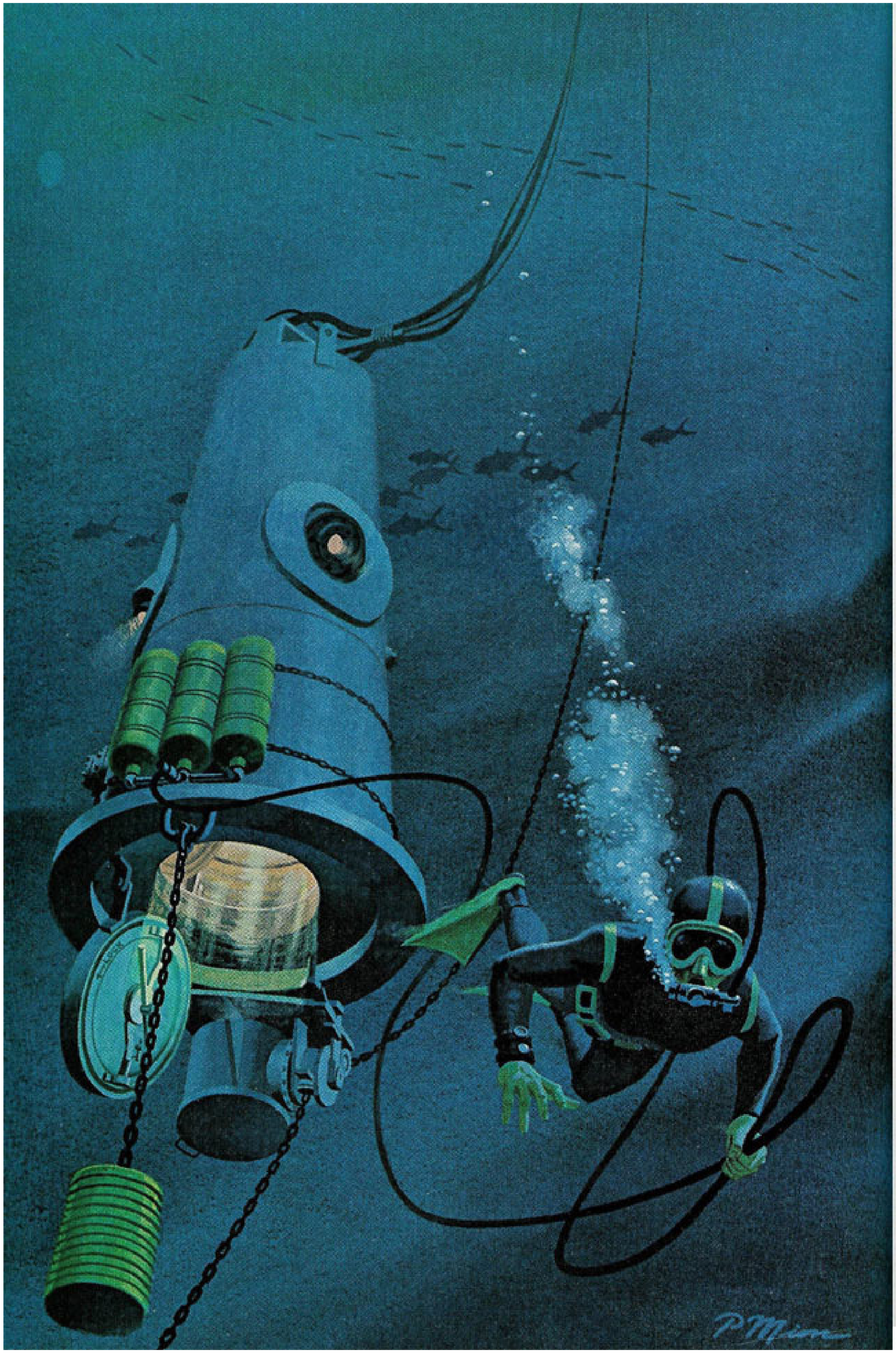


Revolutionary diving cylinder has opened the way to new and unexplored frontiers—the vast continental shelves, with their promise of mineral wealth and scientific riches

Our Man-in-Sea Project

By EDWIN A. LINK

ONE FEBRUARY DAY in 1962 I had the privilege of presenting to the National Geographic Society's Committee for Research and Exploration a project called Man-in-Sea.

The ultimate aim of this undertaking, I explained, was to enable men to live and work on the floor of the ocean at depths of 1,000 feet or possibly more for days, weeks, and even months.

"Working under water for weeks at a time!" I could feel a sudden tightening of attention in the room. These distinguished scientists and Society officers needed no one to tell them what such a development could mean to the world.

The average depth of the continental shelves is around 600 feet. If man could find a way to work there in safety and relative comfort, he would at once possess the key to more than 10,000,000 square miles of sea bed. He could tap the scientific secrets and mineral, animal, and vegetable wealth of these immense submerged plains, exploring ancient wrecks, mining diamonds or gold, farming the sea floor, feeding and herding fish like cattle.

Diver's Working Time Multiplied Manyfold

Most important, by *staying* down for long periods a diver would multiply many times the amount of useful work he could accomplish on the floor of the sea. No matter how long the dive, he would have to go through the time-consuming process of decompression only once. The time a diver on compressed air must spend in decompression after an hour at 300 feet, for example, is 7.63 hours—more than *seven and a half* times as long as he could spend in actual work. Man-in-Sea thus opened the prospect of intensive and continuous undersea work.

But I could feel a polite skepticism. How did I propose to solve the problems of nitrogen narcosis, the so-called drunkenness of the depths; and the dread decompression sickness, the bends?

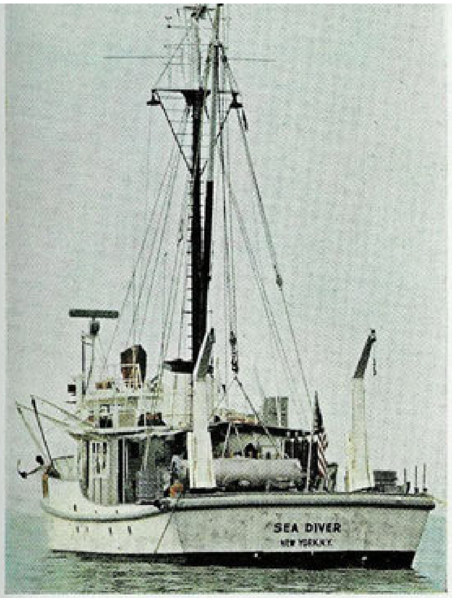
In deep diving, man, not designed for living under water, faces grave dangers. Under pressure, his body absorbs gases contained in the air he breathes. Below 100 feet, nitrogen in the compressed air becomes narcotic, impairing the diver's faculties. His attention wanders, so that

Leaving his "house in the sea," a diver probes 200-foot depths in the Mediterranean. An artist's conception of the Link diving chamber shows how the aluminum cylinder combines the best of two worlds—the submariner's and the free diver's. Tests along the French Riviera last summer proved highly successful.

PAINTING BY PIERRE MION © N.G.S.

KODACHROME BY THOMAS J. ABERCROMBIE © N.G.S.

The Author: Edwin A. Link prepares to submerge for the first test of his ingenious underwater chamber. Inventor of aviation's Link Trainer and an expert diver, the retired industrialist now devotes full time to exploration of the world beneath the waves.



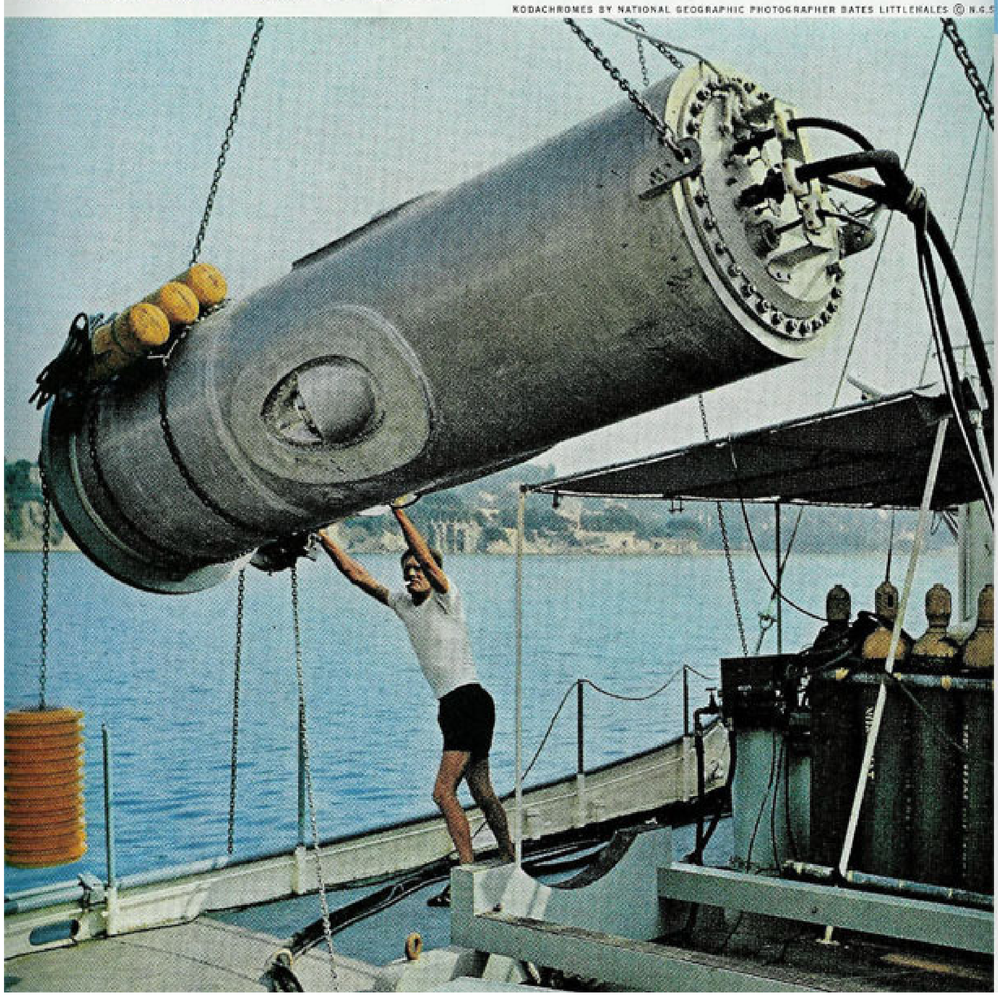
Moored off Villefranche, *Sea Diver* cradles the Link chamber on its afterdeck. World's first vessel built from the keel up for underwater archeology, it can range 7,000 miles.

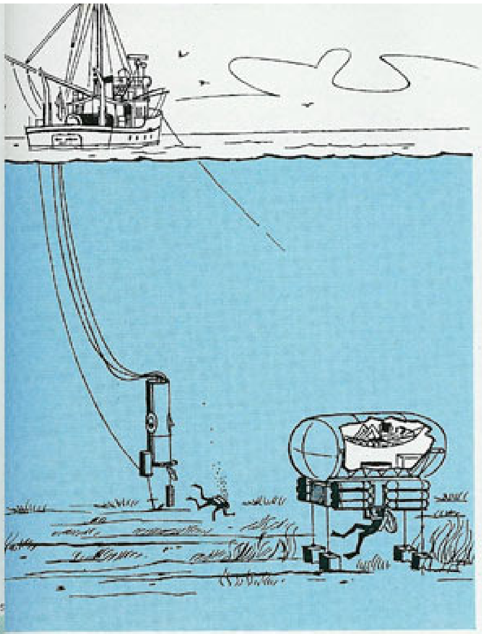
Living quarters on the ocean floor, cylindrical elevator, and large decompression chamber on deck—these are the three elements of Edwin A. Link's Man-in-Sea Project. The sea-floor dwelling is an underwater tent of tough, rubberized fabric. In it an off-duty diver relaxes in his hammock, while another enters from below.

This drawing by Pierre Mion is adapted from a sketch Mr. Link showed to the National Geographic Society's Committee for Research and Exploration early in 1962. Depth is greatly contracted; to show last summer's 200-foot dive in scale would require a drawing 16 inches long.

Ready for baptism, the cylinder swings from ship to sea. The diver who will ride it to the sea floor must swim down from the surface and enter a hatch at the bottom end (pages 712, 716).

KODACHROMES BY NATIONAL GEOGRAPHIC PHOTOGRAPHER BATES LITTLEHALES © N.G.S.





he forgets to take normal precautions. This is nitrogen narcosis, and it has cost many a life.

If the diver stays down for a long time, and then comes up too quickly, gases dissolved in his body do not have time to pass off normally, and form bubbles. In his body tissues, the bubbles may cause itching and excruciating pain. In his circulatory system, they may obstruct the flow of oxygen to vital nerve and brain centers, causing blindness, paralysis, even death.

Because of these physical facts, dives to great depths have had to be sharply limited in time. Long ago it was discovered that if an ascending diver stopped at certain depths for varying lengths of time, gases absorbed by his body would pass off harmlessly. The catch is that so much time must be spent in decompression.

One answer to the problems of deep diving, I pointed out, would be to replace normal atmospheric air with an artificial mixture of oxygen and a non-narcotic gas. Years ago the United States Navy found that, by replacing numbing nitrogen with helium, narcosis of the depths was eliminated.

Another Hazard—Oxygen Poisoning

If a man breathes high concentrations of oxygen for a long period, he risks oxygen poisoning, which usually begins with nausea, progresses to muscular twitching, and ends in a convulsion. To avert this peril, the proportion of oxygen in the artificial helium-oxygen atmosphere must be reduced as the depth of the dive increases. The object is to keep the absolute quantity of oxygen always the same as that at sea level.

The proposed long-range program was described to the committee as envisioning three major pieces of equipment: (1) an underwater pressure chamber affording houselike living conditions; (2) a smaller one-man chamber which would act as an elevator between the bottom dwelling and the surface; and (3) a large pressure-housing on the surface for comfortable decompression of several men at the same time (see drawing at left).

For the present we proposed to limit testing to the Stage 2 diving chamber, which would experimentally serve the function of the other two elements; besides carrying the diver from ship to bottom and return, it would double as a house from which he would emerge to the sea floor at will. It would also serve, aboard ship, as a decompression chamber.

Such a three-purpose diving chamber had already been built to my design through cooperation of the Smithsonian Institution and the Link Division of General Precision, Inc.

To this project the National Geographic Society now gave its powerful support, including a substantial grant of funds. First trials were planned for the summer of 1962.

Diver Exceeds 24 Hours at 200 Feet

"By the end of the year," I told the committee, "I hope to say that man can live and exist at 200 feet or more, coming back into this underwater house to eat or sleep, then going out to work or explore."

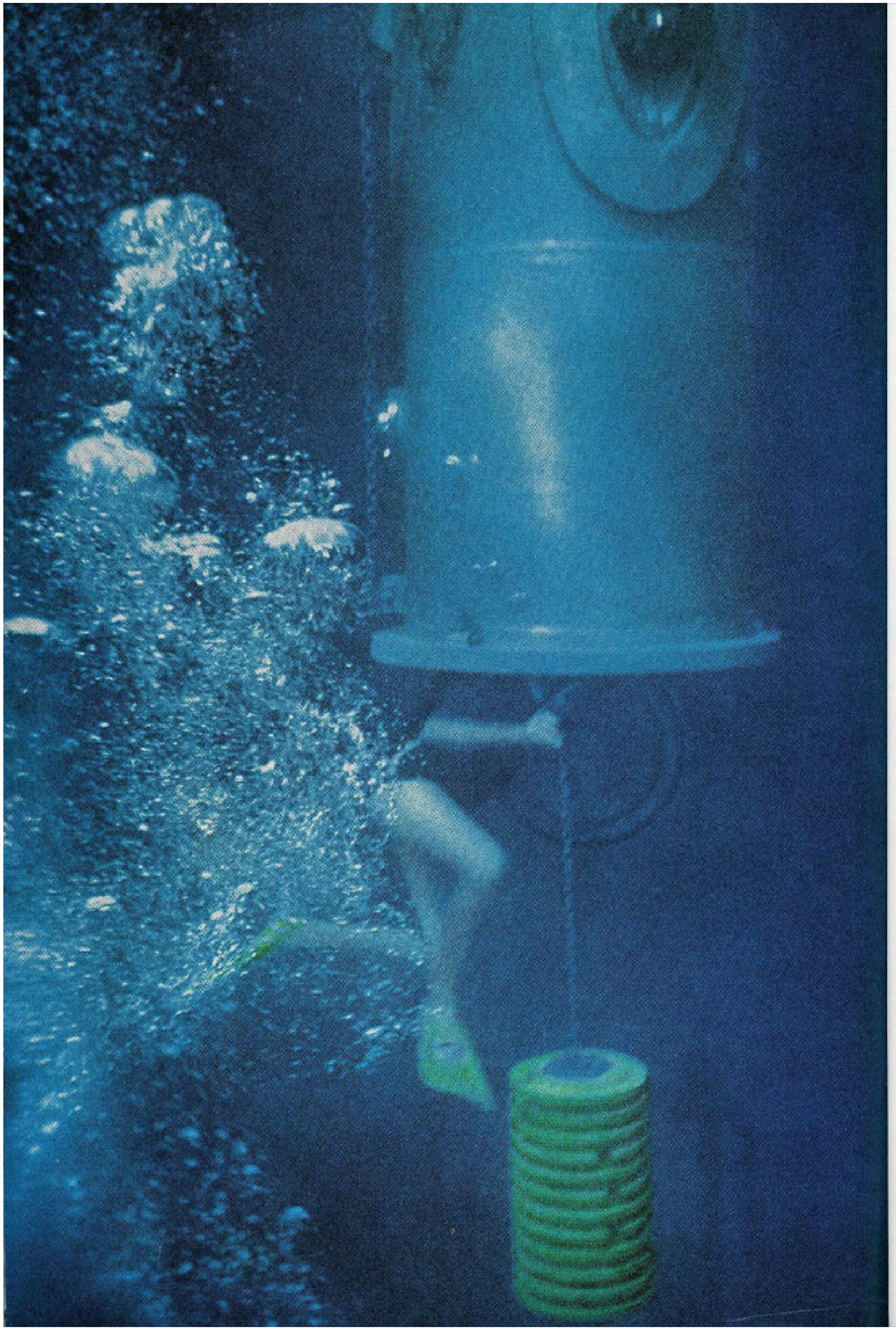
How this, and more, was accomplished off southern France last summer is told by Lord Kilbracken, in the following article.

We are grateful indeed to the U. S. Navy and its Sixth Fleet under Vice Adm. David L. McDonald for the fine cooperation given us in connection with these initial tests.

Besides the U. S. Navy and ourselves, other groups are working on diving problems.

The Swiss mathematician and diver, Hannes Keller, has gone as deep as 1,000 feet, but remained minimal time on the bottom, surfacing with drastically reduced decompression, using mathematical computations based on a secret mixture of gases.

Jacques-Yves Cousteau, the noted French undersea pioneer, has kept two divers in an underwater dwelling for a week, at a depth of 33 feet, from which they made sorties down to 80 feet.



Neither of these two approaches has combined the problems of remaining under water *at great depth for a long time.*

Thus far we have been able to achieve both considerable depth and substantial duration—200 feet for 24 hours, 15 minutes in the dive described by Lord Kilbracken.

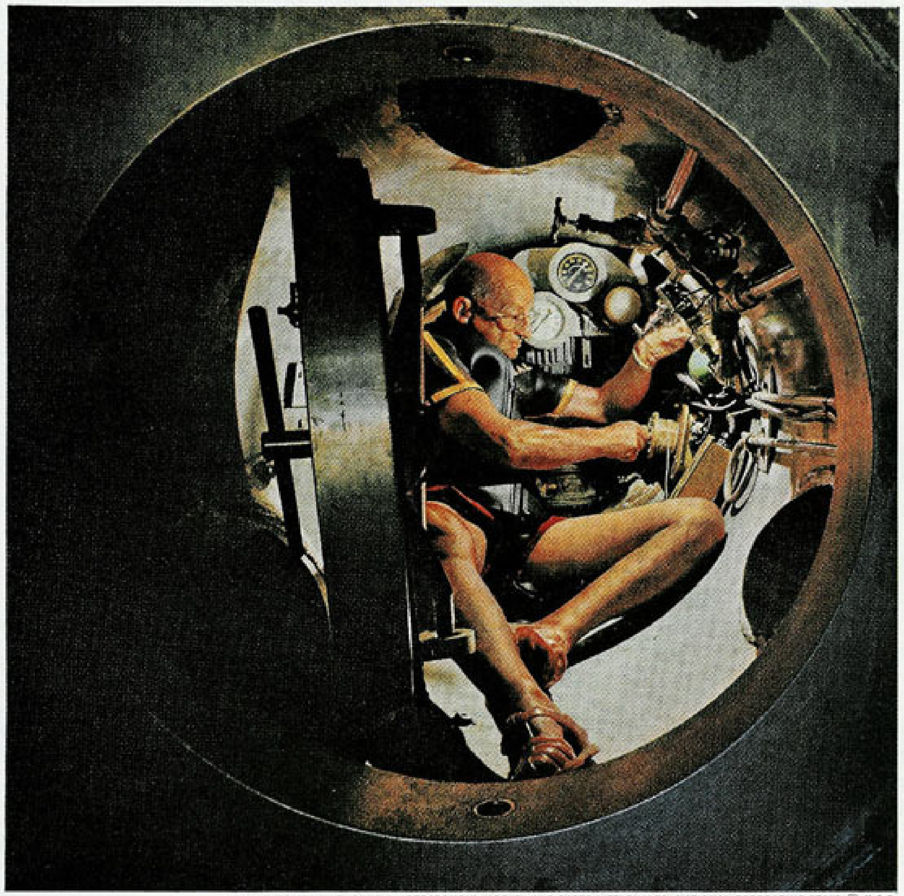
This summer we shall continue our experiments with animals at 400 feet for 24 hours or longer, in preparation for a program of manned dives.

During these experiments, which we shall conduct on the American side of the Atlantic, we plan also to test our Stage 1 large underwater housing for the first time. We are constructing it of rubberized fabric, instead of the steel originally specified. Inflated and anchored to the bottom, this "underwater tent" will house four divers, enabling them to sleep, eat, and work in safety and comfort.

We plan to continue Project Man-in-Sea in this unspectacular scientific manner, checking each step with care before proceeding to the next. * * *

Cloud of exhaust bubbles envelops diver Link as he climbs into the newly launched chamber from below. Although 58 years old, the inventor insisted upon making the first test dives himself. Eyelike port, one of three, enables him to scan the depths. Ballast rings hold the cylinder vertical at any depth and regulate buoyancy.

Zero hour approaches for the first major test. Designer Link makes a final check of the capsule's controls. He stayed submerged 8 hours at 60 feet.



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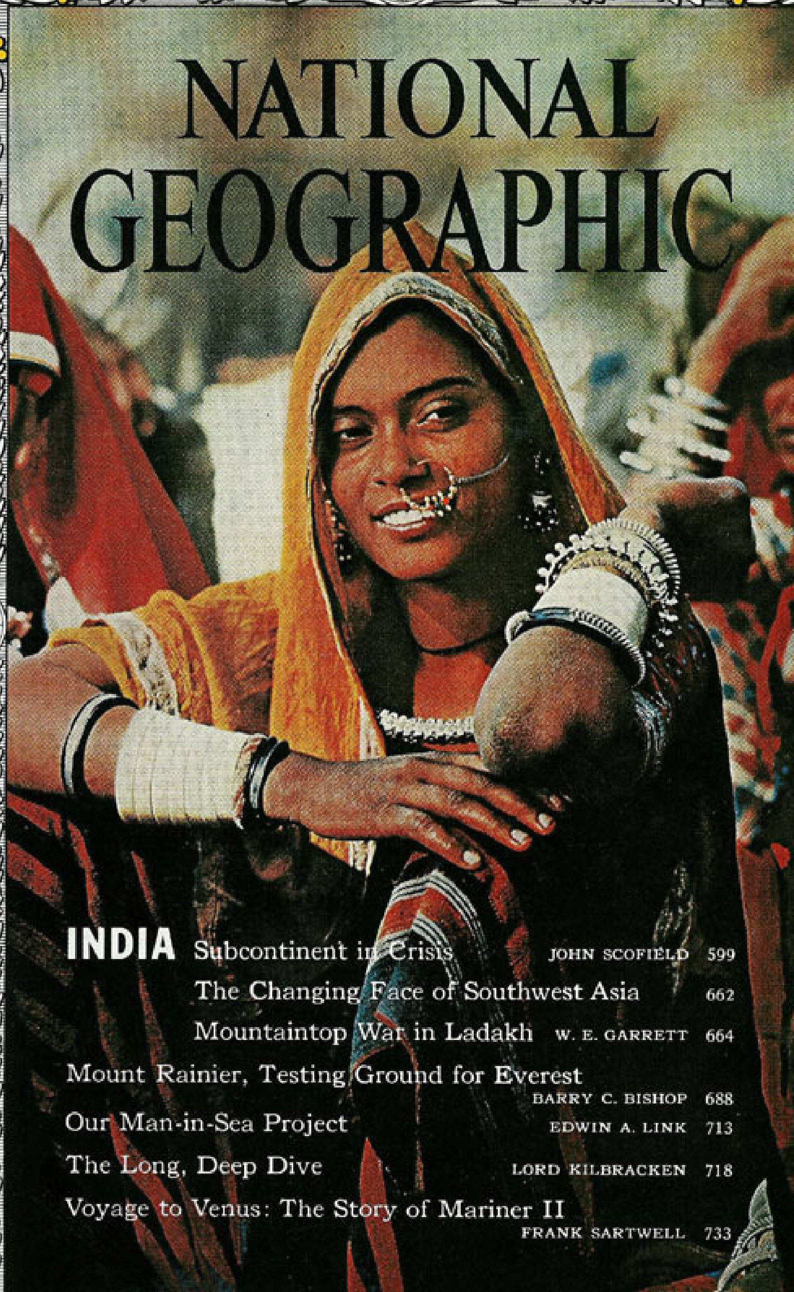

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