U.S. NAVY DEEP SEA DIVERS
WE DIVE THE WORLD OVER

THE FACEPLATE

DEEP SEA DIVING SCHOOL
EXPERIMENTAL DIVING UNIT

WASHINGTON D. C. 20390

RECORD DEEP DIVE

A record-breaking dive to a simulated ocean depth of 1,025 feet has shown that Navy aquanauts can live and work safely under pressure of 470.8 pounds per square inch for a limited period of time.

The dive was one of a series of tests conducted by the Navy's experimental diving unit at the Washington Navy Yard in preparation for SeaLab III, which is scheduled to begin open-ocean testing next October.

Using the saturated diving technique, five aquanauts were submerged gradually to a depth of 600 feet in the dry chamber of a high pressure complex.

The complex consists of two chambers, each about ten feet long and nine feet in diameter. One is mounted horizontally and is dry. The other stands on end and is partly filled with water. The chambers are connected by a pressurized tunnel and can be separated by a pressure-tight lock.

Pressures equal to ocean depths beyond 1,000 feet can be simulated in the complex. By closing the lock between them, different pressures may be maintained simultaneously in the two chambers.

The aquanauts remained in the dry pot at a depth of 600 feet for 24 hours to permit their bodies to adapt to the compressed atmosphere.

Two divers, Machinist's Mate First Class Fernando Lugo, USN, and Mineman Second Class Don C. Risk, moved into the wet vertical chamber of the complex, where they made an "excursion dive" to a simulated depth of 825 feet.

After they had reached 825 feet with no mishap, the dry chamber was lowered gradually to 825 feet, and the five men remained at this depth for another 24 hours.

Then Lugo and Risk made a second "excursion dive" into the wet chamber, this time to the record simulated depth of 1,025 feet. They remained there for 13 minutes and performed tests designed to reveal any effect of depth narcosis due to their helium-oxygen atmosphere.

All five divers remained at 825 feet for a total of 48 hours, 24 before Lugo and Risk's 1,025 excursion and 24 afterwards, the longest period of time man has ever stayed at this depth.

Experience proves that "saturation" level is achieved when the body tissues become saturated with the mixture of oxygen and helium.

Full saturation is reached after 24 hours at a given depth or a known pressure, however, once saturated, divers can work without heavy equipment, enjoy freedom of movement in a dry habitat and swim in wet suits with special mixed gas breathing equipment at ambient pressure.

Decompression time is related directly to the degree of tissue saturation. A fully saturated diver may remain at depth, or go slightly deeper for short periods, without increasing his decompression time.

The Mark II deep diving system used in the test will be used also in SeaLab III's open ocean tests, and is expected to be operational on the new submarine rescue ships next year. This system will increase the Navy's salvage and rescue capability to 850 feet.

Capt. William M. Nicholson, USN, project manager for the deep submergence systems project said recently that "most people in 1964 and 1965 didn't think you could go deeper than 600 or 700 feet."

The man-in-the-sea program's principal medical investigator, Capt. George F. Bond, MC, USN, said man's durability and adaptability to the sea appears to be almost limitless. (Con't. page 2)

FACE PLATE

Published quarterly as an unofficial publication. This periodical is compiled and edited at the U.S. Naval School, Deep Sea Divers, with the assistance of the Experimental Diving Unit, Washington Navy Yard, Washington, D.C. The opinions expressed in this publication are those of the writers and do not necessarily reflect the official policy of the U.S. Navy. The purpose of the FACEPLATE will be an exchange of information between all men who work under the sea.

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EDITORS COMMENT

It is the intentions of the editor to publish items of interest to the diving navy as a whole. This will cover new developments of diving equipment, methods of diving and reports of diving accidents after they have been fully investigated and comments can be made as to cause, effect and procedures to follow to avoid reoccurrence.

At times it will not be possible to acknowledge all letters and suggestions and it is not because we are not interested but because we have more vital information to put out.

DEEP DIVE CONT.

Once a depth is reached where the narcotic effect of the helium-oxygen mixture endangers the diver, a hydrogen-oxygen mixture may be used, he said. After that, Capt. Bond added, man may be able to dive to a depth of 12,000 feet by a fluid breathing technique. However, he said, man could only work one hour before the pressure would crush his bones.

Capt. Walter F. Mazzone, MSC, USN, chief diving officer for the deep submergence systems project technical office, said all the hazards of the ambient environment exist in the "simulated" laboratory dives, except for sharks and other hostile marine life.

The five aquanauts who participated in the saturated dive took eight days to decompress he said.

Capt. Mazzone, said "the men reached the 1,025-mark without a hitch, and appear to have suffered no ill effects."

DIVING WATCHES

Diving commands experiencing difficulties in procuring commercial submersible wrist watches are advised that BUSHIPS INSTRUCTION 10510.3C of 14 August 1961, submersible wrist watches for interim Navy use; procurement and repair of, is still effective and promulgates instructions for local procurement of commercial submersible wrist watches.

With the addition of the high cost ($210), radio active submersible wrist watch FSN 146645-752-8638, AEC license number 8-5970-6 to the SPCC stock list, it is necessary to clarify requisitioning procedures, SPCC INSTRUCTION 10560.1 of 5 May 1965, Atomic Energy Commission Licensed Diving Equipment which is under the cognizant of the Ships Parts Control Center, specifies that the requisitioning activity submit requisitions for AEC licensed diving equipment citing the activity allowance document or other reference authorizing the use of subject equipment in the remarks section. If your command is not authorized to procure this item, so state on the requisition citing SPCC INSTRUCTION 10560.1 and submit in accordance with BUSHIPS INSTRUCTION 10510.3C discussed above.

OLD MASTERS QUIZ

Surface Decompression

1. What is the maximum amount of time a diver can s spend on the surface using surface decompression?
2. What is the rate of ascent using table 1-17 (surface decompression using oxygen)?
3. What is the time between stops using table 1-17 (surface decompression using oxygen)?
4. How long do you take in surfacing from 40' in the chamber using table 1-17 (surface decompression using oxygen)?
5. What are the limits in using surface decompression?
6. What is the rate of ascent using table 1-18 (surface decompression using air)?
7. Is it necessary to have a recompression chamber to use table 1-18 (surface decompression using air)?
8. What table would be used to decompress a diver who had an oxygen poisoning symptom using table 1-17 (surface decompression using oxygen)?
9. What is the one thing the outside tender must <u>not</u> do if the diver goes into convulsions in the chamber?
10. What is the primary breathing media for surface decompression?

EDU PERSONNEL

<u>EDU Receipts</u>

	FROM
LT J.K. SUMMIT	SUBMEDCEN, New London
LT J.S. KELLEY	SUBFLOT SIX
BMCM(DV) J.C. BROWN	DSDS
DCC(DV) R.C. McCLANAHAN	USS TRINGA (ASR-16)
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MM2 R.F. SCHUMACHER	USS ENTERPRISE (CVA 65)

<u>EDU Transfers</u>

	TO
ENC(DV) A. MAY	Fleet Reserve
HM1(DV) H.G. JONES	USS COUCAL (ASR-8)
BM1(DV) W.D. MEEKS	Fleet Reserve

HONORS AND AWARDS

Recognition was made in a ceremony on 6 February of the extraordinary combat service of CAPT Eugene Bryant Mitchell, Officer in Charge, Navy Experimental Diving Unit, and Deputy Supervisor of Salvage. Rear Admiral Edward J. Fahy, Commander, NAVSHIPS, presented to him the Legion of Merit with Combat "V" award in the presence of CAPT Mitchell's family and a group of his friends and associates.

The citation accompanying the Legion of Merit medal awarded to CAPT Mitchell described in detail his outstanding service as Fleet and Force Salvage Officer under Commander Service Force, U.S. Pacific Fleet from 1 July 1964 through 22 June 1967 and as Officer-in-Charge of combat salvage operations in the Mekong Delta, Vietnam from 11 January 1967 to 2 March 1967. Actions he initiated and guided were key factors in the conduct of 57 salvage operations,

including the rescue tow of 18 ships, the refloating of 20 grounded or sunken ships, the removal of three wrecks, the recovery of nine ships and craft sunk by enemy action, and the salvage of seven aircraft. Notable among his accomplishments was his organization and direction of a major harbor/river clearance operation, that of the large dredge JAMAICA BAY. This operation was beset by many hardships because of adverse natural environmental conditions and hostile action by enemy forces. Throughout this period, CAPT Mitchell's conduct was in keeping with the highest traditions of the United States Naval Service.

On 15 March, 1968, the Commanding Officer, U.S. Naval School, Deep Sea Divers, CDR W.R. LEIBOLD, USN, decorated his Executive Officer, LCDR B.L. DELANOY, USN, with his second award of the Bronze Star Medal, with Combat "V", for meritorious achievement against the enemy in Viet Nam. This award represented the fourth combat decoration received by LCDR DELANOY for service while serving with Harbor Clearance Unit One forces in the Southeast Asia area of Naval Operations. The citation accompanying the Medal reads as follows:

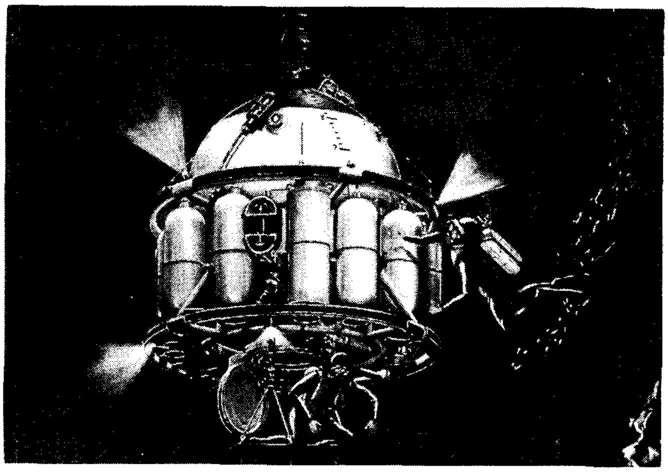
CITATION

"For meritorious achievement in connection with operations against the enemy as Officer-in-Charge of salvage of the SS CLARKSBURG VICTORY which was flooded and disabled after striking a submerged wreck at Vung Tau Bay, Republic of Vietnam and as Officer-in-Charge of salvage of the sunken U.S. Navy Minesweeper, MSB 54 in the Long Tau River, Republic of Vietnam. On 12 October 1966, Lieutenant DELANOY was alerted to the casualty to SS CLARKSBURG VICTORY and in a matter of minutes was on the scene with adequate salvage forces to undertake the task. He promptly organized his salvage teams and craft and set about to survey the damage and prevent further flooding of the vessel. The high priority military cargo aboard SS CLARKSBURG VICTORY made it imperative that this ship be salvaged and rigged for tow as soon as possible. With this in mind, Lieutenant DELANOY proceeded to expedite all phases of the operation and only by the most professional application of salvage methods and tireless effort he made the SS CLARKSBURG VICTORY ready for sea tow in the brief period of five days. On 1 November 1966, as directed by Commander U.S. Naval Forces, Vietnam, Lieutenant DELANOY proceeded immediately to the scene of the sinking of MSB 54. Upon arrival, he quickly surveyed the situation and developed a recovery and salvage plan which he implemented in a matter of minutes. Working day and night for four days, he directed the prompt recovery of the wreckage and ammunition. He then supervised the rigging of the wreck to Light Lift Craft TWO for delivery to Saigon. His rapid response and expeditious salvage of the wreck and recovery of ordnance material minimized the psychological gain of the enemy and denied the enemy the opportunity to recover valuable arms and ammunition. His outstanding performance and devotion to duty were in keeping with the highest traditions of the United States Naval Service."

Lieutenant DELANOY is authorized to wear the Combat "V".

For the President
JOHN J. HYLAND
Admiral, U.S. Navy
Commander in Chief U.S. Pacific Fleet

DDS MK 2



DEEP DIVE SYSTEM MK 2 MOD 0

The prototype Deep Dive System Mark 2 is now being fabricated and will be tested in SEALAB III, a 60-day ocean-floor experiment scheduled to begin in October 1968. The DDS Mk.2 will be the world's most advanced deep diving system.

The DDS Mk. 2 is designed to support eight divers working in shifts for periods of up to 14 days at depths to 850 feet. For conventional diving operations the DDS Mk.2 will offer relatively comfortable decompression for the divers aboard the surface ship; for saturation diving the system will keep the divers at ambient pressure and provide them with a helium-oxygen breathing gas while they are being raised or lowered, and while they are aboard the surface support ship between work. This concept is known as "elevator dwelling."

The prototype DDS Mk.2 is being fabricated at the San Francisco Bay Naval Shipyard for installation in the USS ELK RIVER (IX-501), a converted landing ship (LSMR-501) which will be the primary range support ship at the Navy's San Clemente Island Range. The major components of the DDS Mk.2 are two Deck Decompression Chambers (DDC), two Personnel Transfer Capsules (PTC), two Main Control Consoles (MCC), and the related cables, handling gear, gas stowage, et cetera.

The Deck Decompression Chambers are each designed to support up to eight divers for prolonged periods at an internal pressure of at least 378 psig (850-foot depth). Normally the DDC will accommodate four divers who are working at depths to 850 feet for as long as 14 days plus the necessary time for decompression.

Bunks, a head, and sink are provided in each DDC. The main chamber is 18-1/2 feet long and there is a 5-foot entrance lock plus a smaller medical lock appended to the main chamber. Piping is provided to supply oxygen, helium, helium-oxygen mix, air, power, communications, and instrumentation to the DDC. The chambers are also air conditioned.

The PTCs are raised and lowered by the support ship on a Strength-Power-Communications (SPC) Cable. The PTCs are also fitted with a haul-down winch and cable attached to anchors. These winches enable relatively vertical descent to insure the PTCs return to the same place on the ocean floor. In the event of a casualty with the down-haul winch or cable, explosive bolts can be fired to free the PTC from the down-haul gear. Similarly, should the SPC Cable to the surface foul or break there are explosive bolts which can be fired to disconnect it from the PTC so that the weight of the cable will not turn over or pull down the PTC. (The PTC, being positively buoyant, could then pay out the down-haul cable and slowly rise to the surface).

Each PTC has a self-contained 3,000-psig gas supply and provides the diver with light, communications to the surface, and a warmer environment than the ambient sea.

Finally, the DDS Mk.2 has two Main Control Consoles (MCC) which mount the instruments and controls for the operation of the decompression chambers. Each MCC controls the atmosphere of only the adjacent DDC. However, both MCCs have communications equipment for communicating with divers in both DDCs and both PTCs. This includes television monitors on the control consoles for observing divers in the DDCs and PTCs.

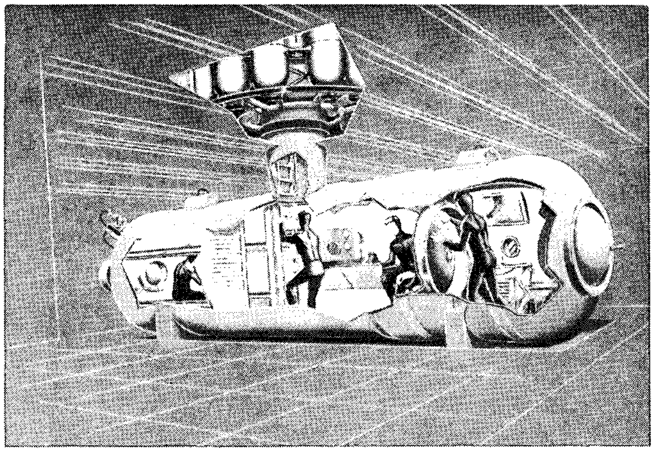
During the forthcoming SEALAB III experiment the ELK RIVER will be moored over the seafloor habitat which will be bottomed at 600 feet. Teams of eight saturation divers (Aquanauts) will be lowered by PTC to the seafloor habitat to conduct oceanographic, physiological, psychological, salvage, and construction experiments. After an eight-man team finishes its 12-day stay on the bottom it will be returned to the ELK RIVER by PTC and transfer directly into the two DDCs for the estimated six-day decompression.

Beyond the ELK RIVER, the DDS Mk.2 will be installed in the Navy's new-construction submarine rescue ships of the ASR-21 class. These ships will have twin, catamaran hulls, each of which will mount a DDC-MCC complex. The first two ships of this class are now under construction and a total of ten have been proposed.

With their DDS Mk.2 diving complexes these ships will be the Fleet's main diving support ships during the coming decades. All of the new ASRs will be able to support the Deep Submergence Rescue Vehicles and perform the innumerable towing, diving, and other utility jobs which have made ASRs the workhorses of the Fleet. For salvage operations the ASRs can be fitted with a mobile Salvage Operational Control Center. It is envisioned that an ASR fitted with one of these control vans will be the command and primary diving ship for the Large Object Salvage System which is now being developed.

The DDS Mk.2 is being developed by the Navy's Deep Submergence Systems Project, as are the Large Object Salvage System and Deep Submergence Rescue Vehicles. The Deep Submergence Systems Project is responsible for developing advanced equipment and techniques for deep sea operations.

DDS MK 2 CONT.



Each of the two Personnel Transfer Capsules in the DDS Mk.2 will transport four divers from the support ship to their working depth for diving and/or observation. After the divers perform their mission the PTC will return them to the surface in a pressurized atmosphere and will mate to the DDC to eanble the divers to pass freely into the decompression chamber for rest or to begin their decompression.

There are several advantages to this system; the divers are returned to the surface quickly and in safety; they can enter the decompression chamber without being exposed to surface atmosphere and then undergo their decompression in relative comfort. These features are available for both the conventional and saturation diver. In addition, the PTC can serve as an underwater refuge for the divers. It is envisioned that during a work period on the bottom one of the surface ship's two PTCs would always be on the ocean floor in the event a diver has trouble with his breathing gear or other equipment, and to provide a rest station.

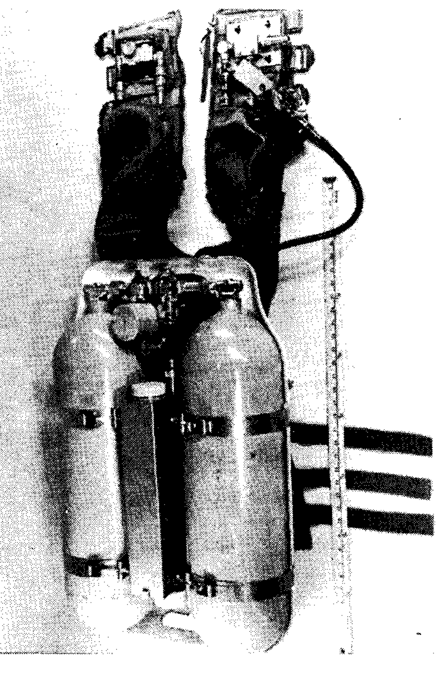
MK VIII IX FOR SEA LAB III

In earlier articles we discussed the development of the MK VIII semi-closed circuit mixed-gas breathing apparatus for SEALAB III and the MK IX semi-closed circuit apparatus for initial use with the MK I deep dive system being constructed for use on the new ATS. In this issue we will review the characteristics of this equipment and discuss the programs of their development.

The MK VIII was developed as an interim apparatus for use with deep SEALAB projects until advanced closed-circuit equipments are available. The apparatus provides a series of back-up capabilities to insure maximum safety for the divers. It utilizes the same concept for rebreathing as the MK VI, and in fact utilizes the breathing bags and vest from that equipment. The carbon dioxide canister, however, has been redesigned to a low resistance flat canister. The flat canister and a set of 90 cubic feet cylinders are mounted on a special built fiberglass backpack. The gas supply system utilizes three selectable sources:

1. From tanks on the SEALAB habitat, through a regulator and hose to the flow control block on the diver's vest and from there injected into the system.
2. From the cylinders on the back through a regulator on the manifold to the flow control block.
3. From the cylinders on the back to a single hose regulator for emergency or buddy breathing.

The three systems are selectable by the diver. He can therefore venture forth with gas being supplied from the habitat. If he should lose this gas supply or 'hang up' on the bottom he may switch to his back pack supply, dosconnect the umbilical and return to the habitat. If his apparatus should flood out he can use the single hose regulator and 'come home' on a demand breathing system.



MK VIII IX CONT.

Provision is made for communications, monitoring of breathing bag oxygen level and heating the diver through wires in the umbilical. This umbilical plugs into a connector mounted at the base of the MK VIII back packs. The apparatus is large and quite heavy at 130 pounds due to the aluminum double 90's required for free swimming.

The MK IX is a lightweight apparatus (30 pounds) designed for use from Personnel Transfer Capsules on a short umbilical. It is also a semi-closed circuit rebreather that utilizes a flat canister for carbon dioxide absorption. It contains a small 'come home' cylinder for use with a single hose regulator. Gas is supplied to the apparatus from the PTC or topside through a regulator and umbilical to the diver where the gas is metered through an orifice block. The breathing bags are constructed of dipped neoprene rubber rather than the usual fabric bags on the MK VI. Initial tests at NAVXDIVINGU with this apparatus have been encouraging and it appears that it will test out with few discrepancies.

The Kirby-Morgan "Clam-Shell" helmet development has progressed to the third prototype. This unit is very comfortable and with few modifications should be 'fixed design' on the next go around.

RAPID MEDICAL ADVISE

NAVXDIVINGU has recently installed the rotary telephone system to insure contact with medical personnel at EDU. should medical advice be required, the new number is 33716.

'NEW' SHEET EXPLOSIVE

From time to time divers will be faced with a job that calls for cutting of metal plates and beams. Explosives can be used to advantage when time is short, or when there would be danger to the diver from the release of material or shifting of structures caused by the cutting.

A new form of explosive, flexible sheet, is now being used by the Fleet, primarily by EOD and UDT units. The "rules of thumb" given here may be useful to those who can avail themselves of the flexible explosives.

To cut steel plates, use explosives at least as thick as the plate, and at least twice as wide as it is thick. Place the explosive directly against the plate along the line to be cut. H-beams, I-beams etc. can be considered as combination of plates and loaded accordingly, with extra allowance for fillets.

Aluminum can be cut with about half as much explosive as steel, and wood can be cut with only a tenth of the amount required for steel.

Shafting and pipes can be cut by a diamond charge or saddle charge. For pipes and thin wall columns, use explosives about 1/2" thick - for solid shafting over 6" diameter use 1" thick explosives. The diamond will be one-half as wide as it is long, and the long dimension will be long enough to go around the shaft. The short corners must be initiated at the same time so the colliding detonation waves will meet at the center. This can be accomplished by using two electric detonators, or by two equal length strips of explosive leading to a single detonator.

The saddle charge is about twice as thick as the diamond charge. The base goes half way around the shaft and the length is twice the base. Only one initiator is required. Shaped charges can be made up in the field by using metal tubing and sheet explosives. Copper tubing is ideal, and any thin wall metal tubing can be used. For use under water the ends must be sealed so as to maintain air in the tube. At great depths it may be necessary to pressurize the tubing to prevent collapse. The diameter of the metal tube should be at least equal to the thickness of steel to be cut. The tube should be placed against the target with the back half of the tube covered with explosives. This shaped charge technique will produce a neater cut, and use only about half as much explosive as the direct method. With either method, a detonator placed on the top end of the charge will produce the better results.

DSDS PERSONNEL

DSDS Receipts	FROM
SFC(DV) R.A. BOSWORTH	USS SKYLARK (ASR-20)
DCCM(DV) F.E. EISSING,JR	USN (RET)
MM1(DV) D.W. PAMPEL	USS RECOVERY (ARS-43)
MM1(DV) R.K. HOWARD	USS PENGUIN (ASR-12)

DSDS Transfers	TO
HM1(DV) C.R. McNEW	UDT Team II, Coronado, Cal.
LCDR D.C. DISNEY	CO, USS FLORIKAN (ASR-9) SF

DIVING LOG SHEETS CAN BE SIMPLE!

The first returns of the new diving log sheets have arrived at the U.S. Navy Experimental Diving Unit and the results have far exceeded our expectations. With the introduction of the new form we had anticipated upward of fifty percent error, however, the error rate in the first 3,500 dive log sheets to arrive has been about 15 percent. Our hats go off to the fleet divers and supervisors who are in the 85 percent majority.

The PAPAGO (ATF-160) was the first diving activity to submit completely error free log sheets, and was sent the following letter of congratulations.

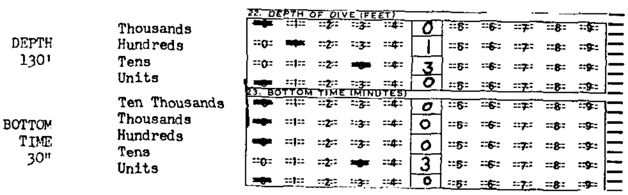
Dear Captain McNIFF,
Since the inauguration of the new diving log record from (NAVSHIPS 9940/1) the Experimental Diving Unit has received hundreds of completed forms, many from much larger diving commands than PAPAGO.

The package from PAPAGO, however, is the first submission in which every log sheet was completely and correctly submitted. Our new system will make a wealth of diving information quickly available for analysis, but it is necessary that the divers themselves log it accurately on these forms. Your efficiency makes our job much easier. I am sure that you are proud of PAPAGO and its diving team. May I extend my thanks and compliments to them also.

Yours for better diving

E.B. MITCHELL

A review of the log sheets received so far indicates that the majority of the errors can be eliminated by the fleet's attention to a few specific items. The most critical errors made are in the recording of depths and times. Several activities recorded these values in reverse order. The correct method for filling out these areas is shown below.



Four information areas that are critical for our analysis of diving procedures and diving equipment are often times neglected. It is essential that items 26, 27, 33, and 34 be filled in for all dives regardless if the dive requires recompression or not.

In addition to the critical items listed above, several questions have been raised concerning various other information items. In an attempt to improve the diving data system, answers to the fleet's questions will be printed in the "Faceplate" periodically.

Q. How should enlisted service numbers starting with letters be recorded?

A. Record the actual letter in the center portion of the line and leave the rest of the line blank. The appropriate letters will be inserted by machine after they arrive at NAVXDIVINGU. This service number problem is far from over. Indications are that in the very near future all three services will be using an eight digit social security number as their service number. When this new numbering system is incorporated we will notify you of the changes to be made.

Q. Will this dive information be used as a check on requalification dives made?

A. No! In order to have reliable data for analysis it was felt that the system must include a guarantee that it would not be used as a check on the diver.

Q. Can more than one diver be recorded on a single sheet?

A. The sheets are designed for one man and one dive. For chamber runs and training dives at the Deep Sea Diving School it is obviously impossible to fill out sheets on every man dive. More than one man dive can be recorded on a single sheet, but we can not guarantee that the dives will be credited to the man's computer data file because of manual handling time and the lack of personnel for such tasks.

Q. When will the fleet see some results from this data recording system?

A. The first few months with the system will be devoted entirely to data verification, computer file establishment and computer programing. About the first quarter of Fiscal 1969 each diving activity will start receiving a quarterly computer listing of their dives for the previous quarter. In addition research reports produced using this data will be listed in the "Faceplate" and those who are interested in them can write NAVXDIVINGU. It is also anticipated that within two years the individual diver's diving file will be used for selecting people with various types of diving experience for advanced undersea systems.

The distribution of the new logs has been turned over to the supply depots. The addresses that are enclosed with this "Faceplate" are to be placed on the inside cover of the log as an easy reference for reordering. The federal stock numbers for ordering are listed below.

Diving log binder	Stock No. 0105643 2000
Log sheets	Stock No. 0105643 2100

Additional questions concerning the new diving log should be directed to the Officer in Charge, U.S. Navy Experimental Diving Unit, Washington Navy Yard, Washington, D.C. 20390

HELIUM DIVING HOW IT BEGAN

The following is a verbatim letter received from Vice Admiral C.B. Momsen, U.S.N., Ret. in response to many questions as to how helium diving was developed.

During World War I the use of baloons and air ships for observation became very popular. Kite baloons were also used in the fleet for observation and spotting. In 1919 I was a baloon spotter on the battleship Oklahoma.

In those days the baloons and air ships were filled with hydrogen gas. This gas is highly inflammable and losses by fire were frequent and disasterous.

The U.S. Navy, seeking a better gas, requested the Bureau of Mines to investigate helium gas as a substitute for hydrogen. In 1921 the Bureau made a report on the feasibility of using helium for air ships. At this time a report was submitted by Sayers, Hildebrand and Yant suggesting the use of helium for use of divers.

The British and U.S. Navy conducted some experiments and reported that helium mixed with proper amounts of oxygen was absolutely harmless at atmospheric pressure, and under pressure seemed to be better than air.

Someone suggested that if half helium and half nitrogen were used, decompression time could be reduced by half. Others suggested that because of the high rate of diffusion of helium, decompression time could be eliminated. Both of these assumptions were erroneous and led to very serious cases of bends The British reported unfavorably on the use of helium gas for divers and the work was stopped. (The British had no sources of supply of helium gas). The U.S. Navy did not make much progress, mainly because of false assumption as to the possible applications. The project was placed on the "back burner" at the Experimental Diving Unit.

In 1937 I received orders to report to the Commandant, Navy Yard, Washington, D.C. for duty as Officer-in-Charge of the Experimental Diving Unit. The Bureau of Construction and Repair was the sponsoring agency of the Navy Department in all matters pertaining to diving. I was told that they wished me to take a hard look at the helium project and to really develop it or drop it. I found that the Bureau of Aeronautics was charged with the production and supply of helium. It had been determined that natural gas in large areas in the U.S. contained small amounts of helium and that it could be recovered by distilling the natural gas. The unit cost of the helium gas could be reduced if the volume of production was increased.

After study of all available reports and then performing certain new tests at the Experimental Diving Unit I arrived at these conclusions.

a. A diver needs proper decompression following a helium dive.
b. Helium has a higher specific heat, therefore, a man with helium in his suit would require for his comfort more heat than one with air.
c. The cost of helium would be reasonable if a system for reusing the gas could be devised.
d. Helium is odorless and tasteless. It is an inert gas and will not combine chemically with any known elements.
e. Helium is highly diffusable and might spread around amongst the various tissues of the body, but will not diffuse out of the human body through the skin.
f. Partial pressure of oxygen used in breathing mixtures may be controlled and maintained at the most effective level.
g. Persons breathing helium-oxygen mixtures are often affected by "raptures of the deep" caused by pressures.
h. Argon gas, much heavier than nitrogen, caused pronounced increase in the ill effects of pressure. This indicated that the weight of the gas breathed, influences the "narcosis" effect.
i. Recovery from exhaustion is more rapid if helium-oxygen mixtures (30% oxygen and 70% helium) are breathed. This is because a lighter gas has less resistance to flow through the small orifices in the lungs, thus there is more efficient ventilation.

The most serious handicap to progress in advancing deep sea diving procedures was the inadequacy of equipment. Research and development money was hard to get. We needed new and stronger tanks, better hoses and all sorts of gas handling and gas analysis equipment. In the spring of 1939 we were planning to run summer tests in the waters off Portsmouth, New Hampshire. We had shipped all of our gear to the Navy Yard in Kittery.

When the Squalus sunk off the Isle of Shoals on 23 May 1939, the Experimental Diving Unit was placed in a most opportune position to conduct deep water tests. Although ill prepared from the standpoint of equipment we were in a position to improvise with the equipment that we had on hand. The work on the Squalus salvage job made diving history. In spite of deep water (40 fathoms), cold water (35°F) and rough weather, we completed the salvage in slightly more than three months. We used 600 dives and experienced only two diving accidents, neither one serious. The Squalus was reconditioned, renamed the Sailfish and performed brilliantly in the war against Japan.

The use of helium for the Squalus salvage job did a lot for the helium oxygen program and contributed much to the new diving era now unfolding in Sea lab and other projects.

OLD MASTERS QUIZ

(Answers)

1. 3.5 minutes
2. 25 FPM to the 1st stop or to the surface if no water stops
3. 1 minute between stops
4. 2 minutes
5. 190/60 using air (1-18); 170/40 using oxygen (1-17)
6. 60 FPM
7. No. In the case of a SCUBA diver he may take his required water stops, surface for a new air supply and re-enter the water for his chamber stops.
8. Table 1-18 (surface decompression using air).
9. Ventilate the chamber. An ascent of 4' can embolize the convulsing diver.
10. Oxygen

DIVING ACCIDENTS FROM THE RECORD

The following is an excerpt of one of the Navy Diving accidents documented and reported in a paper prepared and presented to the Marine Technology Society Symposium by LCDR John V. Harter, U.S.N. and CDR Robert C. Bornmann, M.C., U.S.N. of the Experimental Diving Unit.

The fact that deep sea diving is a hazardous human occupation need not be expanded on at length before those people already closely associated with or actively participating in diving operations. It is unfortunate however that many people work in the ocean without full benefit of the mistakes and experiences of others.

On file at the U.S. Navy Experimental Diving Unit is a library containing reports of diving accidents sent in from fleet units, and from some civilian organizations on a voluntary basis, so that the information collected can be interpreted, analyzed, used in training, disseminated, and put into permanent record. We have selected a variety of these accident reports for inclusion in the FACEPLATE. It is hoped that the facts presented will influence thought and action towards better planning of operations, selection of equipment, and training of personnel in the interest of diver safety and will encourage publication in the future of other accidents so that we may all benefit from this information.

The subject of fire in chambers has received a great deal of discussion this year as a result of the accidents at Cape Kennedy in the Apollo fire, and another at Brooks Air Force Base in an altitude chamber. Most people in the diving community are also aware that a fatal fire took place at the Experimental Diving Unit. The details of two chamber fires will be presented along with some recommendations.

On 22 March 1945 a fire occurred in a decompression chamber aboard the USS CHANTICLEER (ASR-7). One diver and one officer were killed and one medical officer was seriously injured. The fire occurred during a surface decompression stop following a helium-oxygen dive. The diver had been breathing oxygen from an inhalator at the 30 foot stop. The oxygen percentage in the chamber increased and at some point a flash fire occurred. The fire was initiated by a spark from an installed electric fan that ignited the fan lubricant. Among the materials that burned were clothing, mattresses, and wooden deck grates. Efforts to increase chamber safety following this fire included the development of ventilation criteria to reduce the oxygen percentage while utilizing oxygen for decompression and the removal of electric fans and wooden materials from decompression chambers. It is important to note that instructions in force at the time of the accident required that fans be secured during oxygen breathing periods. Where accidents can occur the possibility of their occurrence is high if people disregard safety instructions.

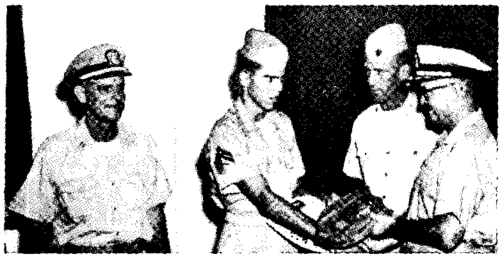
On 14 February 1965 a fire at the Experimental Diving Unit resulted in the loss of two lives. At the time of the accident the chambers were being used to simulate Transfer Under Pressure techniques and a mixture of helium, nitrogen and oxygen was being used as the chamber atmosphere in lieu of compressed air. The divers were decompressing from a dive to 200 feet for 120 minutes and had been transferred from the diving chamber to the decompression chamber at 95 feet during ascent. The chamber was filled with an atmosphere composed of 28% oxygen, 36% helium and 36% nitrogen. The chamber had been pressurized with mixed gas in lieu of using inhalators due to diver's complaints of chest soreness caused by the inhalator breathing resistance on previous dives. A carbon dioxide scrubber system utilizing an electric motor for circulation was in the chamber. This scrubber had been successfully used previously on saturation dives with no problems. On this dive the motor overheated due to malfunction of the centrifugal throwout switch on the starting windings. A spontaneous combustion occurred in the scrubber filter. Within fifteen seconds the chamber was enveloped in flame and within one minute the chamber depth went to 260 feet due to the intense heat.

COMMENT: Decompression from dives other than saturation have not been made in artificial atmospheres since that time. For short duration dives decompression is being accomplished on air within air breathing limits and mask breathing of mixed gas is being used at the deeper stops. The use of air in place of mixed gas also has disadvantages from the aspect of fire safety however. In compressed air one atmosphere of oxygen partial pressure occurs at 125 feet, and at 180 feet 1.35 atmospheres of oxygen are present. This is significant to commercial operators using transfer under pressure techniques with decompression taking place in a deep air atmosphere. The fire hazard under these conditions is greater than that present in the Experimental Diving Unit and CHANTICLEER chamber fires. Recent reports from the Linde Research Laboratory of combustion safety studies conducted under Navy contract provide a means to compare the risks involved under these conditions to normal air or 100% oxygen at one atmosphere absolute. Burning rates at 125 feet in air are 220% greater than at one atmosphere and only 20% less than pure oxygen at the surface.

Additional research at Linde has shown that during saturation dives utilizing 0.3 atmospheres of oxygen partial pressure combustion may occur from 100 feet to the surface but combustion of materials such as paper and cotton will not occur at deeper levels.

I therefore encourage all members of the diving community to be aware of the hazards involved and to insure chamber design and diver training towards elimination or reduction of the fire hazard during their operations.

SRF SUBIC TRAINS MARINE RECON DIVERS



Topping his class, Cpl. Robert C. Fuller (second from left) receives his plaque from SRF CO Capt. David H. Jackson. Others from left are Lt. Richard E. Thomas, SRF Diving & Salvage Officer, and Major George P. Slade, Fleet Marine Force Pacific Liaison Officer.

Nineteen reconnaissance men attached to the First and Third Marines Divisions at Da Nang and Phu Bai flew back to Vietnam this week after completing four weeks of rigorous training at Subic's Diving School.

Brief graduation rites capped by the presentation of diving certificates climaxed the month-long course. Honor Man Corporal Robert C. Fuller received his diploma from SRF CO Captain David H. Jackson. Subic's Fleet Marine Force Pacific Liaison Officer, Major George P. Slade; SRF's Diving & Salvage Officer, LT Richard E. Thomas; and Diving School instructors were also present during the ceremony.

The course is geared to improve water reconnaissance techniques. This training could spell the difference between victory or failure in amphibious landings.

The first two weeks of training consisted of pool swims, classroom instruction on medicine (bends diseases), physics (gas laws and their pressures) and the use of decompression and recompression tables.

The last two weeks was spent in open sea familiarization training, compass swims, underwater search procedures, distance swims (500 yards with SCUBA) and 1,000-yard tests without SCUBA.

DIVERS EQUIPMENT

The Chief of Naval Operations has determined that Navy commands concerned with diving and underwater swimming consider that many items of equipment worn by the individual diver/swimmer are of such a personal preference nature that it is impractical to standardize the Navy equipment and sizes. Moreover, it has been determined that this equipment should be issued to the man in a manner similar to flight equipment.

Navy personnel designated as qualified divers or underwater swimmers are eligible to receive any or all specified items of personal preference and accessory equipment upon successful completion of diving, UDT, or underwater swimmer school, and after designation as a diver or UDT.

An up-to-date listing of personal preference items and the policy and procedures to follow pertaining to these items will be found in the Naval Supply Manual. For commands with Supply Corps Officers assigned, articles 35390 through 35399 pertain. Those commands with no regular Supply Corps Officer assigned will find the information in articles 81720 through 81729.

SEA LAB III TRIALS

We members of the Sea Lab III team on detached duty at EDU are able to report that in spite of equipment delays which have necessitated slipping the down date of Sealab III, the training is proceeding smoothly, and on schedule. To date we have given 59 prospective aquanauts training in MK VI and MK VIII semi closed mixed gas SCUBA. This training has been split between underwater swim school Key West, and DSSP Technical Office, San Diego. Additionally, during the period Oct 66 - Oct 67, at the Experimental Diving Unit, Washington, we have saturated 22 military personnel at 450' and excurted them to 600'. On 23 January we completed the first 600 foot six day bottom time dive with LCDR M. Bradley, LT. E. Shipp, WO R. Garrahan, TMCS P.A. Wells, and EM1 J. Morey. Much physiological data was obtained from exercise and ventilatory dynamics studies which included breathing neon and oxygen mixtures at $50 a breath! Twenty-five more subjects are scheduled for the 600 foot saturation dives. Upon completion of the series, training will shift to San Francisco Bay Naval Ship Yard where the 300 ton habitat is being refurbished. The MK II deep dive system is being placed on the IX 501 (ex-Elk River AGTR) and trials are scheduled to commence shortly. We wish to express our appreciation to EDU for their fine cooperation and patience during this sometimes hectic dive schedule.

OLD MASTER RETURNS

In October 1967, DCCM(DV) Frank E. EISSING, USN Retired decided that being a civil servant and living in the Canal Zone, Republic Panama was not for him. He took immediate steps to effect his recall to active duty. This may sound like a very simple manuever, but not so. It seems it is much more difficult to be recalled to active duty than it is to retire. After many letters and personal interviews and phone calls it was finally decided to call Chief Eissing back to active duty. But this was not the end of the problems. It seems that he was activated at NavSta Charleston and became emeshed in the paper work navy and could have been lost forever to the diving navy. Fortunately the "Old Master" being resourceful contacted the Diving School and hollered "HELP". Help we did! We helped the Old Master and ourselves at the same time. We at DSDS were diligently searching for a relief for our Senior Instructor, who was about to depart and this was the answer to all our problems. A Master Diver with a wealth of knowledge based on 22 years diving experience. Chief Eissing was the first master diver to carry the title of Senior Instructor from 1959 to 1962. His return to DSDS is welcomed and his talents as a diver and a leader will be utilized as the "Old Master".