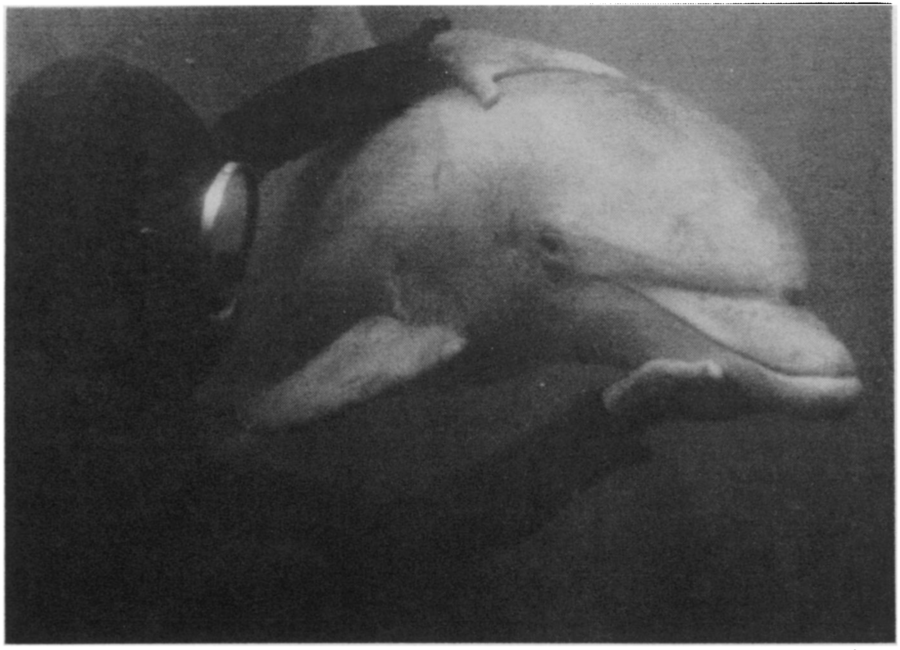
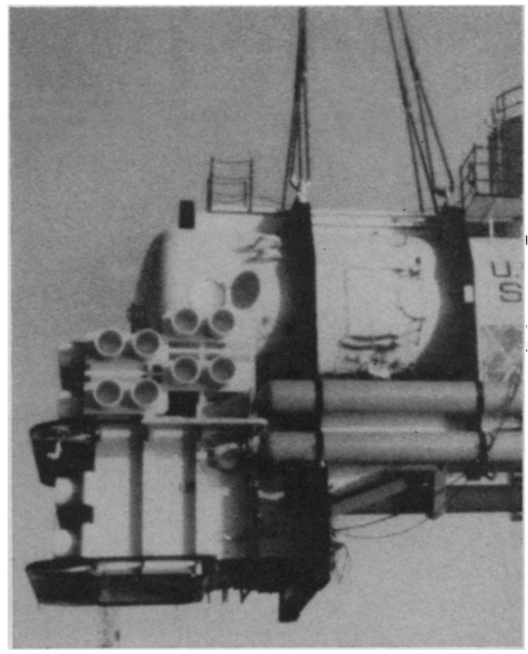


Navy

Porpoise Tuffy, one of Sealab III's five marine assistants, works with diver.



Sealab III = Sealab II + diving and

NEW FRONTIERS

Assault on the wet continent

A land area the size of Africa is at stake as Project Sealab culminates on the continental shelf

by Jonathan Eberhart

Earth's continental shelves, defined as that land sloping down beneath the ocean to a depth of 600 feet, amount to a continent in themselves. Together they cover some 11.5 million square miles—equal to the area of Africa. Exploring and exploiting them is a major oceanographic goal, held up by the limitations imposed by extreme depths.

In October, at least 40 men will join in what will be the first true attempt to live and work at the deepest limit of the continental shelf.

Their home will be Sealab III, an elaborate dwelling anchored in 620 feet of water near San Clemente Island off the California coast. There five consecutive eight-man teams of aquanauts will live for 12 days each, opening wider the gateway to man's exploration and use of the wet continent. The technique that makes this possible, the key to the assault on the deeps, is called saturation diving.

The U.S. Navy's depth limit for hard-hat divers spending half an hour on the bottom is 380 feet; at that depth, decompression from a 30-minute dive takes more than three hours, or six times the available working time.

By the time a diver has been at a given depth for about 24 hours, however, all the tissues in his body become saturated with the compressed gases in his breathing supply. He can stay at that depth as long as he wants without increasing his decompression time. It thus becomes much more economical for divers to refrain from commuting to the surface.

The first diver to reach saturation at significant depth in open water was Robert Stenuit, a young Belgian who spent 24 hours at a depth of 200 feet in a "submersible decompression chamber" designed by Edwin A. Link, inventor of the Link flight trainer.

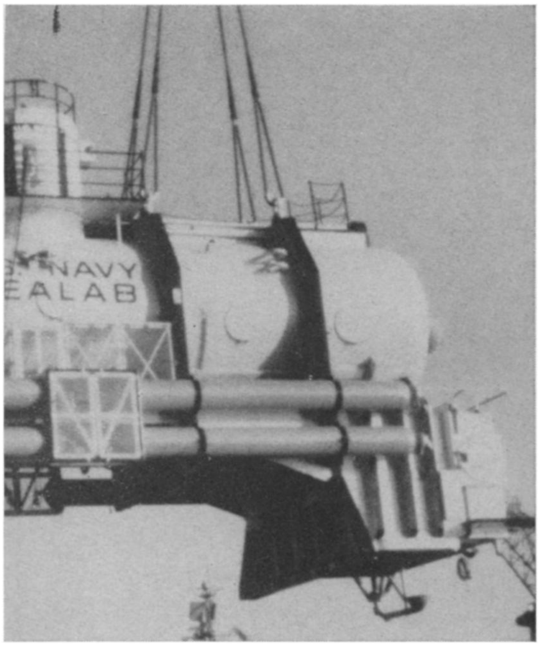
In June, 1964, Stenuit and another diver made what is still the deepest saturation dive, when they spent 49 hours in a new Link-designed capsule, 432 feet down in the Atlantic, off the Bahama Islands. One of the leading pioneers in the field, however, Navy Capt. George F. Bond of the Naval Medical Research Lab. at New London, Conn., began working in 1957 with animals in depth-simulating compression chambers. Besides investigating helium instead of intoxicating nitrogen as the inert component in the breathing mixture, he envisioned "development of both mobile and fixed underwater habitations from which scientists, engineers and military personnel could be routinely deployed."

At first, the use of human subjects in saturation diving was turned down. Soon afterward, however, the Navy's fledgling interest in manned space flight created some interest in research into helium-oxygen atmospheres, and the idea began to grow. In simulation chambers, three Navy divers first spent three days at 200 feet, then 300, and finally 400 feet.

Finally, in July 1964, Capt. Bond got his first sealab.

About the only way Sealab I could have been more of a personal triumph would have been if Bond had paid for it himself. "He practically got it going by the skin of his teeth," says another Navy diving doctor.

By comparison to its successors, Sealab I was a simple affair, made of two old mine floats, sectioned and welded together into a 40-foot cigar, 10 feet in diameter. Four aquanauts lived there for 11 days, placing ultrasonic beacons on the sea floor (the site was also a Navy sonar test area), installing current meters, rigging spot-



Navy

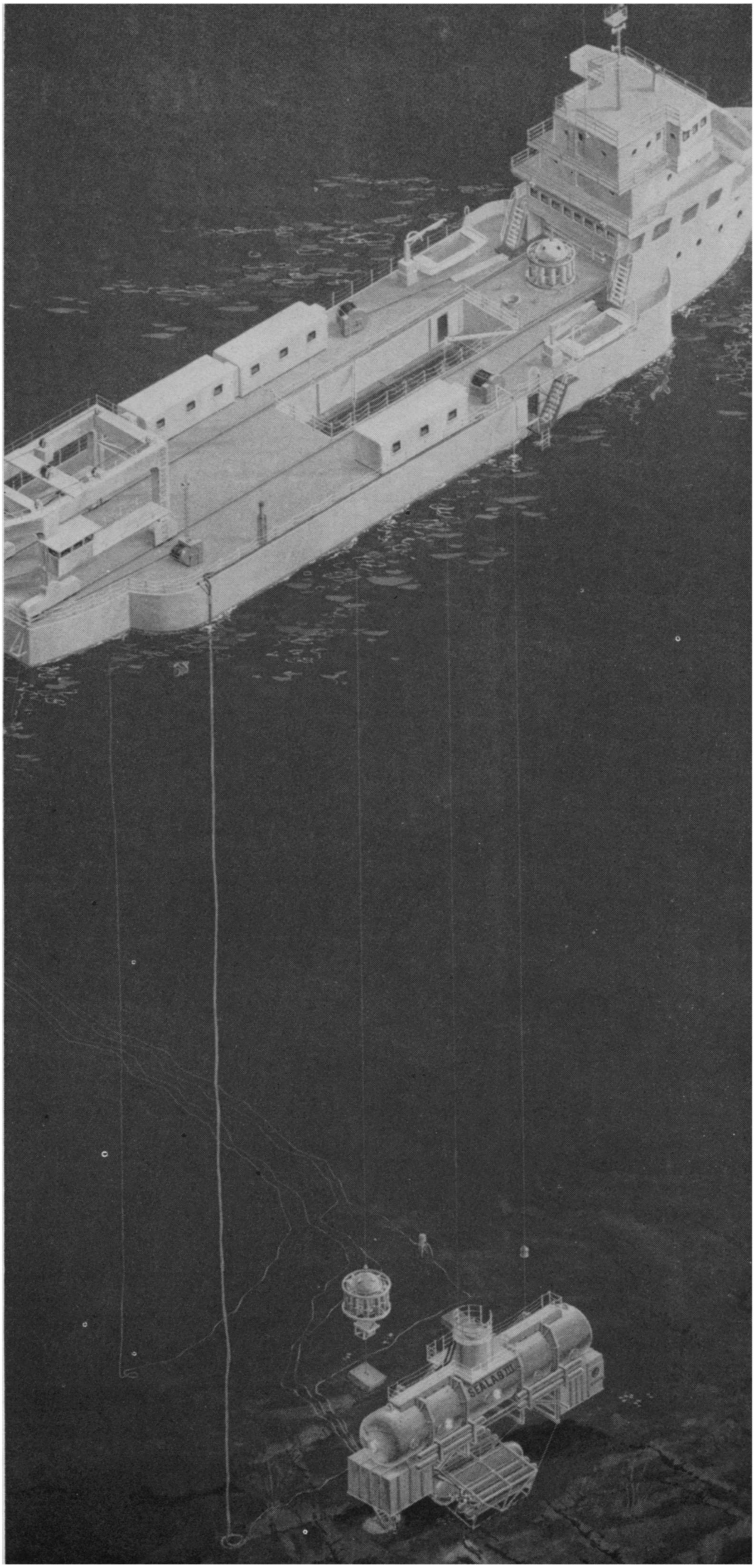
observation stations built on underneath.

lights and providing the Navy with its first first-hand data on living in the sea.

In September of 1965, Sealab II opened for occupancy off La Jolla, Calif. Besides being much larger than its predecessor (three 10-man teams lived 205 feet down for 15 days each), Sealab II was sited in dark, cold waters to tax the working divers to the utmost.

Sealab III is the climax, at the full depth of the 600-foot shelf. At least eight separate Navy units, plus the Bureau of Commercial Fisheries and Philadelphia General Hospital, have been working to develop the research program, which includes 29 projects and four general overall investigations at present, and may require a sixth eight-man aquanaut team to handle the load.

The human divers won't be alone. A member of the Sealab II team was a trained Atlantic bottlenose porpoise named Tuffy, who delivered tools and messages and helped rescue an aquanaut who pretended to be lost. In October, Tuffy will be back, this time accompanied by another porpoise, two



Navy

Sealab's support, once a landing craft, will provide power from above.

sea lions and a harbor seal. They will again deliver equipment to and from the divers, the habitat and the surface, as well as take part in search and rescue tests in which they will bring one end of a tethered line to an aquanaut in response to an acoustic signal.

Even with the help of these marine assistants, the aquanauts will be busy. Elaborate oceanographic instrumentation will be installed and monitored, including time-lapse cameras and equipment to record current and temperature data at three levels above the bottom at least once a minute. There will be a number of studies concerning light's attraction for fish and invertebrates, and the ability of several marine species to produce illumination of their own.

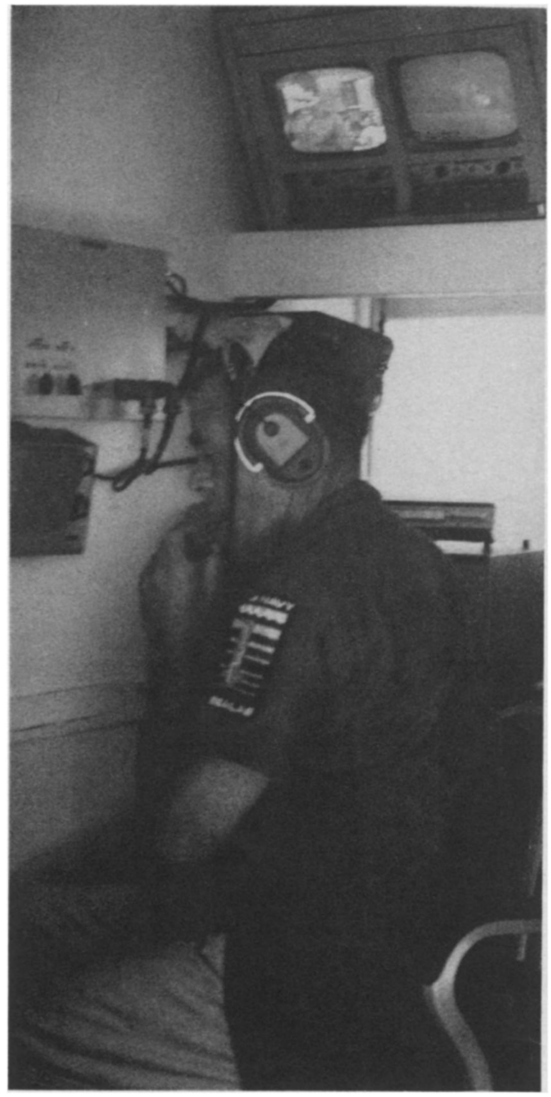
A group of aquanauts from the Bureau of Commercial Fisheries will conduct ecological and biological research.

More importantly, they will be studying the general Sealab engineering, diving and operations techniques to see what benefits the bureau could gain from subsea habitats of its own.

The military research possibilities of Sealab III have not been overlooked. The Navy's Mine Defense Laboratory, Missile Center and Undersea Warfare Center all have projects planned, including identification of the sounds produced by various marine creatures. The fixed habitat is expected to provide a much better laboratory than do submarines.

The biggest single project on Sealab III's schedule is the construction experiment. During Sealabs I and II, aquanauts erected small structures and pieces of equipment, and tried especially designed tools. This time, the divers will construct an entire building—a repair and storage station, 10 feet high and 10 feet in diameter, complete with shelves and interior lighting. To move heavy panels along the ocean floor, they will use a variable-buoyancy pod containing a hydraulic winch to provide lift. While they work, a floating chandelier will hover overhead for light.

Several different salvage systems, capable of lifting up to 25 tons, will be tried out, together with some experimental ways of locating objects on the ocean floor. The location techniques include a grid of lights, arranged in the shape of a spider's web, as well as strings of lights carried between aquanauts. Improved salvage techniques are one of the Navy's most hoped-for goals from deepsea research, and although Sealab III will be the last part of the current program, the next item on the saturation-diving agenda will be salvage methods that can be used down to 850 feet.



Navy

Band—Papa Topside—calls Sealab

Cold is a major problem at great depths, so the aquanauts will be trying out at least three kinds of heated suits (one equipped with an experimental nuclear power source), as well as various partial garments.

Body heat loss will be only one of the many characteristics being monitored in the elaborate medical and psychological program. Resistance to infection, changes in sleep cycles and adaptability to confinement will all be investigated. Telemetry will be used for the first time in Sealab III, to transmit to the surface the heart rates of aquanauts at different depths and while performing a variety of activities.

In the distant future, some researchers believe, man may be diving freely to depths of 10,000 feet or more, probably breathing some oxygen-rich liquid pumped directly into his windpipe and lungs. Experimental animals have already survived tests in which they absorbed oxygen via liquid-filled lungs. To reach such depths, however, there will be many more sealabs along the way. ◇