, Booth's was the final decision on whether or not to attempt a launching in adverse conditions. I waved wanly to him, then fell into a fitful doze.

Suddenly, at eleven o'clock, I wakened to the whine of hydrogen cylinders. With a thrill I realized that we had resumed inflating. "What's up?" I shouted.

"Wind speed's dropped to 12 knots," someone yelled back from the darkness. "Booth thinks you can make it if we move fast."

"Fast it is then!" With surging excitement I roused Tim, and we both hurried to lend a hand in the inflation. Soon the Mudies appeared out of the gloom to join us.

Though I said nothing, my exhilaration was tempered by a twinge of very real apprehension. Twelve knots is a high wind for balloon launching; one bad break would cripple our craft—and perhaps us. But I felt that any action, no matter how fraught with danger, was better than the waiting that had corroded our spirit for almost a week in Tenerife.

The next two hours passed in a blur of activity. Hydrogen whined into our black-and-silver canopy to a babel of commands and countermands in English and Spanish, as our binational ground crew made final preparations (page 125). Automobile headlights illuminated the launching scene, giving a garish, eerie quality to the volcanic sand.

Finally everything was shipshape. I joined Booth's crew as they walked the canopy, now swollen to its full 46-foot diameter, to the seagoing car. As the volunteers struggled to hold the gasbag in place above the car, each crew member shackled on one main suspension rope. We were ready to go. Only 24 lines, each weighted with 120 pounds of sand, and an anchor rope connected to a five-ton truck kept us earthbound.

Tim busied himself with a last-minute check of the radio and electrical connections, while Colin and Rosemary methodically lined up gear on a strict priority basis, in the event we should have to dump ballast to stay aloft.

Assuming a reasonable take-off wind, we had planned to balance the craft with ballast bags until it attained a lifting force of 60 pounds. At that point, Booth would release the moorings, and we would rise slowly to an operational height of 100 to 200 feet. As we wafted west, our 80-pound trail rope dragging through the sea would act as an automatic brake on our altitude. For as the balloon rose, the weight of rope lifted clear of the sea would become part of the load; as it dropped, progressively more rope would hit the sea, lightening the balloon accordingly.

But, functioning as we were on a shoestring, we had been unable to afford even a single rehearsal. And finally, the necessity to translate and retranslate every order to our launchers led to a welter of confusion.

Launching Scene Resembles Babel

Here is the scene: Some 70 Spaniards try to hold the car steady as it sways and bucks beneath the straining gasbag. Booth and Gerry Long go from line to line, helping the Spanish ground crew undo the knots that hold the sandbags.

"Hurry, hurry!" prods a voice. "*Pronto*," comes a Spanish echo.

But the wind is rising, the car is rocking dangerously, and I am growing desperate with impatience. "Slash the lines!" I shout. "Slash them quickly, or we'll be in trouble!" Booth and Long whip out knives, and in a minute the lines are free. Now only the anchor rope binds us to the earth. The canopy bucks wildly.

Almost in unison, Booth, Long, and I chorus through the linguistic chaos: "Throw off the ballast!"

As quickly as possible, Colin heaves out three 60-pound bags of unessential rations. Still no lift. Two heavy bags of calcium hydride go over the side. We rock, bounce hard on the sand, and rock again.

"More off!" shouts Booth.

Colin throws off still another 60 pounds. The car shoots up, but promptly bounces

SUPER ANSCOCHROME BY ROTHBART MEDIA © NATIONAL GEOGRAPHIC SOCIETY

To reassure our anxious families, Colin set adrift this message balloon with a note giving our location. It was never found.

Constantly haunted by thirst, Tim filters sea water that has been purified by chemicals. As with all of us, the men wear lifelines in the event of a tumble overboard.

Energy sapped by scant meals and little water, exhausted by hours in sun and wind, we collapse under the awning while off duty. Colin, an experienced sailor who served as skipper during the sea voyage, rouses to check navigation details.

back down. Up we go again. This time I cut the anchor rope.

A gust of wind catches us and begins to drag us across the sand toward the sea. The car swings and bounces violently as the unleashed canopy fights to rise. But the wind keeps cuffing us across the beach.

Abruptly we hit the surf line, and now we are bouncing off the waves. I feel spray against my face and taste salt on my lips. Colin jettisons another bag of food as we skitter across the water. From the shore, now a diminishing crescent of headlights, I hear above the pounding waves Booth's cry, "Get rid of more ballast!"

Airborne at Last

Over the side goes an eighth 60-pound bag, but this time we open it and dole it out pound by pound. We slap into the crest of a wave, skim the top of another, and suddenly we're airborne. Up we go, gently now, into the black chimney of night. Our car rocks languidly on the breeze, and the roar of the sea recedes. We've made it!

I looked at my watch. It was 1:07 a.m., December 12, 1958.

Small World began to oscillate easily, rising a few dozen feet, then descending to wave level before rising again. We slapped the ocean a few more times and dumped a few more pounds of calcium hydride, but the interval between bounces grew longer and longer.

All of us paused to stare back at the shoreline. The automobile headlights still carved a lonely electric island in the night. Suddenly we were all conscious of the intense darkness.

"They can't have seen us rise," Rosemary said. "Do you think they're worried?"

"They must be," answered Tim. "The last they saw of us, we were being swept off across the waves."

"I shall give a reassuring blast on the bugle," said Colin, who had been a Boy Scout in his youth. Whipping the instrument to his lips, he blew bravely. But alas, his old skill had withered on the vine. What emerged from the bugle was a hideous cacophony—like the moos of a milch cow in distress.

We looked at each other in startled silence. I said dryly, "Now they'll surely think we've come to grief."

The last tension of the take-off vanished in the ensuing roar of laughter.

"Now," said Rosemary, "we can play with all our toys in earnest."

And our "toys" made a formidable array. We had applied all the ingenuity we could muster to the problem of remaining in the air between the Canaries and America. Given ideal conditions, such a flight would require at least eight days. The world record for remaining aloft in a balloon was 87 hours.

The chief problem we were to face was the constant drain on our resources of gas and ballast. In ballooning practice, the gas in the canopy expands and contracts, principally through changes in temperature. We were to find, for example, that "superheat" caused by the morning sun expanded the gas, pulling us aloft; to check our ascent, we would valve some gas. Then we would lose altitude and check our fall by dropping ballast. As the balloon rose again, the cycle would repeat itself.

Further complications would face us should our craft encounter a thermal, or updraft of warm air. Thus our flight would resemble that of a leisurely yo-yo—up and down, up and down. And sooner or later we would run out of gas, ballast, or both. At this point our flight would come to an end.

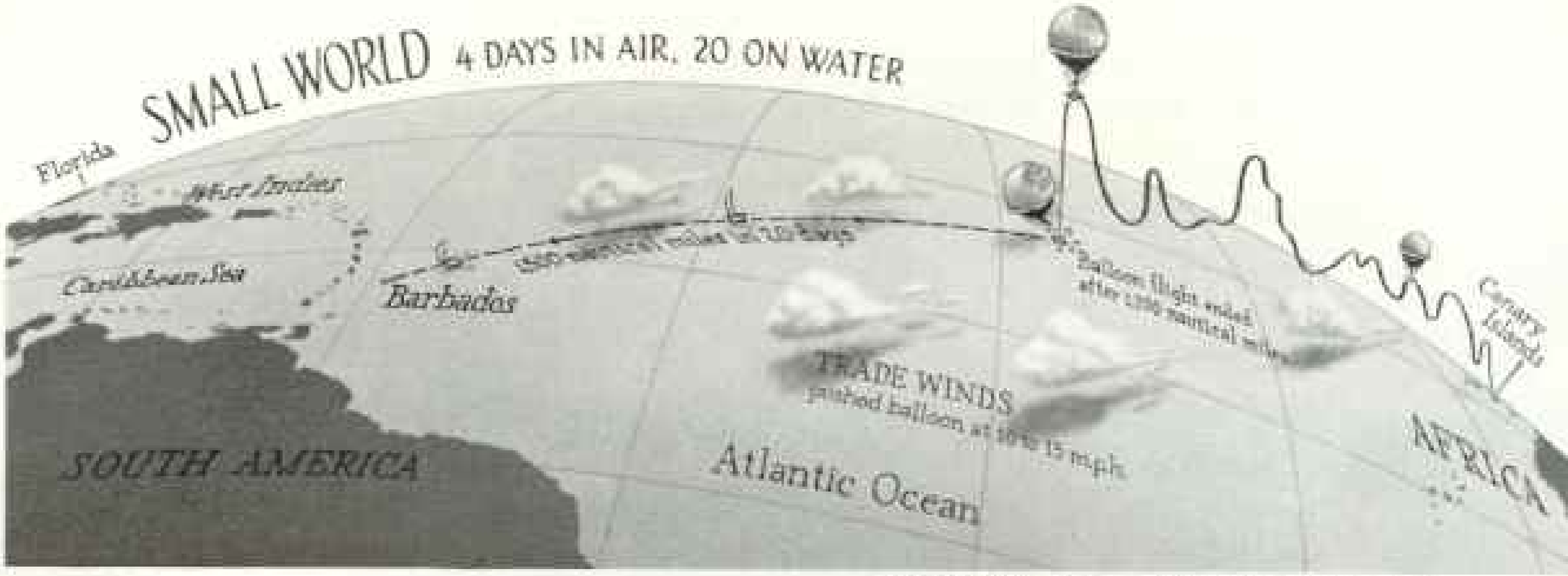
Aware of this problem from the beginning, we had equipped *Small World* with several devices of our own invention. One was a pedal-driven winch designed to raise and lower a specially constructed canvas bag at the end of 3,000 feet of Terylene line.

Sea Provides Plentiful Ballast

From the air we could drop the bag into the sea, scooping up as much as 300 pounds of water to use as expendable ballast. By hauling up the partly filled bag at daybreak, we hoped to counterbalance the superheat generated by the morning sun. We could also jettison the water at any time without the slightest qualm, since a fresh supply of ballast was no farther away than the sea below us.

The four bicyclelike sets of pedals which controlled the winch also turned an electric generator. In addition, we could rig the pedals to rotate helicopterlike propellers on either side of the gondola; these would provide 10 to 20 pounds of added lift when needed. Finally, since we were realists, we had fitted the car to the canopy with four quick-release cables. In the event of ditching at sea, one pull at the release handle would instantaneously free the car-boat from the flapping gasbag.

Less than an hour after take-off we had to unlimber the first of our inventions. Almost



DRAWN BY GILBERT A. GRONSON © NATIONAL GEOGRAPHIC SOCIETY

Our balloon flight (right) resembled a ride in an elevator controlled by a mischievous child. When the sun's heat expanded the gas, we leaped skyward. When obscuring clouds cooled it, we plummeted. To slow our ascent, we dropped a canvas bag on a long rope and loaded sea water as ballast. Going down, we dumped the water.

before we realized it, we were rising rapidly: 400 . . . 500 . . . 600 feet. Our trail rope—which acted as a kind of height anchor—swung clear of the water and we were out of control!

Every 400 feet our altimeter sounded a buzzing alarm and flashed on a light. "Quickly!" I cried. "Lower the water-lifting bag. We need ballast."

Colin, stationed at the altimeter, sang out, "We're at 1,200 feet, Bushy, and still rising!"

"Let out more line," I ordered. "Another 1,000 feet." Rosemary and Tim paid it off the winch. Then all four of us scrambled to the pedals. For 15 minutes we pumped furiously to reel in the line with its precious load of ballast.

At 1,800 feet Colin glanced again at the altimeter. "We've stopped rising," he announced.

All of us, still pedaling mightily, breathed easier. Our bucket had saved us. Or had it? The winch abruptly jammed. No matter how we strained at the pedals it refused to turn.

I played a flashlight down into the darkness. My heart sank. Four feet below the car dangled the water bag, enmeshed in more than 1,000 feet of tangled line.

"How is the altimeter?" I asked Colin.

"We're at 1,600 and dropping."

"A fantastic bit of luck," I said, "because we haven't been pulling ourselves down at all. There's not a drop of water in the ruddy bag!"

Through that night and into the next day, Colin and Rosemary spent 10 arduous hours unsnarling the fouled mass. The heart of the knot, however, was truly Gordian. In the end Colin had to take his knife to it. Our first venture with the lifting bag cost us several hundred feet of valuable line.

Happily, we descended to 300 feet. There we steadied, and the remainder of the night passed calmly. The trade wind carried us westward in easy oscillations that kept us at an average altitude of about 200 feet.

Skipper on Call at All Times

Rosemary, bless her, had thoughtfully stowed a flask of coffee aboard just before take-off. As she poured a bracing cup for each of us, we got down to ship's business.

"Look here," I said, "I suggest that we split the watches down the middle, Colin and Rosemary on for six hours, then Tim and I for six hours. What do you say?"

"It's no good, Bushy," Colin replied. "You forget you're the only one here who's done any free ballooning at all. You're also the skipper. So you'll have to be constantly available. Now this is my idea. We three will take four-hour watches in turn. That gives each of us four on and eight off. You will be on call for every watch."

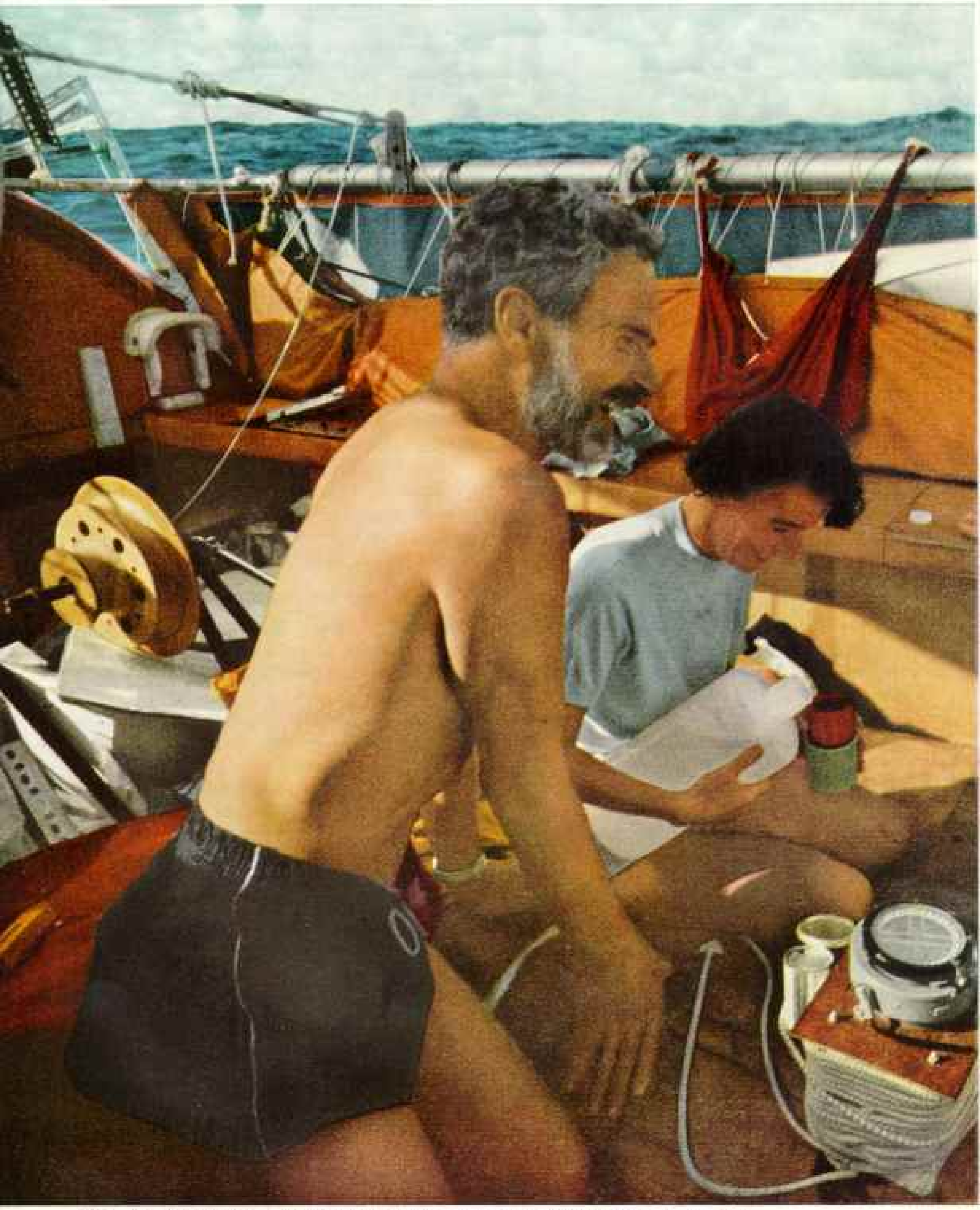
All hands agreed that this was the best approach. Colin took the first watch and, at 5 a.m., I curled up for an hour's rest.

When the dawn broke gray and misty, I rose to my feet and anxiously scanned the sky. With a feeling of relief, I realized that it would be an overcast morning, no direct sunshine, and—thank God—little superheat.

Colin and Rosemary, hollow-eyed from lack

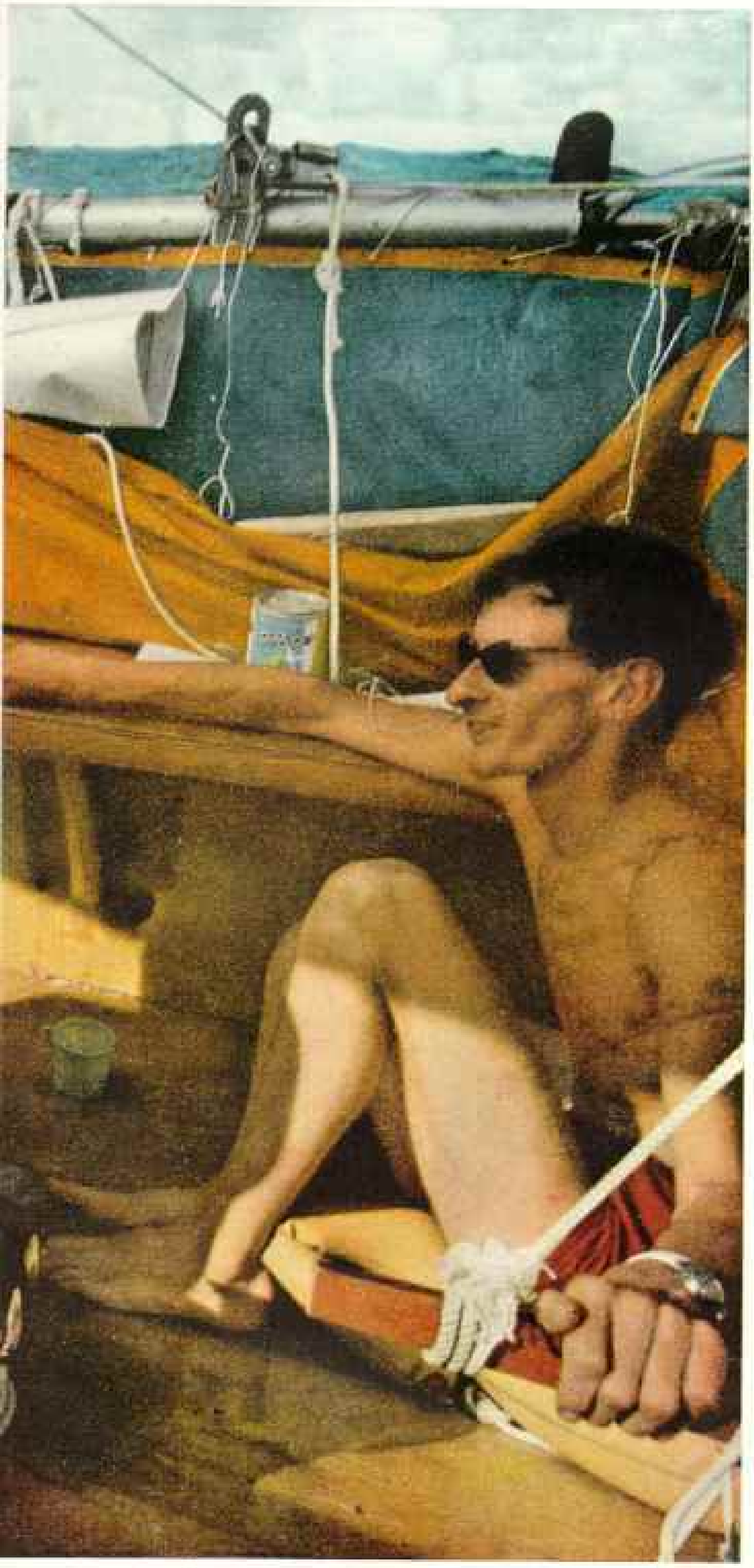
Midday Water Ration: a Fourth of a Cup Evokes Eager Smiles, a Moment's Gaiety

Grim uncertainties nagged. If the wind died, we would be becalmed; if it rose, a wave might capsize us. With water in short supply, we doled out a daily ration of half a pint a person. The measure cost us our appetites. All of us



lost weight; Tim (right) shed 33 pounds.

Here open jars of lemon juice and jam are strapped to the compass post to prevent spilling. Red canvas bag holds supplies of biscuits, nuts, raisins, cheese, and chocolate.



An aluminum sextant, used to sight the sun, helps our navigator determine latitude and longitude.

Since a balloon travels only with the wind, we had little control over our course while aloft, but Colin kept careful check on our position.

Once on the water, Mudie and his instruments really came into their own. He plotted courses across the trackless sea and scored a bull's-eye with the Barbados landfall.

of sleep, were doggedly untangling the water-bag line. Actually, while the concept of the bag was sound, the mechanics of using it plagued us almost until our last minute aloft. When lowered into the sea, the bag would fill nicely with water; but when we commenced to haul it up, it would drag along the waves and empty itself. It took two days of trial and error for Colin and Tim to contrive a valve that would shut when the bag surfaced.

I can liken our time in the air only to an unending marathon. Each of us was so busy tending to odds and ends of gear and, when on watch, keeping the balloon in some kind of equilibrium, that we barely had time to eat.

That first day aloft we nibbled at nut pemmican, some raisins, chocolate, and bread. Since I am a vegetarian, the others had elected to exclude meat from our larder. "But," Rosemary observed, "if we should be driven to cannibalism, Bushy, you must be prepared to do the decent thing and offer yourself."

We weathered a number of minor crises that first day. Several times we dropped so low that we bounced off the waves, and we had to jettison our radio receiver, one propeller, and a bag of food to regain altitude.

For Rosemary the nights were the worst. "It's horrid," she told us the second morning. "You sit there on watch and you can hear the sea getting nearer but can't really see it. The altimeter drops and I hate to see it going down, jerk by jerk. Then, as suddenly, you're going up again, and you don't know if you'll ever stop."

Thermal Lofts *Small World* Skyward

Still, all went relatively smoothly until eleven o'clock on the third morning. We were preparing to haul up a bagful of water ballast when Tim glanced at the variometer, which indicated the balloon's rate of rise.

"We're in trouble!" he cried excitedly. "The needle is hard up against the stop and has run out of dial!"

We were caught in our first thermal! Some of these violent updrafts are sufficiently powerful to sweep a balloon up to 30,000 feet, where the crew could perish from lack of oxygen. Up we shot, completely out of control. At 800 feet we rocketed into the belly of a cloud (page 127). Cold rain pelted us, and the thick gray of the cloud enclosed us like soiled and clammy wool. Rosemary, at the altimeter, yelled out the readings: "2,500 . . . 2,600 . . . 2,700. . . ."

"You've got to release some gas," Tim shouted. "You've got to!"

Tim was always impatient with me when I valved. But the fact is that one must valve and wait, valve and wait—releasing no more than a few hundred cubic feet at a time. If a pilot valves enough gas to brake a rise immediately, then he has valved far too much and the balloon will plummet like a stone.

At 2,800 feet I tugged the valve. At 3,100 feet we began to slow. Then, tense and silent, we all listened to Rosemary's readings: "3,200 . . . 3,300 and nearly

Hunched Under the Awning, I Scribble a Note in the Log

steady . . . 3,400 . . . still 3,400." And then an exultant, "We've done it! 3,300 feet . . . we're going down."

"We're not out of it yet," I shouted. "We're going to hit the sea before this is over. Stand by to ballast. Tim, get ready to drop the radio transmitter. Colin, you heave out the batteries; Rosemary, the sleeping bags. We'll also have to dump the starboard propeller."

Down, down we chuted through the silent, gray murk. Ballast went over the side piece by piece. We threw—and waited; threw—and waited. At 800 feet we shot out into a wind-swept world of bleak sky and bleaker ocean.

Tim heaved the 56-pound transmitter overboard and my eyes followed its lazy arc into the waves; with it went our last contact with the outside world. But none of us had time for regrets. Almost at once we crashed into the sea. The car lurched crazily; the tension wires reinforcing the hull screeched in metallic anguish.

We hung on in desperation as the car heeled and pitched in the angry sea. Then, with another lurch, we lofted back into the air.

"We're going to hit again," I shouted. "Toss out the generator, Tim."

We braced ourselves for the impact, but our second bounce was incredibly gentle—no more than a featherlike contact with the waves. We skimmed the surface for a few seconds, then inched skyward. Colin carefully jettisoned several tins of nut pemmican—which no one liked anyway—to preclude another descent. *Small World* eventually leveled off a few hundred feet above the sea, and the wind once more kited us toward the west.

Our 15 minutes in the thermal had cost us dearly, however. I glanced overhead at the canopy. It was faintly slack; we had expended about a hundred pounds of precious lift. And we had lost another hundred pounds of essential gear as well.

Our Galleon Inches Along Under a Scrap of Sail

With such a rig we could not hope for much speed. Storm brewing, I reef the sail by rolling it around the mast.

700 Miles of Ocean Spanned

The rest of the day, our third aloft, passed without incident. The wind diminished, and we fell to repairing some of the mischief wrought by the thermal. That evening Colin broke out his sextant and found that we had covered 700 nautical miles, approximately one-fourth of our course to the West Indies.

The following day broke sunny and hot. Fleecy clouds spattered a dazzling blue sky, providing a perfect backdrop for ballooning.

A Ship! Colin Waves a Flare... To No Avail

Fifteen days on the water, 2,350 sea miles from the last sight of land, haggard and bone-tired, we sight a passing freighter. Relief filled us in warm flood as we anticipated fresh water and contact with home. Yet our burning flare brought no answering signal. As we watched in silence, the ship sailed off to the horizon.

Uninvited visitor, a flying fish, leaped over the low rail during the early morning of January 3. It landed on a sleeping Rosemary. Nerves taut, she screamed in fright.

We had finally conquered the water-lifting bag, and with it we offset the morning's superheat without losing a cubic inch of gas.

The sinking of the sun marked an important event for us. Colin took a fix and found we had passed the 1,000-mile mark; we were cheered by the knowledge that we had completed more than a third of our journey.

Because we had all been working for 19 hours straight, I thought it only fair that the others get some sleep while I stood one of the night watches. Just before midnight I noticed that the altimeter's oscillations were peaking at 600 feet; a few moments before their peak had been 400.

Even as I watched, the dial swung to 700. I leaped to the winch to lower the water-lifting bag, but we were rising at the rate of 30 feet a second—much faster than I could pay out the line. "Get up, kids," I shouted. "We're in another thermal!"

Even before they could get to their feet, the car was tossing at violent 45-degree angles. For a moment no one could get his bearings; the night was black and impenetrable. Sheets of rain lashed into the car.

At 2,000 feet Tim daringly scrambled up the whipping rope ladder to the load ring and wrenched open the balloon's neck, which we had tied the previous day. By then we were at 3,400 feet. Had it not been for Tim's providing an escape route for the rapidly expanding hydrogen, it would have burst the canopy.

"You must valve," Tim shouted to me anxiously. "At this rate we could shoot up to 30,000 feet in no time."

Small World Becomes a Boat

Tim was right. We couldn't afford to lose a pound of lift. But now our very lives were at stake. It was the gas or us. I jumped for the valve rope and hung on, feet off the deck. More than 2,000 cubic feet of hydrogen hissed out into the night. I waited to observe the effect, but there was none. Again I leaped to release more gas.

Rosemary, hanging onto the altimeter, kept calling the readings. At 4,600 feet she shouted with relief as *Small World* steadied.

But this time, I thought ruefully, there would be no recovery. We had valved far too much gas. This time when we hit the sea, we would stay there.

"4,500 . . ." Rosemary called. "4,400 and dropping . . . 4,300 . . . dropping faster. . . ."

As the balloon fell drunkenly through the rainy darkness, Colin grabbed his knife and cut the auxiliary suspension lines. He then checked the quick-release mechanism to see that all was in order. A single fouled line at the moment of impact could capsize the car and drown us all.

Colin and Tim ballasted everything in sight. Water bags, food, the last of the calcium hydride. Overhead, the flabby canopy—now in its death agony—made thunderous flapping noises as it heaved from side to side.

"1,700," Rosemary called. "1,600 . . . 1,500." Her flashlight grew dim. "I can't see . . . 1,100 . . . 900 . . . I can't see . . . I can't see. . . ."

At that point, we plunged out of the clouds, careening toward the sea at 30 feet a second.

Rosemary and Tim flattened themselves on the deck. Colin and I braced ourselves against the side of the car. I glued my eyes to the sea. Any miscalculation might prove fatal: 50 . . . 30 . . . 10. . . . About three feet above the water, I swung the release handle with all my power.

Weary Crew Faces Weeks at Sea

It was a perfect landing. The car struck the sea with a soft plop. Freed of its yoke, the gasbag yawed skyward and shot away into the darkness. It flapped convulsively just as it flew out of sight in a low cloud. We had remained airborne 94½ hours—7½ hours longer than the official world record, although a faulty barograph denied us the satisfaction of establishing a new record—and had covered 1,200 nautical miles, almost half the distance to the New World.

Breathing hard, I slumped down into the bottom of what was now our boat. "Well," I said, "now we're all in a boat again, and I, for one, am glad."

"I'll second that," Colin said. "I think, though, that I've hurt my ankle."

We examined it as best we could in the darkness, but couldn't ascertain whether it was broken or only sprained. Later, in Barbados, a doctor found that Colin had broken his ankle in two places.

As Rosemary bandaged it, I told him, "It's all yours now, Colin." We had previously agreed that, in view of Colin's extensive deep-sea experience, he should assume command once we ditched. "But," I added, "I'll bet I've done my half quicker than you'll do yours."

Colin's first order was to drop the sea anchor for the remainder of the night. The rain had not abated, and the waves were high and

KODACHROME BY CHARLES ALLMON, NATIONAL GEOGRAPHIC STAFF © N. G. S.

Barbados: Land at Last. The Capital City of Bridgetown Greeted Us as Lost Friends

Sail furled, *Small World* accepts a tow from the fishing boat *New Providence*. Thus our 24-day Atlantic adventure came to an end.

Jubilation swept us on sighting the palm trees and silvery beaches of Barbados. The crossing had taken three times as long as planned.

SUPER ANSCOCHROMES BY ROSEMARY MUSIK © NATIONAL GEOGRAPHIC SOCIETY

BARBADOS TOURIST BOARD

Clean Shirts for All Hands Break Out on the Moment of Arrival

Our "cigar box," as Rosemary dubbed it, sits bedecked with the clutter from the voyage. Later it seemed incredible that four people could live in the gondola-boat for more than three weeks, much less fly and sail it across the sea.

heavy. His second was for Rosemary to distribute antiseasick pills to all hands. He felt that the bobbing of the boat, combined with the emotional stress of ditching, would upset our stomachs.

He was right—but the pills came too late. Before the night was over, we had all weathered a bout of nausea.

The following morning, as rainy and dismal as the night, found us all hard at work rigging our 180-square-foot sail, fitting the rudder in place, and lashing down supplies. Colin took the helm, and we were in business again.

"Look," Colin warned, "we're going to have to cut down on our water ration. We now have about six and a half gallons plus the Permutit packs which can purify another four gallons. From now on, we'll issue only half a pint of water per person per day, plus another eighth of a pint of Permutit for anyone who wants it."

The food picture was brighter. In addition to a good supply of cheese, chocolate, and pemmican, our larder boasted nuts, raisins, sugar, dried and evaporated milk, tinned butter, biscuits, jam, honey, and cereals (page 136).

Our second day afloat was sufficiently clear for Colin to take a fix. He estimated that if the wind held, we would make Barbados in from two to three weeks.

Colin had done a masterful designing job on our car-boat: it sailed well and shipped no water. With its raking mast, golden color, and high poop, it rather resembled a miniature galleon.

To balance the boat, we divided it roughly into two living sections: the Mudies had the portside, Tim and I the starboard. The same teams stood watches on a four-hour-on, four-hour-off basis. For the first few days at sea, most of us slept away our off-duty time. The four-day ordeal of flying *Small World* had left us physically and emotionally drained.

Modern-day Galleon Sails Westward

As we bobbed ever westward, the rain squalls gave way to brilliant tropical sunshine. The covering that had protected us from the night rain now became an awning to shield us from the sun. It also served to isolate the forward part of the boat. There we placed our single toilet facility: a bucketlike container lined with a disposable polyethylene bag.

We soon found that there was no need to ration food. Thirst, not hunger, haunted us; and, as often as not, eating served only to

make one thirstier. Everyone ate what and when he pleased. Soon the average meal consisted of a handful of raisins or nuts and a swallow of water laced with powdered milk.

More and more, as the days slipped by, water became an obsession with us. Whenever it rained, we would gather what rain water we could from the top of our awning. It tasted vilely of neoprene, but we carefully stored it as a foul but drinkable reserve.

Ceaseless Thirst Tightens Nerves

The chemically treated salt water was disappointing. We made it by filling a special bag with sea water, adding several cubes of a compound, and shaking well (page 133). We would squeeze the resultant mixture out through a filter. While it was drinkable, it had an overpowering chemical taste that was far from pleasant. Rosemary refused to touch it, and I drank it only sparingly. We found that by flavoring it with jam, or cereal, or concentrated lemon juice, we could get it down.

Tim suffered most for want of water. I remember one day, goaded by an intolerable yearning for something liquid, he insisted that we open our last tin of tomatoes.

"The metal might rust," he argued, "or the heat might cause it to explode. We have everything to gain by eating it now, and everything to risk by delay."

Tim forced his argument so stubbornly that in the end he carried the day. We opened the tomatoes. Carefully divided among our four cups, the contents provided a bare half pint for each. Ironically enough, Tim's stomach had so shrunk that he couldn't finish his share and gave it to me.

In the unending routine, time soon ceased to have any significance. Days we measured by watches and by half pints of water.

Tim, Colin, and I organized a Water Taster Connoisseur's Club. We met in solemn conclave each time we purified a new batch of sea water. Colin, as head taster, would swish a mouthful across his tongue as though savoring a rare sauterne. "Full-bodied," he might say, "but not devoid of subtlety."

We derived an inordinate amusement from this foolishness, but Rosemary did not share it. One day she ended the tasting sessions by exploding: "Stop it! Stop talking about water, for heaven's sake! I'm perfectly able to get along on our ration as long as you don't keep bringing the subject up!"

During all this time we had been absolutely

A Carnival of Welcome Swirls Through the Streets of Bridgetown

This heart-warming reception occurred just before we received a cable from our royal patron, Prince Philip. "Congratulations on a remarkable journey," he said.

alone on the vast expanse of sea. Once a bosun bird winged across the lonely sky on a solitary course from horizon to horizon; and twice stormy petrels swooped low to investigate us. But, on the afternoon of December 23, Colin, who was at the tiller, said, "I do believe we're being followed."

We all scrambled aft. And, sure enough, we saw a surfaced submarine about a mile astern. We could hear the engines plainly. Low-slung, lethal, the sub was loafing along on a southerly course. Hoping she was an American craft well stocked with fresh water and ice-cold Coca-Cola, we waved wildly. But she either failed to see us or chose to ignore us. Soon she disappeared in the distance. Colin, who is quite competent on the subject of ships, felt sure that the submarine was a Russian.

Christmas day found us with 800 sea miles still between us and Barbados. We celebrated it by repairing the tiller, which had snapped during Colin's early-morning watch, and by issuing an extra quarter mug of water and a spoonful of dried milk per person.

We had all grown weak from lack of water and restricted intake of food. Any task, no matter how minor, now required a supreme act of will power. And every exertion left us panting and exhausted for 30 minutes after. Almost every off-duty hour passed in dozing on the deck.

Tim's birthday fell on December 29, our 14th day afloat. We roused ourselves from our lethargy to open a tin of evaporated milk by way of a party. The milk showed us how debilitated we had become. All of us had to dilute it with water; alone it was too strong.

Superstition a Part of Sailors' Life

By the following day we were only some 400 miles from Barbados, according to Colin's fix. This was cheery news, and we all perked up momentarily. "Well," I said, "it's heartening to know that this funny cramped life will end in five or six days."

Everyone looked at me in horror. "Do shush, Bushy," Colin said, with an apprehensive glance at the sky. "You're just asking for trouble. A healthy superstition is part of being a good sailor."

But my thoughtless remark apparently failed to anger Davy Jones, for January 4 found us thirstier and thinner, but only 50 miles from the West Indies. Even then, to Tim's distress, we couldn't relax the fresh-water ration. As Colin pointed out, we must still face up to a terrifying prospect: if the wind died, we might drift completely through the West Indies and have to sail more than a thousand miles to the mainland of Central America. But all that day we spanked across the white-flecked sea. The wind gave no sign of failing.

That night, just before midnight, I was roused from a lingering dream of a chilled, foaming glass, to take the midwatch—12 to 4. I settled myself at the tiller and stared out across the dark ocean.

Small World Makes a Landfall

The night was calm, filled with the hum of the car's wire braces and the faint, hollow boom of the water rushing beneath our bow—familiar, comfortable sounds that made me feel it a privilege to be awake and on watch. I even felt a kind of pity for people who have never seen the moon's track reflected in the wake of a boat.

At 12:35 a.m., I glanced ahead and my eyes widened. "A light. Get up, Colin, a light!" I shouted. Colin checked his charts and decided that it was the beam of Ragged Point lighthouse on Barbados.

By 7 a.m. of that day, January 5, we could see land looming solid on the horizon. Two hours later we hailed the 25-foot fishing boat *New Providence* and—for 50 Barbados dollars (U. S. $29)—negotiated a tow into Crane Beach (page 142). There we marked time for more than an hour, moving gently in the water, until a port official cleared us for health, customs, and immigration.

When we finally wobbled ashore on the sandy beach—our legs rubbery after 24 days of bouncing across air and sea—almost 4,000 people had gathered to bid us a cheering, jubilant welcome. As I shouldered my way through the crowd, someone grabbed at my arm. "Tell me one thing," asked a strapping policeman, "why did you ever do it, man?"

I ran a hand across my sun-scorched forehead and down through my grizzled beard. "Why?" I echoed. "I can't say exactly. I guess just because no one had ever done it before."

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BIRDS LURE VICE CHAIRMAN OF RESEARCH TO TROPIC WILDS

More time to spend in the jungle—this is what retirement from one of the Nation's top scientific posts as Secretary of the Smithsonian Institution has meant to Dr. Alexander Wetmore. The renowned ornithologist is Vice Chairman of the National Geographic Society's Committee for Research and Exploration and a member of its Board of Trustees. At 73 he is as much at home in the towering rain forests of Panama as in his Washington, D.C., office.

For more than 40 years Dr. Wetmore has studied the birds of Latin America. This year he and his wife traveled by bush plane and dugout canoe into the border wilds of the Paya River. Here, after a morning's search accompanied only by a Choco Indian guide, Dr. Wetmore prepares the skin of a bright Panamanian parrot. Beside it lies a specimen of the forest owl, whose ghostly calls come daily at dawn from the trees around the camp. Both will become a part of the Smithsonian's world-famed collection.

With scientists like Dr. Wetmore on its Research Committee, your Society continues, year after year, in the forefront of researches which have ranged, since the war, from cosmic rays to the sea's abyssal depths, and from New Guinea's birds and Stone Age men to lost cities of the ancient Maya. Thus your modest dues help support an ever-continuing study of the universe and its wonders, and every man's knowledge is the richer.

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7-59

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And you can muse for a moment on the unlettered backwoodsmen *who wrote a shining page in freedom's book.* The handwriting might be crude — but the message was unmistakably clear . . . *no mountain is too high for men to scale when freedom waits at the top.*

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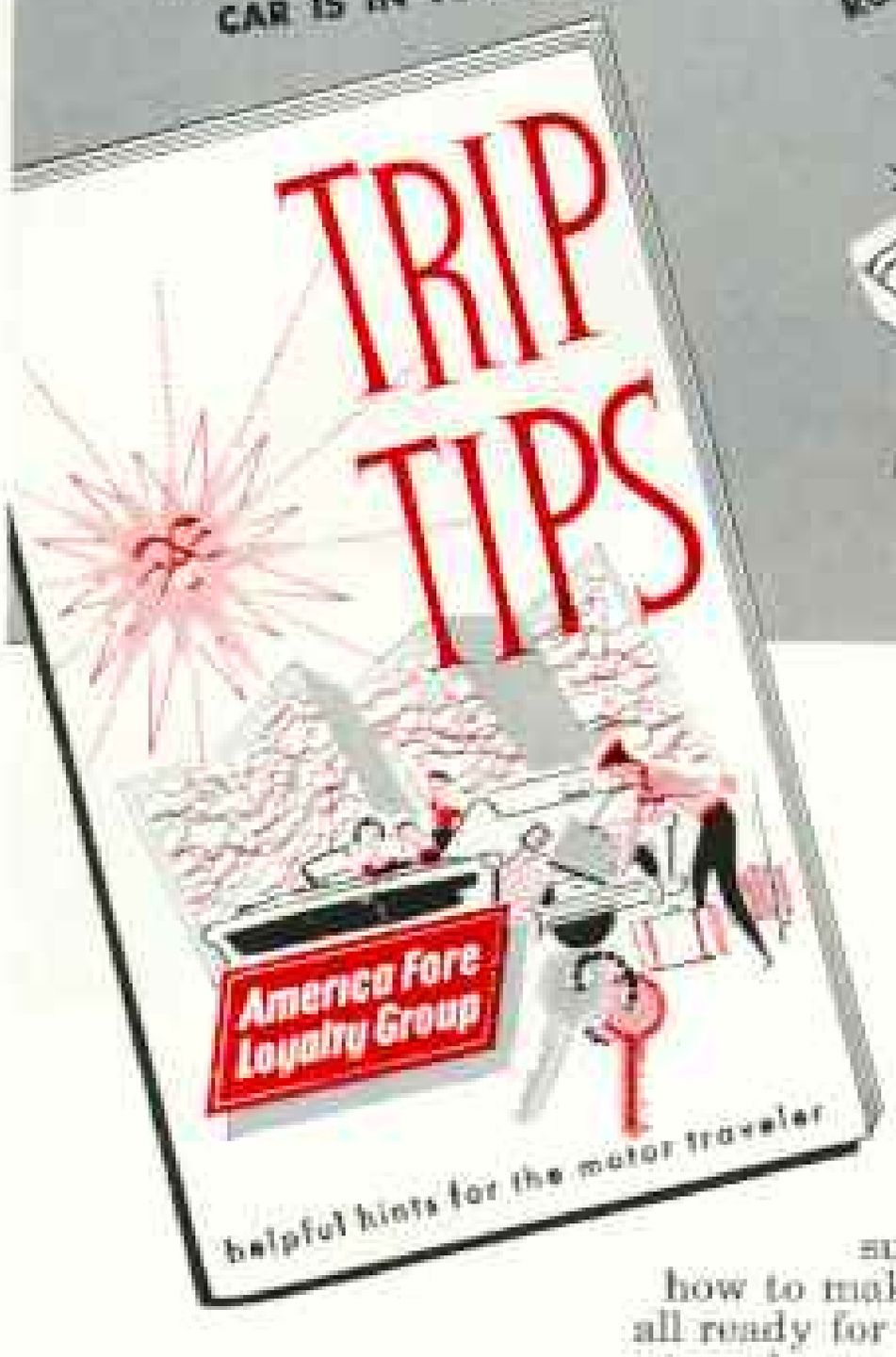

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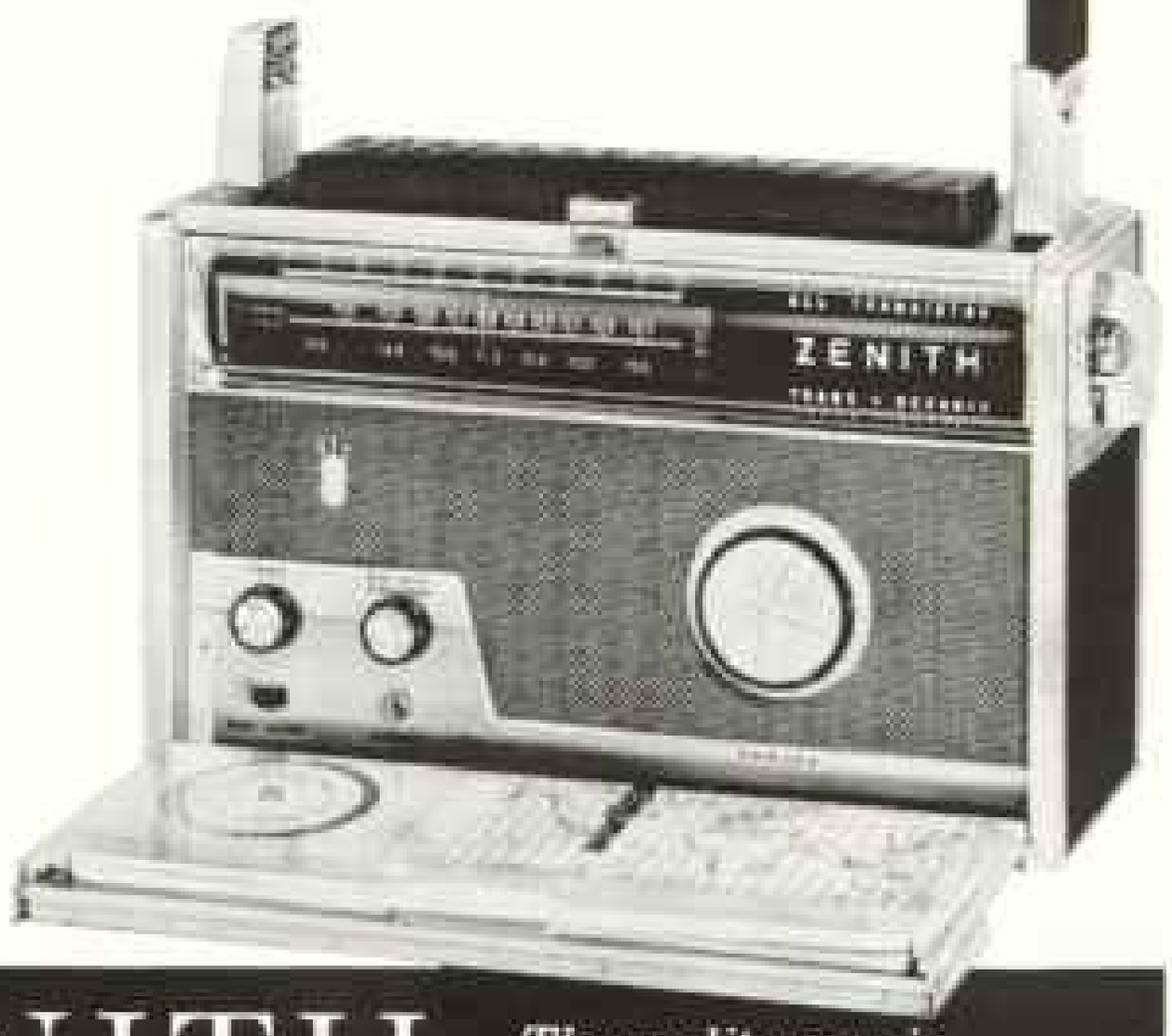

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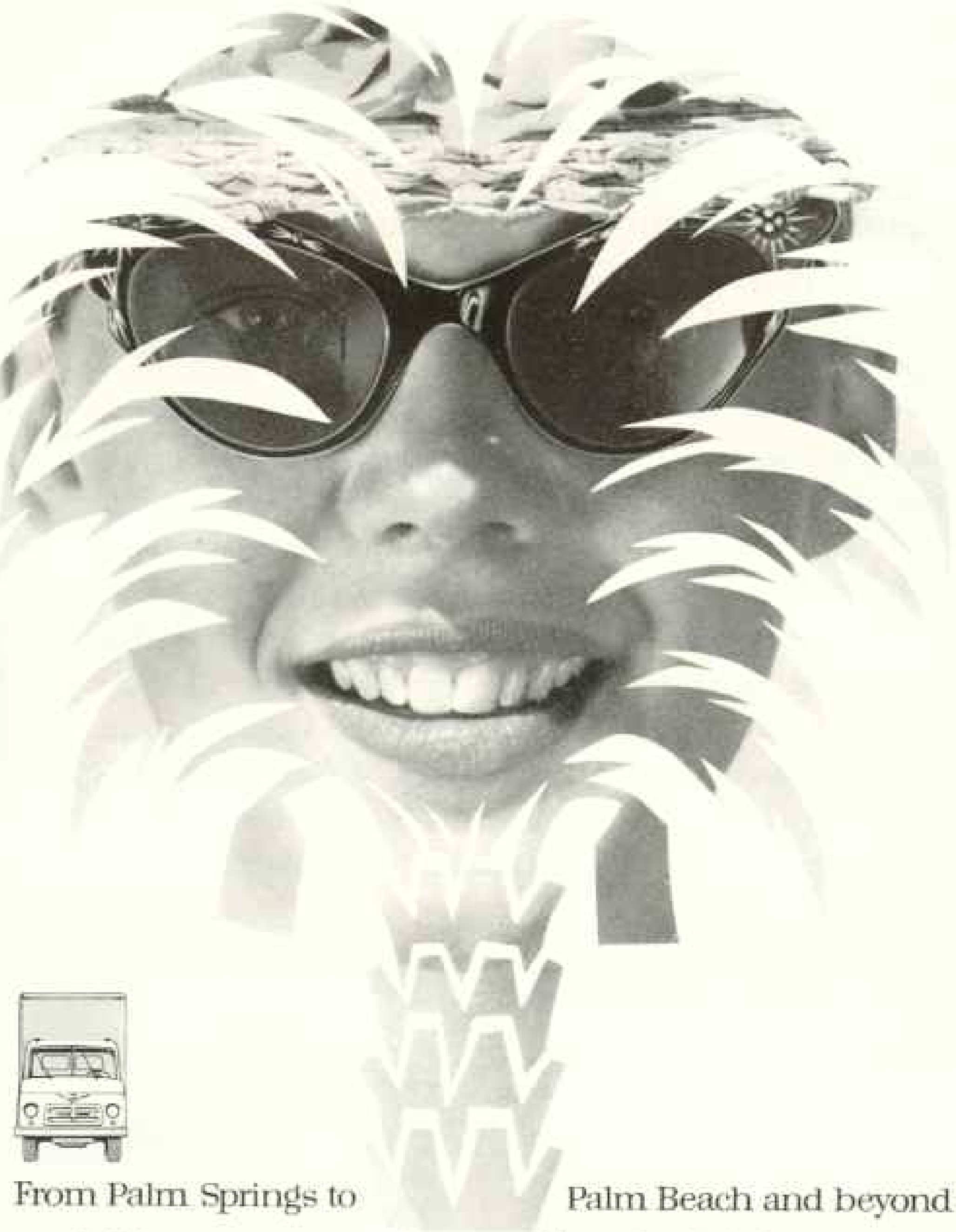

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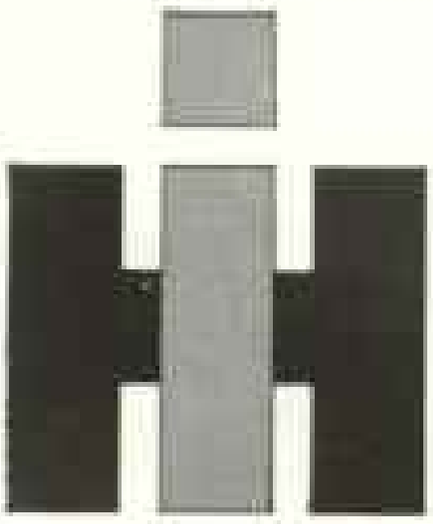

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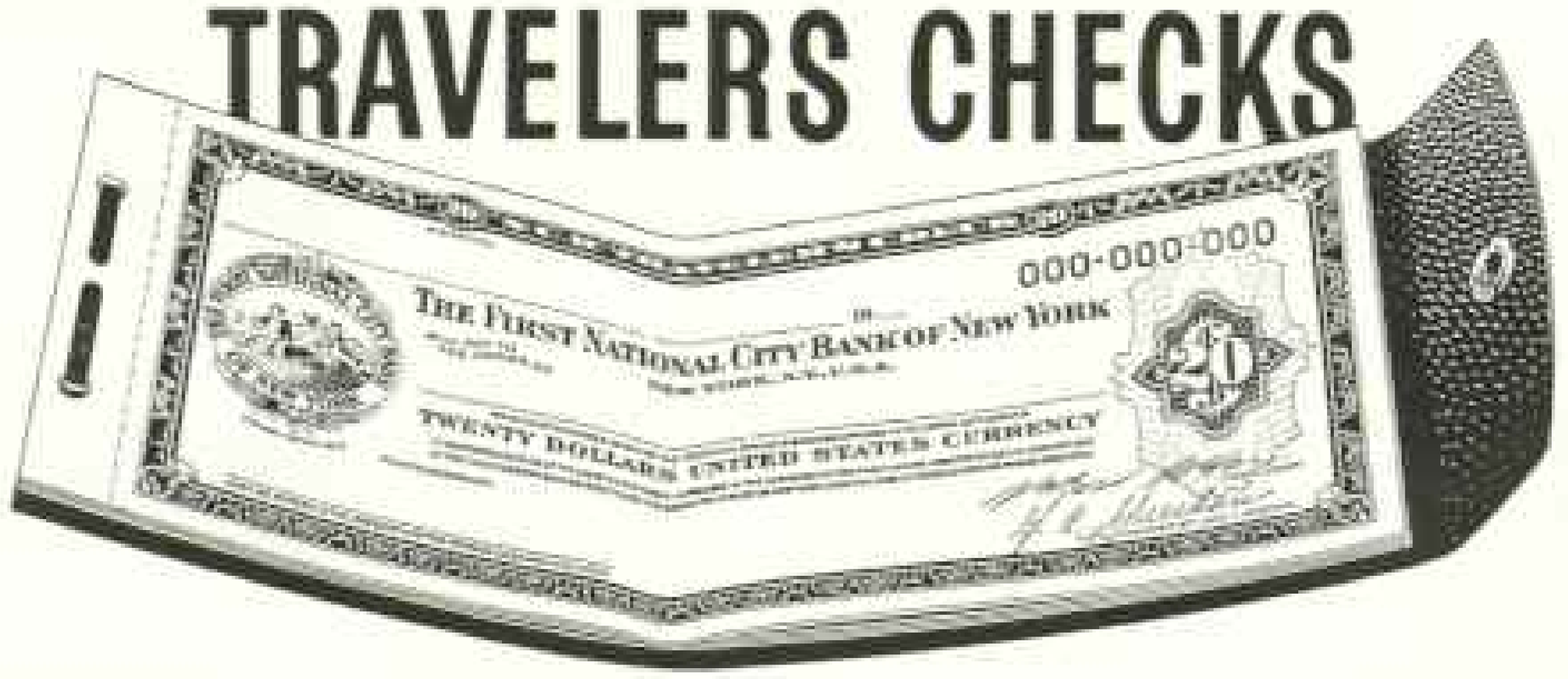

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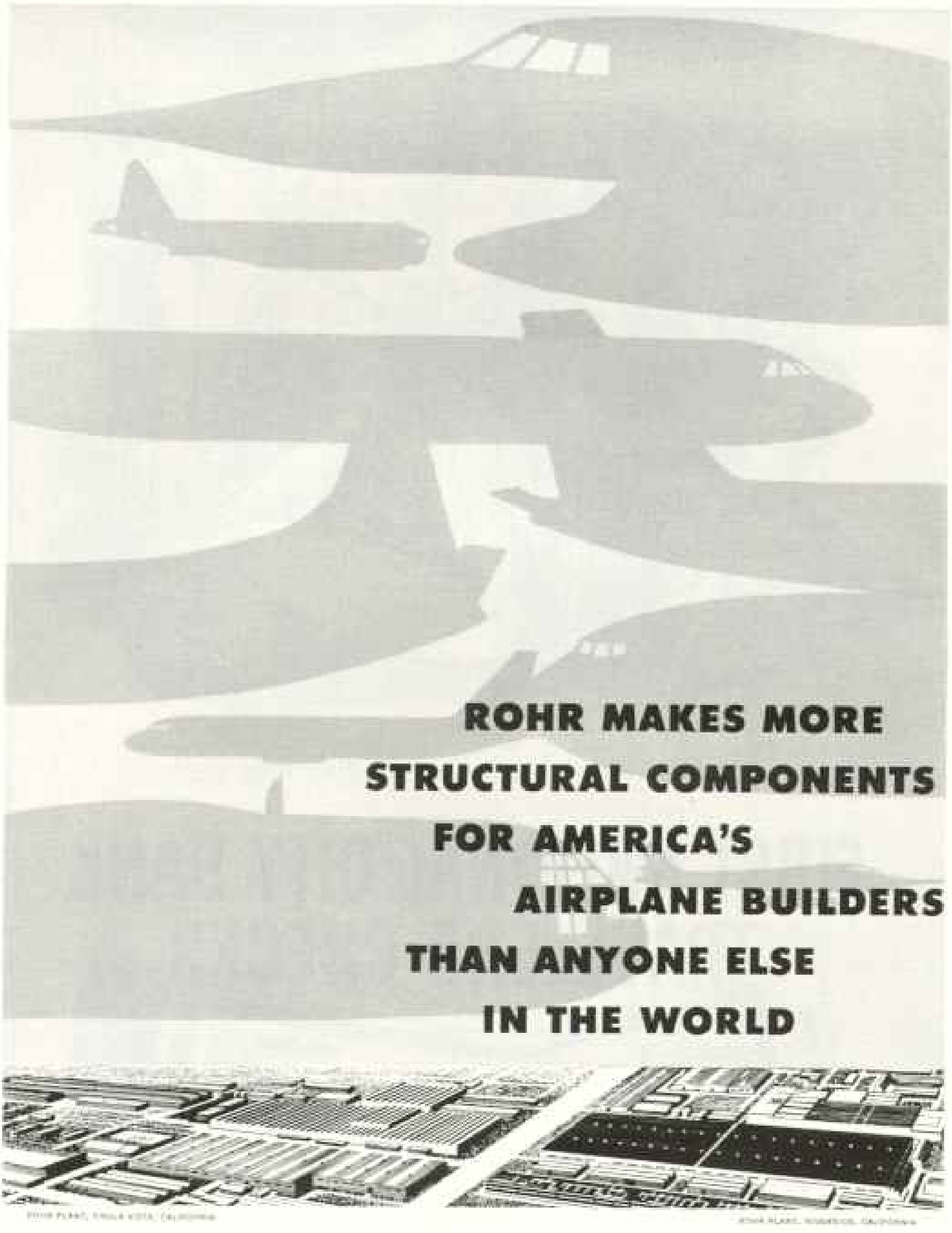

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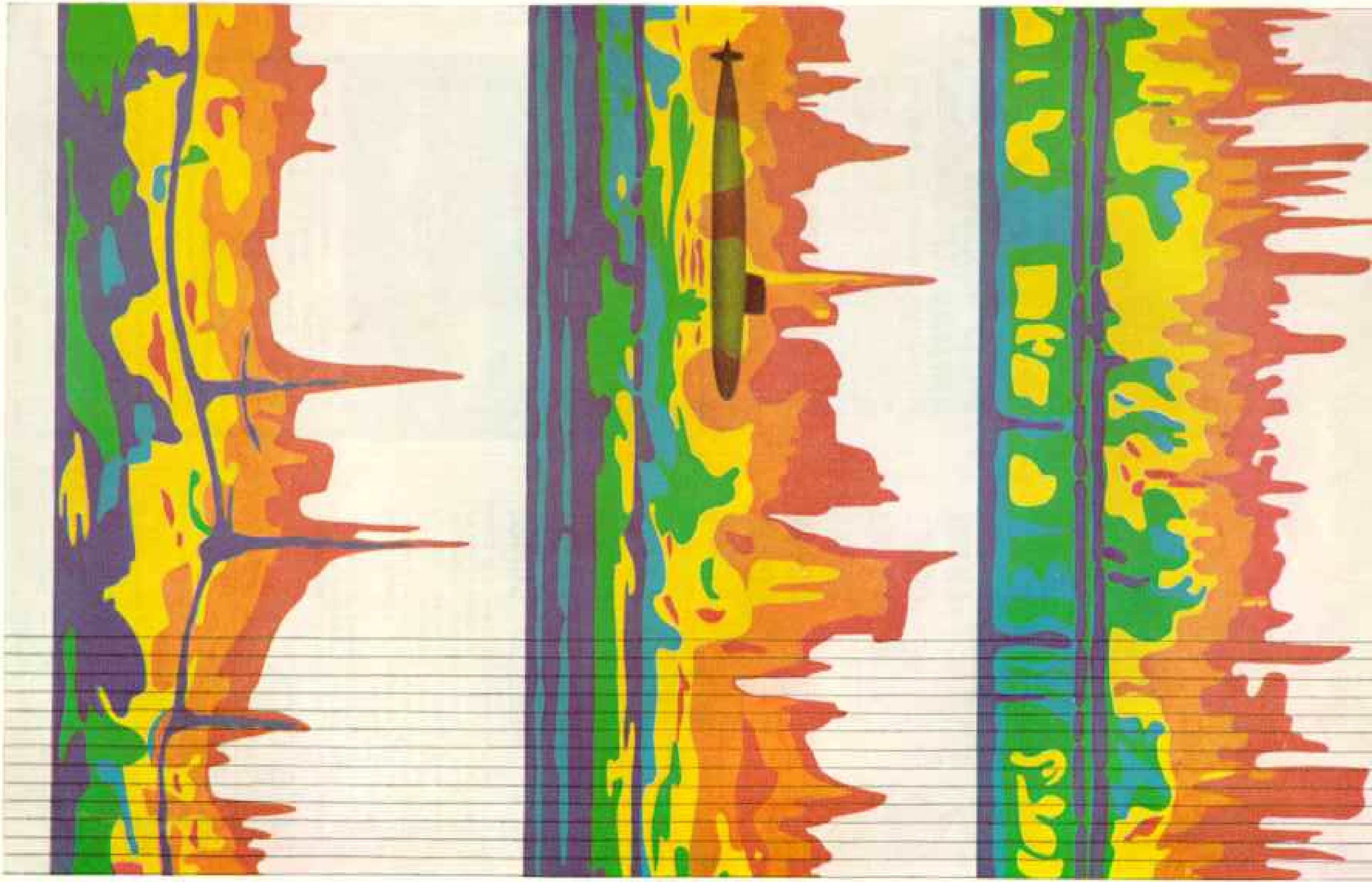
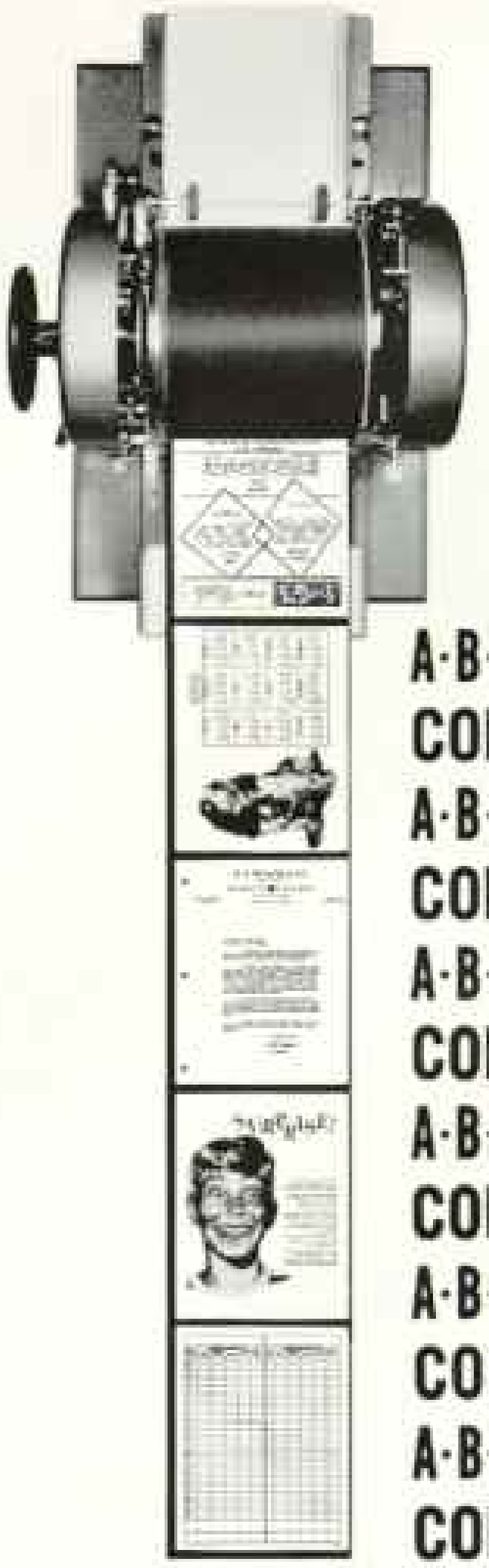


Problems of Earth: In the blind and sonant canyons of the sea, who is the enemy? where is he? how near? has he heard me?

GENERAL DYNAMICS



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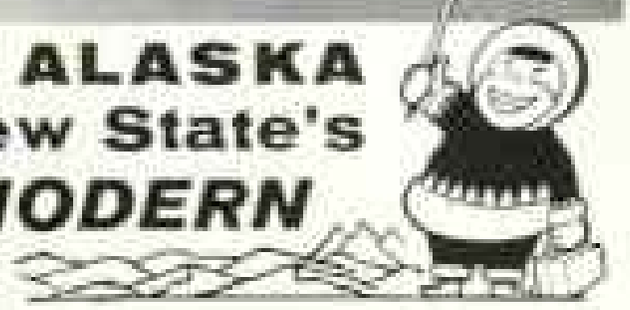

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Habits of exercise, sleep and recreation can make a big difference in how you feel. Your doctor can help you work out a plan for living to conserve your physical and mental resources.

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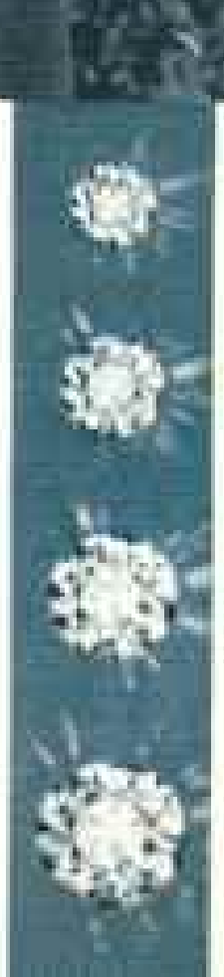

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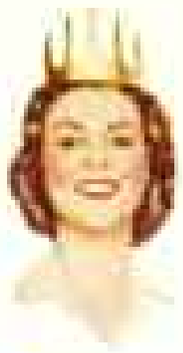

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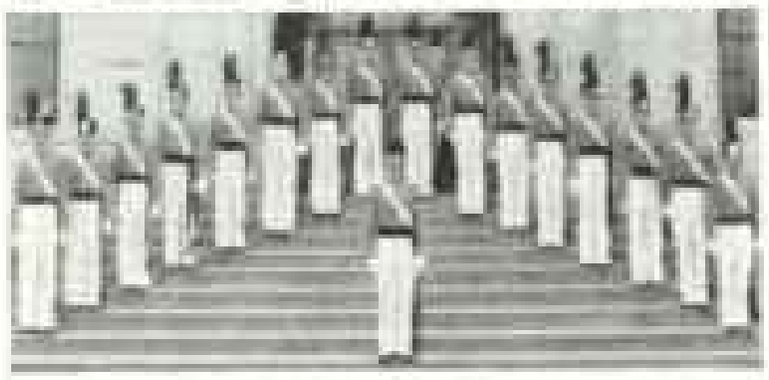

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