



# Technology to Research the Ocean Depths



## NOAA's Undersea Research Program

NOAA's Undersea Research Program (NURP) has been a leader in supporting NOAA's undersea research requirements for over two decades. Through its unique consortium of six university-based NURP regional centers and one research institute, NURP has afforded NOAA access to the full spectrum of undersea technology systems and established an effective foundation for capacity-building partnerships with the private sector, academia, and a variety of government agencies. These factors, along with a long history of safe diving and undersea operations, place NURP in a singular position to cost effectively support NOAA's undersea research, technology development and operational requirements.

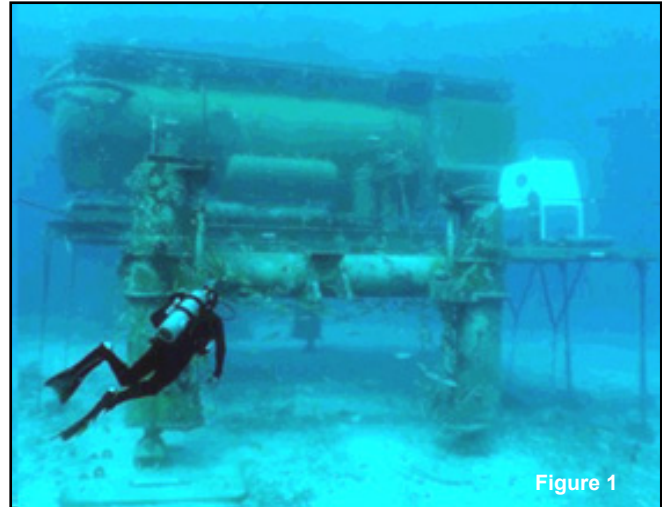


Figure 1

### Undersea Habitat

- Aquarius (Figure 1), located in the Florida Keys National Marine Sanctuary, is the world's only undersea laboratory devoted solely to oceanic research. Aquarius provides habitat and a base from which scientists conduct detailed studies of the surrounding coral ecosystem; habitat and training for NASA astronauts; and science projects and lessons for high school students through a web link.

### Human Occupied Submersibles

- HOVs owned by NURP centers include *Pisces IV* and *V* (Figure 2), two of only 9 submersibles in the world that can dive to depths of 2,000 m (6,562 ft). Their use has provided unprecedented knowledge of the Pacific's undersea volcanic processes and deep sea coral habitats.
- NURP provides scientists the means to lease submarines, including the Johnson Sea Link, Delta, and Alvin.



Figure 2

### Remotely Operated Vehicles

- ROVs are underwater robots controlled from a support platform by a long tether. NURP provides scientists access to such ROVs (Figure 3) as the Kraken, Phantom, Hela, and Jason/Medea which are fitted with advanced camera, lighting, and sampling systems allowing scientists to be virtually transported, through real-time video transmission, to depths up to 6,500 m (21,385 ft).

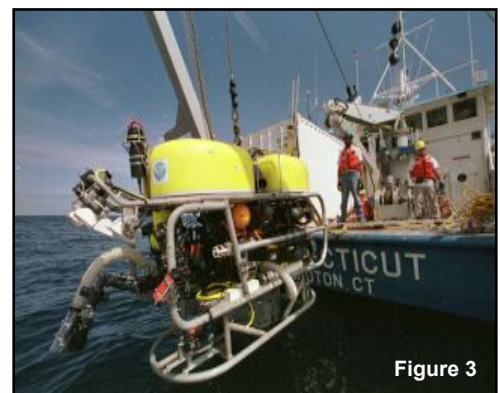
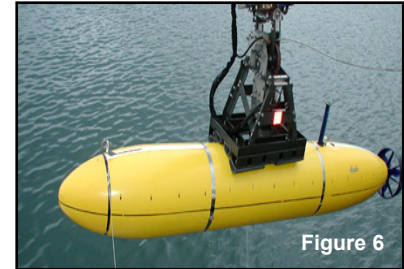
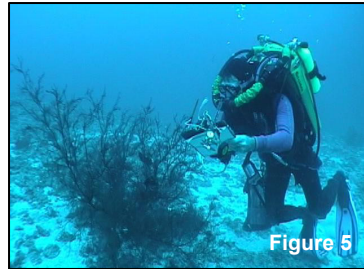


Figure 3

## Advanced Diving

- NURP served as NOAA's lead agency in producing the *NOAA Diving Manual*, considered by many as the standard for scientific and recreational diving.
- NURP has been instrumental in introducing deep diving techniques, including development of NOAA's requirements for the use of closed-circuit mixed gas rebreathers (Figure 5), to support scientific dives to 300 feet and expand NOAA researchers' abilities to explore and characterize the full scope of coral and fisheries ecosystems.



## Autonomous Undersea Vehicles

- NURP has used various types of AUVs (Figure 6), which are untethered submersible robots, to carry out wide continental shelf surveys and to determine fish distribution patterns.
- In 2006 a second NURP research center begins operating an AUV capable of mapping the seafloor continuously for 10 days.
- NURP has purchased Autonomous Underwater Gliding Vehicles (AUGV) capable of changing buoyancy, allowing them to record temperature, turbidity and oxygen levels at varying depths. These will be used to conduct wide-area coastal ocean surveys lasting up to 30 days in length.

## Ocean Observing Systems

- The world's first undersea observatory (LEO-15) demonstrated the feasibility of an undersea observatory, and has collected valuable scientific ecosystem information for the Mid-Atlantic Bight.
- In May 2005, NURP, in partnership with DOE and MMS, began deploying the nation's first deep ocean observatory at a methane hydrate site in the Gulf of Mexico. A microbial observatory will soon be established at the site.

## Develop and test new technologies

- Through its National Institute for Undersea Science and Technology (NIUST), NURP develops innovative remote and direct sampling technologies for the investigation of deep sea beds with ROVs, AUVs, and HOVs.
- NURP has supported tests of new laser line scan (LLS) technology to map deeper seafloor habitats and to quantify the composition of fish inhabiting these areas.

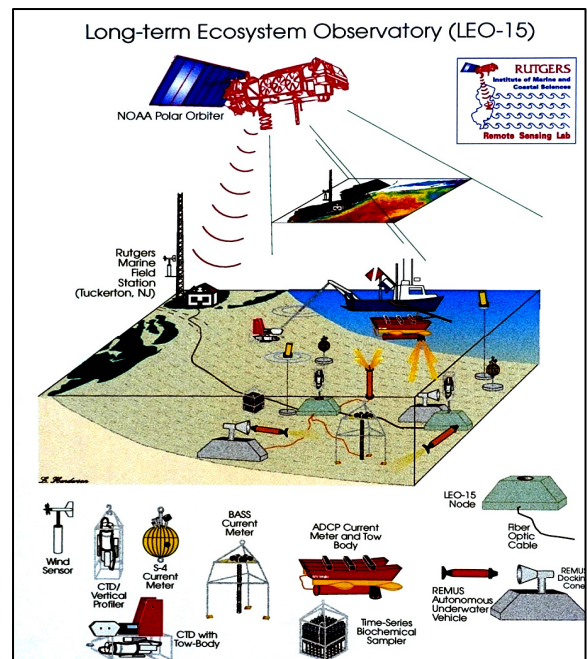


Figure 7



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