NOAA’S SURFACE-SUPPLIED DIVING PROGRAM: PAST, PRESENT AND FUTURE

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Introduction

The National Oceanographic and Atmospheric Administration (NOAA) administers a variety of programs that require research below the surface of the water. Methodologies include the use of diving, ROVs, and submersibles. Both the NOAA Diving Program and the NOAA Undersea Research Program utilize wet diving.

Intramural Diving Program

The NOAA Diving Program (NDP) trains, certifies, and equips NOAA employees and contractors to perform a variety of underwater tasks in support of NOAA's mission and to ensure that all diving operations are conducted safely, efficiently, and economically. NOAA has 500+ active divers in 57 locations throughout the United States, including Alaska, Hawaii, and American Samoa, and on all 19 NOAA ships. The headquarters for the dive program is located at the NOAA Western Regional Center in Seattle, Washington.

NDP’s experience with surface-supplied diving is limited. In the 1980s, the dive program developed and tested hybrid surface-supplied diving systems and specialized equipment for diving in polluted water. Operationally, there were less than 10 surface-supplied diving missions between 1970-date. The last mission was to the U.S.S. MONITOR in 1993. At present, the NDP only conducts surface-supplied familiarization dives once a year in the dive center’s training tower during the Diving Medical Officer class. Future plans include the development of shallow-water tethered scuba and lightweight surface-supplied diving programs.

Extramural Diving Program

The NOAA Undersea Research Program (NURP) provides scientists with the tools and expertise they need to investigate the undersea environment, including submersibles, remotely operated vehicles, autonomous underwater vehicles, mixed-gas diving equipment, underwater laboratories and observatories, and other cutting edge technologies. NURP is comprised of six regional Centers and a National Institute and is headquartered at the NOAA complex in Silver Spring, Maryland.
NURP’s experience with surface-supplied diving has been confined primarily to two Centers: the University of North Carolina at Wilmington, North Carolina and Rutgers University in New Jersey.

From 1982 thru 1985, NURC/UNCW operated the R/V SEAHAWK and conducted undersea research in the South Atlantic Bight using commercial diving equipment and techniques (i.e., surface-supplied diving). In 1986, the program was discontinued due to inadequacies of the support vessel, and limitations of the technology and number of interested/qualified scientists. In December 1986, the Center sold the R/V SEAHAWK and adopted a multidisciplinary approach to operations using nitrox scuba, ROVs, and leased manned submersibles. Currently, NURC/UNCW uses surface-supplied diving for deploying and retrieving the Aquarius undersea laboratory, as well as performing shallow, close range excursions from the habitat.

NURC/Rutgers currently uses surface-supplied diving for science-related work on the underwater observatory, LEO-15. The Center has no plans to expand the use surface-supplied diving in the future.

NURC/UNCW Diving Program

The Center at UNCW was established by NOAA in 1980 through a national competitive process. Originally called the Southeast Undersea Research Facility (SURF), the title was later changed to NURC. The program utilized a mobile diving platform (R/V SEAHAWK) and commercial diving equipment and techniques to place scientists on the seafloor.

The R/V SEAHAWK was a converted 80-foot shrimp trawler with a 3-point mooring system. Equipped with berthing for 14 for up to 10 days duration on station, it was capable of 7-9 knots speed and operated from Cape May, NJ to the Flower Gardens in the Gulf of Mexico. Personnel included a Captain, Engineer, Cook and additional crew provided by the diving staff. The onboard diving systems included KMB masks and Superlite 17 helmets, a 60-inch double-lock recompression chamber, two HP air compressors, air, nitrox and HeO2 gas storage cylinders, a three-diver console, and a Class II diving bell. The diving staff included one diving supervisor and four divers/tenders.

Surface-supplied dive training

Surface-supplied dive training prerequisites consisted of proof of scuba certification, a diving physical examination, and 25 logged dives. The four-day training program, which was taught immediately prior to the start of a mission, included classroom theory and pool and confined water exercises.

The classroom training curriculum covered surface-supplied diving equipment, diving and tending procedures, dressing/undressing procedures, in-water and surface decompression tables and procedures, and emergency procedures such as loss of
umbilical supply. The practical sessions involved tending procedures, dressing/undressing the diver, entering/exiting the water, voice and line-pull communications, tether management, and simulated emergency situations such as a loss of primary gas supply or voice communications.

**NURC/UNCW surface-supplied diving standards**

The minimal staffing level required a diving supervisor, rack operator, standby diver, and two tenders. Minimum equipment included masks or helmets, voice communications, umbilicals, gas supplies, gas rack/console, diver worn equipment (e.g., bail-out bottle, weight belt, safety harness, boots/fins, and knife), a recompression chamber, and a diver stage or bell with deployment capability.

Depth limits were restricted to 190 fsw on air and 300 fsw on mixed gas, with bottom times limited to those in the U.S. Navy air and HeO₂ decompression tables. Environmental conditions for surface-supplied diving could not exceed 3-5 foot seas, current over 1 knot, and wind over 20 knots.

**Table 1. NURC/UNCW Surface-Supplied Diving Statistics.**

<table>
<thead>
<tr>
<th>Depths (fsw)</th>
<th>0-25</th>
<th>26-50</th>
<th>51-75</th>
<th>76-100</th>
<th>101-125</th>
<th>126-150</th>
<th>151-175</th>
<th>176-200</th>
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<tbody>
<tr>
<td>Dives</td>
<td>15</td>
<td>7</td>
<td>5</td>
<td>27</td>
<td>44</td>
<td>74</td>
<td>13</td>
<td>2</td>
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<table>
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<tr>
<th></th>
<th>1983</th>
<th>1984</th>
<th>1985</th>
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<tr>
<td>Dives per year</td>
<td>45</td>
<td>76</td>
<td>66</td>
</tr>
<tr>
<td>Hours BT</td>
<td>15</td>
<td>41</td>
<td>26</td>
</tr>
</tbody>
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**Lessons Learned**

The diving platform must have adequate open deck space and be stable and capable of holding station in changing sea conditions, winds, and currents.

Surface-supplied diving requires substantial pre-dive preparations and offers limited vertical and horizontal mobility compared to scuba. Diver thermal protection must be considered due to longer bottom times and voice communications are definitely a positive feature. Such diving is not for everyone. Some scientific divers do not have the physical strength to handle the gear, and others may never get comfortable with it. Four days is not enough time to train the average scuba diver to become comfortable and competent in surface-supplied diving equipment for moderate to deep open-sea diving. Additionally, once trained most scientists cannot maintain surface-supplied diving proficiency at their home institutions. Surface-supplied diving requires an appropriate number of trained and experienced professional divers to serve in support roles. And finally, diving support personnel (i.e., divers, tenders, supervisors) should not be used in other capacities aboard (e.g., standing watches) that prevent them from getting adequate rest.
Conclusions

Surface-supplied diving operations can be a viable diving mode for certain research applications. The limiting factors are the availability of stable platforms, adequate training and experience of scientists, and professional support staff. Scientists must be comfortable in the gear in order to be productive. In NOAA’s experience, moderate to deep open-sea dives using surface-supplied equipment from a stage or open-bottom bell may have limited application for the average scientific diver.