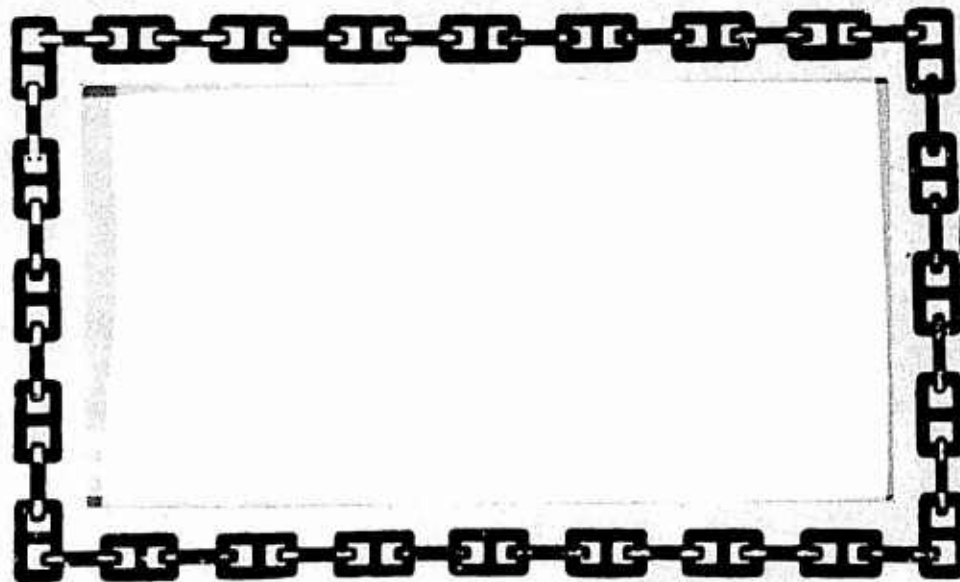


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NAVY EXPERIMENTAL DIVING UNIT

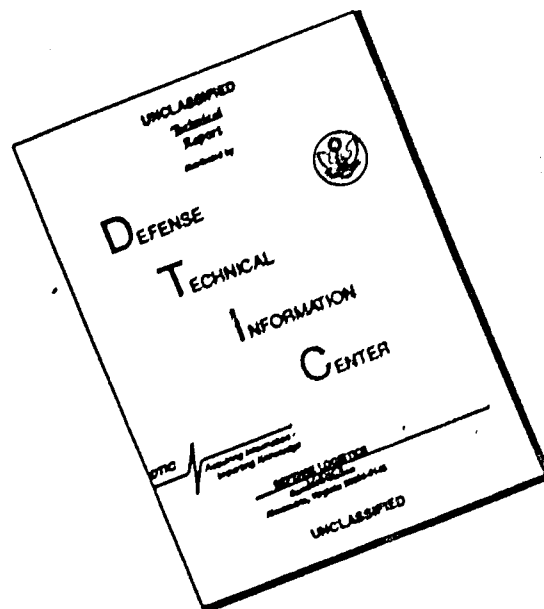


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REPORT NO. 1-49

REPORT OF DIVING TRAINING IN USS
CHANTICLEER OFF KEY WEST, FLORIDA
DURING PERIOD 19 OCT TO 8 DEC 1948

G. G. MOLUMPY

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

REPORT OF DIVING TRAINING
IN
USS CHANTICLEER
OFF KEY WEST, FLORIDA
DURING THE PERIOD
19 OCTOBER TO 8 DECEMBER 1948

BUREAU OF SHIPS
PROJECT NO. NS 186-042
REPORT NO. 1

REPORT NO. 1-49

PREPARED BY:

G. G. MOLUMPY
COMMANDER, USN
OFFICER IN CHARGE

Reference may be made to this report indicating author,
title, source, date, project and report number.

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PRELIMINARY

During the period 19 October to 8 December 1948, helium-oxygen diving operations were conducted by personnel of the USS CHANTI-CLEER and of the U.S. Navy Experimental Diving Unit in waters off Key West, Florida.

OBJECTS

The objectives of the training were:

- (a) To train all members of the diving party in operations at deep depths.
- (b) To evaluate surface decompression procedures.
- (c) To test modified diving gear.
- (d) To prove newly computed decompression schedules.
- (e) To promote confidence in helium-oxygen diving.

PROCEDURE

After equipment was tested and all divers drilled in ventilating, circulating and going on open circuit in shallow water alongside the dock, a total of 67 dives, summarized below, between 272 and 485 feet were made.

NUMBER OF DIVES	DEPTH	AVER. EXPOSURE TIME (MINS.)	REMARKS
5	265	9	
5	261	8	
6	253	9	
5	285	9	
4	355	8	
2	356	9	One case of O ₂ poisoning
4	350	9	
5	350	9	
1	345	7	Strong currents. Bottom at 355 not reached.
3	345	9	
5	362	9	
3	295	9	
2	365	10	
3	365	10	
1	401	9	
2	400	9	
5	418	9	

NUMBER OF DIVES	DEPTH	AVER. EXPOSURE TIME (MINS.)	REMARKS
3	343	19	Attached and detached rescue chamber downhaul cable and salvage hoses to false seat.
2	485	9	
1	385	10	Unsuccessfully attempted false seat exercises. Strong currents.

Standard procedure with surface decompression was followed. The average time from 50 feet in the water to 50 feet in the recompression chamber was 3 1/2 minutes, with the diver being fully undressed on deck.

A 450 foot partial pressure decompression schedule, computed in the same manner as are the published schedules, was used for the first time following the dives to 485 feet. The 60 foot stop, however, was computed for HeO₂ mixtures, and oxygen was given at 50 and 40 feet. It is planned to change all 60 foot stops to HeO₂ with the view of reducing the incidence of oxygen poisoning.

The following listed modifications and additions were made to standard diving gear:

1. The CHANTICLEER provided a second diver's telephone speaker at the helium manifold. This permitted the diving officer and the personnel operating the manifold to hear all talk from the diver and to listen for variations in the sound of the gas flowing through the high pressure jet in the diver's helmet.
2. The diver's air hose and life line were lengthened to 800 feet for all dives below 300 feet.
3. Oxygen hose with the open end terminating at the diver's helmet was made up with the life line and air hose. The end on deck was connected to a footage gauge and to an air supply. By blowing air through the hose until it was clear of water and securing the air, the depth of the diver can be read from the gauge.

This method was also used to take soundings when the vessel was centered in her moor. The fathometer, reading only in fathoms, was about 52 feet light at depths of 400 feet.

As variations in the depth of a diver of as little as one foot are readily shown, this method is considered more accurate and reliable than others in present use.

In USS FLORIKAN, with the helium manifolds carried in the after hold, a second footage gauge is installed at the manifold.

4. The weight of the CHANTICLEER diving shoes were increased to 38 pounds each. This additional weight made the diver heavier and more stable while on the bottom without altering his balance or the normal inflation of his suit. The bottom was smooth and hard.

5. A duct, open only at the discharge end and terminating close to the faceplate, was installed from the discharge of the canister. This provides good circulation and mixing of gas in the helmet. In case of casualty, any moisture will be directed to the lower part of the front of the helmet where it will drip or flow into the bib. It prevents any mixture of water and shell natron from being sprayed over the diver's head and face while he is in an upright position.

6. A screw-pin shackle large enough to take the diver's life line and air hose was welded, open end up, to the diving stage, about 5 1/2 feet above the platform. Just before leaving the last water stop, the diver shackled in his life line and air hose. Thus the tenders had the diver under control at all times and could prevent his falling off the stage when his breastplate was above the level of the deck.

7. A Pauling oxygen meter was used to test all bottles of helium-oxygen mixtures. As a check, about 15 - 20 percent of the bottles also were tested with the Haldane-Henderson apparatus. Almost instantaneous readings of oxygen content are given. Only one quickly made correction based upon the variation of barometric pressure from standard is required. It is expected that a portable, possibly battery operated model, accurate to within one-half of one percent, will be available for test and evaluations within a few months.

8. Bendix type oxygen regulators were, in the main, used in the recompression chambers. By separate correspondence (EDU report No. 1 of Bureau of Ships Research Project No. 1162/47 entitled "Tests and Evaluation of Various Types of Oxygen Breathing Equipment for Use in the Recompression Chamber" of November 1948) it has been recommended that Bendix type regulators be furnished as the type currently in use requires replacement.

9. When shifting to oxygen with the 800 foot life line and air hose in use, 100 pounds over bottom pressure was necessary to provide an adequate volume of gas during ventilation.

The pressure was reduced to 50 pounds over bottom pressure when the diver went to closed circuit.

10. The exhaust lines from the recompression chambers led to a common discharge line terminating in the superstructure above the boat deck. This arrangement prevented high concentrations of oxygen from being discharged into the recompression chamber compartment but, at the same time, prevented independent simultaneous venting of the chambers unless they were at the same pressure. A "tee" connection discharging to the chamber compartment and three valves were installed to provide flexibility.

11. At depths of less than 100 feet, the 100 pounds over bottom pressure of the diver's helium-oxygen supply causes noisy jet operation. To improve voice communication, 50 pounds over bottom pressure was used until the diver reached about 60 feet. The pressure then was built up gradually to the required 100 pounds over bottom pressure by the time the diver reached about 125 feet. During ascent, the pressure was correspondingly reduced.

DISCUSSION

The helium-oxygen helmets and breastplates of the CHANTICLEER were of the old type converted from air helmets manufactured in 1918. They were 15 pounds lighter than the standard type and were more comfortable as the diver's head was centered fore and aft in the helmet. Wearing the new types the diver is heavy aft and has a tendency to fall backwards.

The depth gauges on the CHANTICLEERS recompression chambers were calibrated in pounds. As decompression tables and treatment tables for caisson disease and air embolism are expressed in feet of salt water, footage gauges are more convenient.

CONCLUSIONS

1. That the training was valuable, especially to personnel of this activity.
2. That surface decompression procedures as used proved satisfactory for all dives made.
3. That a larger venturi discharge nozzle and larger high pressure nozzle used with gas at 50 pounds over bottom pressure gave satisfactory performance. Detailed tests are in progress at this activity.
4. That tentative decompression schedules to at least 550 feet may be computed without considering tissues slower than the 70 minute tissue, for dives of short duration (up to 20 minutes).

5. That helium-oxygen diving is safe to partial pressures of 410 feet - the limits of the published decompression tables - for short exposures providing present instructions are carefully followed.

6. That the personnel involved in this training have confidence in diving with helium-oxygen mixtures.

7. That current is a major obstacle to any planned diving operations.

8. That 40 pound diving shoes are useful on a hard bottom.

9. That personnel from the Experimental Diving Unit be assigned temporary additional duty aboard a submarine rescue vessel at regular intervals for the purposes of:

(a) Assisting in fleet diving training.

(b) Using at sea, procedures and material developed ashore.

(c) Training.

That personnel from the Experimental Diving Unit, upon completion of shore duty, normally be assigned to submarine rescue vessels.

RECOMMENDATIONS

1. That the method of determining depth by air pressure be used, and that necessary pressure gauges calibrated in feet of salt water be furnished.

2. That ducts as described above be installed in all helium-oxygen diving helmets.

3. That recompression chamber exhaust lines be modified, when necessary, for independent venting.

4. That recompression chamber depth gauges be calibrated to indicate depth in feet of salt water rather than in pounds of air pressure.

5. That copies of this report be furnished all submarine rescue vessels and other activities interested in helium-oxygen diving with a request for comment.

6. That Bendix type oxygen demand regulators be furnished as the types currently in use require replacement.

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13. ABSTRACT

During the period 19 October to 8 December 1948, helium-oxygen diving operations were conducted by personnel of the USS CHANTICLEER and of the U.S. Navy Experimental Diving Unit in waters off Key West, Florida.

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