NAVY EXPERIMENTAL DIVING UNIT
WASHINGTON NAVY YARD
WASHINGTON, D.C. 20390

EXPERIMENTAL DIVING UNIT REPORT
21-72
1000 FOOT UNMANNED CERTIFICATION
DIVE IN #6 CHAMBER COMPLEX

BY
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25 AUGUST 1972

Approved for public release; distribution unlimited

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ABSTRACT AND INTRODUCTION

An unmanned dive was made in #6 chamber complex at the Navy Experimental Diving Unit on 7 August 1972. The dive's purpose was to demonstrate the operation for the purpose of certification before commencing a manned deep dive program reaching depths of up to 1000 feet sea water.

With the exception of the problem of fouling in the drain valves, and the two false alarms in the fire suppression system, the complex met all performance requirements satisfactorily. Based on this test, the complex demonstrated that it is capable of supporting life at 1000 feet sea water, after removal of foulage in the drain valves.
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1. Purpose

1.1 The three major areas of concern for certification were the stress analysis, life support and electrical systems. The following personnel from Naval Facilities Engineering Command and Naval Ship Engineering Center witnessed the tests:

Mr. A. P. Ianuzzi Certification Engineer NAVFAC
Mr. T. Hayes Electrical Engineer NAVFAC
Mr. R. Medani 6154C NAVSEC

2. PreDive

2.1 All teledyne automatic O2 monitoring and adding sensors were removed for instrument protection. The sanitary holding tank was filled with fresh water to test the flushing system. The flushing system inner hull stop valve was opened.

2.2 The shower was rigged in front of a port and its inner hull stop valves opened. The inner door of the medical lock was rigged with rubber elastic straps for testing at depth. The air winch was rigged with a weight attached to the inhaul control chain and a suitable weight was attached to the hook and the inner hull stop valves were opened.

2.3 All gauges were calibrated. A dial indicator was rigged to the wetpot drain line to measure, if any, the expansion of the drain line under pressurization, and the fire suppression system was activated for testing.

3. Compression

3.1 Compression was followed according to a schedule of pressurizing the complex to 14 feet at 60 feet per minute on air; then on to depth at 40 feet per hour with oxygen being added to maintain the PO2 at .3 atmospheres. CO2 was kept to 0.5% surface equivalent, stopping at 54 feet, 300 feet, 600 feet, 800 feet and 1000 feet, for leak testing and equipment checkout.

4. Equipment Checkout and Test Data

4.1 All equipment and testing was carried out according to a dive protocol containing the equipment scheduled to be tested. The following is a summary of the test results.
4.1.1 Chamber Complex

4.1.1.1 Leak testing of all fittings and valves was carried out at each stage of compression. A leak was discovered in the wetpot drain valves at 900' due to foulage caught between the seating surfaces of both valves. Except as noted, all fittings and valves held satisfactorily according to design specifications.

4.1.1.2 Communication and lighting: Operated satisfactorily according to design specifications.

4.1.1.3 Outer Lock: Was tested by taking it to 14 feet on air, then to 1000 feet at the rate of 40 feet per minute on helium. The lock operated according to design specifications.

4.1.1.4 Medical Lock: Was operated by equalizing with the igloo, at a depth of 1000 feet satisfactorily according to design specifications.

4.1.1.5 Air Winch: Was operated satisfactorily at 1000 feet according to design specifications.

4.1.2 Life Support System

4.1.2.1 Temperature and Humidity Control: The life support system maintained a temperature range of between 81° and 85°F with a relative humidity of 49 to 51%.

4.1.2.2 Atmosphere Monitoring Instruments: Monitoring of the atmosphere inside the complex was achieved through the use of two (2) Beckman F-3 oxygen analyzers and two (2) Beckman IR 315 carbon dioxide analyzers. One set (F-3 + IR 315) was coupled to the chamber and the other set coupled to the igloo, giving a constant readout of the O₂ and CO₂ content. All monitoring instruments operated efficiently according to design specifications.

4.1.2.3 Teledyne Automatic O₂ Control System: This system was not used during the dive due to the fact that the sensors would not be able to keep up with the rate of descent and ascent. It was feared that the sensors would embolize, causing damage to the instruments.

4.1.2.4 Manual O₂ Add System: Was used throughout the dive and proved satisfactory according to design specifications.

4.1.3 Bib Mask System and Emergency Gas System

4.1.3.1 The emergency gas system was charged to 150 psi over ambient complex pressure with no leakage or regulator creep noted.
4.1.3.2 O₂ Dump System: Was not tested as the system requires a person inside the complex to breathe through the bib mask.

4.1.3.3 Divers Gas Supply System: Was charged to 150 psi over ambient complex pressure with no leakage or regulator creep noted.

4.1.4 Sanitary System

4.1.4.1 Fresh Water System: The shower was rigged to test the hot and cold water system. Both hot and cold water flowed fully meeting all requirements according to design specifications.

4.1.4.2 Flushing System: The commode holding tank was flushed at 1000 feet. There was no leakage through the valves or from the main holding tank.

4.1.4.3 Reefer System: This system was not tested as it had not been installed at the time of the test.

4.1.5 Gas Supply System

4.1.5.1 He System: Helium was lined up to He supply lines from the tube truck and into the mixmaker. The system was charged to 2500 psi with no leaks and operated satisfactorily to design specifications.

4.1.5.2 O₂ System: O₂ was lined up to the bib masks and O₂ makeup (manual O₂ adding system) from O₂ banks. A separate system coming from #6 bib mask bank was lined up to the mixmaker. The system was charged to 1800 psi with no leakage. The system operated satisfactorily according to design specifications.

4.1.5.3 Air System: Air was lined up through the truck line at 500 psi to the supply console. The system was charged and the emergency backup was tested, satisfactorily meeting design specifications.

4.1.5.4 Mixed Gas System: Mixed gas was lined up from the mixed gas banks to #6 Complex bib mask regulator at 1800 psi and showed no leakage when the bib mask system was charged to 150 psi over ambient complex pressure.

4.1.5.5 Mixmaker: The mixmaker was not tested, as it tested satisfactorily during the unmanned dive in #5 complex. Ref: EDU Report 19-72.

4.1.6 Other Significant Information

4.1.6.1 A dial indicator was placed on the wetpot drain line for the purpose of measuring any expansion of the drain line caused by pressure. The dial was set on zero and remained on the same throughout the dive.
4.1.6.2 Fire Suppression System

4.1.6.2.1 Proceeding the dive all sensor units were installed. RTV compound was used to make sensors water resistant. Plastic bags were placed over sensors for further protection.

4.1.6.2.2 During descent at 60 FPM, IR circuit one false alarmed at 170'. At 1000' system functioned as designed in both automatic and manual modes. During ascent at 75 FPM, IR circuit two registered a false alarm at 740'.

4.1.6.2.3 Inspection after completion of dive revealed a 1" diameter hole in #3 IR detector lens and plastic bag. All sensors were subjected to a flashlight test and all functioned normally.

4.1.6.2.4 One week after completion of test no shorts or malfunctions of any kind were detected due to water seepage.

4.1.6.3 Pressure Loss Test

4.1.6.3.1 The complex console supply and exhaust valves were secured while the unit was pressurized to a simulated depth of 1000' for the purpose of measuring the amount of leakage in terms of footage over a given amount of time. The following observations were noted; test commenced at 1500 7 Aug 1972 at 1000 feet:

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<tr>
<td>1600</td>
<td>995</td>
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<tr>
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<tr>
<td>1800</td>
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Test was completed at 0700 8 Aug 1972.

4.1.6.4 CO₂ injection for Life Support Canister scrubbing:
A cylinder of 100% CO₂ was piped directly to the chamber of #6 complex. Two pounds of CO₂ by weight was added to the atmosphere producing a CO₂ content of 5.79% in the complex. The life support system reduced the level of CO₂ in approximately 15 minutes to the acceptable limit of .5% surface equivalent.
5. Conclusion

5.1 With the exception of the problem of fouling in the drain valves, and the two false alarms in the fire suppression system, the complex met all performance requirements satisfactorily. Based on this test, the complex demonstrated that it is capable of supporting life at 1000 feet sea water, after removal of fouling in the drain valves.
1000 FOOT UNMANNED CERTIFICATION DIVE IN #6 CHAMBER COMPLEX

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Experimental Diving Unit Report 21-72

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