Scientific diving beyond 190 FSW! The NURC/UNCW Experience

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Technical diving is currently being refined to enable man to gain access to depth, dive time and unique underwater environments through the use of specialized equipment and diving techniques. NURC/UNCW, with a grant from NOAA, has been providing advanced undersea technologies to the marine scientific diving community for nearly two decades. This paper explores NURC's experience in the development of new diving technologies to meet the ever-increasing demands of marine scientists, and to maximize the safety and productivity of scientific diving.

INTRODUCTION

The National Undersea Research Center at the University of North Carolina at Wilmington (NURC) is funded by a grant from the National Oceanic and Atmospheric Administration (NOAA) to support marine research using undersea technologies including divers, ROV's, submersibles and undersea habitats. Since 1986, NURC has increased bottom times and maximized scientific productivity of its scuba operations primarily through the use of Enriched Air Nitrox (EANx). During the past decade, NURC divers have logged well over 20,000 manned dives using EANx in scuba and surface supplied diving modes. Despite the increase in bottom times, scientists still seek greater dive times and depths. In the past few years, NURC explored the operational capabilities needed to dive beyond 130 FSW.

TECHNICAL DIVING

Technical Diving is defined as "the use of advanced and specialized equipment and techniques to enable the diver to gain access to depth, dive time and specific underwater environments more safely than might otherwise be possible." [1] In 1994, NURC sought approval from the NOAA Diving Program (NDP), which governed Center operations at that time, to conduct staged decompression for scientific research diving application. With the assistance of Captain Billy Deans of Key West Divers, Inc., NURC personnel participated in technical dive training to determine if this was a viable technique for marine science. Late

Figure 1. Divers completing staged decompression following an extended range dive off the NC coast.

in 1994, NDP granted approval for NURC to conduct decompression dives incurring a one stop, decompression obligation. An in-house pilot program explored equipment issues, training, field logistics and the use of hyperbaric chambers. A series of decompression dives were conducted to gain experience and refine techniques for this diving mode.

Figure 2. Technical diver explores the remains of a sunken shipwreck off the NC coast.

FIELD EXPERIENCE

In 1995, NURC participated on an expedition to the Ironclad Warship U.S.S. Monitor National Marine Sanctuary (NMS) to conduct archaeological research dives and determine the feasibility of technical diving in this environment. Dives were completed concurrently with the U.S. Navy's efforts to recover the propeller from the *Monitor*. This mission was conducted as a cooperative venture by the U.S. Navy, NDP, NURC and the *Monitor* National Marine Sanctuary. Captain Billy Deans was contracted by the *Monitor* NMS to serve as the Mission Diving Supervisor and provided initial training and field supervision for all NDP and NURC divers. A total of eight dives were accomplished to 218 FSW on the *Monitor*, and an assessment was made of technical diving for scientific research applications. NOAA Trimix I tables developed for NOAA by R.W. Hamilton [2], were used to support the NDP diving operation. These tables, which were developed for use on previous Monitor missions sponsored by the NDP, used 18% oxygen that was selected by Dr. Morgan Wells, former NDP Director, to help ease the field preparation of the trimix gases.

ENHANCED DIVING CAPABILITIES

With the growth and popularity of technical diving and the means to safely dive beyond 190 FSW for scientific exploration, NURC began to assemble the necessary components to conduct a technical diving program in anticipation of requests from the scientific diving community. This year, NURC built a new portable, mixed gas delivery system capable of supporting compressed air, enriched air nitrox and trimix diving operations. The system is housed in a trailer that can be towed to a remote shore location or placed on shipboard for extended operations. The system includes; two (2) Rix 5.5 cfm oil-free compressors,

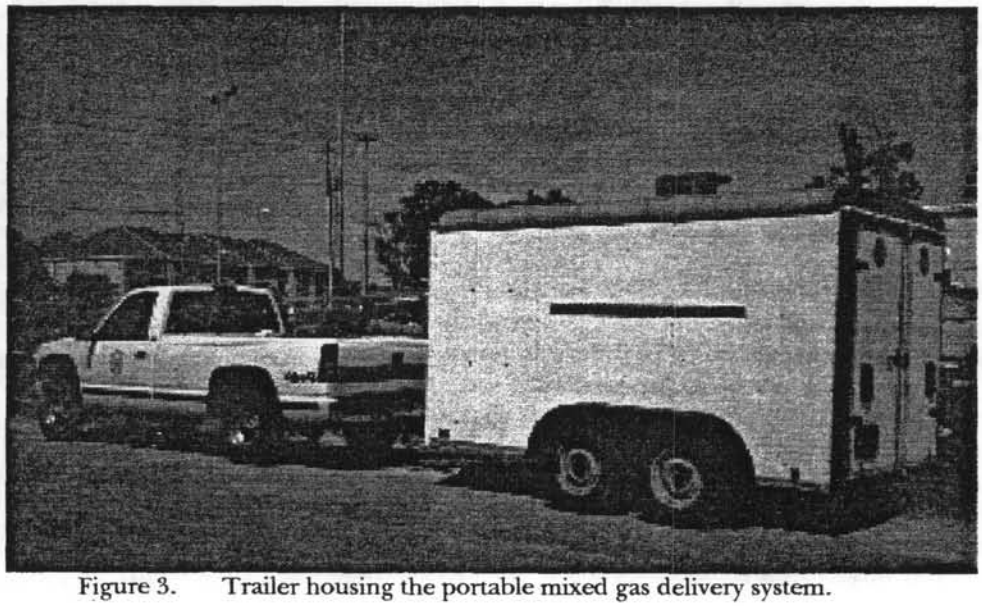

Figure 3. Trailer housing the portable mixed gas delivery system.

3,000 cubic feet of stored gas, an electric Sierra boost pump, oxygen analyzers and a Haskel boost pump for gas transfer of helium and oxygen. Construction of the system was cost shared with the NOAA Gray's Reef National Marine Sanctuary and is currently in use in Savannah, Georgia in support of research diving in the National Marine Sanctuary.

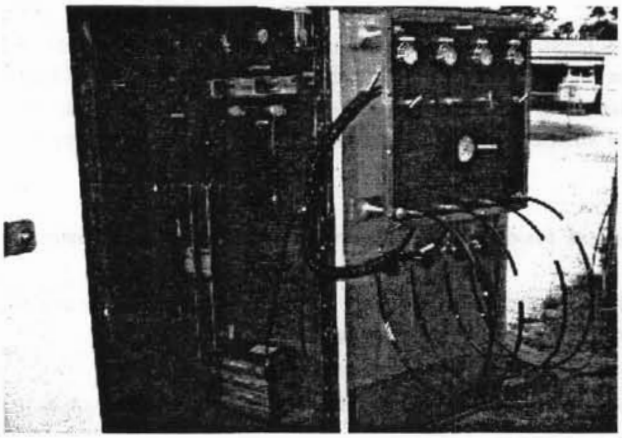

Figure 4. The mixed gas delivery system is capable of supporting compressed air, enriched air nitrox and trimix diving operations.

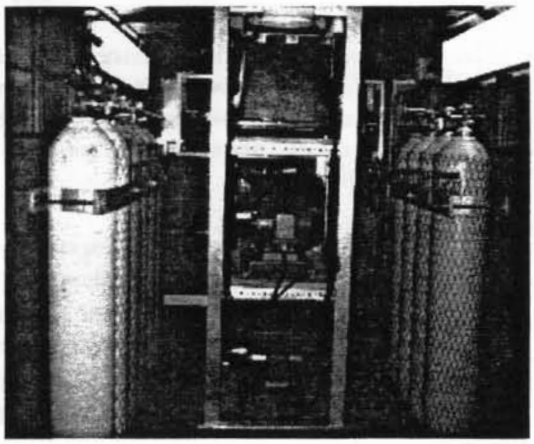

Figure 5. The portable mixed gas delivery system can be towed to a remote shore location or placed on shipboard for extended operations.

RESEARCH VESSEL OPERATIONS

It became evident from our field experience to the *Monitor* in 1995 that a research vessel, larger than NURC's 46 foot Bertram, would be needed to support the additional diving equipment and personnel required for an extended range diving operation. In June of 1997, the University of North Carolina at Wilmington purchased a 63 foot vessel, *R/V Cape Fear*. The *R/V Cape Fear* is a fast, comfortable vessel capable of supporting oceanographic research, scientific dive training and marine education in waters from near-shore to the continental slope along the Southeastern United States. The *R/V Cape Fear* can operate as a day boat, returning to port each night; or for extended missions, staying out to sea for up to

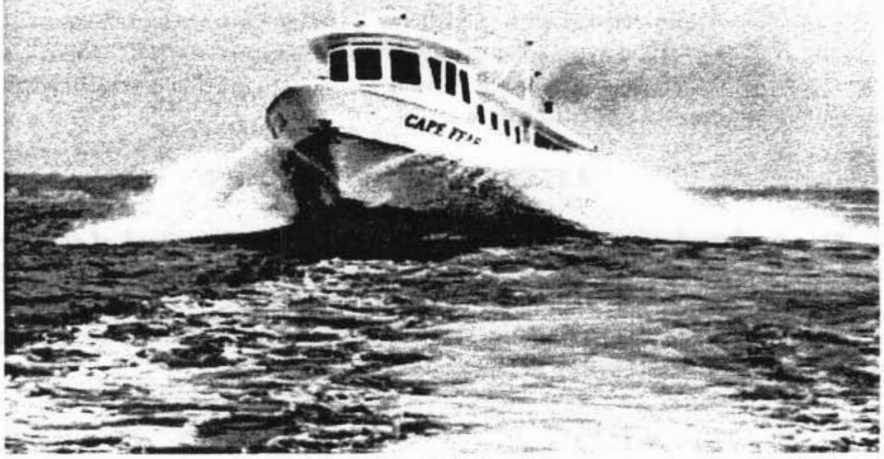

Figure 6. *R/V Cape Fear*

five days at a time. Operations can be conducted from Chesapeake Bay to the Gulf of Mexico. The *R/V Cape Fear* has berthing for eight scientists and two crew with a total capacity of twenty for day operations. An A-frame and enriched air nitrox mixing station is planned in the near future.

1997 AND BEYOND

The requirements of the science community determine the technologies that NURC adopts and develops. The Center is now reviewing the needs and operational aspects of offering technical diving to the science community. A related survey is being circulated by mail and electronically (see NURC Web site at www.uncwil.edu/nurc). Recent requests to the Center specifically require scuba diving greater than 130 FSW, including:

- exploration for new marine compounds extracted from invertebrates, for a variety of potential biomedical and biotechnical applications
- ecological studies of mid and outer shelf reef fish habitats, targeted by commercial fisheries off the southeast and likely candidates for future closed management reserves
- monitoring of fouling and fish communities on offshore oil and gas structures
- geological surveys and sampling of ancient submerged shorelines in order to understand past climates and sea level rise
- further archaeological investigations of the *U.S.S. Monitor* and other notable wreck sites throughout the southeast region.

Many questions remain which need to be answered concerning scientific research dives beyond the OSHA scientific diving exemption of 190 FSW. Current issues to be resolved include:

Will the OSHA scientific diving exemption allow for scientific diving beyond the 190 FSW limit?

Will the use of hyperbaric chamber on-site be required for technical diving?

What constitutes a reserve breathing supply?

Will the nature or task of work dictate the diving technology required?

As NURC becomes more experienced with these new technologies and advanced capabilities, many of the questions facing the scientific diving community will be answered. NURC will continue to provide safe and effective diving operations to scientific divers from around the country, and push back the frontiers and mysteries that remain beneath the sea.

LITERATURE CITED

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2. Hamilton, R.W. 1993. NOAA/HRL Trimix decompression tables for dives on the *USS Monitor.* Hamilton Research, Ltd, Tarrytown, NY.