

Patrolling the pipeline at the bottom of the North Sea

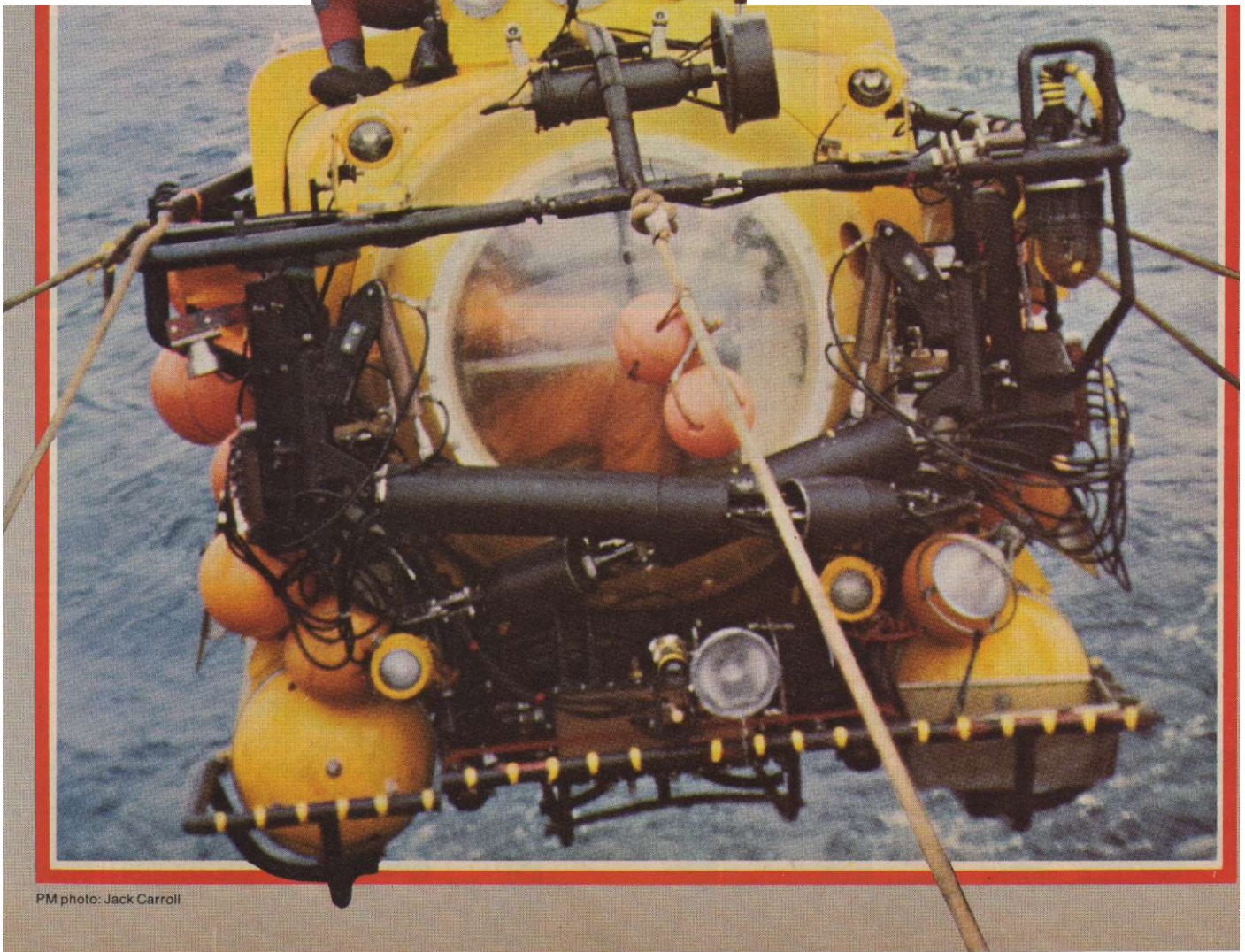
Hundreds of feet deep, divers trust their lives to high technology*^

by Jack Carroll

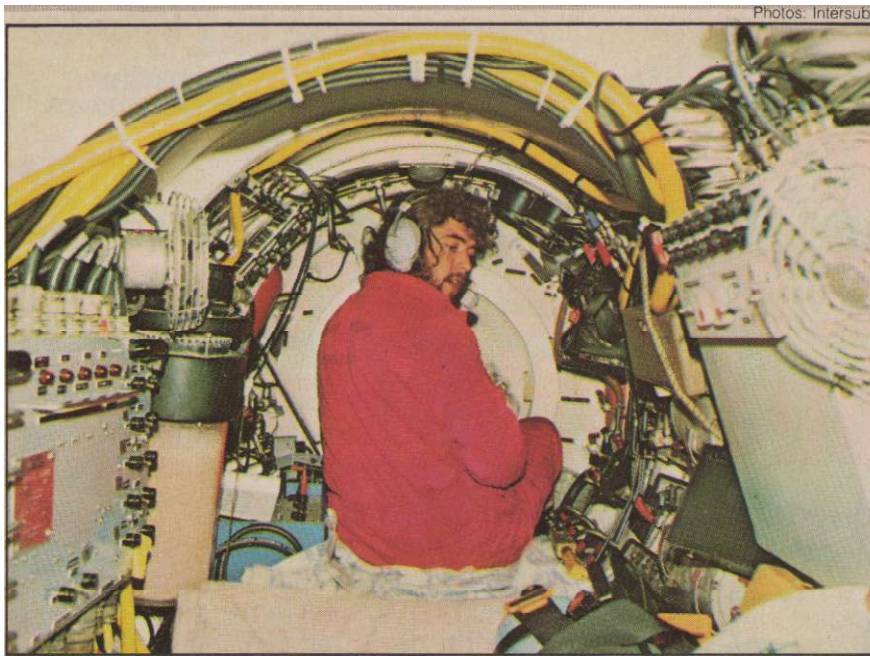
Ungainly looking yellow submersibles like this one ferry crews back and forth from the oil-rich sandy sea bed. Subs can track buried pipeline and "fly" courses with military precision.

BuchenField, North Sea, 58°N. Latitude, 0°Longitude.—Aboard Intersub Two, a support vessel, mechanics prepare the ungainly looking, 22-foot-long yellow submarine for the day's first dive. My first dive.

The sea has relented from the previous day's Force 7 condition—near-gale winds with waves up to 14 feet—to a benign, almost unnatural smoothness. To the hum of electric motors, the submersible moves in a cradle from the security of the *Intersub Two* hangar to the afterdeck. There, the crew hooks on



PM photo: Jack Carroll



Photos: Intersub

main hawser and secondary lines from the giant A-frame launching crane.

I climb the oil-slippery ladder to the tiny conning tower. And with a passing thought about claustrophobia, in we go. Tony Miller, a 2000-hour sub pilot commanding this mission, advises me to crawl back into the rear compartment; in other words, stay out of the way. It's a chin-on-knees situation, made even more cramped by the black boxes and electronic gear that crowd the 41-inch width of the vessel's pressure hull.

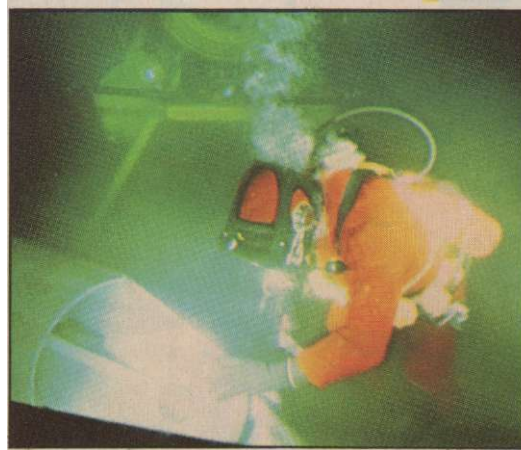
This rear compartment is normally occupied by two divers and sealed off from the front compartment. But today's mission will not involve divers, so I have the small space to myself.

All set to go

With a slight lurch, the submersible is lifted up and away from the stern of *Intersub Two* and deposited gently into the sea. Now the swimmer from an attending Zodiac inflatable detaches all connecting lines. We're powered up, in communication and ready to go. Miller floods the tanks and we begin the descent,

as I get a fleeting, final look at the mother ship through the bomber-like plastic bubble in the sub's nose.

From cramped quarters aboard a North Sea submersible (above), a diving supervisor monitors the work of men outside. After 3- to 4-hour shifts at 500 feet, divers return to pressurized compartment aboard the sub.



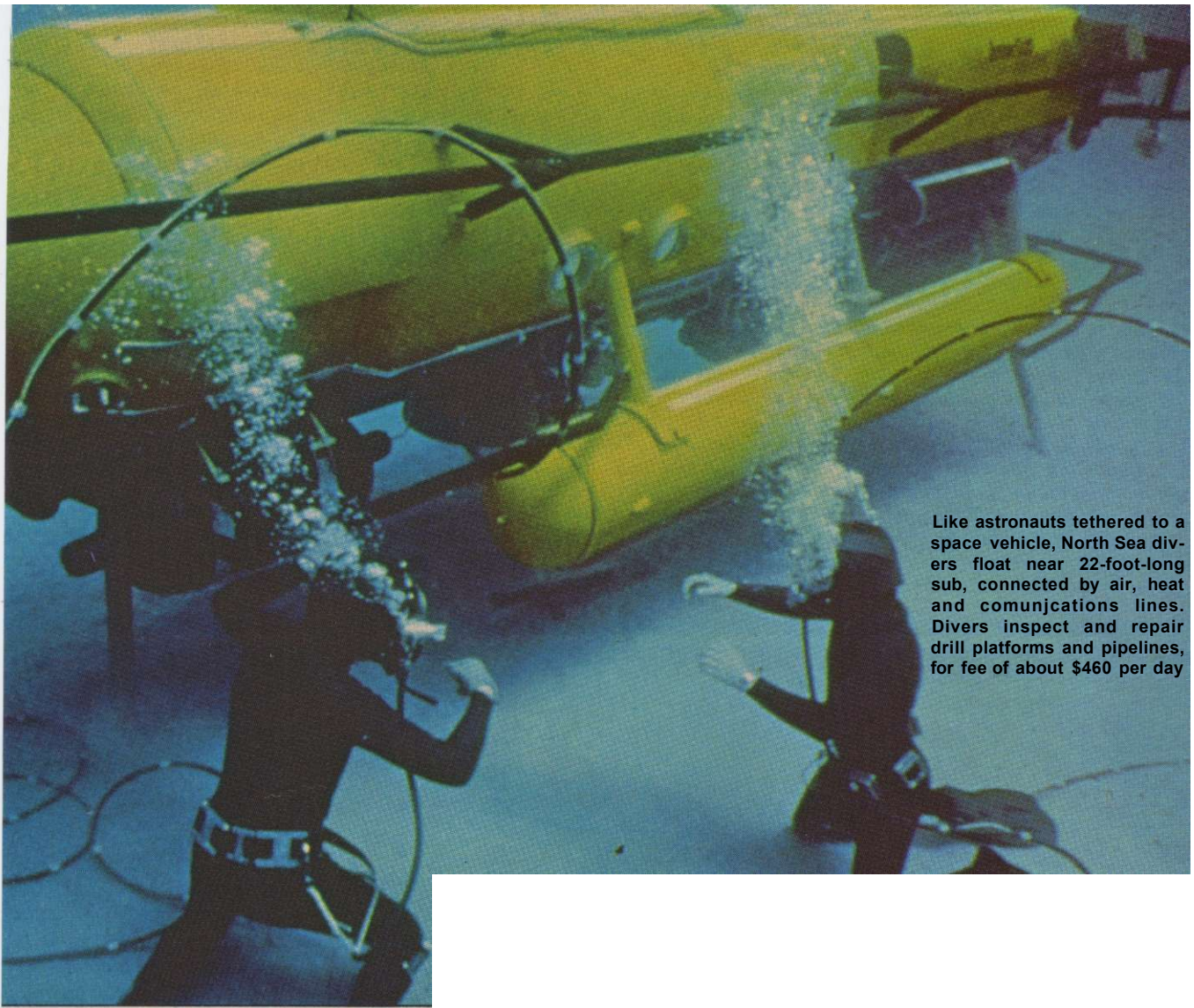
The vessel I'm riding has become an essential tool for offshore engineering tasks, working successfully in the most demanding proving ground of all: the oil-rich North Sea

fields. So rich, in fact, that from the Buchen Field alone, which is considered marginal, BP expects to extract more than 50 million barrels of oil in the next four years.

The submersibles work hard to keep this oil flowing, cruising over pipelines or around drill platforms on inspection missions, aiding deep-

PM photos by the author





Like astronauts tethered to a space vehicle, North Sea divers float near 22-foot-long sub, connected by air, heat and communications lines. Divers inspect and repair drill platforms and pipelines, for fee of about \$460 per day

sea surveys, ferrying divers. The small subs perform these tasks with the help of technology you'd expect to find only on much larger vessels. For example, Intersub has developed an inertial navigation system based on military aircraft technology to provide highly accurate, rapid distance and angle measurements.

The Marseilles-based company has also developed a patented pipe tracker allowing the submersible to follow a pipeline buried up to three meters deep.

Intersub's gamble on developing new technology for the oil industry has apparently paid off. The company, which was founded in 1973, has grown from one sub and support vessel in 1974 to a fleet comprising one remotely piloted and 14 manned submersibles, including the one I'm riding now.

"Passing five zero feet," reports T.J. Jaynes, the observer, who is stationed forward with the video monitor and controls for the craft's two

mechanical arms, or manipulators. The sea changes color rapidly, darkening to a sediment-laden green, captured in the glare of the sub's quartz-iodide lamps.

It is 10:21 and all the old late-night television submarine movies never prepared me for this: Calm prevails and there are no sharp commands or anxiety. Just the reassuring whirs, rasps and hums of electric motors and servos. One motor, somewhere, keeps cutting out. Miller instructs me to "Give that box there a good rap when it happens." It works, and it seems I now have a job for the duration of the voyage.

There is little sense of motion as we reach 150 feet at 10:26, 350 feet at 10:29, and our working depth of 376 feet shortly thereafter. The bed of the North Sea—as I had been advised earlier—is unspectacularly



At the end of a dive, swimmer from Intersub support vessel attaches lines (far left), then leaps for safety as swells shove sub perilously close to mother ship.

flat and sandy. But that's where the oil is, and that's why Intersub vessels are here—complemented by some of the best divers in the world.

Saturation divers—the elite

As versatile and useful as the submersibles may be, they're still only machines and lack the dexterity and mobility of humans. So Intersub teams saturation divers with the submersibles, especially for close-in detail work and inspections of drilling platforms.

Divers "in saturation" breathe a mixture high in helium and low in oxygen and, when not out working in the ocean's depths, are "stored" at that same pressure level in a chamber aboard the support vessel. When it's time for work, the two divers on duty (the mother ship's chamber usually holds four divers) suit up and pass through a transfer trunk and lock system. They enter the rear compartment of the submersible—my compartment.

When divers are aboard, the after

section of the sub is "blown down" to a pressure level precisely matching that of the chamber on the support vessel. The sub's pilot, observer and diving supervisor remain in a one-atmosphere environment (the same as you're in as you read this) in the front compartment. From there, they observe, direct and control the divers' activities throughout the mission.

Once the sub reaches the work site, the diver steps out through an airlock with tools, testing probe or camera. Supplied with heat, breathing mixture and communications link through an umbilical cord, he goes to work.

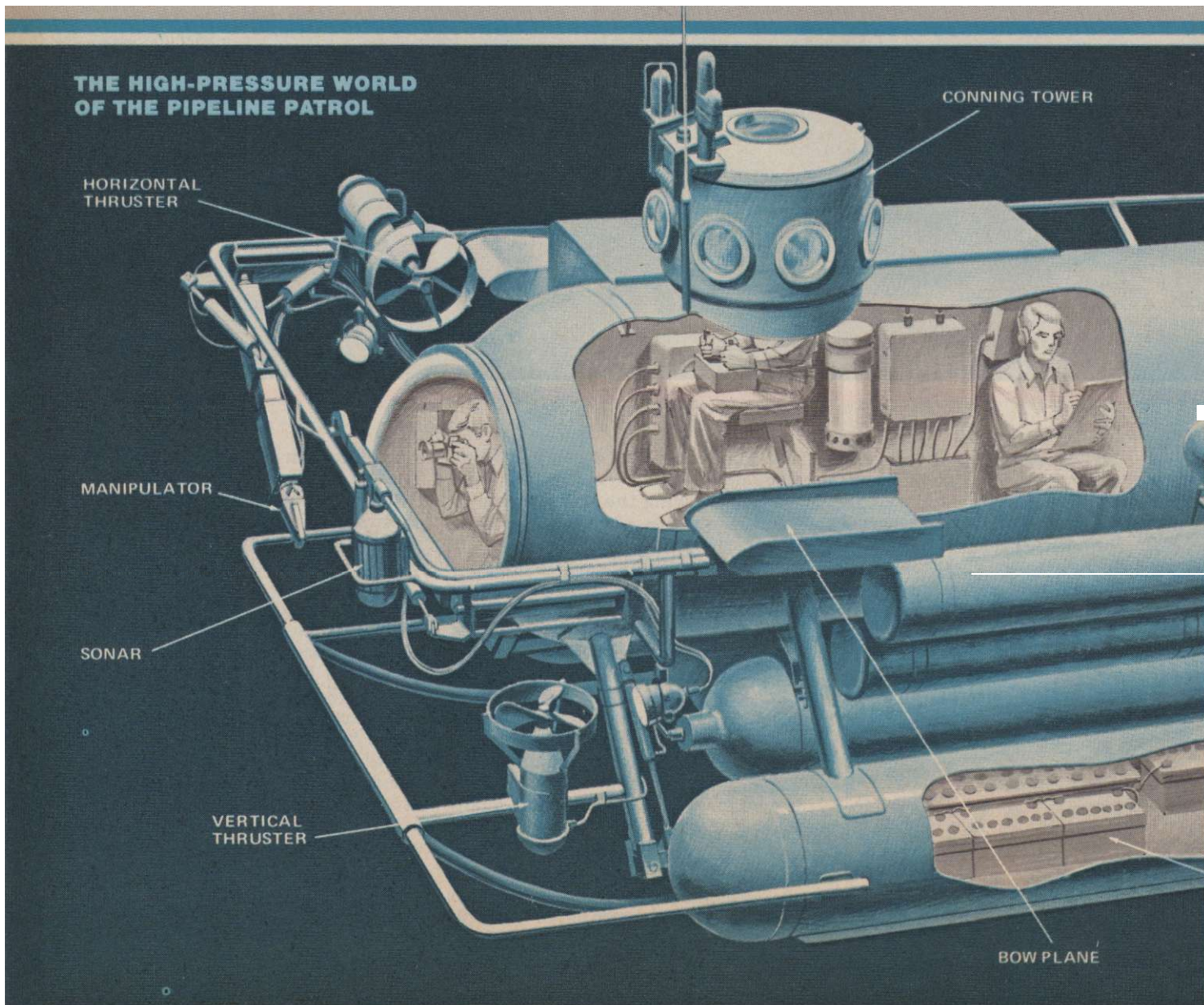
At the end of a shift lasting three to four hours at 500 feet, the procedure is reversed. The divers pass from their compartment in the sub, through the support vessel's airlock and into the confines of the chamber. There, they'll eat, sleep and try to avoid boredom, usually for about 21 days plus 6 days for decompression; sometimes for as long as 48 days.

According to Laurie Duffin, a saturation supervisor with Wharton-Williams Ltd., an Intersub diving subcontractor, "There's really not too much of a problem with boredom as long as you're working.

"But when the weather is too bad for operations and all your time is spent in the saturation chamber, it can be difficult, no matter how many books and magazines you have to read." Like any other job, said Duffin, "You get used to it." And, presumably, to the pay, which can amount to approximately 215 pounds or about \$460 per day.

Life in a pressure chamber

While in the chamber, the divers' lives are controlled completely from the outside by life-support technicians who continually monitor the pressure and breathing mixture, control the lock through which meals are passed, and even operate the divers' toilets. Communication between the divers and their operators is made possible by a voice "scrambler" that brings the divers'



voices from a helium-induced, Donald Duckish squawk to a more human level. And they'd better get along in their steel prison, said Hartmut Winterberg, a diver with more than 3000 hours in saturation.

"You observe the divers closely in those tight quarters—their personal cleanliness and how they get along with the other divers—so you can stop trouble before it starts. If the friction gets to be too much, we get them out of there as fast as we can." Fortunately, though, divers are a tight little fraternity and most get along accordingly.

Locating a template

After long confinement in a chamber, the high-pressure underwater work is comparatively pleasant. Far below hostile weather, the emerald-colored waters are calm and quiet. And—I'm finding on my North Sea dive—easing through these waters is as smooth and quiet as a glider flight on a clear day.

Our first task is to locate a tem-

plate, a square piece of metal on the seafloor used to mark a drilling site. The sub "flies" just above the bottom and, using its sophisticated inertial navigation system, finds the plate easily—but not before an unexplained communication lapse occurs with the mother vessel. At 10:44, as we're positioned precisely at the template, communications are restored with a matter-of-fact query from the surface: "Where've you been?" An inquisitive cod swims casually into the halo of light in front of the transparent nose blister, pauses momentarily and moves on, perhaps used to these little yellow submarines by now.

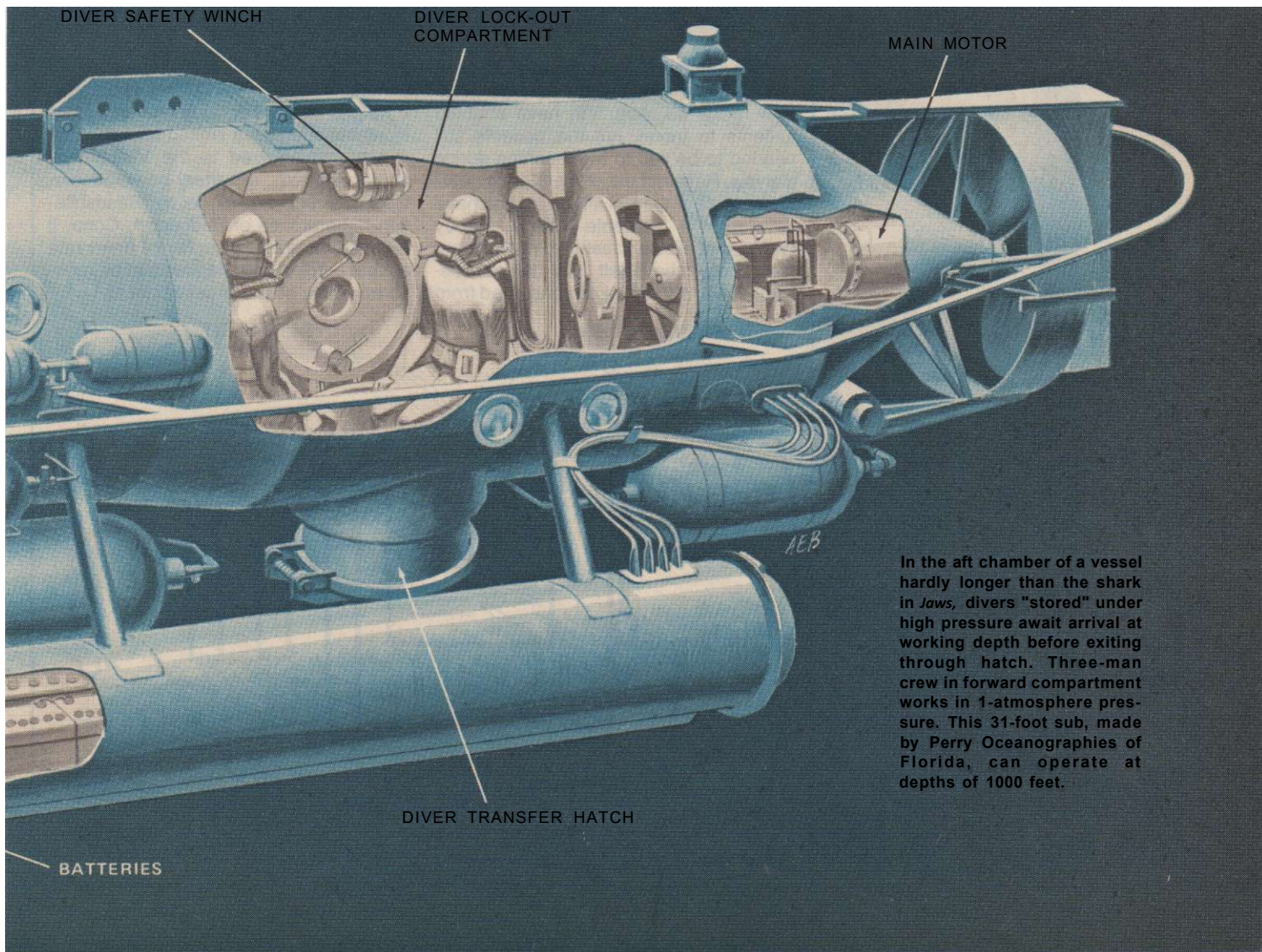
We inspect the template and the pilot begins to fly the sub along a nearly two-kilometer length of 12-inch pipe that leads to a connection with a hose to a surface buoy. As the sub flies over the pipeline, seemingly faster than the stated cruising speed of just one knot, a videotape unit continually covers all objects in the sub's path. Meanwhile, the observer supplements the visual

record with his own running commentary for the benefit of British Petroleum Oil, which is paying for this trip. The picture on the TV monitor flip-flops intermittently, and mission control in the mother ship advises there may be too much light. The problem is never fully resolved on this flight.

An odd-job request now crackles over the radio speaker: A transponder buoy that should have been released by radio signal, allowing it to rise to the surface for recovery, is hung up. Do we see it, and can we release it? Suddenly, as if on cue, there it is, looking like a bright yellow pencil sticking straight up out of the greenish haze.

The sub hovers efficiently, as observer Jaynes flexes his "muscles"—the sub's manipulator arms. One arm has a clawlike grip. The other holds a mean-looking rotary disc cutter. Jaynes adroitly maneuvers the sub's right arm to grip the transponder's restraining line. But before the disc can go into action,

(Please turn to page 194)



In the aft chamber of a vessel hardly longer than the shark in *Jaws*, divers "stored" under high pressure await arrival at working depth before exiting through hatch. Three-man crew in forward compartment works in 1-atmosphere pressure. This 31-foot sub, made by Perry Oceanographies of Florida, can operate at depths of 1000 feet.



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the transponder sails up and away, like a captive balloon released.

Arms folded back in a stowed position, the sub continues its flight up the pipeline, stopping along the way to photograph sacrificial anodes. These are designed to corrode, protecting the pipe itself against corrosion. It all seems controlled and routine, exactly the way it should be, as the crew munches cookies. The PLEM—the pipeline end manifold joining the main line to a vertical hose—comes into view.

Routine. But there are some reminders of potential dangers facing this pipeline patrol. There's the notice on a gray canister a few inches above my head, for instance. "Emergency," it reads. "In case power supply fails, spread Vi-inch depth over flat surfaces not in contact with water . . ." The canister contains carbon dioxide-absorbent lithium hydroxide.

And there are a few alarming stories, known well by everyone aboard this vessel, about North Sea work. One comes from Dick Winchester of Intersub about another company's trapped submersible.

"The other sub became a little overenthusiastic," explains Winchester, "and it moved in too close to a wellhead, getting itself completely tangled in cables and netting in the process. After getting the call, our ship, *Intersub Two*, arrived at the scene within 11 hours." The mother ship lowered a submersible, which in turn released a diver. He was able to cut the trapped sub loose. No one was injured.

Dangers of diving bells

Much more frightening, though, are stories told about diving bells, dangling chambers hung under their support vessels and connected by cable and air lines. At least for now, diving bells are still the acknowledged workhorses of North Sea diving, with good reason: Divers can work outside a bell longer—more than twice as long as diners from a submersible—since heat and breathing mixture come down through an umbilical from the mother ship.

The threat to divers working from bells is that the mother ship on the surface will drift off station, dragging and bouncing the bell along the bottom or—worse—toward something hard enough to sever lifelines. An anchor cable sheared through one bell's lines, for instance, cutting off its two crewmen's supply lines. By the time it was brought to the surface 14 hours later (with the help

of a submersible), the men had died. Duffin told me four bells have been lost in the past year.

By contrast, the submersibles are independent—their only umbilicals run from diver to sub. They're not restricted to the seabed, as bells are, since Intersub has perfected a clamping system permitting subs to be attached to any bracing member of a platform. Best of all, the subs appear to be comparatively safe: To date, there have been no fatalities in North Sea submersibles. Nor have there been any accidents involving divers operating from subs. Man and machine seem perfectly at ease beneath the surface of the North Sea, and bob back to the mother ships ready for more.

A sigh of relief

After a careful survey of the PLEM, pilot Miller delicately guides the sub, like an undersea helicopter, around and up the flexible hose that leads to a turntable-like CALM buoy on the surface. CALM stands for "Catenary Anchor Leg Mooring" to which, ultimately, tankers will connect their hoses to load oil at sea.

The hose looks okay to me, and apparently to the crew, and soon the sub blows out its ballast with—it seems to me—a sigh of relief. It begins to rise to the surface. With more light penetrating by the minute, we pass through "five zero" feet at 14:58 and break surface at three o'clock landlubber time, rolling and dipping in the chop that has developed in the nearly five hours that we've been below. Had rough weather developed, as happens often in the North Sea, retrieval would have been unsafe and we would have been forced to remain on the seabed to wait out the weather. This would have been no problem, since the subs have life support for a week.

A hand, then a flipper, pass by a conning-tower porthole, indicating the swimmer is on the job. He's attached the towing cable to the sub's nose and now rides the sub as it's winched to the stern of the mother vessel. Once the main hawser and side restraining leads are attached, we're plucked from the grip of the sea, up, in and down on the cradle with a minimum of juggling, thanks to relatively calm waters. The dive is over. The hatch opens, and we're again breathing unbottled air.

"How was it?" asks one of the swimmers, as I wobble across the slightly sloping deck. And without hesitation, I answer: "Just routine." Strangely enough, I think I really mean it. PM