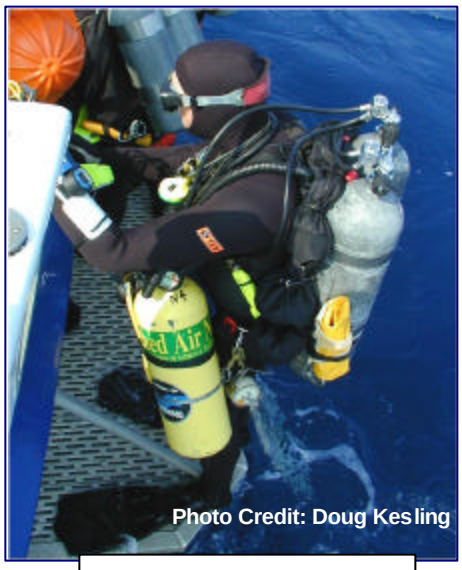
Advanced Diving in NOAA's Undersea Research Program

NOAA's Undersea Research Program (NURP) and the NOAA Diving Program together support more than 25,000 dives per year. Under the Outer Continental Shelf Lands Act, NOAA has the mandate to address the needs of scientific divers through advanced diving technologies.

Important objectives are to extend the current depth limit and bottom time per dive so as to increase significantly the undersea areas where self-contained wet-diving scientists can make first hand observations, take fine measurements, and conduct experiments. This extended capability will support NOAA missions in fisheries management, habitat restoration, National Marine Sanctuaries, ocean exploration, deep-sea corals, and marine biotechnology.

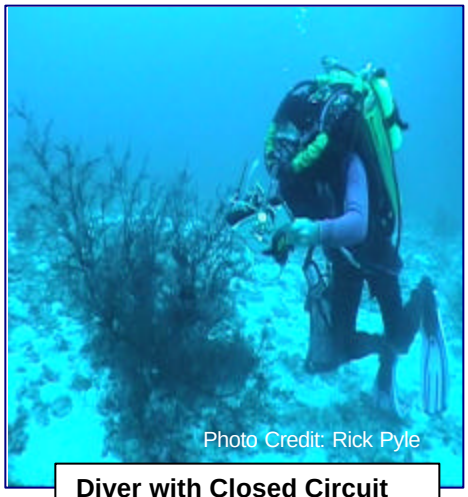


Open Circuit System

To increase the bottom time and depth limit of NOAA scientific dives, NURP is working with the NOAA Diving Program to:

Introduce closed-circuit mixed-gas rebreathers (CCRs) into NOAA dive programs

Standard SCUBA operates as an open-circuit system where the diver's breath is exhaled into the water. Closed-circuit breathing uses apparatus that recycles the diver's exhaled breath, removes the carbon dioxide, and replaces the consumed oxygen. This reduces the amount of gas that must be carried by the diver and increases dive time. A NOAA-sponsored working group has generated a safety standard, *Minimum Manufacturing and Performance Requirements for CCRs*. CCRs that meet these requirements will be approved for use on NOAA-sponsored dives.



Diver with Closed Circuit Rebreather (CCR)

Adopt techniques to extend the safe diving depth of NOAA dives from 130 feet to 300 feet

Several scientific diving programs operated by NURP's university partners have implemented innovative deep diving techniques that use in-water decompression and helium-nitrogen-oxygen gas mixes to extend the safe diving depth to 300 feet. These techniques have been successful, most notably in conjunction with NOAA's scientific oversight of the recovery of artifacts from the USS *Monitor* shipwreck. Based on this success, NURP is working with the NOAA Diving Program and the American Academy of Underwater Sciences to establish advanced diving procedures for scientific dives to 300 feet.

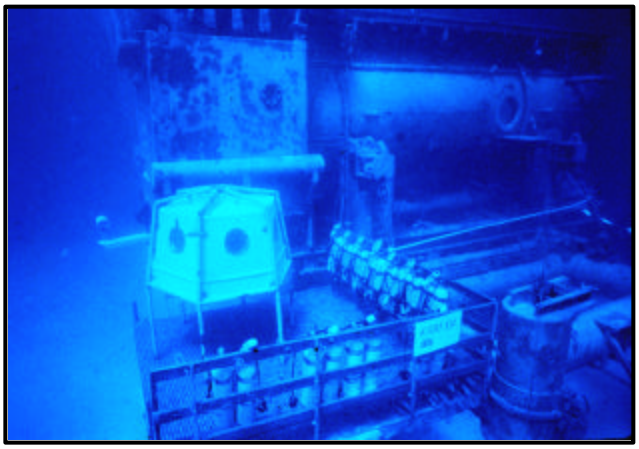
In addition, NURP is also working to:

Facilitate the formation of the Hawaii Advanced Diving Consortium

The Hawaii Advanced Diving Consortium will function as a regional multi-agency association where members may share expertise and equipment to support advanced scientific diving operations. Proposed participants include several NOAA agencies and programs (NURP's Hawaii Undersea Research Laboratory, the NOAA Diving Program, Office of Ocean Exploration, National Marine Fisheries Service, and the National Marine Sanctuaries Program), the University of Hawaii, the Bishop Museum, and possibly, the U.S. Navy and the U.S. Coast Guard.

Develop a Next-Generation Undersea Laboratory System

The NURP-sponsored undersea lab *AQUARIUS,* deployed at a depth of sixty feet in the Florida Keys, has advanced NOAA's capability to conduct strategic shallow coral research. Part of NURP's long term scientific and, potentially, economic vision is to develop the ability for humans to live and work under the sea, to the edge of the continental shelf (to depths up to 3000 ft). NURP is working toward the next generation of undersea laboratories, which will be mobile, increase bottom time for a greater number of scientists over a larger geographical area, and have enhanced underwater depth capability.



AQUARIUS on ocean floor, Florida Keys

This will require development of a combination of tools and techniques for humans to interact productively with the deep-sea environment from on-site and remote locations. Tools could include submersibles that allow divers to lock out at depth, undersea laboratories where humans live and work for extended periods at depth and remotely operated vehicles, to be used in combination with these facilities.

Scientific Dive, Deep Ocean Floor (Artist's Concept)

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