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VOL. 118, NO. 5 NOVEMBER, 1960

Powered by the atom, the largest United States submarine makes naval history by circling the globe submerged

Triton Follows Magellan's Wake

By CAPT. EDWARD L. BEACH, USN

Illustrations by National Geographic photographer J. BAYLOR ROBERTS, Comdr., USNR

THERE she stood, alone on a rock where the river meets the sea, the chill February wind whipping the red scarf about her head, the old but still useful coat wrapped tightly around her.

I waved my white cap until I could no longer bear to look. That blue-eyed girl had joined her life to mine during the flaming years of World War II and had watched me sail over the horizon many times since. But this time was like no other.

I was taking the U.S.S. *Triton,* the largest and most powerful submarine in the world, out of Groton, Connecticut, on the voyage submariners had been dreaming of ever since nuclear energy had made it feasible.* Our mission was secret and unprecedented: To circumnavigate the globe along the route Ferdinand Magellan took 441 years before; to do so submerged, unsupported, and undetected; and to bring back new knowledge about the oceans, our ship, and ourselves.

We say ship—not boat, as submarines are generally called—because *Triton,* the first vessel carrying two nuclear reactors, has the horsepower and size of a light cruiser. We need a flying bridge to see in all directions when conning her in a crowded harbor, and when I stand up there, my eye level is 41 feet above water, the height of a modern four-story building. The ship's length is 447½ feet—more than two blocks along Fifth Avenue in Manhattan. Her power supply is a grapefruit-sized chunk of uranium.

From Groton, across the Thames River from New London, it took *Triton* 3½ hours to cross the continental shelf and reach water deep enough for diving. I scrambled down

*See "Our Navy's Long Submarine Arm," by Allan C. Fisher, Jr., NATIONAL GEOGRAPHIC, November, 1952.

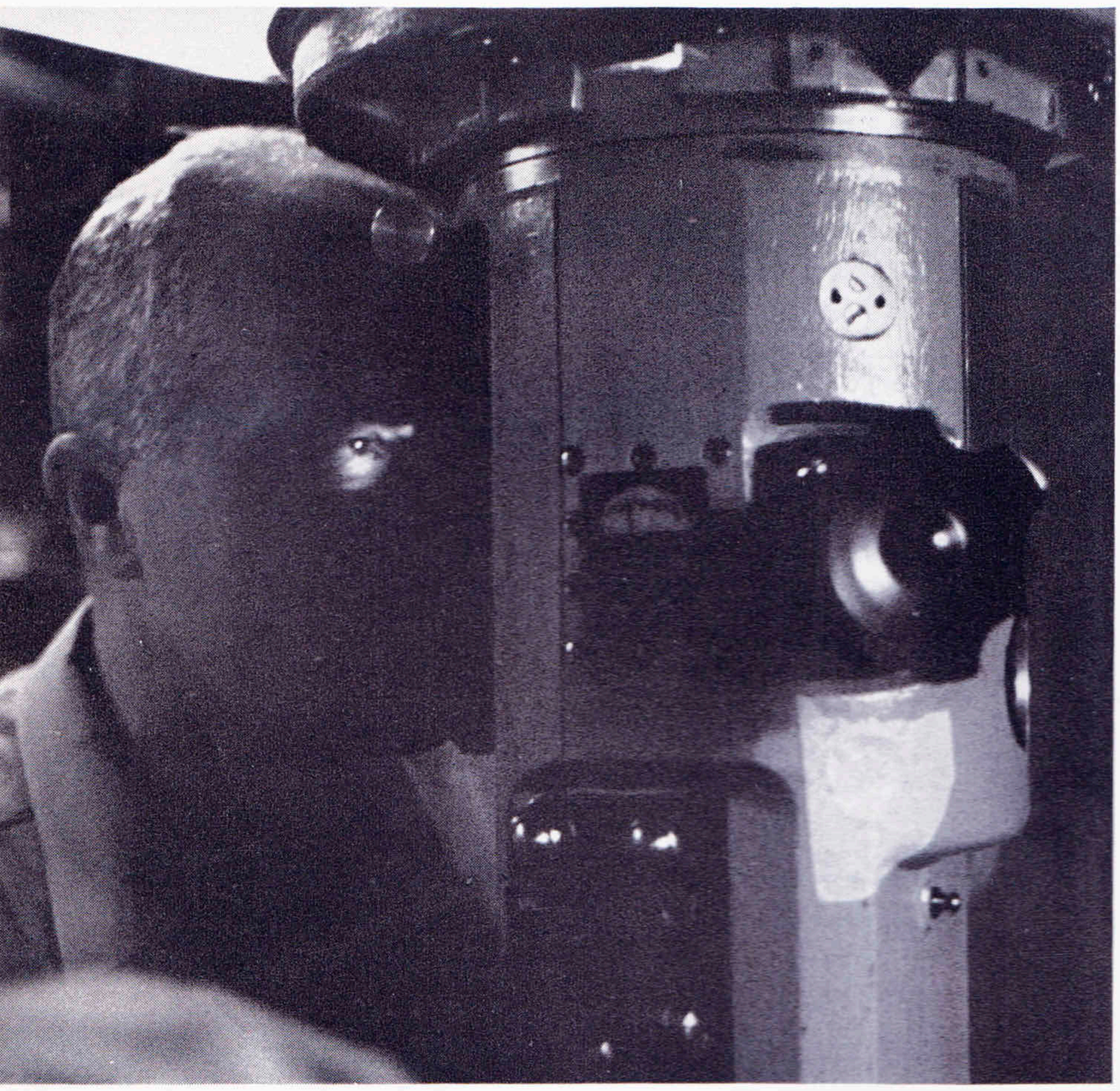
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At U.S.S. *Triton*'s periscope, Capt. Edward L. Beach sights a gaff-rigged merchantman, her decks laden with lumber, in Makassar Strait between Borneo and the Celebes.

A modern Magellan, Captain Beach this year wrote a new chapter in the epic of man against the sea when, running submerged, he conned *Triton* around the world.

After graduation from the United States Naval Academy in 1939, second in his class of 581, Beach saw duty aboard three submarines in the Pacific during World War II. Cited for extraordinary heroism and conspicuous gallantry, he earned the Navy Cross, two Silver Stars, and two Bronze Stars. Out of these experiences came his book *Submarine!* and the best-selling novel *Run Silent, Run Deep.* From 1953 to 1957 he served as naval aide to President Eisenhower. He took command of *Triton* when she was commissioned last November.

At the request of the Department of Defense, the National Geographic Society lent one of its crack photographers, Joseph Baylor Roberts, a commander in the U. S. Naval Reserve, to sail in *Triton* and record her epoch-making voyage.





Tall-masted survivor of the days

into the control room, where the executive officer, Lt. Comdr. Will M. Adams, grinned cheerfully: "Here we go at last!"

I thought, Yes—and we won't surface again for a quarter of a year.

The men were not yet aware of this. They simply knew that we were on our shakedown cruise, to weld ship and crew into a unit.

Traditionally, a shakedown cruise includes a stop at some pleasant foreign port such as Lisbon or Rio. But our crew had already had hints that we were in for a lot more than that. We had loaded 40 tons of food, including compressed turkey, the bones removed to save space and weight. Though income tax deadline was still two months off, the men had been advised to file their returns before leaving. We had also told them to renew their automobile license plates.

The second day out I requested the officer of the deck's permission to use the general announcing system. The ship gathered itself together in silence. I revealed the full extent of our mission, the contribution we were ex-

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HIGH SPEED EKTACHROME BY NATIONAL GEOGRAPHIC PHOTOGRAPHER J. BAYLOR ROBERTS © N.G.S.

of sail—photographed through the periscope of a nuclear submarine

pected to make to science, to the Navy's Polaris program, and to the prestige of the United States.

Whenever I paused, I had the feeling that a penny dropped anywhere in the ship would have sounded like a hammer blow on an anvil. Around the world without surfacing!

Lively discussions followed. Everyone suddenly realized the importance of the three scientists from the Navy Hydrographic Office and their gear, now installed in our combat information center; of Comdr. Joe Roberts, USNR, a veteran photographer recalled to active duty to record our voyage for the Navy and the National Geographic Society; and of Dr. Benjamin Weybrew, the psychologist from the Navy's Medical Research Laboratory of New London.

Dr. Weybrew needed 50 volunteers for an especially intriguing task. Every day he would collect confidential questionnaires from them, listing each man's rating of himself in 51 categories: from "Bored stiff" and "Homesick" and "Don't feel like eating," to "Energetic"

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Triton, on a Super Shakedown Cruise, Circles the Earth Under Water

Averaging 18 knots submerged, the U. S. Navy's longest, heaviest, and most complex submarine followed approximately the course charted by Ferdinand Magellan's expedition of 1519-22. With 184 officers and men, including half a dozen scientists and technicians, *Triton* sailed out of Groton, Connecticut, February 16, 1960. Eight days later, about 600 miles off the tip of Brazil, she reached St. Peter and St. Paul Rocks (page 591), which served as "home plate" for the around-the-world voyage.

From leave-taking to home-coming, the world's first twin-reactor submersible recorded a grand total of 41,814 statute miles in 84 days, 19 hours, 8 minutes. In girdling the globe, she logged 30,752 miles in 60 days, 21 hours. Magellan's expedition took three years. Never once did *Triton* ride atop the waves, but she twice broached —partly surfaced—once off Argentina to transfer an ill crewman to the cruiser *Macon*, and again off Spain to honor the country for which Magellan sailed. National Geographic cartographic artist William N. Palmstrom designed the illustrative maps that trace *Triton*'s voyage. Antarctica's icy fingers appear here in white.

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KODACHROME © NATIONAL GEOGRAPHIC SOCIETY

Forty tons of food, including 1,820 pounds of coffee, jammed every inch of usable space. Black-eyed peas appeared often on the menu, because—*Triton*'s skipper suspects—his executive officer hailed from Texas. These sailors stow sacks below forward torpedo tubes.

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and "Happy" and "Want action." Within an hour Dr. Weybrew had his quota.

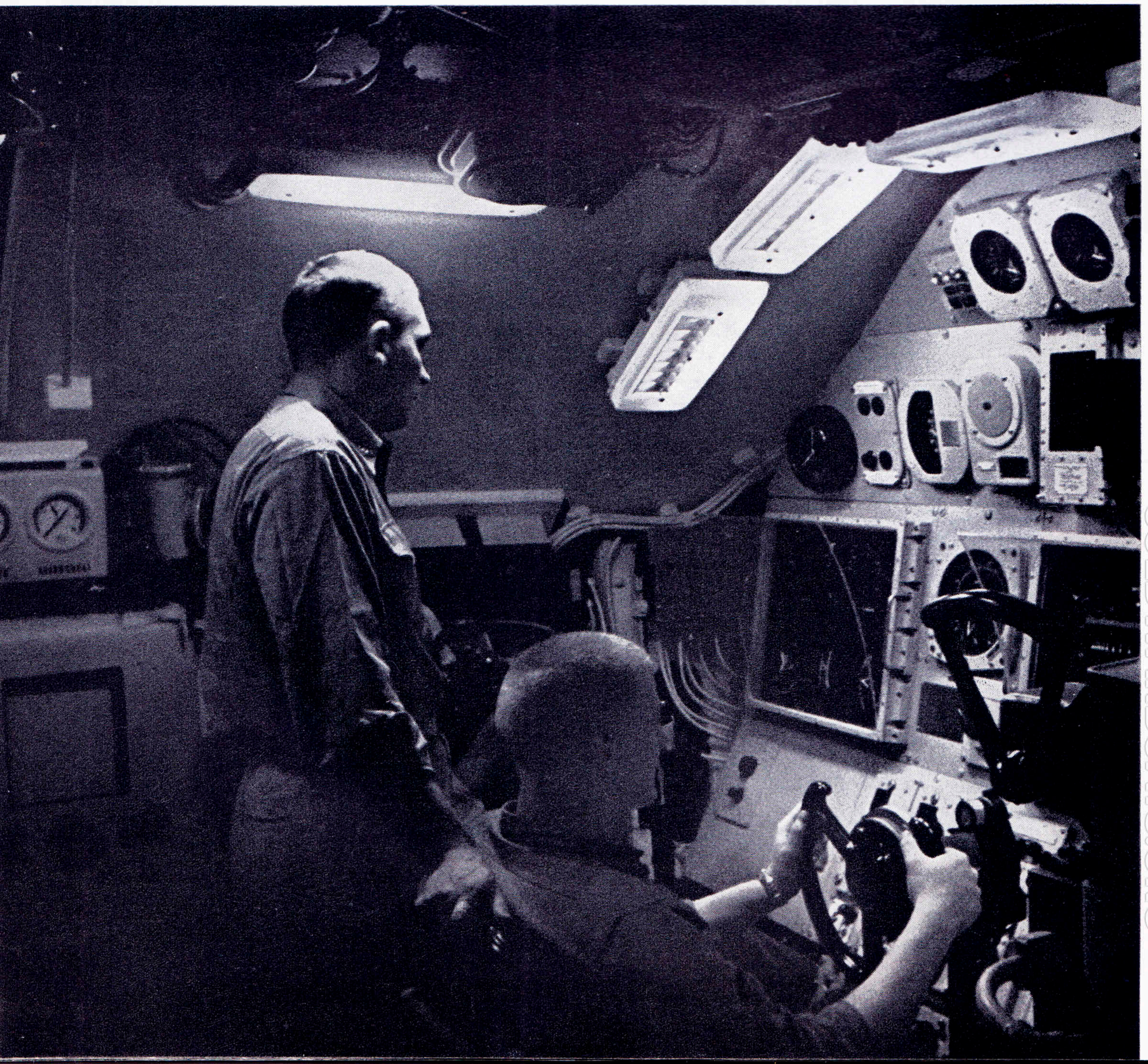
We traveled at varying depths. Our oceanographer, Nicholas Mabry, recorded temperature and salinity profiles from the surface to below 400 feet. Periodically we rose to periscope depth to listen for messages on the radio, to make our observations, and to revitalize our atmosphere without using our precious oxygen bottles.

All this necessarily slowed us down. Were *Triton* to make all the speed of which she is capable and at the same time raise her periscopes, masts, and antennas while submerged, they would be bent over and ruined, or snapped off where they emerge from the sail —the tower for periscopes and antennas.

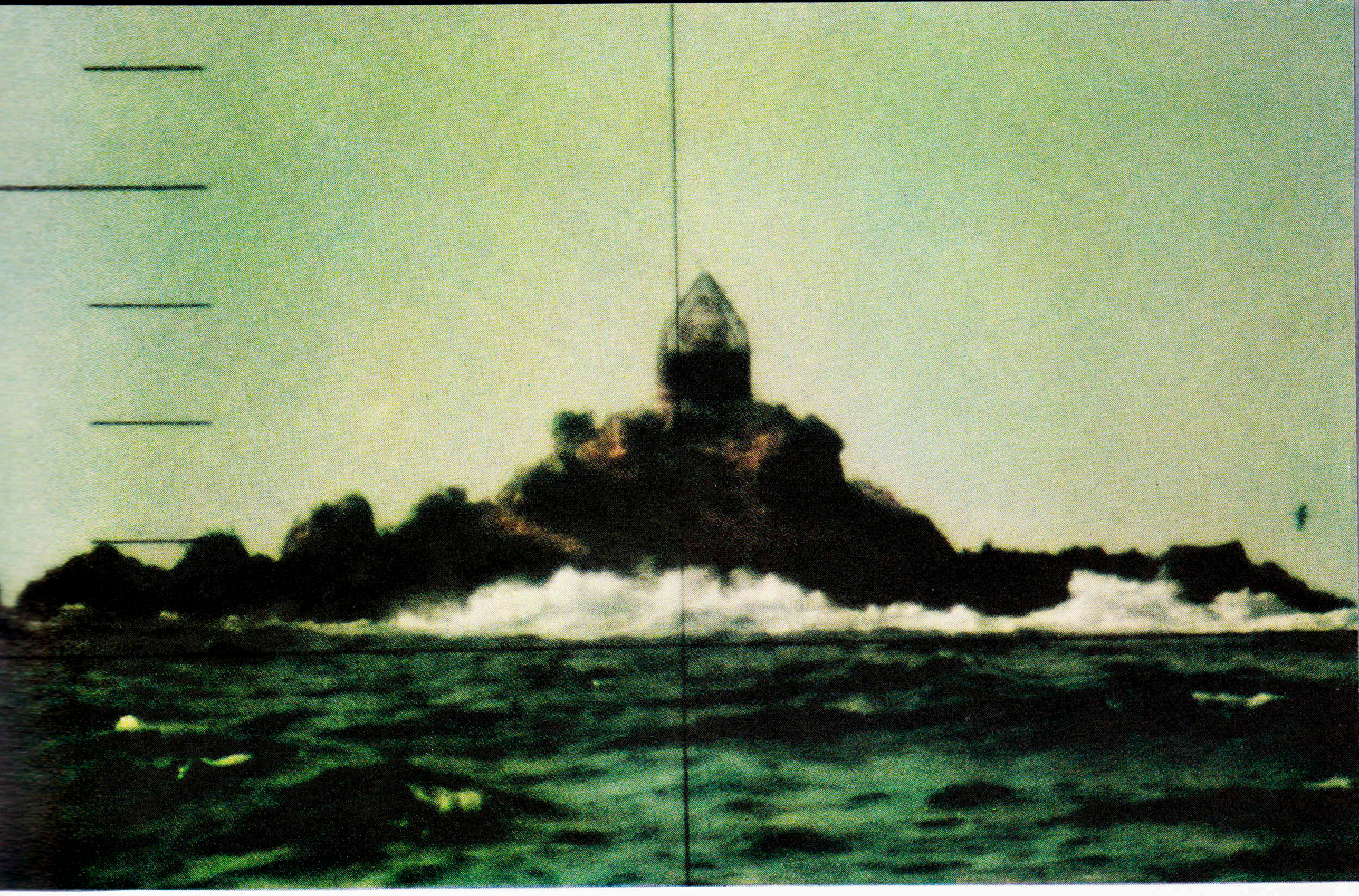
Coming to periscope depths takes time, too, because we must first listen cautiously, at slow speed, for fear of crashing into some innocent ship above. Thus our progress was a bit like that of a heavy truck on a highway —lickety-split on the straightaway (deeply submerged), much slower on the upgrades (to periscope depth).

On February 23, the depth recorder registered a 9,000-foot seamount, one of the two highest encountered on the voyage. And next day our enthusiasm reached a peak when we made our first landfall on St. Peter and St. Paul Rocks, off the coast of Brazil just north of the Equator. The "Rocks" are jagged peaks

Like airplane pilots, planesmen manipulate the diving and rudder controls. Chief of the watch checks gauges that register speed, course, and depth. *Triton*'s top speed is secret, but Captain Beach's log points out: "Almost with disbelief, we note what speed we are registering. And, looking at the various gauges of the propulsion equipment, we realize we have but scratched the surface of *Triton*'s real potential." A single charge of nuclear fuel about the size of a grapefruit sufficed for the entire run.



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HS EKTACHROME © NATIONAL GEOGRAPHIC SOCIETY

Abandoned lighthouse crowns one of the St. Peter and St. Paul Rocks, jagged tips of the Mid-Atlantic Ridge. "It looked," says the author, "like a damaged ship laboriously proceeding at slow speed." Periscope cross hairs center on crashing surf. Other lines help estimate range.

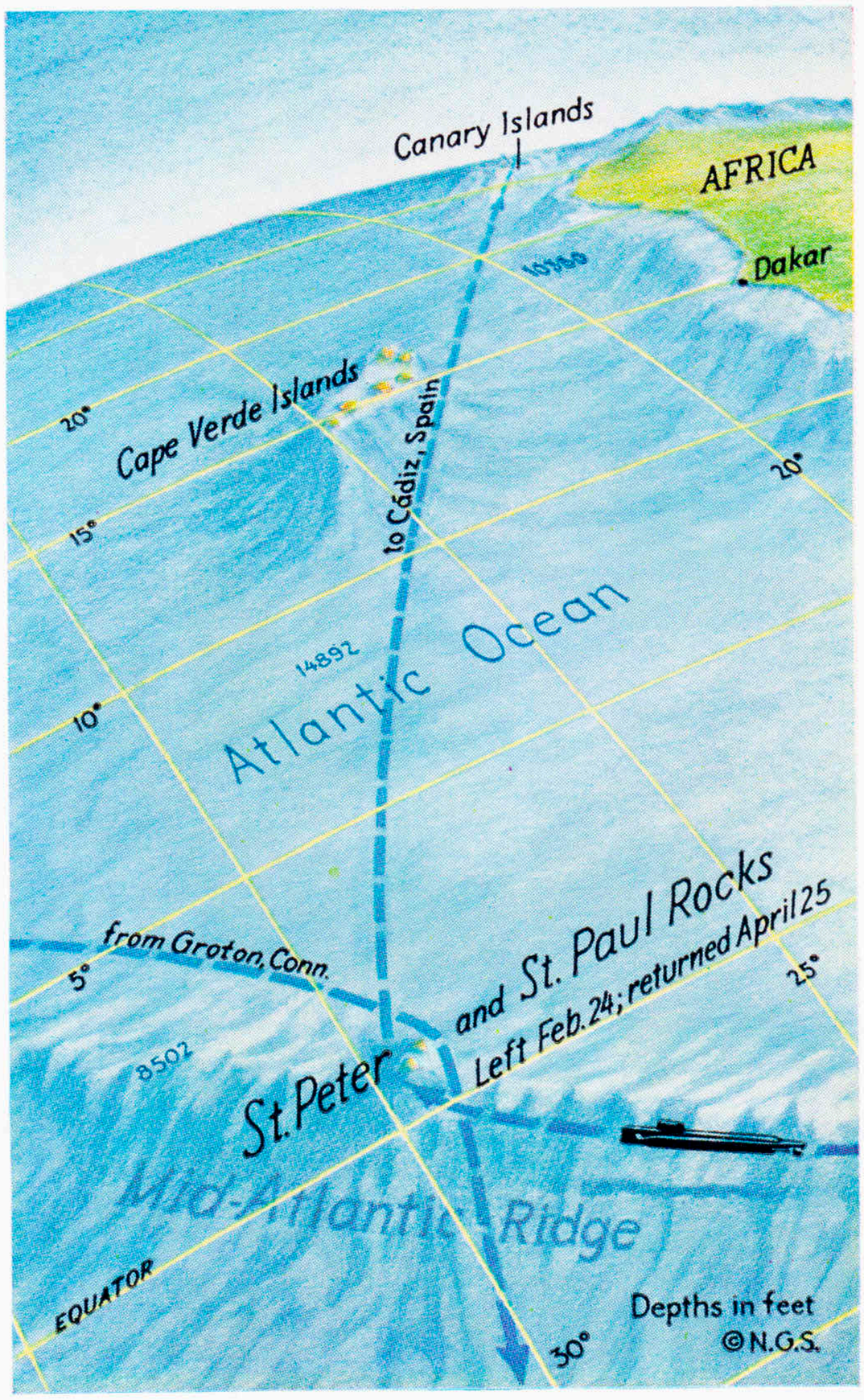
where the Mid-Atlantic Ridge rises above the surface. (See map on page 588, and the new 10-color Atlas Map **The World,** a supplement to this issue.)

We passed the Rocks to the eastward and set course for the Falkland Islands. The second long leg of the trip and the first leg of the submerged circumnavigation was now underway—and we were in for our first emergency.

On March 1, Chief Radarman John R. Poole suddenly developed a kidney-stone attack, and for the next three days my big worry was what to do about it. Poor Poole was often in extreme pain, and *Triton*'s doctor, Comdr. James E. Stark, kept him under heavy sedation during his attacks. Many kidney stones take care of themselves without surgical treatment, but not all. To give Poole proper medical care would require X-rays and other equipment that we did not have.

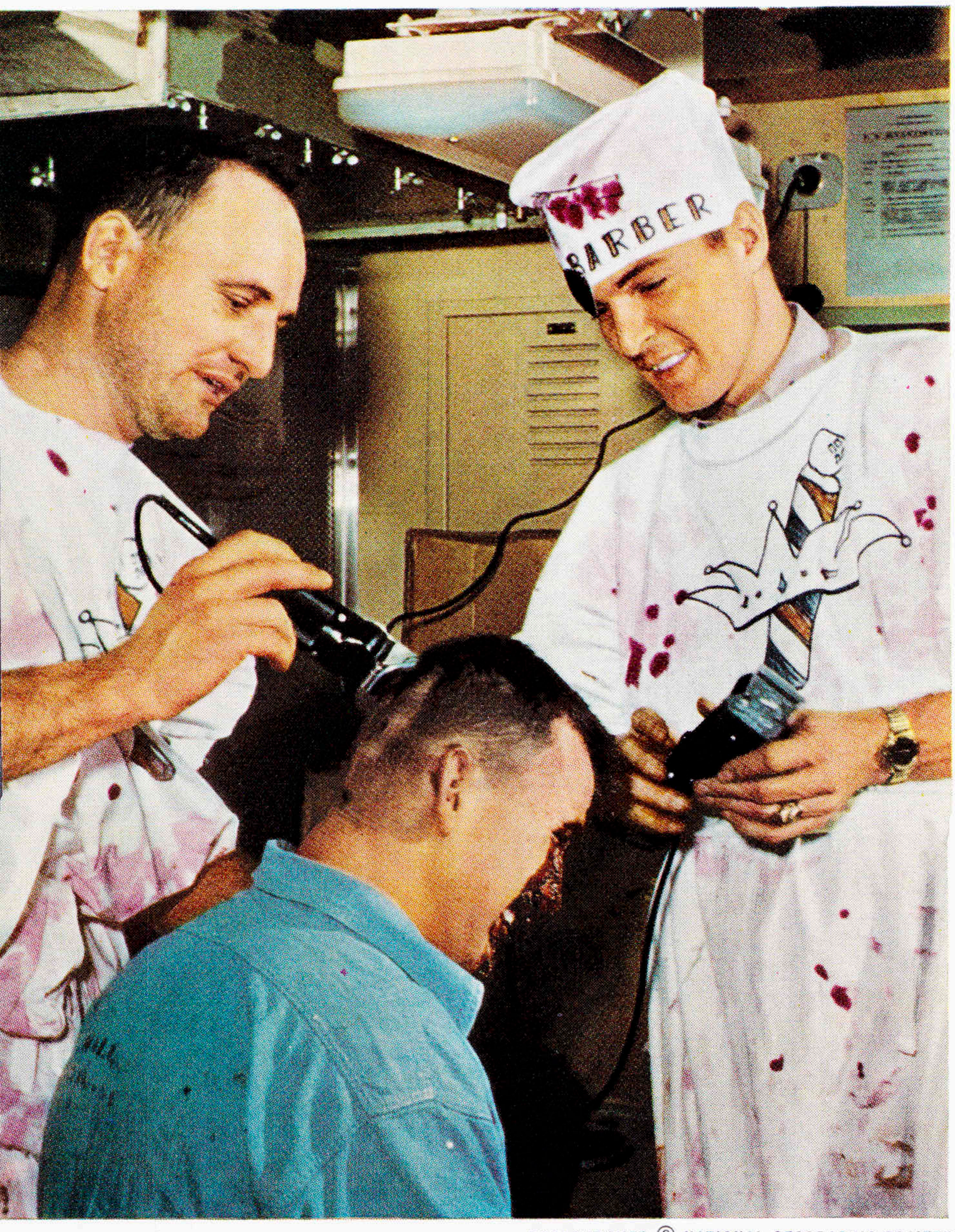
Captain Faces a Calculated Risk

As if a sick man were not enough to worry about, our echo sounder chose this time to lose sensitivity. Once clear of shallow water, surface ships seldom run their echo sounders, since they are rarely concerned with how deep the water is, provided it is known to be deep enough. But a deep-diving submarine can easily strike bottom on a seamount—like the one northwest of the Rocks—over which surface ships have passed in ignorance for centuries.



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Bearded King Neptune, his cigar-smoking queen, and hefty royal baby (right) take over *Triton* on the first of four Equator crossings. Captain Beach (center) gave Neptune free rein to punish lowly polliwogs—sailors crossing the Equator for the first time—who dared to enter the sea king's realm. As polliwogs knelt before the royal court, the queen broke out a water pistol to squirt the accused in the eye. Crew's mess hall served as a courtroom.

Triton takes its name from a large marine snail, and indirectly from the merman son of Poseidon, Neptune's Greek equivalent.

Royal barbers carve a groove in the hair of an oil-smeared polliwog. Bald-headed initiates got free toupees from hair swept off the floor and stuck fast with grease.

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KODACHROMES © NATIONAL GEOGRAPHIC SOCIETY

At our speed of 20 knots the impact could crumple our bow like an accordion.

Failure of an echo sounder is so rare that spares are not ordinarily carried. Should we lose ours for good, the cruise would be endangered. But giving up now is unthinkable. Here is the perfect example of the "calculated risk." We shall be calculating it from here on.

Luckily, Lt. Milton Rubb and his electronics technicians put the recalcitrant echo sounder in operation again within a day. A great weight lifts from my mind.

U. S. Cruiser Comes to the Rescue

All during the second of March we drive on toward Cape Horn, while Poole wrestles with his kidney stone and I wrestle with the problem of Poole.

On the morning of the third, with the Falkland Islands visible in our radarscopes, Poole has his fourth attack, by far the most severe. I finally decide to turn back.

The nearest place where help might be available is Montevideo, Uruguay, 1,100 miles north, where the cruiser *Macon* is visiting. We race toward Montevideo with all the furious energy of our twin nuclear plants.

There is only one place in this ship roomy enough for a sick man to have an attendant, and that's my bunk. Jim Stark moves Poole there and warns me before I make a visit: "You'll have trouble talking to him, he's so changed by pain and sedation."

All hands in the ship share the burden, as is customary among submarine crews. The whole tone of the ship lowers perceptibly and tension is evident in a hundred small ways. I catch many sober eyes turned in my direction. My slightest desire, whether for an extra cup of coffee or for some report, is carried out with even greater alacrity than before.

No one in *Triton* will ever forget the instant elevation of our spirits when at last a message assures us that *Macon* is sailing to meet us, and we decide that we can transfer Poole to one of her motor whaleboats without surfacing. Our shipmate will be safe. And our submerged cruise will not be broken after all.

On March 5, at two in the morning, *Macon* and *Triton* made rendezvous in the waters off Argentina; and at ten minutes to three we eased our conning-tower upper hatch out of water (page 595).

Everyone in the transfer party, including Jim Stark, was soaked by the water sweeping over the submerged main deck. Poole, bundled and swathed for protection against just this eventuality, stepped groggily from the arms of his shipmates into those of the *Macon*'s boat crew. We learned later that he recovered without an operation.

Now we could head again for Cape Horn, and once more *Triton*'s turbines roared. Compared to the 36,335 nautical miles now charted for the entire trip, our diversion to meet *Macon* looked small. But it was a pretty good run, about as far as from Newfoundland to the British Isles.

On March 7 *Triton* entered Estrecho de Le Maire, between Staten Island and Tierra del Fuego (map, page 596). Just before noon we at last sighted Cape Horn. I directed that all men aboard file up into the conning tower and look at this landmark, so important in our country's history. At 1408 we passed from the Atlantic to the Pacific Ocean.

The sea was unusually rough topside. We were safely submerged and comfortable enough, but our ship, even though 65 feet down, rolled from side to side.

"Imagine what this must have been like in the old clipper days," said Quartermaster Curtis K. Beacham, recently nicknamed Pappy. (I had summarily abolished his former nickname, which was Beach.)

"This is supposed to be good weather for Cape Horn, but the waves look about 12 feet high, the current is setting us back three knots to the east, and the wind comes at 25 knots from the west. What would a windjammer do in a real storm?" No wonder old-time sailors cursed this place!

Three Times Around the Horn

It was my first glimpse of Cape Horn. The promontory was bold and forbidding, like the sway-backed profile of some prehistoric sea monster (page 596). Partly overgrown with straggly vegetation, it was washed clean and undercut by the sea down low. The water, deep as we approached the Cape and deep on the far side, was quite shallow over the actual passage.

Our sole problem was that the ship had only two periscopes. To give everyone a chance, we went by the Cape twice more.

Why did we not follow Magellan's route in this instance and pass through the Strait of Magellan? This would have involved threading narrow Chilean waters. Permission would have had to be obtained, and, as I have said, our mission was secret.

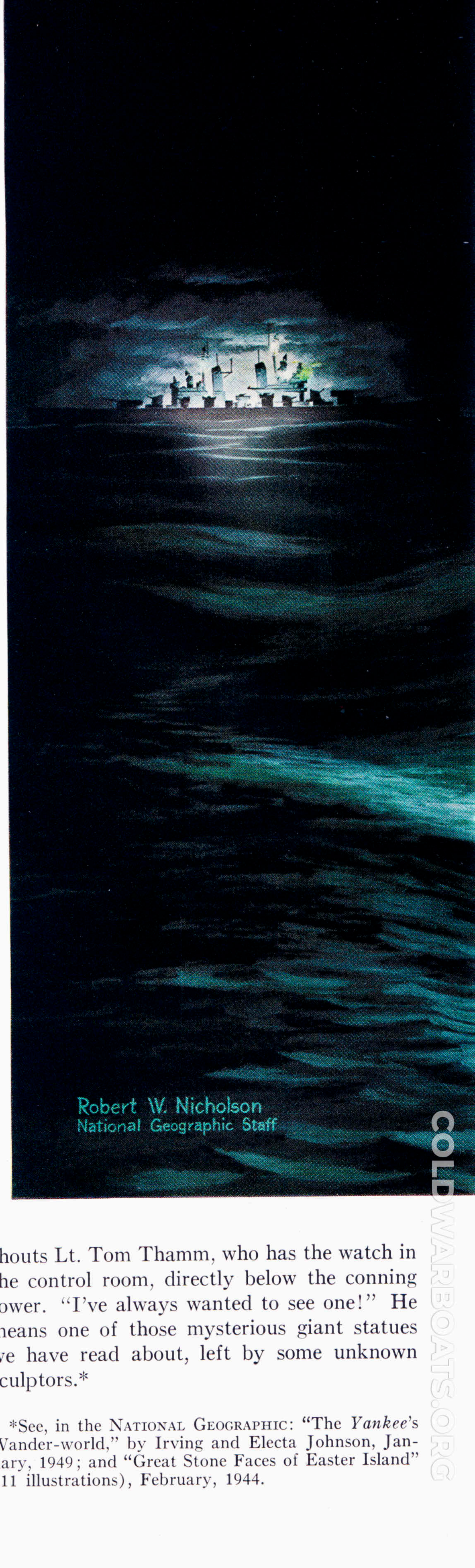
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In a Dramatic Night Rendezvous, *Triton* Transfers a Sick Crewman

As the submarine neared the Falkland Islands off South America, her medical officer informed Captain Beach that a sailor needed immediate hospitalization. Radioing the U.S.S. *Macon* in Montevideo harbor for assistance, the skipper swung about and raced north at maximum speed submerged. The two ships met off Argentina at 2 a.m. March 5.

Staff artist Nicholson, working from eyewitness accounts, depicts *Macon* standing off as her rescue party in a motor whaleboat comes alongside the submarine. *Triton* lifts her sail high enough to open the conning-tower hatch. Captain Beach, on the bridge, directs operations, while a crewman beams a light on the sea-washed deck. Members of the line-handling party, in life jackets and safety rigs, ring their ill shipmate, bareheaded Chief Radarman J. R. Poole, who is bundled in protective clothing.

Minutes later *Macon* flashed the welcome message: "Poole safely on board."



Early in the morning of March 13, as we near Easter Island, 2,900 miles northwest of Cape Horn, our sonar equipment picks up a submerged peak, previously unknown. Its highest point reaches within a few hundred fathoms of our hull. Evidently it is a part of the geological formation that created Easter Island, itself rising 1,969 feet above the surface of the sea.

"Monkey" Works for Scientist

This great undersea feature also is detected by geophysicist Mike Smalet and his "monkey in a cage"—a metal box about a foot square, suspended from gimbals in a big wire framework to keep it steady.

"It's a very sensitive sea gravity meter," Mike tells curious crewmen. "It measures the varying pull of gravity as we go along. If you've got to do such measurements at sea, a submerged submarine is best because it gives you a good, steady platform, not affected by surface conditions. Besides, you don't get seasick."

Mike's gravity survey will eventually help the Navy to place electronic navigation aids in remote areas, but right now his equipment has a more immediate utility: When we approach a land mass, the device records increased gravity values.

We come to periscope depth for Easter Island. "Find me one of those big stone heads!" shouts Lt. Tom Thamm, who has the watch in the control room, directly below the conning tower. "I've always wanted to see one!" He means one of those mysterious giant statues we have read about, left by some unknown sculptors.*

*See, in the NATIONAL GEOGRAPHIC: "The *Yankee*'s Wander-world," by Irving and Electa Johnson, January, 1949; and "Great Stone Faces of Easter Island" (11 illustrations), February, 1944.

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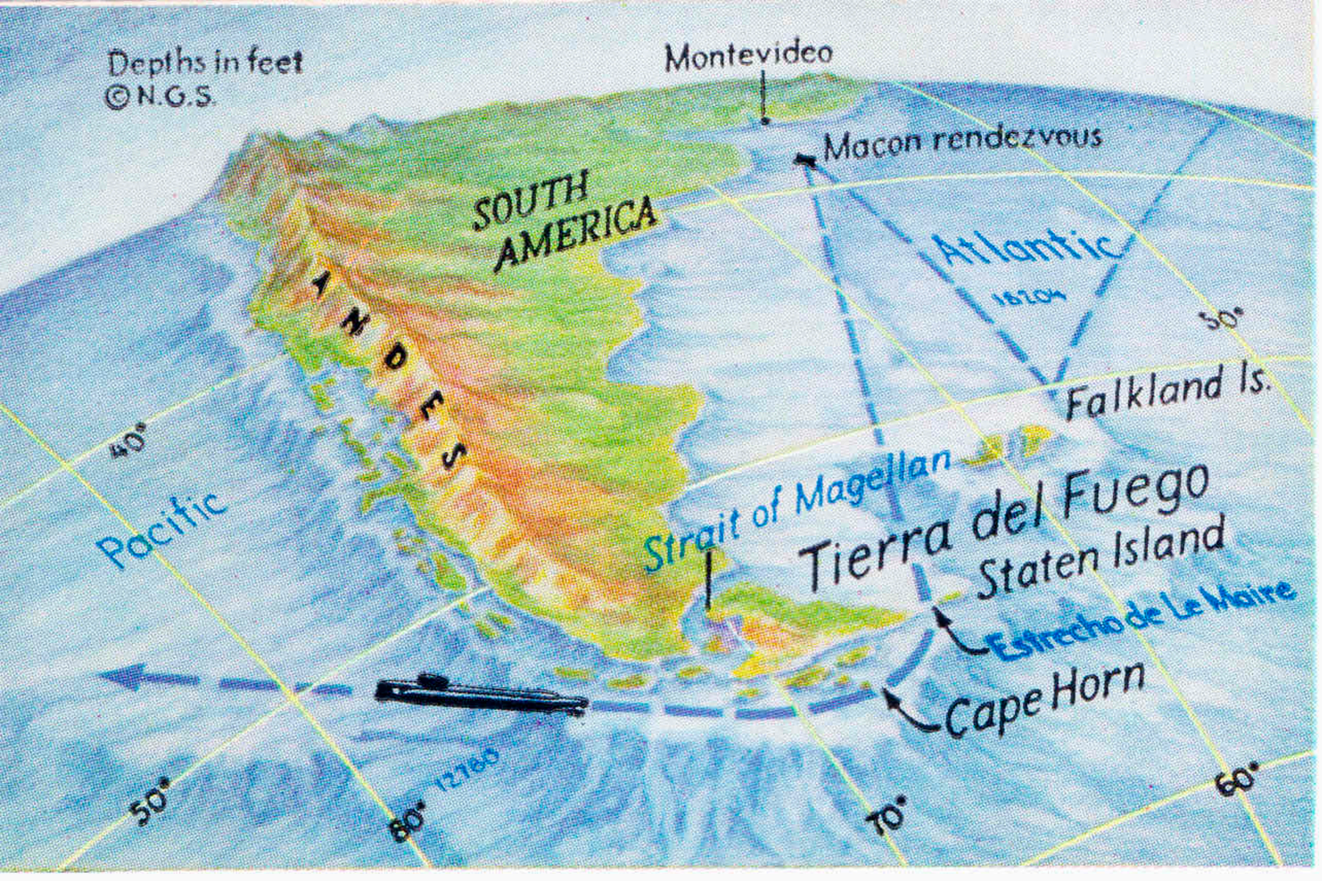
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I search and vaguely discern vertical shapes amid the rolling hills. But they look more like trees. Then the morning sun glints in orange and crimson on a huge piece of angular volcanic rock. My imagination fills in the details.

Word passes through the ship that anyone wishing to see the statue had better come to the conning tower. We call it "periscope liberty."

From now on, the trip across the Pacific becomes a long, almost interminable journey. Deeply submerged most of the time, staying out of the sight and ken of man, 8,000 tons of nuclear warship teeming with activity passes unnoticed from one end of the Pacific to the other.

What keeps us occupied? We work a 12-hour day—eight hours of watch, and then training, because carrying your weight on this



Map shows 2,200-mile dog-leg *Triton* took to meet *Macon*. Resuming course, the submarine sailed west of the Falklands, rounded the tip of South America, and passed into the Pacific.

Radarscope in the combat information center shows mountainous Cape Horn clear and bright.

Periscope view reveals rain squalls and 10- to 12-foot waves kicked up by 25-knot winds.

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ship means a lot more than knowing your job alone.

Everybody must know as much as he can about the next man's job, too; you'll find an electronics technician or a cook making his way the length of the ship, up and down our three decks, periodically looking up from a blueprint. He's "walking pipe"—perhaps tracing out the 400-pound air system amid our 86 miles of pipe and thousands of valves.

This system supplies air under 400 pounds of pressure per square inch to the internal salvage air valves, one on each side of our 10 bulkheads. If a compartment should be flooded, we would use air to force out the water. The man on the spot might be a cook.

Other men attend classes in English, French, Spanish, mathematics, or civics at *Triton*'s "College of Undersea Knowledge."

Commissaryman Ramon Baney, one of our five cooks, tools a leather holster for his Western-style six gun. Electronics Technician Martin Docker paints a New England seascape. Seaman Jim Smith models a head of the Chief of the Ship, Chester R. Fitzjarrald, in green clay.

Electrician's Mate Richard Brown and Torpedoman's Mate Tom Schwartz assemble plastic models of cars and planes—without the plastic cement that came in the kit.

This is significant. No plastic cement may be used while the ship is submerged, no paint or lacquer. These materials contain chemical solvents which in small quantities are harmless in a well-ventilated ship. But they could be toxic if allowed to accumulate in our closed-off atmosphere, along with the carbon dioxide we breathe out, and the odorless carbon monoxide caused by smoking, hydrogen generated by the batteries, and the Freon-12 gas that sometimes leaks from our air-conditioning system.

Germs Lose Grip on *Triton*'s Crew

To cope with all this, we have filters, air-regeneration machinery, and four corpsmen under Commander Stark, an experienced physician with a master's degree in radiation biology. Aside from Poole's kidney stones, there has been little sickness aboard. Living closely together as we do, everybody quickly gets everybody else's cold, but after a couple of weeks we are immune to our own germs. Thus Jim Stark's main business is health physics and atmosphere control: to see that our air is wholesome and to monitor nuclear-radiation levels with compact Geiger counters and other instruments.

"You might actually receive less radiation here than if you stayed home," he says. "Our reactors are well shielded, and deep in the water we get less radiation from cosmic rays than we would on the surface. Water itself is an excellent shield."

Lighted "Candles" Give Off Oxygen

Jim Stark and his crew help in highly important detective work. They sample the air with foot-long vacuum cleaners, whose filters pick up tiny particles for laboratory examination ashore later. We want to know precisely what floats around here, how much, and is it toxic? How can it affect men? Where does it come from? How can it be controlled?

For extra oxygen, we carry one of the Navy's newest marvels: chunky black "candles," combining powdered iron and sodium chlorate. If we light them, they will give off oxygen, not consume it.

We have plenty of fresh water. In contrast to World War II submarines that used electricity, *Triton* has steam evaporators. These can distill thousands of gallons a day, enough for unrestricted use by all hands.

As we crossed the Pacific, attendance at our submerged Sunday services in the crew's mess increased. It was perhaps natural that this ocean should evoke, for submariners, so many thoughts of the past and the hereafter.

On March 27 we passed due north of the spot where our namesake, U.S.S. *Triton I*, was lost in action in 1943. It was her sixth combat patrol. Three Japanese destroyers attacked with depth charges. I was a few miles away, as engineering officer on the submarine U.S.S. *Trigger I*, and remember those explosions now, distant but angry. Somebody, we realized, was taking a beating.

We held a memorial service for *Triton I*. A ship on the surface would fire a salute, with guns. This we could not do. But it occurred to us that the only salute we could fire was one the people of the old *Triton* would best have appreciated.

With the crew at attention, the forward torpedo tubes were discharged three times in rapid succession. We heard the echo of the water ram—a slug of water which in our newest submarines ejects the torpedo from the tube, leaving no telltale air bubbles. We

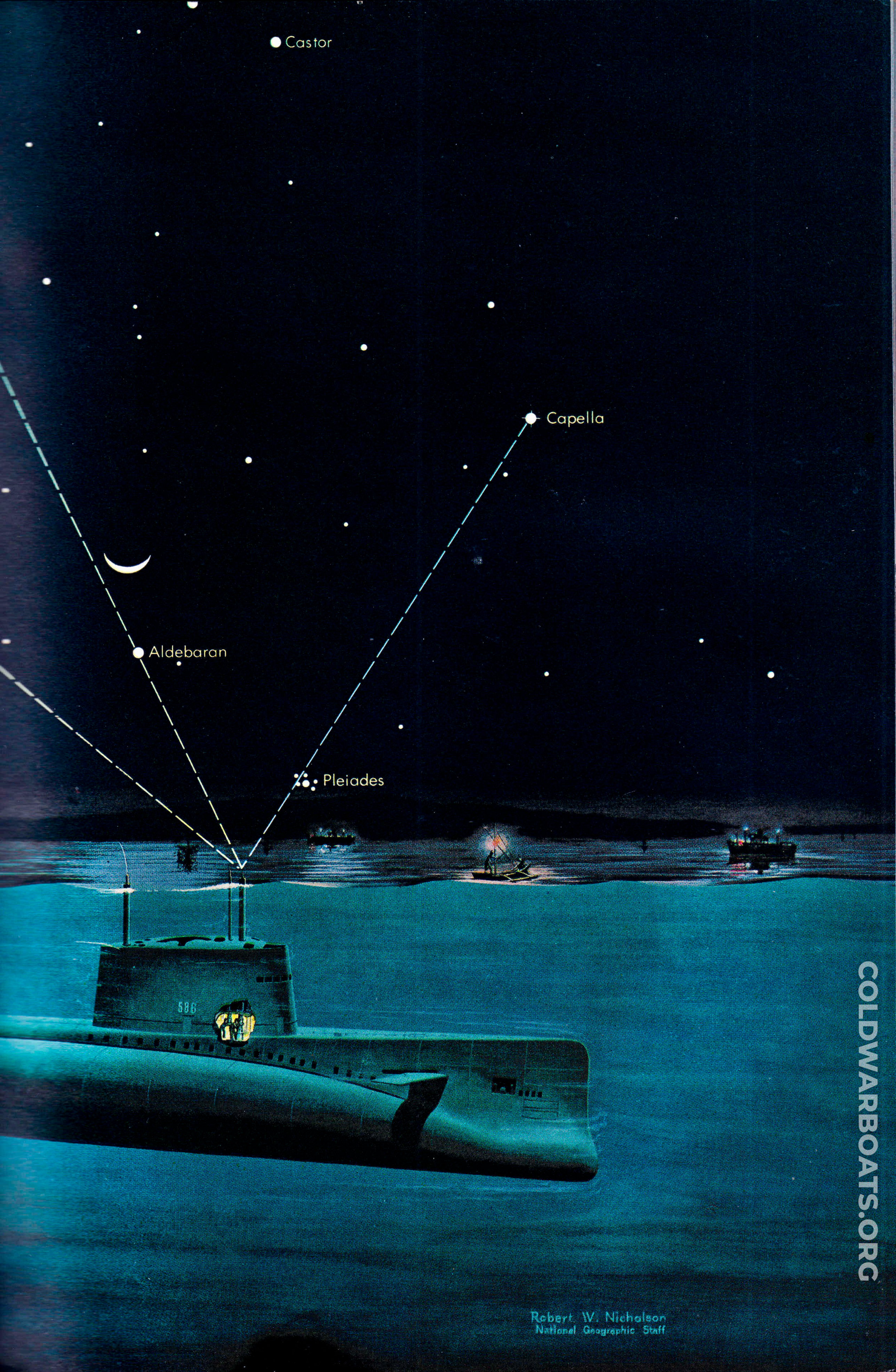
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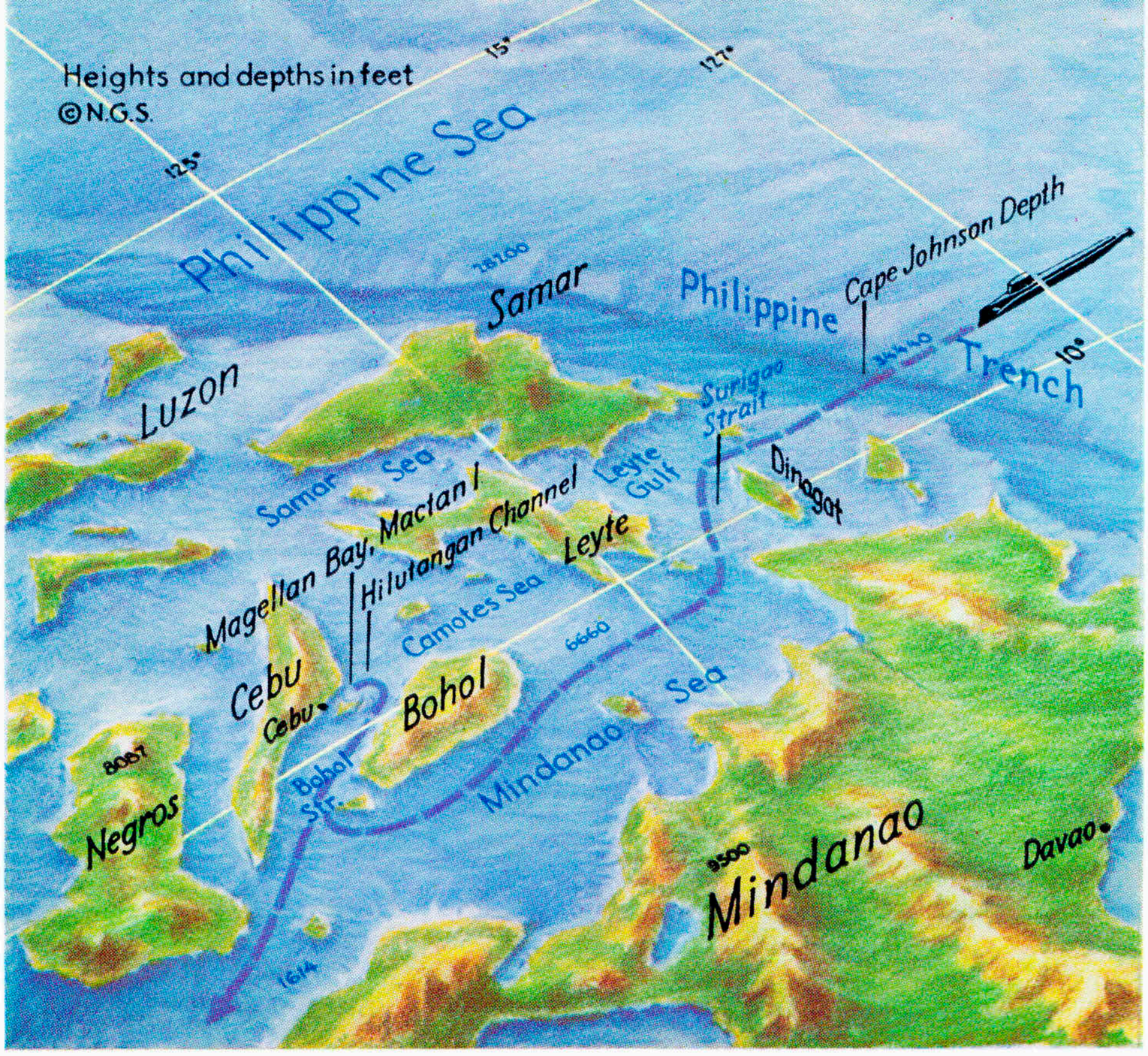
Running by dead reckoning, *Triton* glides silently beneath brightly lit fishing boats and interisland freighters in Bohol Strait, the Philippines. To check position, the ship utilizes all her senses. Sonar shows bottom topography. Periodically the submarine rises to periscope depth, and navigators crowd the conning tower to observe shore lights and landmarks. Setting the scope on previously computed bearings and altitudes, they mark the bright stars as they appear. The "fix" confirms *Triton*'s remarkably accurate dead-reckoning course.

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Robert W. Nicholson
National Geographic Staff

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***Triton*'s track** led across the Philippine Trench and through Surigao Strait, graveyard of Japanese warships sunk in World War II. Crossing the Mindanao Sea, the submarine turned north through Bohol Strait (page 598) and Hilutangan Channel (below) and reached Magellan Bay on the north shore of tiny Mactan. Here Ferdinand Magellan died April 27, 1521, at the hands of native warriors.

Using periscope and probing with instruments, *Triton* makes a slow passage up Hilutangan Channel. Her echo-ranging sonar flashes a picture of the waterway's shape, as illustrated by the artist's cutaway. The visual repeater, the sonarscope in the conning tower, clearly defines the depth of the channel and warns of coral reefs near shore. Later *Triton* returned down the channel, using instruments alone. The monument to Magellan, on Mactan Island, was sighted through the periscope.

felt the fluctuation of air pressure on our ear drums. Then sounded the clear notes of taps.

We sighted Guam on March 28 and headed for the village of Agat, where one of our crew, Edward C. Carbullido, had been born. Carbullido's service spans 14 years and he has never been back to Guam. But he has sent virtually all his money home to help build a new house for his parents and to pay college tuition for his younger brothers and sisters.

"Pass the word, Carbullido to the conning tower!"

Carbullido scrambles up, beaming. Chief Quartermaster Bill Marshall asks, "Captain, how about shooting him out through a torpedo tube?"

"Negative," I say. "He might scratch the paint."

Carbullido happily takes over one of our periscopes.

Cars drive on the road along the water. My only worry is that somebody may spot us. People ashore rarely look to sea, however. We stay in Agat Bay long enough for Carbullido to get a close look.

"Many more people," he says, "so many more houses. There's my father's house! I know it from the pictures he sent me."

When we finally turn *Triton* west and Carbullido disappears down the ladder into the control room, there is a lump in everyone's throat. Fourteen years away, and now so near—and so far!

Periscope Picks Up Suspicious Lights

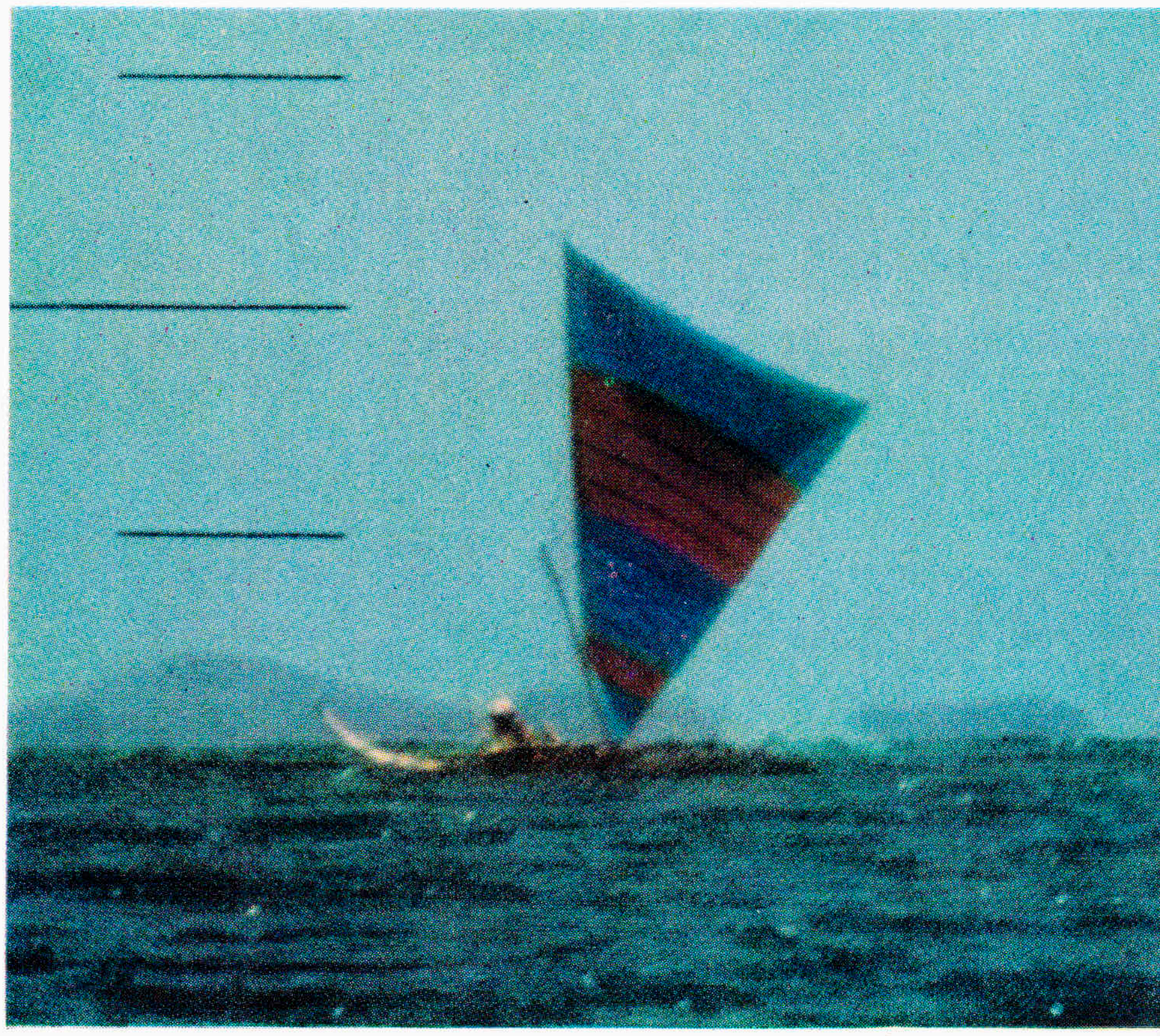
Late that night, while ventilating, we spotted what we believed to be an aircraft flashing red and green lights and apparently closing in. We dived immediately.

The following evening those lights followed us again. Had we been detected? Had our routine been figured out?

We became even more cautious with our periscopes, taking only short observations and spacing them out, in case the plane had a particularly sensitive radar. The bearing of the plane appeared constant.

"Let's check the star charts," someone muttered, and all at once it hit me. I ran the periscope all the way up and left it there.

In a moment, sure enough, Marshall reported from the chartroom below: "Arcturus



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

Skimming before the wind, a high-prowed Philippine boat shows its striped triangular sail to the periscope's eye. To avoid hitting such craft, Captain Beach made frequent observations while navigating Hilutangan Channel. This view catches a hazy glimpse of mountainous Bohol Island.

bears 070 at this time of night, at the altitude we have sighted the aircraft." Furthermore, Arcturus is known to have a red glow occasionally. Our red and green lights were the results of refraction through the spray and dampness of our periscope lens.

On March 31 *Triton* crossed the fantastically deep chasm in the ocean bottom known as the Philippine Trench and entered Surigao Strait, site of a dramatic naval engagement of World War II. Here America's battle force, crushed into the mud of Pearl Harbor, had its turn at destiny.

Vengeance is not a pretty word. But U. S. Navy men exult in the salvos of hot armor-piercing shells those old battleships—the *California, Tennessee, Maryland, Mississippi, West Virginia,* and *Pennsylvania*—hurled upon the Japanese fleet they had caught in confined waters. Of these U. S. ships, all but the *Mississippi* had been at Pearl Harbor; three had been damaged and two sunk.

Here we took more than our usual number of water samples—with the thought that we might send some to Adm. Jesse B. Oldendorf, now retired. He commanded U. S. forces at the Battle of Surigao Strait. Perhaps he will detect some Japanese rust in that water.

Among the islands forming the northern

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PHOTOGRAPHED THROUGH TRITON'S PERISCOPE BY J. BAYLOR ROBERTS

Terrified fisherman thought *Triton* a sea monster

WHEN CAPTAIN BEACH raised periscope in Magellan Bay, he found himself looking into the eyes of the Filipino fisherman above. Although he did not realize it, the canoeist was the sole unauthorized person to detect *Triton* during her round-the-world voyage.

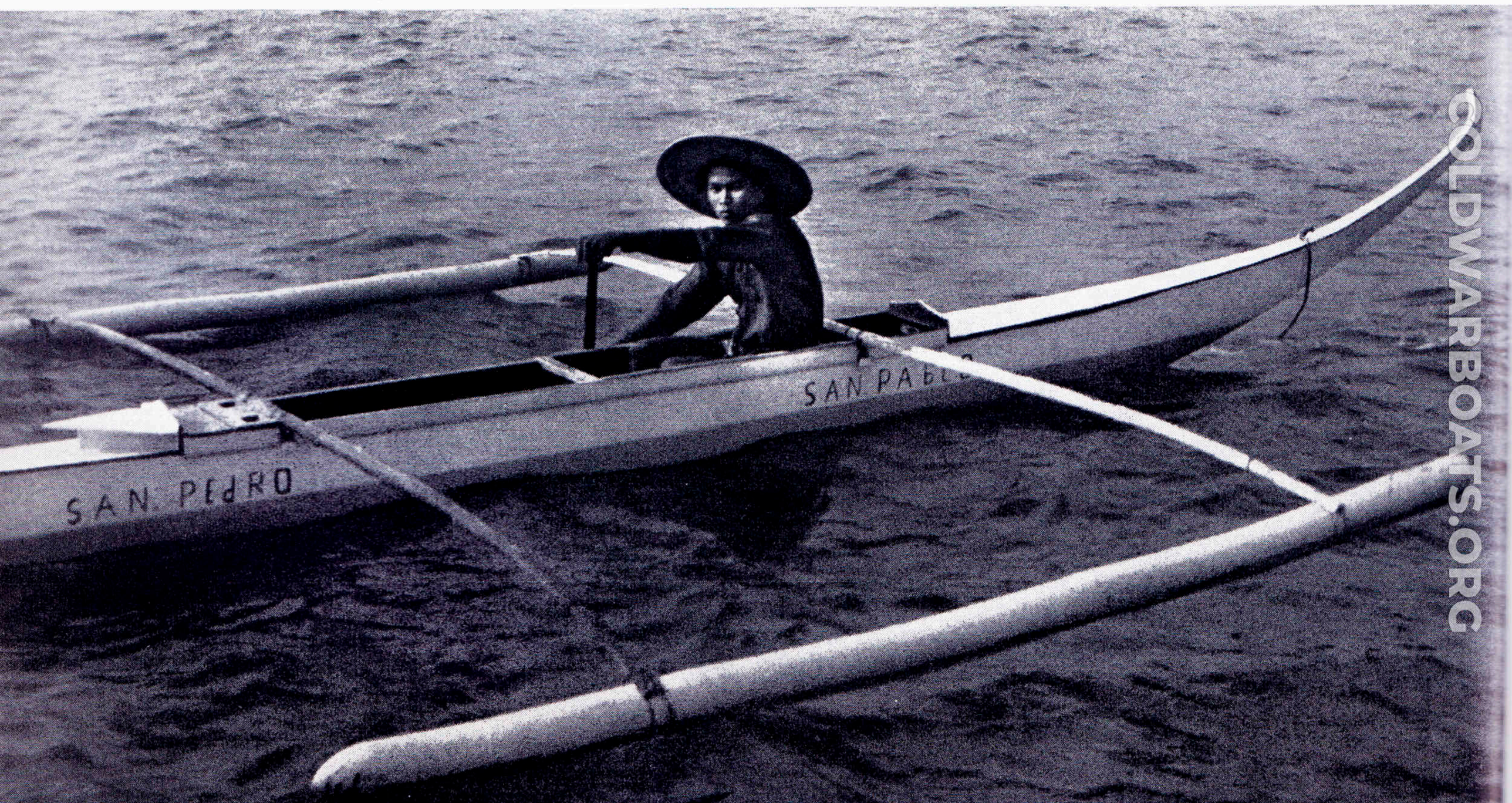
With only the periscope picture and Captain Beach's description (opposite page) as a guide, the NATIONAL GEOGRAPHIC undertook to find and interview the fisherman through a Society member, Edson H. Canova, of Cebu City. Finally came the triumphant cable: "Have found needle in haystack." At Punta Engaño on Mactan Island, Mr. Canova had located and identified the fisherman as 19-year-old Rufino Baring.

When the periscope appeared, the youth recalled, he first thought it was a piece of wood. Then, seeing its wake, he wondered if it might be the fin of a fish. As the periscope dipped beneath the surface, he decided that his eyes were playing tricks. When it suddenly reappeared, Baring imagined he was sharing the bay with a sea monster.

"I was very frightened," he said. "I tried to get away as fast as I could." Baring never looked back as he paddled for home, and he concealed the incident from his family, though he later confided it to a friend. His last trace of dread vanished only when Mr. Canova told him what he had really seen.

Putting on the clothes he wore the day of his encounter, Baring climbed into his freshly painted *banca* for the portrait below. To protect the craft from further meetings with sea monsters, he had added the names of saints. By coincidence, he chose the apostles who gave their names to St. Peter and St. Paul Rocks, the Atlantic outcropping where *Triton* began and ended her circumnavigation.

EDSON H. CANOVA



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boundary of the Mindanao Sea are Bohol and Cebu. Between them Bohol Strait extends northward to the tiny island of Mactan, where Magellan fought a skirmish with natives and was killed (map, page 600).

This part of our trip was a pilgrimage. In darkness, we turned north into heavily traveled Bohol Strait to work our way up the channel toward Mactan.

We ran deep as we headed northward, our sonar picking out the channel for us, probing ahead for ships. Twice, when heavier-than-normal screw noises were heard, we came to periscope depth and saw the brightly lighted decks of coastal steamers proceeding southward. After daybreak we also saw log sailing rafts—an easy means of getting newly cut trees across Bohol Strait. A log tripod covered with tree branches stood at one end, a sweep or steering oar at the other. Usually only one figure could be seen, presumably the capitalist who would dismantle and sell his craft at the trip's destination.

After we entered the Hilutangan Channel—between Mactan Island on the west side and smaller islands on the east—we saw fishing and pleasure boats too, the latter carrying colorful and artistic sails (page 601).

A curious sight was a decrepit ferry powered by an old one-lung steam engine with a tall stack extending up through the large awning that covered the entire craft. It carried a number of people, but the only one looking in our direction was a young woman with a child on her lap. The other passengers and the steersman looked toward Cebu, their destination. She faced us directly, so close that I thought she might spot our periscope. But she seemed lost in her thoughts.

Magellan Bay, in northern Mactan, was the place we had come so far to find. On its shores we sighted a monument to the Portuguese navigator and explorer who dreamed so greatly and here lost all (page 614).

Periscope Meets Canoeman Eye to Eye

The placid waters of Magellan Bay contained its quota of small boats, also—and just before noon, as described in the log:

"Upon raising the periscope, I am looking right into the eyes of a young man in a small canoe, close alongside. Perhaps he has detected the dark bulk of our hull in the relatively clear waters of the bay, or he may have sighted our periscope earlier.

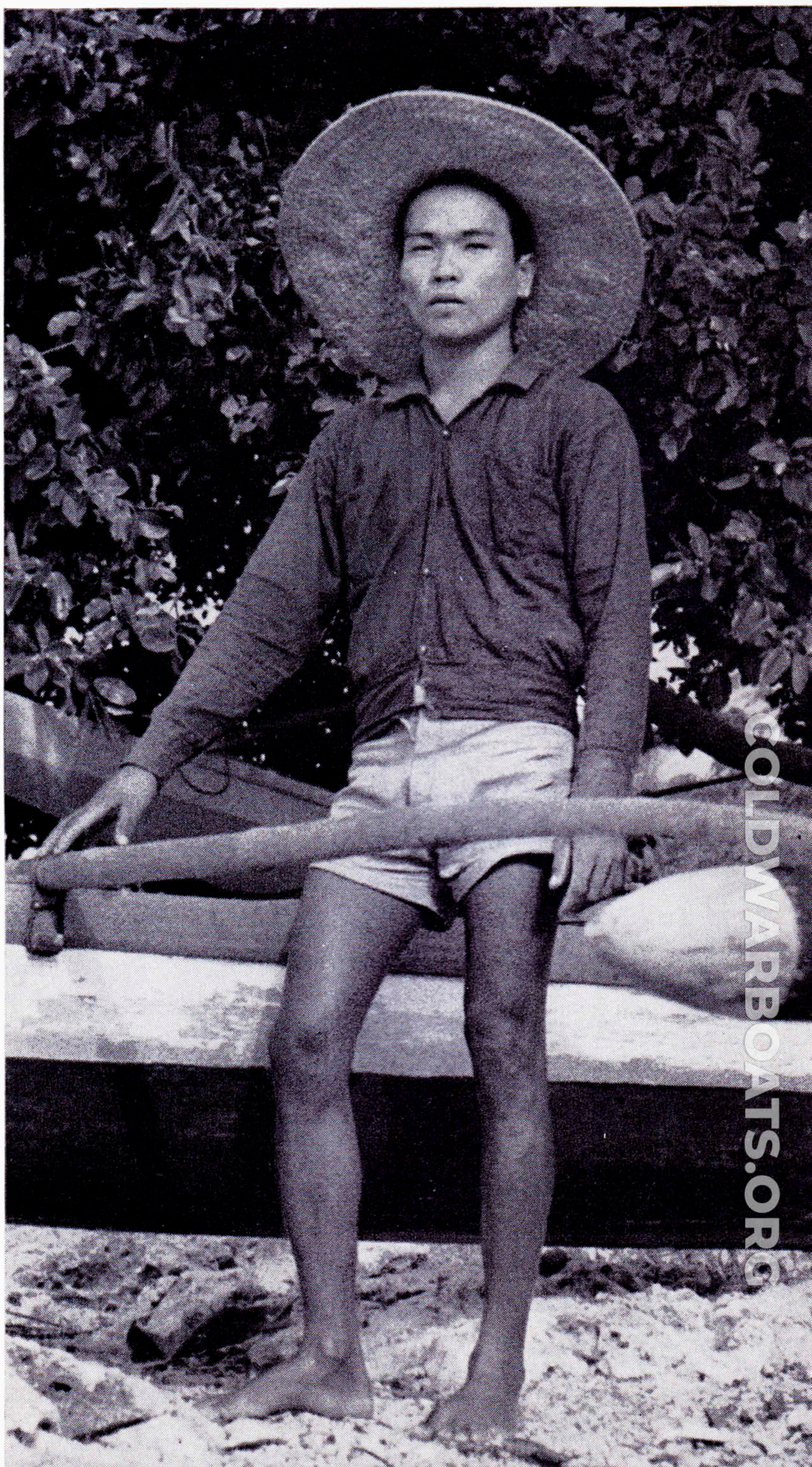
"He and I study each other gravely. His boat is a small outrigger, perhaps 12 feet long, innocent of any paint and without mast or sail (*which is why he got so close in on us*). He has a paddle with which he easily maintains a position abeam of us at our present slow speed. He looks ahead and looks behind, looks down in the water and maintains position about 25 yards abeam with occasional muscular sweeps of his paddle [opposite].

"Our friend is a dark-complected, moon-faced young man with a well-fed physique. His clothing is tattered, and he wears some kind of a battered hat for protection from the sun."

"Down periscope!" The bright steel tube slides down into its well as I describe the scene above to the people in the conning tower.

Right man, wrong expression. "After we made sure that Baring was the fisherman we sought," writes correspondent Canova, "we showed him his photograph [opposite] taken from the 'sea monster.' What I wouldn't give for a picture of Baring's face! Unfortunately, we were in his dimly lit *nipa* house, and I had no flash."

EDSON H. CANOVA



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A few seconds later I motion for the scope to be raised once more. Sure enough, there is our friend, impassively leaning on his gunwales and staring right at the periscope as it rises barely two inches out of the water.

It is a ludicrous situation: On the one hand an impassive Asian, staring with curious concentration at an unusual object in the water; on the other hand, a U. S. Navy officer, equipped with all the technical devices money and science can procure, looking back with equally studied concentration. On one end of the periscope, an outrigger canoe propelled by the brawny arms of its builder; on the other end, a $100,000,000 submarine, the newest, biggest, most powerful in the world, on a history-making cruise.

What an abyss—what centuries of scientific development—lie between him and me!

"All ahead two-thirds, right full rudder!" I snap up the periscope handles as a signal to start it down. *Triton* slips neatly ahead and away. A few minutes later, slowing for another look, I spot our friend many hundreds of yards away, paddling rather strongly in the opposite direction.

Ship Plunges in a Watery Downdraft

Back in the Hilutangan Channel, we ran 150 feet deep at 10 knots, relying entirely on our highly developed sonar—a feat no ship would have attempted a few years ago. Once clear and in Bohol Strait, *Triton* further increased depth and speed and raced out into the Sulu Sea.

Well before noon the next day we reached Pearl Bank Passage, a narrow and tricky spot (map, page 608). Fortune smiled: A good-sized freighter was heading for the same point. We swung a wide circle to allow him to catch up, and kept throttled well back to stay astern. With him for a guide, the passage was easy.

Three days later, after traversing the Celebes Sea and Makassar Strait, we approached Lombok Strait. I recalled what our wartime operations orders had said about this spot. "A most hazardous passage because of unusual currents and strange variations in water density." Many a submariner has extraordinary tales to tell of this passage.

The view was spectacular, with cloud-shrouded mountains on either side of the strait. We favored the island of Bali, to the west, although we could see no more of it than terraced hillsides on the steep sides of a volcano.

Shortly after noon we sighted a ridge of water up ahead, several feet high. A few minutes later *Triton* slipped a few inches below periscope depth, blinding me.

"I'll have her back up in a moment, Captain," Lt. Jim Hay, diving officer of the watch, announced confidently.

But no. First gradually and then rapidly, the depth gauges spun around. *Triton* was falling. At last a surge of increased speed pulled us out.

I cut short Jim's crestfallen attempt at explanation. "Now we know what those old-timers were talking about," I said.

Analysis of the data later revealed that at this point the deep and colder waters of the Indian Ocean met the shallower, warmer waters of Lombok Strait with tumultuous vertical currents. We had never been in real difficulty. But we could imagine the serious position of a diesel-electric submarine hazarding this passage with low batteries.

Turbine Makes Music for Crewman

Triton entered the Indian Ocean on April 5 and set a great-circle course for the Cape of Good Hope (map, page 588). The ship was steady as a church, as solid and as quiet.

But not to everyone. Electrician Raymond Comeau, for example, heard a whole symphony of sounds. Young Comeau bunked in the aft torpedo room, only a few feet from our right screw, and his usual watch was at the right turbine throttle. He confided to his diary:

"When you have time on your hands, it doesn't mean that you are bored; you think of all sorts of things. How does the turbine feel? After a while the noise becomes a

All hands worked a 12-hour day. As *Triton* approached a landfall, Captain Beach conferred with his operations and executive officers in the wardroom (upper right).

Painted bottles (center row, left) were ejected to aid the study of ocean currents. A slip in each bottle requested the finder to note position and date and to report to the U. S. Navy's Hydrographic Office in Washington, D. C.

Electronic instruments (right)

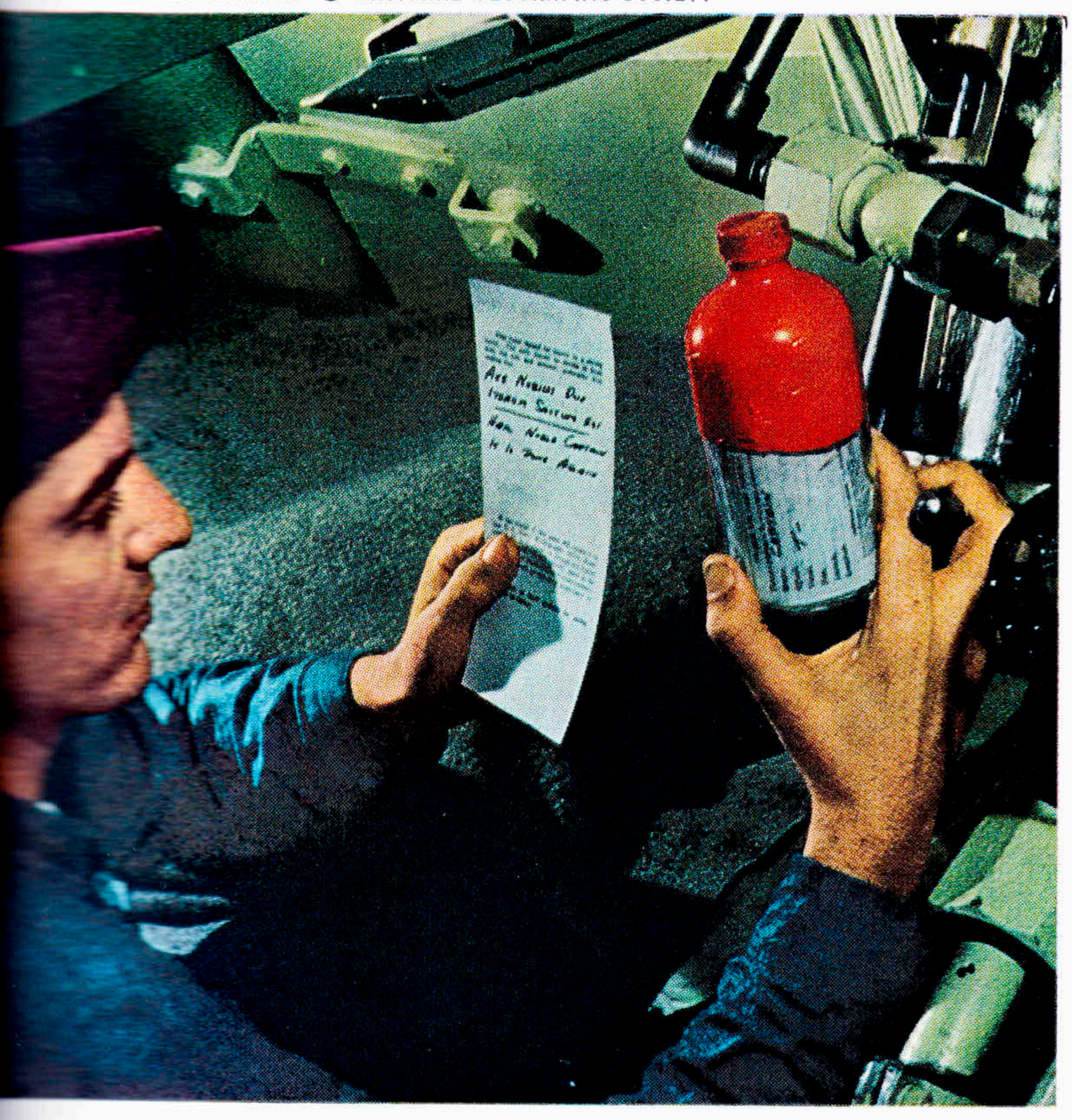
measured the ocean floor for a precise chart along *Triton*'s track.

Nucleonics laboratory (lower left) developed and checked the crew's film badges once a month to determine whether any man had endured excess radiation.

Ship's cook concocted a crew-sized cake to surprise the skipper. Summoned with a false report of trouble, Captain Beach was greeted by popping flash bulbs and a raucous "Happy birthday!"



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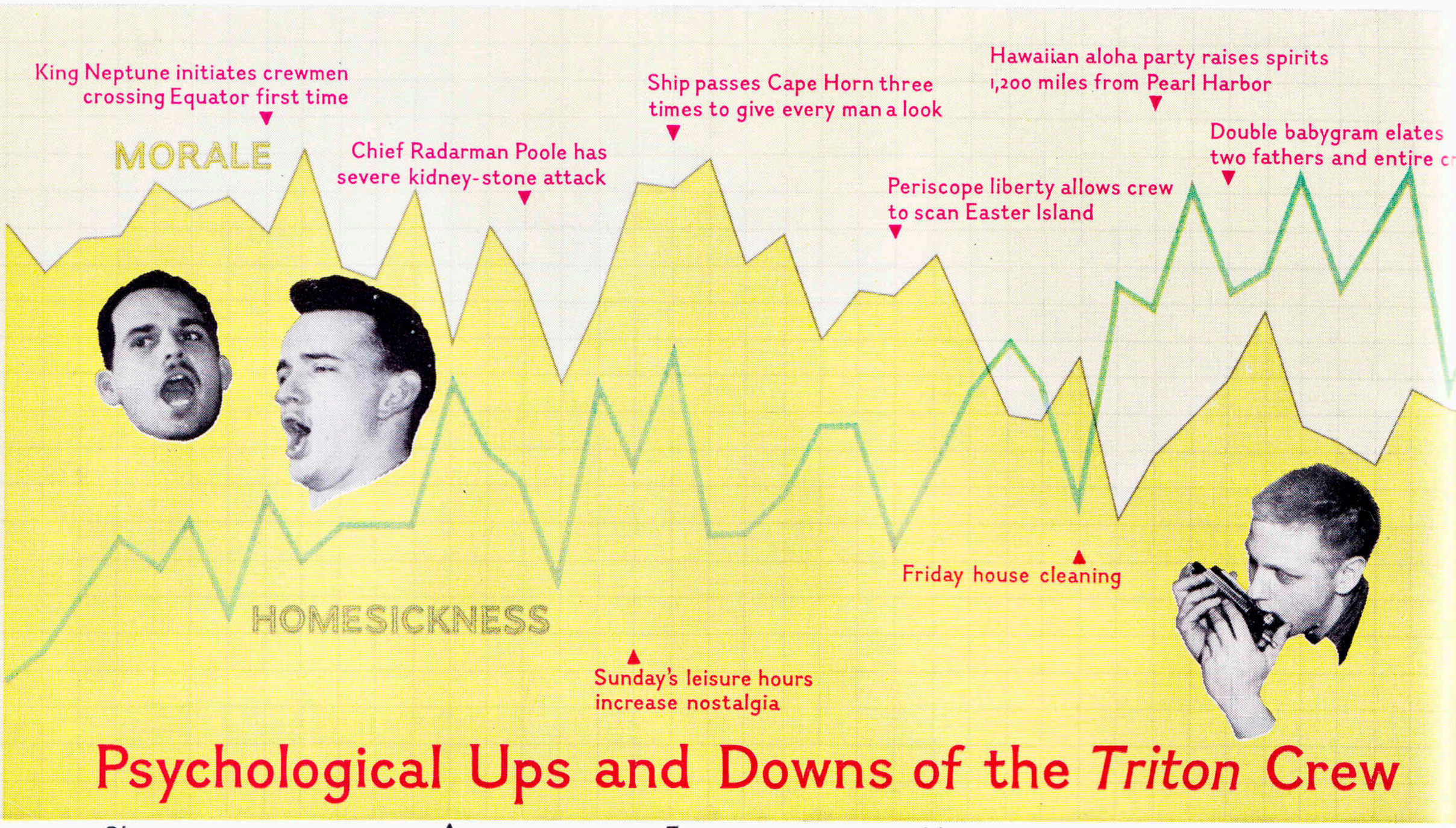








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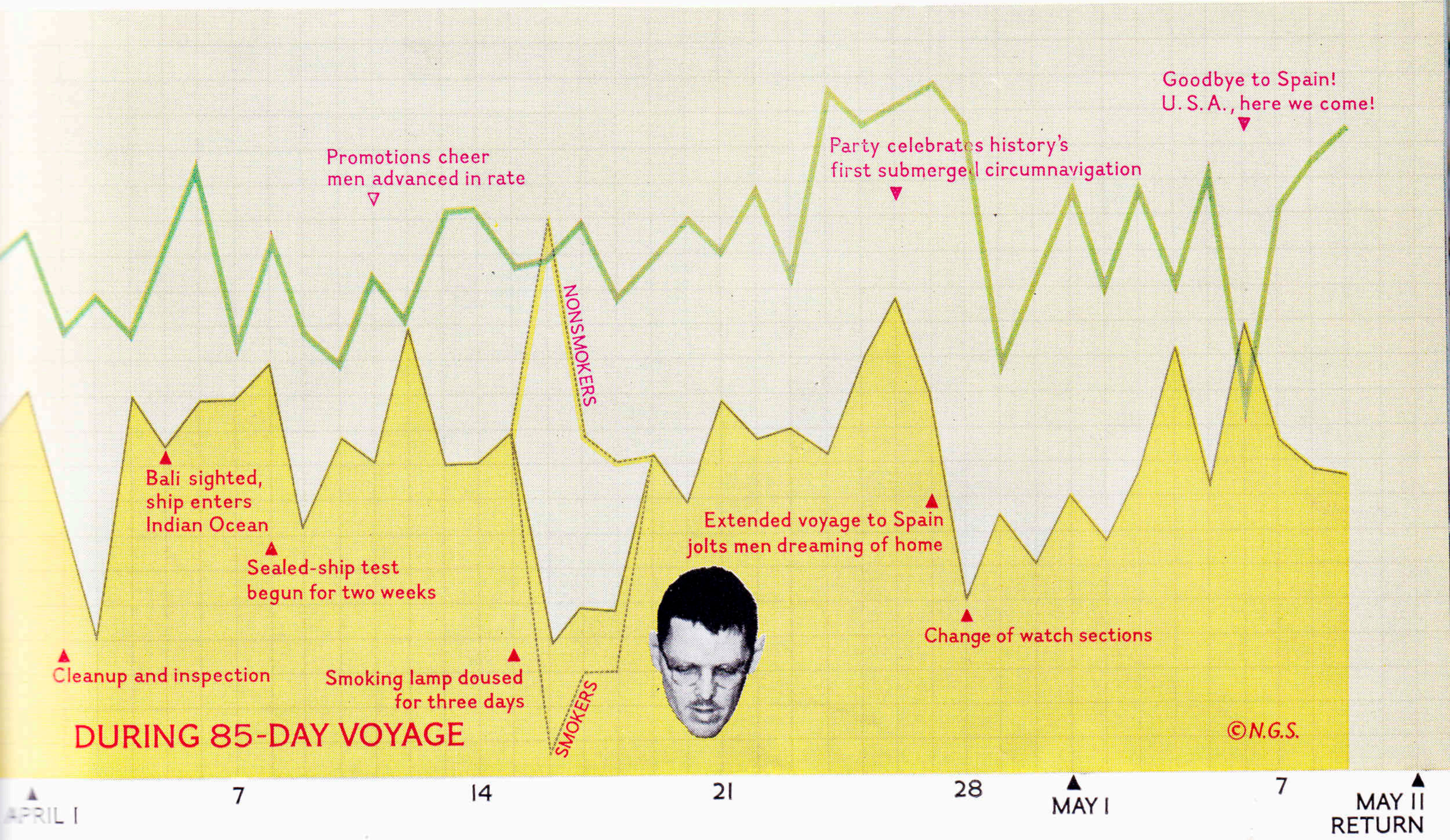
"Fireroom Four" and an Aloha Party Combat Boredom and Boost Morale

"Babygrams" announcing the birth of a child lifted crew spirits, but a three-day ban on smoking produced mixed reactions in the morale graph above. Navy psychologist Dr. Benjamin Wey-





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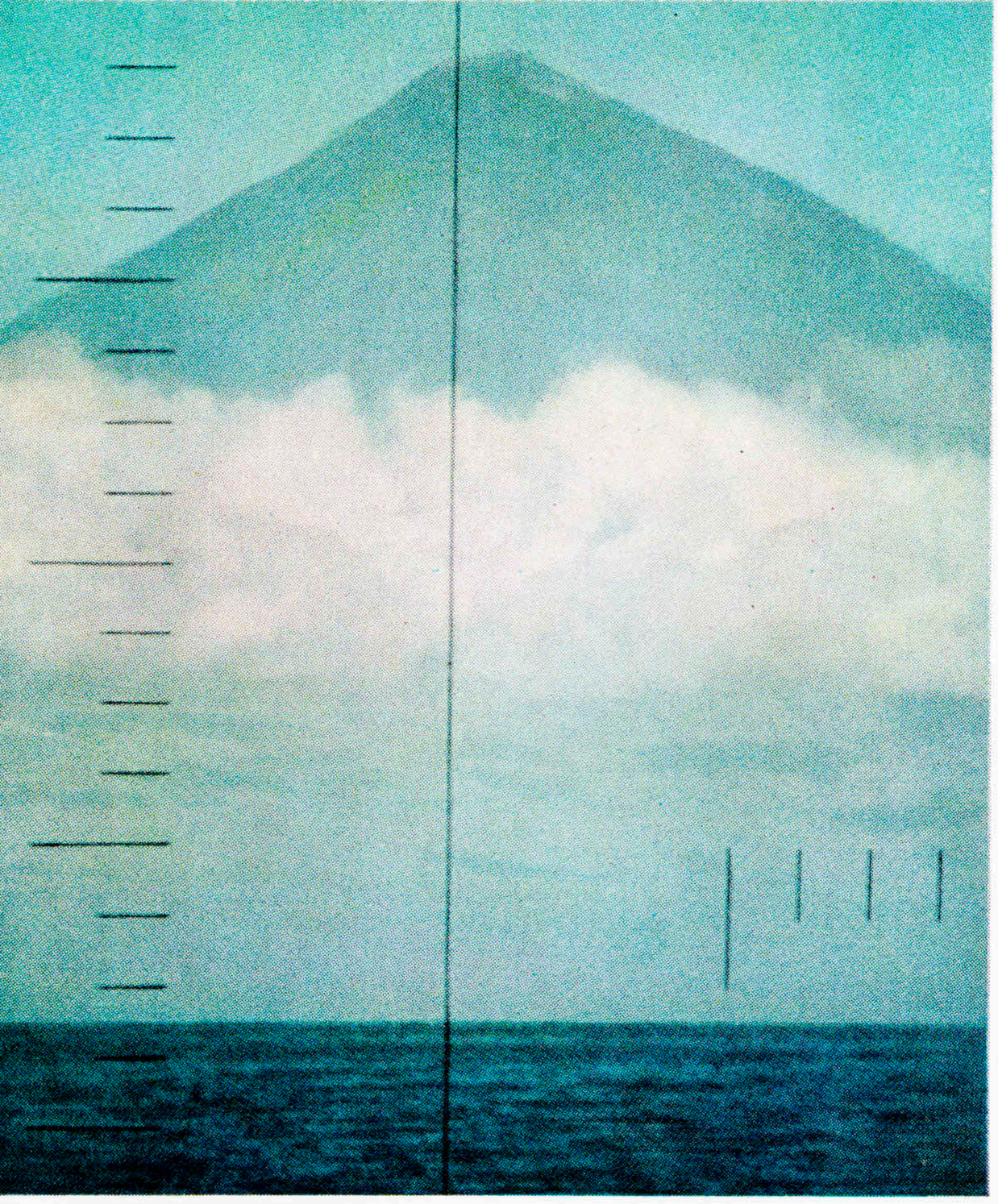


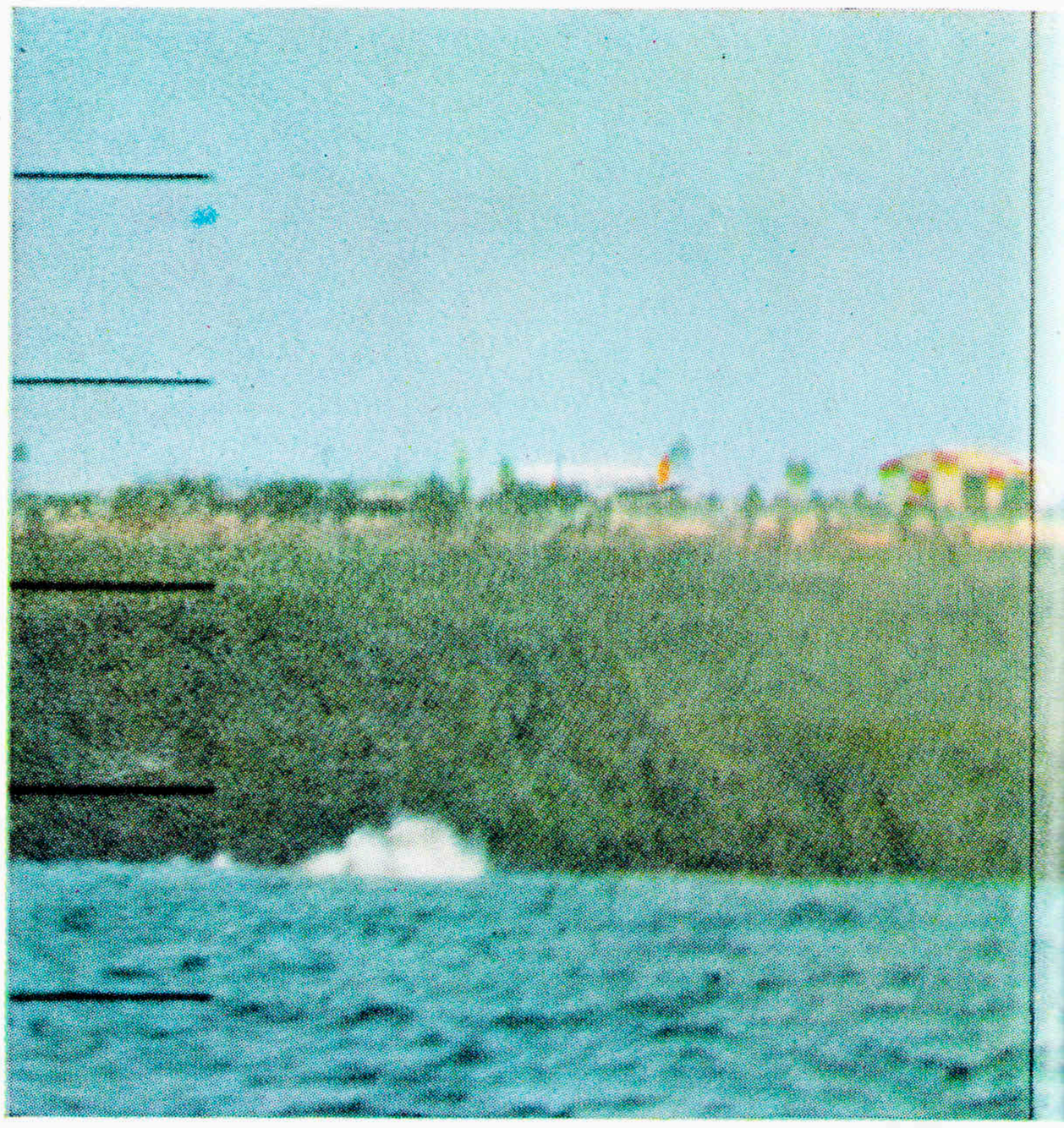
brew compiled data for the chart with the help of questionnaires distributed among 50 volunteers. The reactions of men confined for 85 days may guide those who will later venture into space. Bongo drums and homemade French horn (lower left) celebrate completion of the world cruise. Party at right marks the closest approach to the Hawaiian Islands—1,200 miles.

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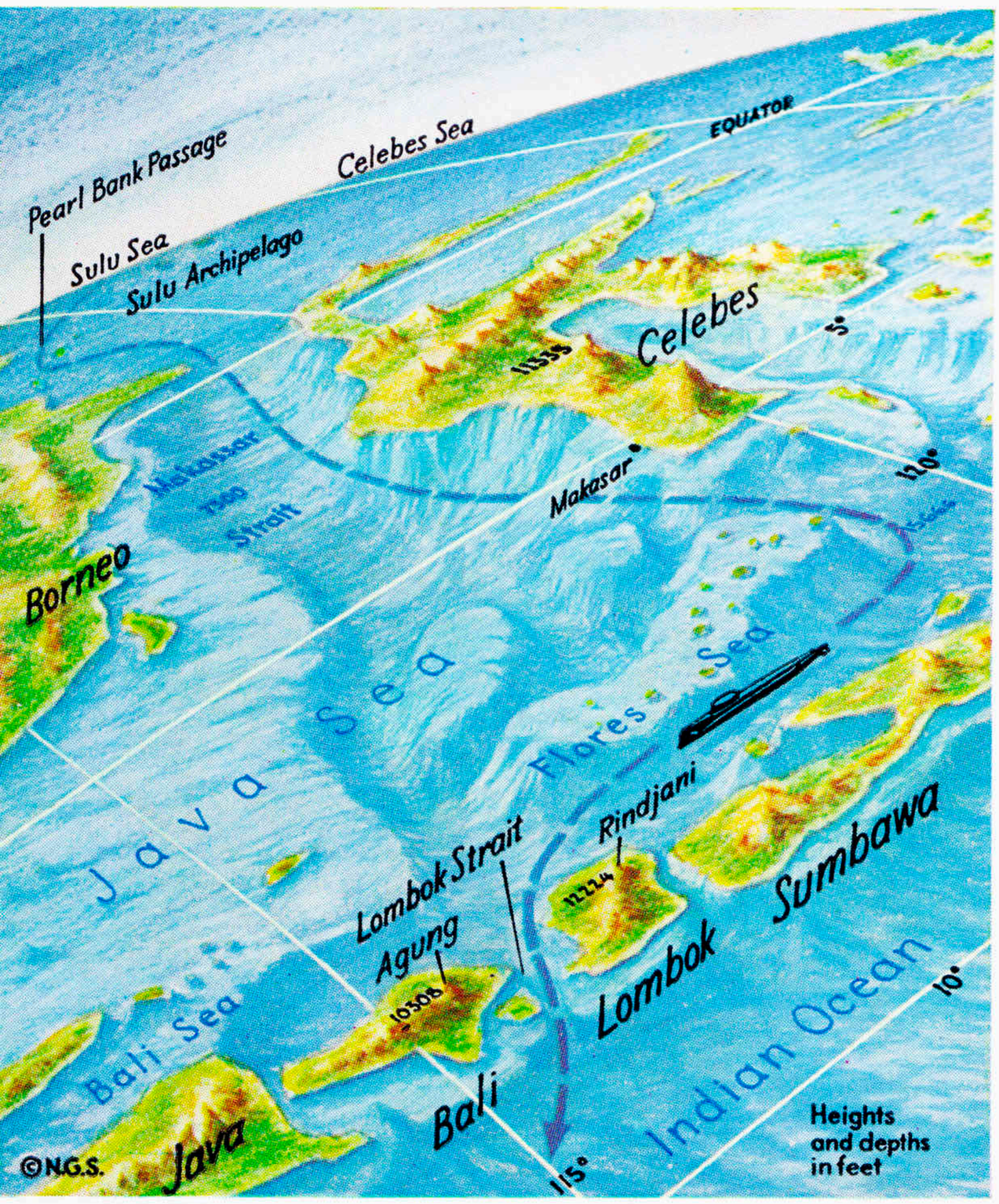
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Periscope "liberty" (opposite, lower), given at every opportunity, enabled crewmen to see such spectacles as Mount Agung, Bali (above), a dormant volcano towering above Lombok Strait, and the planes on a Guam airstrip. In the Indian Ocean they observed the masts of a wallowing tanker.

While transiting Lombok Strait (below), between the islands of Bali and Lombok, *Triton*'s depth gauges suddenly began to spin, and the ship involuntarily dived to 125 feet in 40 seconds. "It was as though we had hit a hole in the water—similar to air pockets encountered by planes," says Captain Beach. An abrupt change in water densities apparently caused the phenomenon at a point where currents from the strait met those from the Indian Ocean. Powerful engines quickly regained control.



melody, different melodies. And you can tell when the turbine is happy, and when it doesn't care, and when it whines as if it were crying.

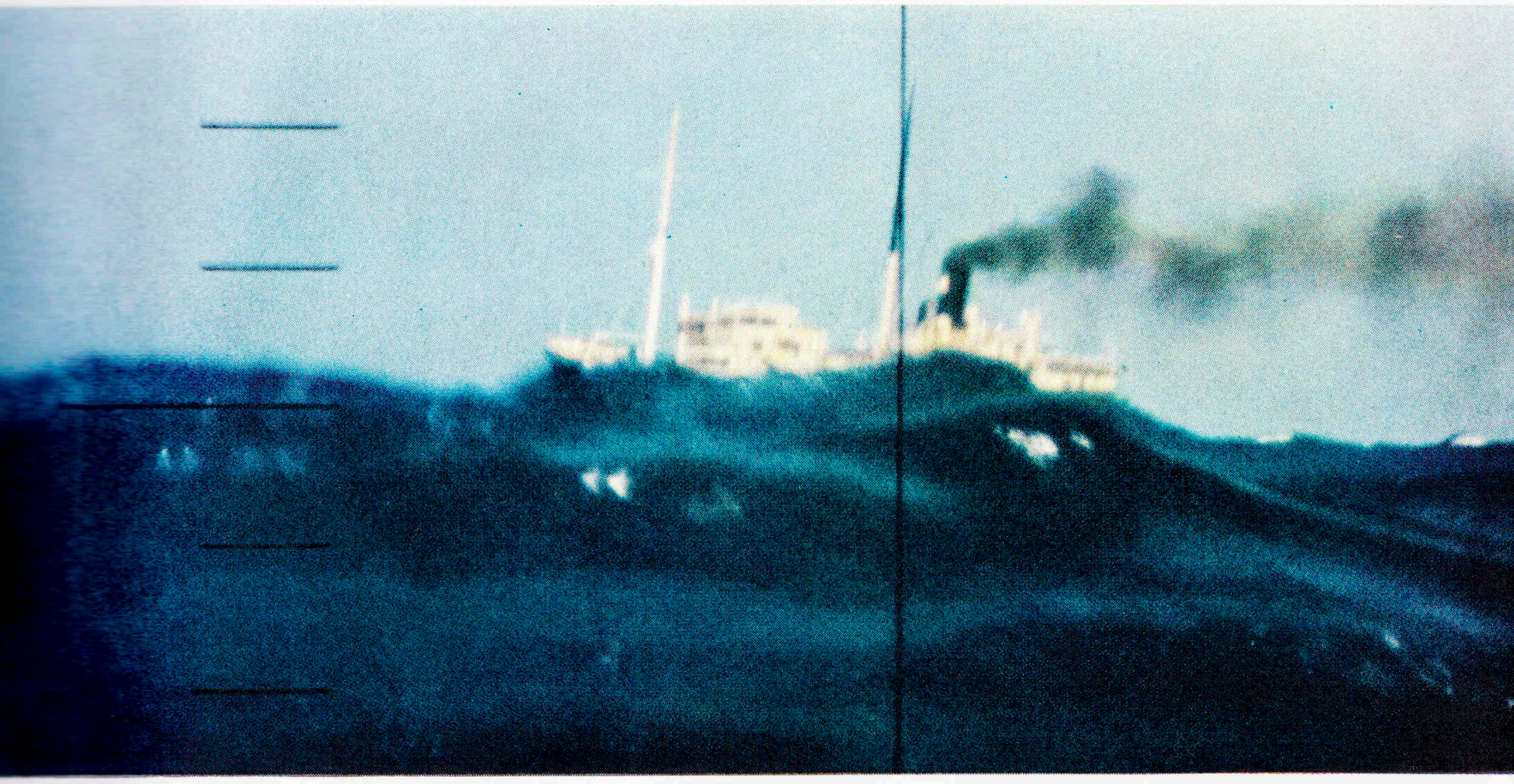
"After a while I realize that the turbine sounds sad when I feel sad and happy when I feel happy. Does that mean that I have become, somehow, part of the machine? No! It is the slave and I am the taskmaster; I can make it purr and I can make it whine. This gives me a feeling of power, that the 160 pounds of me help to control all these tons. It's a good feeling. . . ."

No-smoking Test Tries Crew's Nerves

The big events of this leg of the voyage were our sealed-ship test and the no-smoking period. For two weeks we did not ventilate the ship, but refreshed our atmosphere with our chemical candles when necessary. Later, smoking was prohibited. It was a trying time for many.

I am not a smoker, except for an occasional cigar, and felt little difference beyond a certain heightened well-being—due, probably, to

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Lofty buildings of Santa Cruz hug the hills of Tenerife Island in the Canaries. "Far and away the most spectacular scenery we saw on our cruise," reports Captain Beach.

lessened tobacco fumes in our atmosphere. Most everyone else hated it.

The nonsmokers felt elated at first. Some would kid their suffering shipmates, "Got a light?" But soon the nonsmokers also were on edge as men chewed unlit cigarettes and cigars cut into small pieces. Irritability grew in little ways.

Bad Movie Has Good Effect

We carried 45 movies aboard and we had already seen them all—but word leaked out that one film was lost. This was a horror story starring an unearthly monster, and suddenly there was wide demand to see that one film again. Why?

"Because it's so bad," I was told. "A good movie you forget fast, but a thing like that you can talk about for days." Curious what ideas people get under tension.

After three days we decided to end the test. Instead of passing the word to relight the smoking lamp, I strolled about the ship, puffing on a cigar and blowing smoke in people's faces, saying pleasantly, "Don't you wish you could do this?" It took about 40 seconds for the word to get around.

Meanwhile Doctors Stark and Weybrew kept track of our physical and psychological condition with periodic vision tests, questionnaires, and interviews. In our close quarters, less than three square yards of deck space per man, Dr. Weybrew found a tendency toward excessive projection.

"You may say to the man next to you, 'Boy, are you irritable this morning!' " Dr. Weybrew told me. "Chances are that it's you who are on edge. You tend to perceive the same state in others, and so justify your own irritability to yourself."

But Dr. Weybrew also surmised that such a cramped and comparatively monotonous passage may not be a bad thing. He notes:

"For some younger men of the high caliber of the *Triton* crew, prolonged confinement may be beneficial. For some it provokes a kind of life-reorientation process. One told me, 'Now I've had a chance to think over where I've been and where I am going. I've decided I'd like to be a school teacher.'

"Living in a relatively unchanging environment, such as the submerged submarine, seems to evoke novel, ofttimes creative thinking. Some men are writing poems. One man described to me an original electronic circuit for an air-conditioning system. . . ."

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We sighted the Cape of Good Hope on April 17, Easter Sunday. It seemed a particularly good omen to make this landfall on that holy day. Our spirits rose as our ship once again clove the waters of the Atlantic. We set *Triton*'s course northwest, toward St. Peter and St. Paul Rocks, on the last leg of our circumnavigation.

Shortly after eight on the evening of April 24, a valve burst in our after hydraulic system. As Torpedoman Allen Steele described it later, there was a loud report and then a heavy spraying noise. Clouds of oil vapor rose from beneath the deck plates on the starboard side.

"The stern planes aren't working, sir!" reported Comeau at the diving controls. Lt. "Whitey" Rubb ordered: "Shift to emergency!" We had trained for this many times.

Torpedoman Steele truly distinguished himself. His compartment was filled with oil vapor and he could see nothing. But he plunged into the high-pressure spray and found the two quick-closing valves to the supply and the return pipes. He struggled desperately to close them, and finally did, with the help of Engineman Arlan Martin.

Not until afterward, with repairs well under way, did we reflect on what might have happened. The heavy concentration of oil

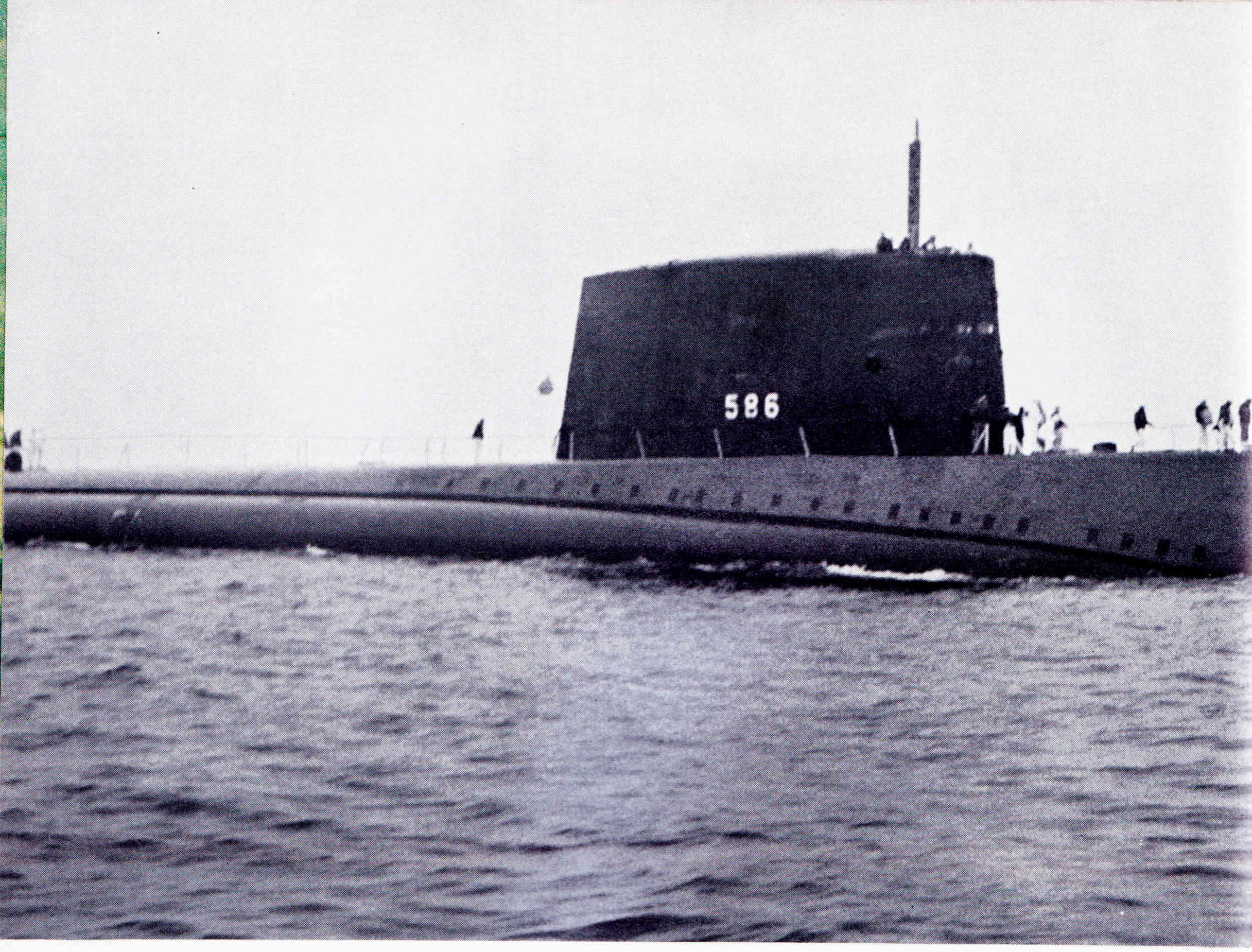
Visiting Sailors Get an Unexpected Bath as Their Whaleboat Careens

Rendezvousing off Cádiz, Spain, a boat from the destroyer U.S.S. *John W. Weeks* swept above *Triton*'s submerged deck. A subsiding swell slammed the craft against the deck. Tossed head over heels into the brine, the men scrambled back wet but unhurt. NATIONAL GEOGRAPHIC photographer Roberts captured the action from the bridge.



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HS EKTACHROME © NATIONAL GEOGRAPHIC SOCIETY

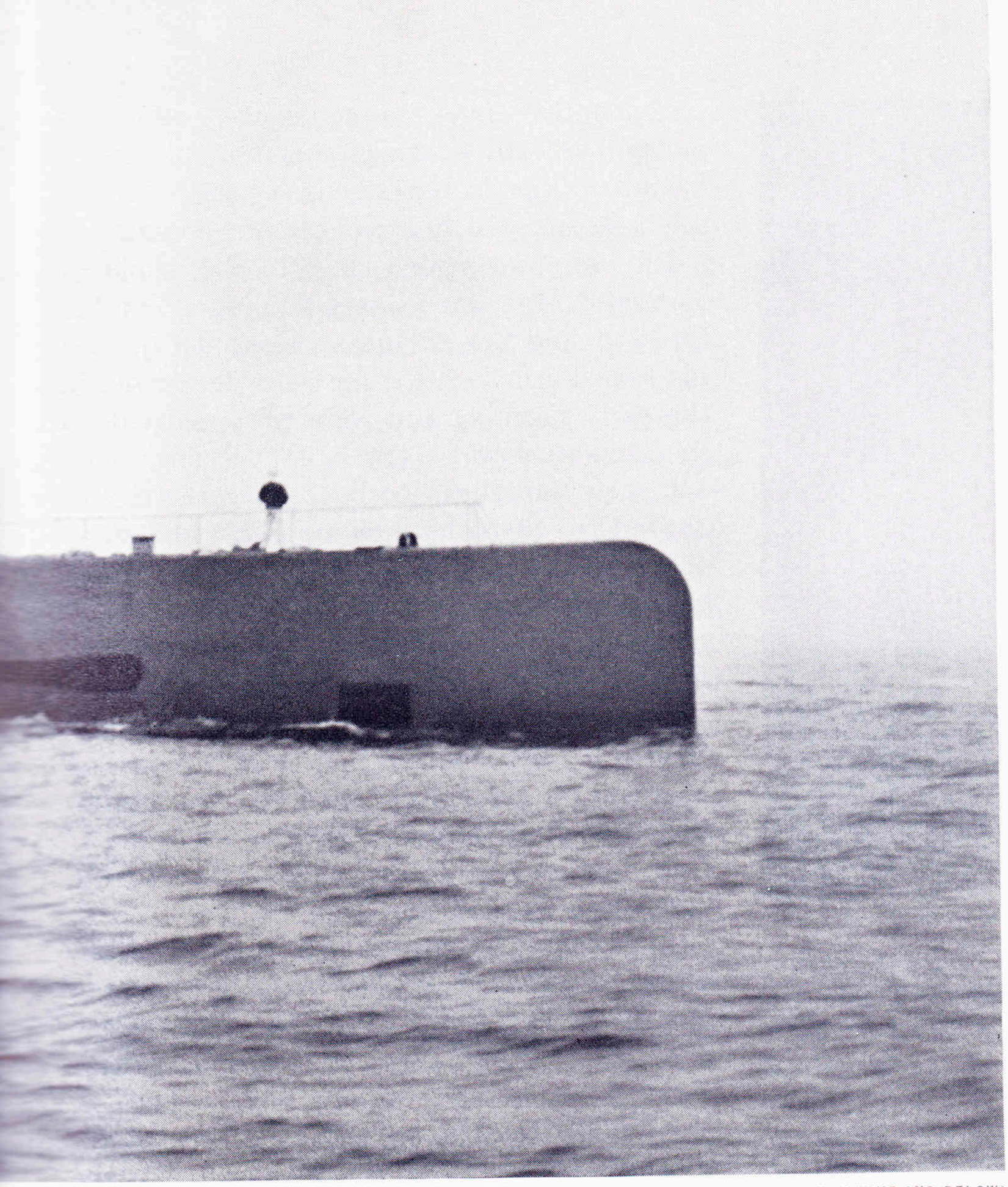


A touching welcome for Commissaryman Earl E. Bruch, Jr., and new mustache



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

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NORWICH BULLETIN (ABOVE AND BELOW)

Home to Connecticut's Thames River Comes the Great Steel Whale

A cold, drizzly day failed to mar the welcoming party last May 11 at New London. As crewmen made ready the landing lines, Navy officials, wives, children, and other well-wishers crowded the pier (below). To them *Triton* exposed the 447½-foot silhouette she had hidden from the rest of the world for 85 days.

Last person seen by Captain Beach as *Triton* sailed was his wife Ingrid, "alone on a rock where the river meets the sea." And when the submarine came home, "that blue-eyed girl" was on the dock, with their three children waving signs of welcome.

At the White House in Washington the day before, Mrs. Beach had seen her husband awarded the Legion of Merit by President Eisenhower. Off Rehoboth Beach, Delaware, *Triton*'s captain had been picked up by helicopter and flown to the White House lawn, returning to his ship the same day.



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"Hail Noble Captain, It Is Done Again." In honor of Ferdinand Magellan, *Triton* presented a plaque bearing these words to Spain, in whose service he undertook the first world voyage 441 years ago. The Portuguese navigator's portrait hangs in Mariners Museum, Newport News, Virginia. Freely translated, the Latin inscription reads: "Ferdinand Magellan, most famous for having conquered the difficulties of the Antarctic Strait."

vapor might have caused a fire; there might have been a severe explosion.

Had Steele's action not been so instantaneous and so precisely correct, *Triton*'s main hydraulic system would have been lost in a few more seconds—with the momentary loss of all diving-plane controls, and steering as well. Even with our quick shift to emergency control, we might have been in serious trouble because we were going so fast.

Speed Averaged 21 Miles an Hour

"Monday, April 25," said the log. "St. Peter and St. Paul Rocks in sight, bearing due west. First submerged circumnavigation of the world is now complete."

We circled the bleak islets again, as we had done two months before. The sun was shining brightly. Our mileage, Rock to Rock, was 26,723 nautical, or 30,752 statute, miles. It had taken us 60 days and 21 hours. Dividing gives an average speed of just over 18 knots, or 21 statute miles an hour. No other ship—and no other crew—could have done better.

After passing St. Paul Rocks—on the western side this time—we set course, still submerged, toward Cádiz, Spain, lying 17 miles from Sanlúcar de Barrameda, where Magellan set sail on his historic circumnavigation.*

En route we passed close to the island of Tenerife, Magellan's last stopping point before crossing the Atlantic. There he quelled his first mutiny. We came upon the island in the early morning and were rewarded with a spectacular view (page 610). Roads, lined with new buildings, led back from the city of Santa Cruz toward a high mountain and many peaks on the skyline.

Two days later we were off Cádiz and in contact with the destroyer U.S.S. *John W. Weeks*. We wished the *Weeks* to deliver a plaque, designed by Lt. Tom Thamm, as an offering to the country from which Magellan set forth on his historic voyage. The inscription was in Latin and English: *Ave Nobilis Dux, Iterum Factum Est*—"Hail Noble Captain, It Is Done Again."

At 6 a.m. *Triton* broached, just as we had while transferring Poole to the *Macon* two months earlier (page 611). Joe Roberts was taken off to fly his pictures to Washington.

Of the remainder of our voyage back to port, there is little to tell. We crossed the Atlantic Ocean clear of steamer lanes and U. S. Navy exercise areas. We had eaten steak once a week before, and now we could have it twice as often. There was enough food left to go around the world again at half rations. Those of us who had tried to diet on the cruise surveyed mixed results.

A lieutenant said proudly: "I think I lost ten pounds." A chief answered, "Turn around, sir. I think I've found it."

After hearing the doctors talk, I warned the men to use special care while driving during their first day back home. For months most of us had looked at nothing farther than 10 feet away, and it might take a little time to get our eyes accustomed to focusing quickly from near to far objects.

Before dawn of May 10 we surfaced off Rehoboth Beach, Delaware. After daybreak, boats and planes came to photograph us. A helicopter hovered with sacks of mail.

Following radioed instructions, I was ready in my unaccustomed dress khaki uniform, and in a little more than an hour the helicopter had put me down in Washington, D. C., on the back lawn of the White House. Soon I would see the President of the United States.

* See "Greatest Voyage in the Annals of the Sea," by J. R. Hildebrand, NATIONAL GEOGRAPHIC, December, 1932.

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Waiting, I thought of what *Triton* had accomplished. For one thing, we had proved that a submarine can go around the world undetected. It can go wherever there is deep enough water—and that's about 65 percent of the globe—unknown to any but those ordering its movements. In a way, it is potentially the world's fastest weapon. Until the moment it strikes, it simply isn't there.

I also thought of long-range submarine exploits to come. Fuel would be no problem; our piece of uranium could have taken us around the world several times more.

Navigation problems would diminish with the improvement of inertial-navigation apparatus that tells position constantly, without the need of any external observations.* And machinery to produce oxygen from sea water would soon be ready—allowing a submarine to stay down deep as long as rations and the nerves of the crew held out.

To this question of human endurance, *Triton* had perhaps made its greatest contribution. I imagined the electronic sorting and computing machines busy at the Navy Medical Research Laboratory of New London, sifting the data we had gathered about ourselves (graph, page 606). This information about men shut off from the world was urgently wanted for the Polaris-missile submarines already operational—the *George Washington* and the *Patrick Henry*. Their crews might have to stay submerged as long as we did.

* See, in the NATIONAL GEOGRAPHIC: "Submarine Through the North Pole," by Lt. William G. Lalor, Jr., USN, January, 1959; and "Up Through the Ice of the North Pole," by Comdr. James F. Calvert, USN, July, 1959.

Submarine Findings Aid Space Scientists

The same information would also be prized by the scientists who look ahead to explorations in fathomless space above. For nothing so resembles a spaceship as a submarine in inner space—the sea.

My thoughts were interrupted when a pair of feminine arms encircled my neck and a firm kiss was planted on the side of my face. Swiftly I swung about.

She had discarded the red scarf, and the old coat was replaced by a fur wrap; but the blue eyes and the smile were exactly as I had remembered them.

"A line inching its way across a National Geographic map," Captain Beach recalls, "was our only visible sign of progress." To a crew sealed in their submarine for 85 days, the map, hung in a passageway, became a window on the world. "We all knew a lot more about geography by the time we arrived home," he admits.

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