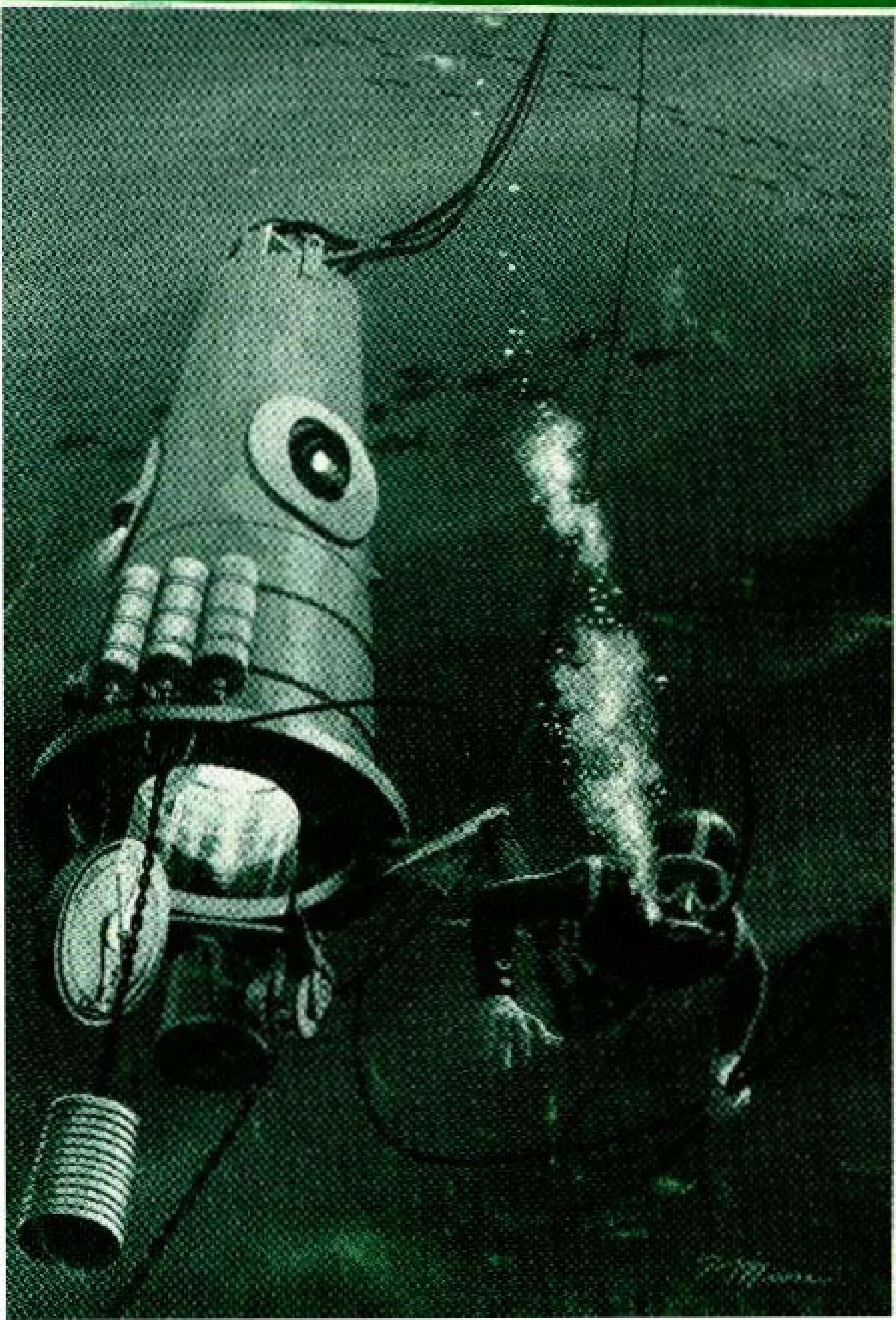
FACEPLATE

The Official Magazine for the Divers and Salvors of the United States Navy



Saturation Diving

Summer 1985
Volume 16, No. 2

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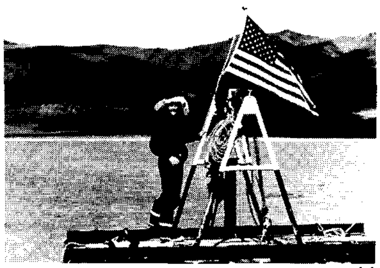
p. 17



p.11

p.25

FACEPLATE is published quarterly by the Supervisor of Diving to bring the latest and most informative news available to the Navy diving and salvage community. Articles are presented as information only, and should not be construed as regulations, orders or directives. Discussions or illustrations of commercial products do not imply endorsement by the Supervisor of Diving or the U.S. Navy.

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SOUNDINGS

Safety: Beach Gear Wire

Standard beach gear leg drawings have been amended to reflect that poured sockets, rather than pear-shaped detachable end links or plate shackles, are the preferred end fittings for 1-5/8 inch wire rope.

All salvage commands should replace their old style wire rope, as it becomes unserviceable, with new 1-5/8 inch wire rope with poured socket fittings.

Commands using the poured socket fittings should have the approved nut and bolt assemblies manufactured as per NAVSEA Drawing No. 5584614A.

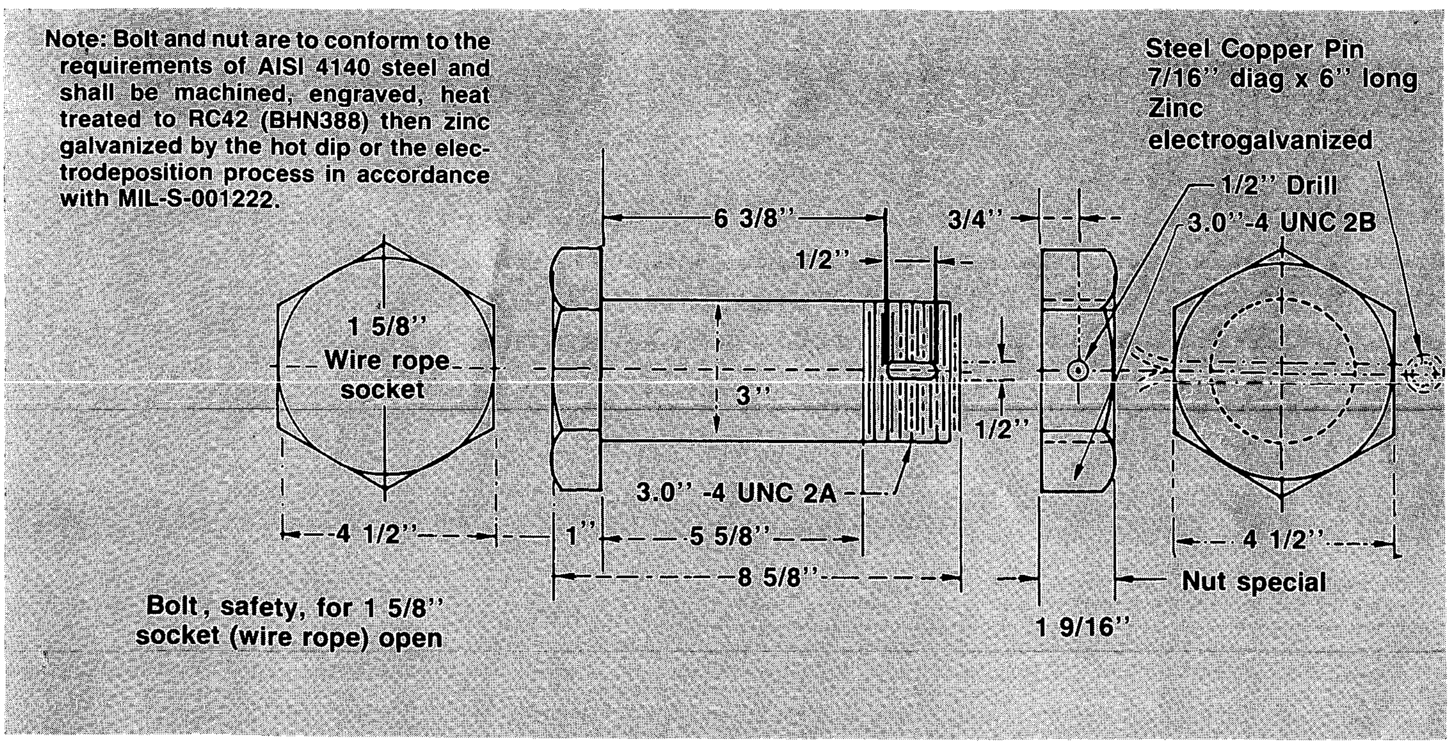
MK 14 MOD O Update

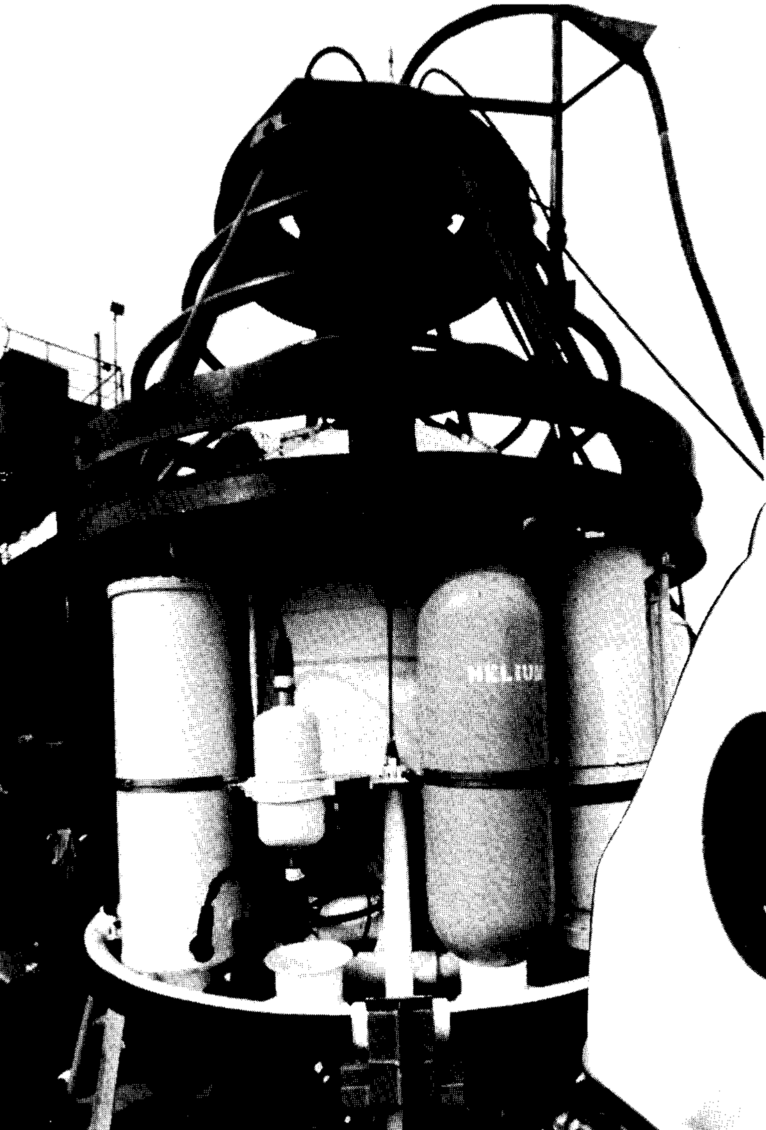
The arrival in the Fleet of the MK 14 MOD O Closed Circuit Saturation Diving System (CCSDS) will greatly increase the Navy's deep water salvage and submarine rescue operations. The system will join the MK 1 in the saturation diver's bag of tools, providing greater thermal protection and easier communications up to 850 FSW.

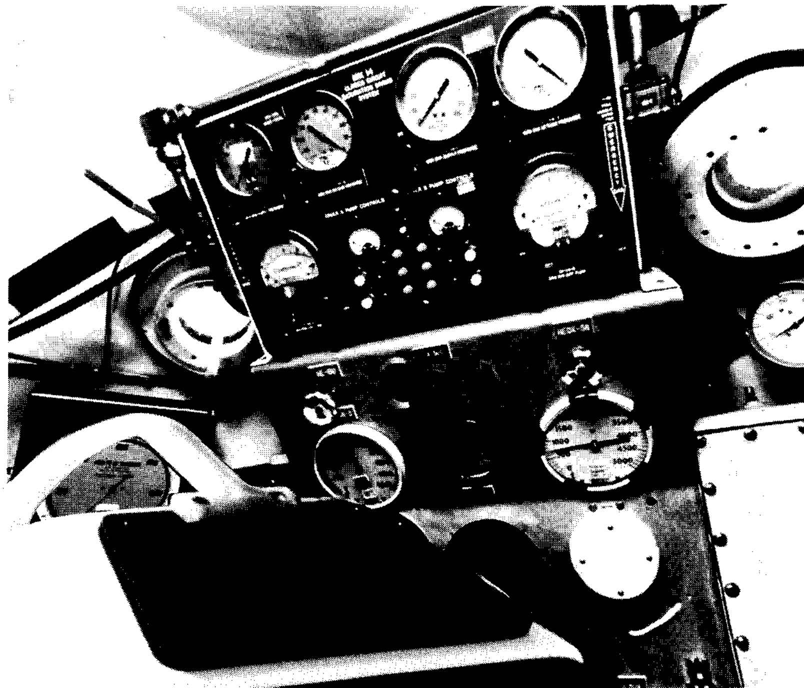
Designed to be used with the MK 2 Deep Diving System (DDS), the system will interface with the Tethered Diver Communications System (TDCS). This new system will facilitate a greater ease in communications between the excurting diver at the work site, his standby diver in the Personnel Transfer Capsule (PTC) and the console operator aboard the support vessel. As the system is closed circuit, the logistics involved with supplying a large amount of helium will be eliminated.

The Navy Experimental Diving Unit (NEDU) recently continued evaluation of the system during Deep Dive 85 at the Ocean Simulation Facility (OSF) located in Panama City, Florida. Much of the system tested satisfactorily and additional problems were identified. Many of these problems have been solved, with the rest to be remedied in time for final testing during Deep Dive 86 early next year. A final shakedown of the system will occur during March-April 1986.

At-sea testing will commence in May-June 1986 when the system, installed onboard the USS ORTOLAN (ASR 22), undergoes Technical Evaluation. This process will continue in September-October with the Operational Evaluation also on ORTOLAN. Final acceptance of the system is anticipated and procurement is scheduled to begin in FY 1989.







(Clockwise, from upper left)

Personnel Transfer Capsule (PTC) on-board USS ORTOLAN (ASR-22). The MK 14 will undergo OPEVAL and TECHEVAL from USS ORTOLAN and the PTC.

The console inside the Personnel Transfer Capsule (PTC) is designed to support the MK 14.

MK 14 helmet.

NEDU personnel participate in evaluation of the system during Deep Dive 85 at the Ocean Simulation Facility (OSF) in Panama City, Florida.

Peanut Grinder Recommended for ANU

The Fairmont Peanut Grinder, Model HU 6935, has recently been recommended for Authorized for Navy Use (ANU) status. The Peanut Grinder is a hydraulically powered, hand-held, light duty grinding tool configured to operate underwater at a rated no load speed of 8900 RPM.

Intended uses of the Peanut Grinder include underwater grinding and cutting where space is limited, weld pass cleanup, removal of wire or fabric line from propeller shafts, and work in confined areas such as sea-chests.

Weighing 5 1/2 pounds and measuring 13-7/8 inches in length, the Peanut Grinder is a sealed open-center type tool supplied with whip hoses and quick disconnect couplings compatible with NAVSEA Model 2 or Model 4 hydraulic power units. Tool speed and torque are proportional to applied flow rates (GPM) and pressures (PSI), respectively. Maximum oil flow rate recommended for the Peanut Grinder is ***10 GPM.*** Maximum pressure should not exceed ***2000 PSI.***

Grinding wheels, brushes and other accessory hardware attach to the Peanut Grinder via a 1/4-inch chuck assembly on the drive shaft of the tool. A variety of accessory hardware exists. Some available hardware encompasses permanently mounted 1/4-inch shafts; other hardware contains 1/2-inch diameter mounting holes and requires a mandrel to mount the accessory on the tool.

Recommendation for ANU resulted after field testing carried out by CINCPACFLT. The tool's safety, reliability, and maintainability, as well as its effectiveness for use in welding, have been well established. Mobile Diving and Salvage Unit ONE (MDSU-1) maintenance divers evaluated the Fairmont Hydraulic Peanut Grinder from June 1983 to June 1984 in Pearl Harbor, HI. During 65 hours of operation, 62 in water and 3 on surface, no problems were encountered that required maintenance downtime. The deadman-type switch enabled safe operation of the Peanut Grinder at all times.

Prior to CINCPACFLT testing, the Naval Coastal Systems Center determined that the Peanut Grinder is mechanically practical, and the Navy Experimental Diving Unit in Florida established that the tool was safe for diver use. The Peanut Grinder will be listed in the next change of NAVSEAINST 9597.1A

For more information on the Fairmont Hydraulic Peanut Grinder, Model HU 6935, contact LT Karin Lynn at NAVSEA OOC (AUTOVON 227-7403; Commercial 202-697-7403).

RADM William A. Sullivan,

the U.S. Navy's first Supervisor of Salvage, passed away 6 September 1985, in San Diego, California. He was 91.

RADM Sullivan served as SUPSALV from December of 1941 to November of 1942 and again from March 1946 to April 1947.

During his tenure as SUPSALV RADM Sullivan directed the salvage at Pearl Harbor, the USS LAFAYETTE salvage operation and the clearance of the harbors in Le Havre, France, and Naples, Italy.

Burial was held at Arlington National Cemetery on Tuesday, 17 September.

Noise Exposure Times for Hydraulic Tools Recalculated

After a study conducted by the Navy Experimental Diving Unit and the Navy Medical Command, the permissible noise exposure time for high-noise-level hydraulic tools was recalculated. The times were determined to be the maximum safe exposure for a 24-hour period. The maximum cumulative permissible times recommended for in-water use of these tools are:

Partek waterjet tool - 5 hours, 15 minutes
Daedalean concaver waterjet tool - 1 hour, 50 minutes
Cavijet waterjet tool, 1B - 1 hour, 40 minutes
Stanley hydraulic chipper, CH 18 - 3 hours, 40 minutes
Stanley impact wrench, IW20 - 15 hours

The command diver training program should be amended to reflect these standards. All diving officers and supervisors should consider these limitations when planning dives using these tools.

View from the SUPERVISOR OF DIVING

By CDR Raymond Swanson, USN

Master Diver Working Conference

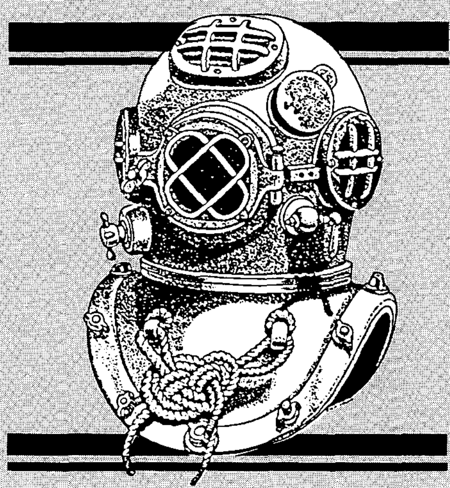
In response to a growing concern about the increase in diving accidents, a Working Conference was called for Master Divers. The meeting, held at the Naval Diving and Salvage Training Center in Panama City, Florida, 8 July to 12 July 1985, was attended by 61 Master Divers representing the majority of diving activities. The conference was conducted under the sponsorship of the Supervisor of Diving, with the full support of the Navy Diving Program sponsor, the Chief of Naval Operations (OP-23).

Five working groups covered topics as diverse as ship's husbandry, mixed gas diving, clean rooms, configuration management, diver training and Personnel Qualifications Standards during the four and one-half day Master Diver Working Conference. Twenty-five point papers were developed and will be forwarded by the Naval Sea Systems Command to the Chief of Naval Operations via the Fleet Commanders in Chief. Some of the papers will also be discussed in September by the ad hoc Safety Committee, which was established by the Chief of Naval Operations on 15 August 1985 as a response to recent diving fatalities.

Let me summarize some of the point papers were developed and will be forwarded by the Naval Sea Systems in with more details should you be interested in knowing more of the insights provided by our experienced team.

The Master Divers felt that the quality of underwater diving could be improved by the development of standard procedures to cover tests frequently encountered by the diver. This would enable all divers to benefit from lessons previously learned. The idea of an Underwater Work Techniques Manual (under development by the Director of Ocean Engineering) was endorsed. A second suggestion was that a tiger team be tasked to teach the standardized techniques either in a formal school or in classes held at the various locations in the fleet.

Another major concern of the Master Divers was that divers arriving in the fleet had insufficient water time in some diving rigs and therefore had too little experience to handle emergency situations. It is, therefore, important that ad-



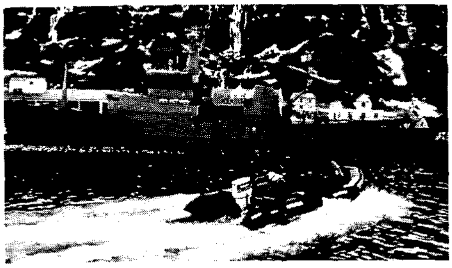
ditional training be just that, and that training such as that given to support the Underwater Work Techniques Manual not replace divers' in-water time during basic diver training.

Certification was discussed a great deal. The consensus was that there is a low level of awareness throughout the fleet of certification requirements and procedures. Once again, increased training was recommended as the remedy to the problem. The Master Divers recommended a cookbook-type text be written describing the necessary procedures and forms that must be used to obtain certification. Since certification rules must be known and understood by all divers, it was also recommended that the course of instruction in certification be standardized for all classes of divers. It was further recommended that units check their knowledge of certification through local audits.

The most important topic and the one which precipitated the Master Diver Working conference was the increased number of diving accidents over the past decade. Some of the increase can be accounted for by the installation of more accurate and complete reporting procedures; however, many of the accidents can be attributed to human error. In almost every accident of a serious or fatal nature, the cause was found to be failure to follow established and approved diving procedures rather than equipment failure.

In discussing these statistics, the Master Divers noted that at times it is easier to relax one's guard and take short-cuts than to strictly adhere to established procedures. In such an unforgiving environment, however, a diver is responsible not only for his own life, but also for the life of his shipmate. Supervisors must set the example for all because as leaders they have a profound influence on others. The Master Divers concluded that they as professionals have a responsibility to ensure that all are aware of and follow safety procedures in diving.

In summary, the 1985 Master Diver Working Conference provided valuable insights into problems in Navy Diving and Salvage. Sound recommendations resulted from this conference and will bring about major improvements in diving safety. My thanks to all those who contributed their time and effort to make the conference both possible and successful.



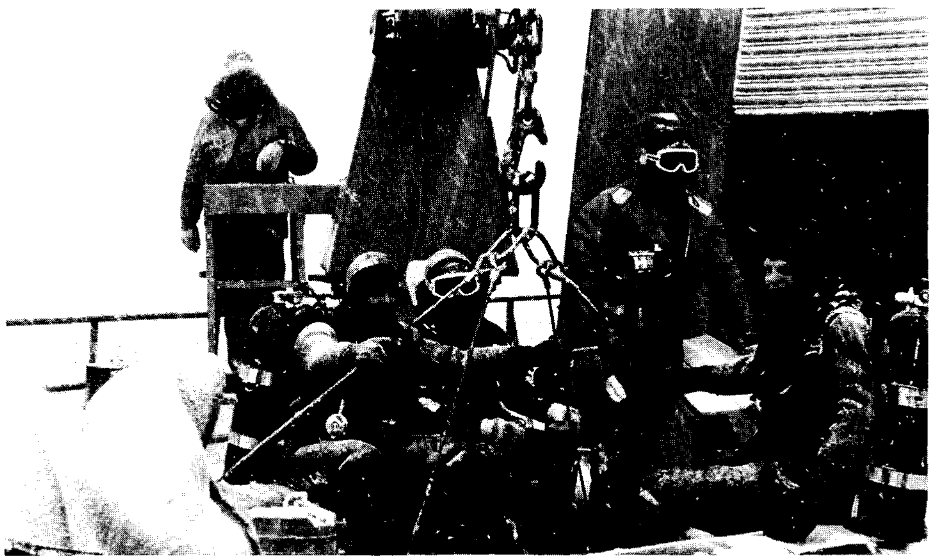
EOD DET KEFLAVIK

Disarms WW II Tanker


Standby diver LT J. Jeffries, EOD DET Keflavik.

By LT Jim Jeffries, USN
EOD Detachment Keflavik

Preparing for the first dive of the day, the team faces typical Northeastern Iceland weather.



On the morning of 10 February 1944, three German Luftwaffe fighter-bombers attacked an isolated British refueling depot in a narrow fjord on the northeast coast of Iceland. Trapped in the fjord was the fully laden British tanker EL GRILLO, waiting to refuel an Allied convoy destined for Murmansk in the Soviet Union. Easy prey for the bombers, a near miss off the starboard bow crushed her hull below the waterline. The 30-man crew escaped injury during the attack, and fought throughout that day and night to keep the tanker afloat while thousands of tons of her precious cargo were pumped ashore. The captain, fearing a return of the Luftwaffe, ordered that the slowly sinking ship be intentionally scuttled. This prevented the possibility of a renewed attack that would destroy the ship and pollute the fjord, or worse, set the fjord and city of Seydisfjordur (nestled within the fjord) ablaze. Finally, just prior to dawn on the 11th, EL GRILLO settled gently in the fjord's thick silt bottom, 140 feet below the surface.

In April 1945, a little more than one year after EL GRILLO sank, the British Legation in Reykjavik, Iceland notified the Ministry for Foreign Affairs that the British Minister of War Transport and the Admiralty would not intervene in any salvage operation by the Icelandic Government, and that they officially abandoned their interests in the wreck and its cargo.

British records confirmed that the EL GRILLO carried a full cargo of 9000 tons of fuel and diesel oil. Before she was scuttled, the crew pumped approximately 3000 tons of oil from her holds. The remaining oil was the focus of many diving operations in the next 40 years.

In 1952, a salvage company discovered several depth charges on the after--deck of the ship during an operation to pump up most of the remaining oil. These depth charges were carried by the ship for use by escort vessels during the Atlantic crossing. During the summer of 1963, an Icelandic civilian diver made several dives to the EL GRILLO. He confirmed the presence of the depth charges, each containing 300 pounds of TNT, and retrieved several rounds of ammunition from lockers on the gun platforms. The 70 and 20 millimeter shots contained intact charges, although their primers were ruined. The EL GRILLO was armed at her stern with four PAC (Parachute and Cable) Rocket Launchers, designed to fire a cable into the air to deter enemy aircraft from making low level bombing runs.

More dives were made to the EL GRILLO in the following years. Oil leakage led to further inspection of the wreck in June 1972. During that inspection, one depth charge was lifted and detonated ashore. In November 1982 and March 1983, US Navy divers inspected closely the sunken depth charges, and lifted three, detonating them underwater in the next fjord to the north from Seydisfjordur.

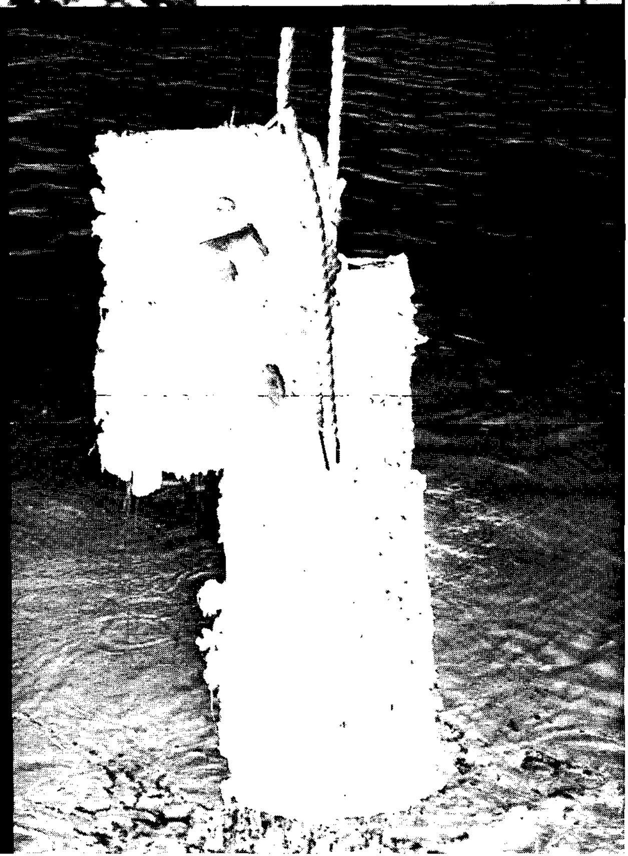
Forty years after the EL GRILLO sank, the people of Seydisfjordur and the Government of Iceland requested U.S. assistance to remove the depth charges from the wreck's main deck.

Explosive Ordnance Disposal Group TWO Detachment Keflavik from U.S. Naval Station, Keflavik, Iceland was assigned the task. Assisted by the Icelandic Coast Guard (ICG), work began on 21 March 1985 using ICG Cutter M/S TYRE as a diving platform.

In the next 10 days, over 75 dives were made in the fjord's icy waters. With the main deck at 110 feet below the sur-

Depth charges being removed from the EL GRILLO. (above and right)

Dive team (L to R): HT2 M. Richardson, LT J. Jeffries, MNC W. Spoerer, TM1 G. Torres, HFTN S. Puio, EN3 E. Seuter, LT G. Geirsson.



face, divers were limited to a 15-minute bottom time. This provided a 5-minute safety factor in case of emergency and accounted for possible effects of extreme cold water on the divers.

The first dive set conducted a survey of the wreck. She was found to be on an even keel, virtually unchanged from the day of her sinking. What little damage that was visible was not caused by the bombers, but by numerous anchors and chains belonging to both naval and fishing vessels being dragged across her decks, tearing away at her weakening hull. Anchors, chains, nets and wreckage littered the deck and hampered removal of the depth charges, though some areas of the wreck lay undisturbed and her loaded anti-aircraft guns appeared ready for action.

The dive team consisted of four EOD Technicians, two EOD Apprentices and two Icelandic Coast Guard Divers. Each diver made two dives per day with a minimum four-hour surface interval between. All first dives were made to the main deck of EL GRILLO. The dive set would descend to the wreck with a retrieval line in tow. Once on the main deck, they would locate one or more depth charges and, using carabiners, attach them to a large eye spliced into the retrieval line. The carabiners provided a quick and sure method of attachment, eliminating the need for shackles or knot tying. Capstans aboard the M/S TYRE were then used to recover the depth charges.

On several occasions, extreme weather conditions delayed operations. Snow on all but the second day hindered both surface and underwater visibility. With wind chill temperatures well into the minus numbers, it was a race to get the divers into the relatively warm water (-3 °C) before their equipment froze and became inoperative.

Recovery operations concluded on 30 March 1985. Twenty-one depth charges were removed from the EL GRILLO and detonated locally. The wreck also yielded two PAC rockets and several cases of 20mm ammunition for its eight anti-aircraft guns.

Support and hospitality provided by the Icelandic Coast Guard and townspeople of Seydisfjordur were excellent. Divers from EOD Group TWO Detachment Keflavik had completed an operation that made the harbor of Seydisfjordur safer for town residents and shipping traffic.

EOD DET Keflavik detonates depth charges recovered from the EL GRILLO.

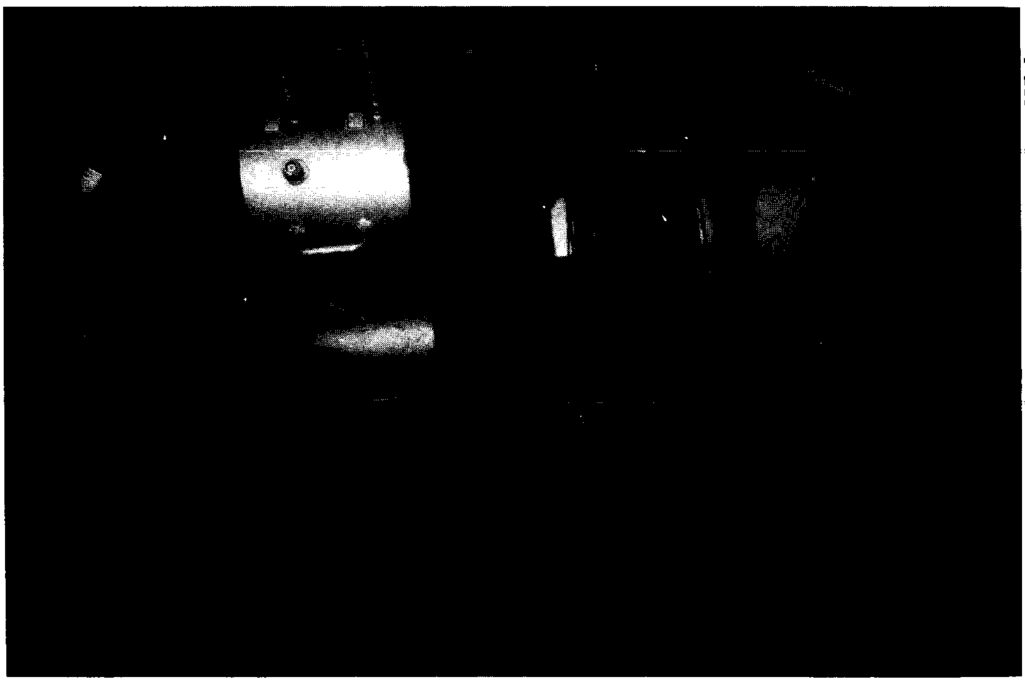
Waterborne Double Screw Changeout ON THE USS HEPBURN

By LCDR P. Herlin, USN
Mobile Diving and Salvage Unit ONE

On 24 January 1985, USS HEPBURN (FF-1055) reported hitting a whale while underway and experienced severe shaft vibrations with an associated acoustic signature. On 25 January, MOBDIVSALU ONE DET (MDSU ONE DET.) divers conducted an inspection of the screw which revealed a 62-inch rip on the edge on one blade. The screw had to be replaced and the ship ordered a 12½-ton replacement screw which was on scene by 27 January. Due to time constraints caused by the ship's upcoming deployment and cost factors, COMNAVSURFPAC decided to do the screw change waterborne and tasked MDSU ONE and USS SAMUEL GOMPERS (AD 37) with the job on 30 January.

Diving operations began on 1 February using the Fly Away Diving System (FADS) II Air System with MK I masks and MK 12. The initial plan involved using Charleston gear with two 200-ton hydraulic jacks and assist, if necessary, with det cord. The nearest pilgrim ring was unavailable due to its use with a drydocked ship in Pearl Harbor, HI.

From the start, the divers experienced problems. The horseshoe padeyes above the screw were welded closed and all rigging had to be done with a belly band under the stern of the ship. Additionally, all plugs in the lifting padeyes for the screw and dunce cap, along with the fairing screws, were staked eight to twelve times making removal difficult. Finally, the ropeguards were triple-pass welded and required two days of grinding to remove.



Charleston gear in place on the USS HEPBURN.

By Monday, 5 February, these problems were resolved and an initial pull was made with the Charleston Gear. During the first pull, one of the two 2½-inch studs broke. All diving halted and a new plan using det cord was agreed upon. Message authorization was requested for the use of demolitions. MDSU ONE also requested the pilgrim ring from Pearl Harbor and the assistance of technical advisors from NAVSEA and Pearl Harbor. In addition, NAVSEA OCC sent an equipment van which later proved to be invaluable.

On Wedneday, 7 February, MDSU ONE divers and EOD personnel shot off the screw in two successive detonations using four wraps of det cord once followed by another shot of three wraps. The screw was then removed using a balance bar and 25-ton chain fall. The new screw was quickly installed using the pilgrim ring, but advanced one-half inch further up the taper than the original screw. The USS SAMUEL GOMPERS machine repair shop made modifications to the existing dunce cap and constructed a specially designed spacer to get the complete dunce cap to fit. Finally, after twelve days, on 14 February, the screw was on, air tested and ready for operational test.

On the evening of 14 February the ship conducted sea trials and found that the new screw had an unacceptable acoustic signature. On Friday, 15 February, MDSU ONE and USS SAMUEL GOMPERS were again tasked to change the screw. However, time was especially short with less than five days available. On Saturday morning, 16 February, divers began working around the clock on two 12-hour shifts. The pilgrim ring was used to remove the old screw and install a new screw which had been flown in from Norfolk. The final working dive was completed prior to midnight on 20 February. The USS HEPBURN deployed the following morning after a successful sea trial.

In two and one-half weeks MDSU ONE divers compiled in excess of 380 hours of bottom time in MK 12, MK I and SCUBA while rigging and handling extremely heavy loads throughout the day and night. The divers experienced no injuries, although at times they were extremely fatigued and frustrated. Through the combined efforts of USS SAMUEL GOMPERS and MDSU ONE divers, two successful screw change-outs were completed with almost $1 million in drydocking costs avoided, allowing a surface combatant to meet its deployment schedule.

Members of Waterborne Double Screw Changeout Dive Team

LCDR Herlin
LT Linn
ENS Cortez
ENS Frost
BTCM(DV) Walker
MRCM(DV) Thoenes
EMCS(DV) Gerdom
BMCS(MDV) Engles
BMCS(MDV) Jennings
BMC(DV) Stephens
HTC(DV) Davis
ENC(DV) Dawson
EN1(DV) Marrs
HM1(DV) Dunagan
EM1(DV) Bonnan
GMG1(DV) Boyd
CPO(DV) Ryan
GMG1(DV) Orns
HM2(DV) Morgan
OS2(DV) Neste
HT2(DV) Gordina
AE2(DV) Grau
EM2(DV) Webb
EM3(DV) Carter
HT3(DV) Saenz
EM3(DV) Andersen
OSSN(DV) Cuevas
FN Rose
EM3(DV) Riede
HT2(DV) Van Cleave

Road leading to the base salvage camp.

F/A-18 Aircraft Salvage

By LT R.P. Linn, USN
Mobile Diving and Salvage Unit ONE

On Sunday, 17 March 1985, a USN F/A-18 Hornet aircraft crashed in Carson Sink, Fallon, Nevada while conducting a bombing run. The crash site was located in a shallow seasonal lake, 15 miles from shore.

Two days later, the advance party consisting of LCDR Herlin and ENS Hoff from Mobile Diving and Salvage Unit ONE Detachment (MDSU ONE) arrived at Naval Air Station, Fallon, Nevada and contacted the Accident Mishap Board. At the site location the next day, investigators located two pieces of aircraft with grappling hooks. The salvage team, including divers from MDSU ONE DET, arrived by ground transportation that afternoon to assist the Accident Mishap Board in the salvage operation. A salvage conference held that evening determined a jackstay search between PVC pipe guides to be the most effective search method.

Throughout the salvage operation weather conditions continually hampered the divers. During the sixteen days of the salvage operation, there were five days of extremely adverse weather. Diving conditions consisted of zero visibility, eight to ten feet depths and 48-52°F temperatures. Topside, the divers worked out of 16-foot motor boats in three to four foot seas, and frequently faced 15°F chill factor wind with sleet and snow showers.

Towing four-ton lift pontoon to the salvage site.

As the search continued, several large pieces of wreckage were discovered that could not be raised by hand. As there was no floating crane available, divers constructed two different lifting pontoons. These two pontoons consisted of several 55 gallon drums, an A-frame and chain hoists. The first lift pontoon was capable of two tons of lift and the second was capable of four tons. With the equipment, divers raised, identified and photographed all large sections of the wreckage.

Divers continued hand-searching the bottom using a grid pattern made up of PVC pipe stuck into the bottom to mark areas searched. The search area was expanded as more wreckage was discovered until the desired magtape was found on 1 April. However, the tape was missing the last 72 seconds of information. The search continued until both mission control computers and the ejection seat were found.

Sixteen days after the salvage operation commenced, divers had hand-searched almost five acres of lake bottom and discovered the maintenance status display and recording system (MSDRS), both mission control computers, the ejection seat, the inertial navigation system and assorted wreckage. Salvage operations were then terminated.

MDSU ONE DET overcame inaccessibility, remoteness of the site, and adverse weather during this successful salvage. The innovative, determined methods of divers were the key ingredients which brought the operation to completion, and provided the Accident Mishap Board with the information needed to determine the cause of the crash.

Members of F/A-18 Aircraft Salvage Dive Team

LCDR Herlin
LT Linn
ENS Hoff
EMCS Gerdom
GMG1 Boyd
HM2 Morgan
AE2 Grau
EM3 Andersen
BM2 Brown
HT3 Saenz
SKSN Miller
MM1 Nichols
IC1 Simmons

Divers recovering wreckage.

Maintenance Data Recording Tape.

Recovered wreckage, the salvage crew and the intact F/A-18.

Ice surrounded the YSD 53 as far as the eye could see.

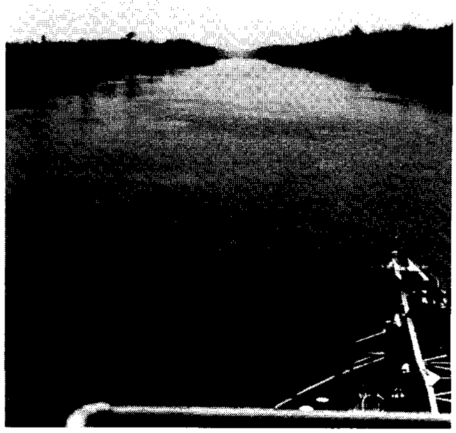
Salvage Icebreaker

By LT P.G. Beierl, USN
Mobile Diving and Salvage Unit TWO

"Just Another Airplane Job!" That's what the divers at Mobile Diving and Salvage Unit TWO (MDSU TWO) thought when word arrived on 28 December 1984 (as usual on Friday afternoon) that a Navy aircraft from VA-75 at NAS Oceana had crashed in North Carolina. What followed proved to be anything but routine. Doubts began to materialize when the crash site was pinpointed on a chart of the Alligator River between Albemarle and Pamlico Sounds. The A-6E bomber had crashed into the murky water during a cold and foggy night, ten miles from civilization and a mile short of the swamps that surround the Stumpy Point Bombing Range.

For several days after the aircraft was located, a team of divers from MDSU TWO and an EOD team from EOD Mobile Unit TWO operated their small boats from a narrow canal deep in the swamps on the west bank of the Alligator River. Eight miles of shallow water strewn with treacherous mangrove stumps separated them from the crash site. Each day after carefully traversing this area, known as the "Frying Pan," divers quickly set to work locating and marking aircraft wreckage for recovery by the YSD 53.

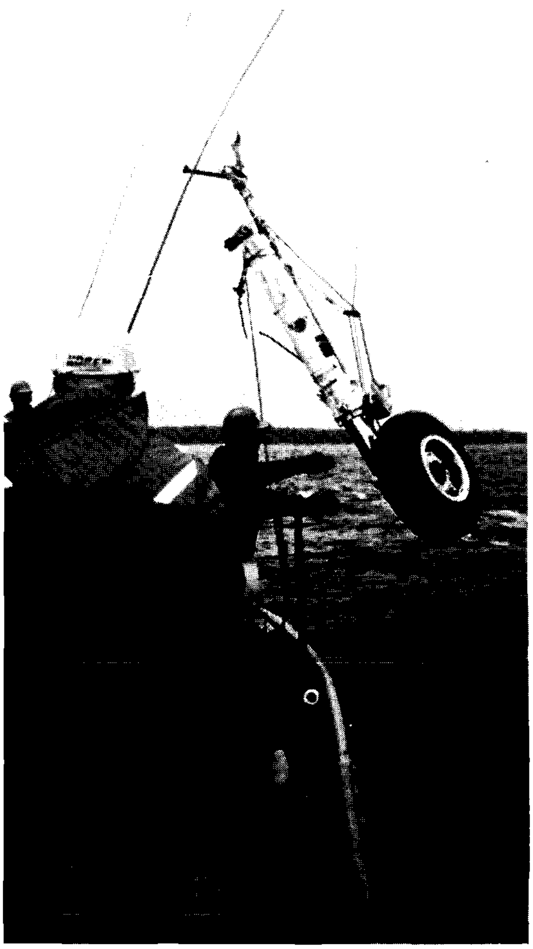
Mounting a ten-ton crane and drawing a mere five feet of water, the 105-foot long, self-propelled YSD 53 was ideally suited to the shallow water and restricted navigation of the Intercoastal Waterway. After an exciting three-day transit south from downtown Norfolk, through Great Bridge Locks and countless drawbridges, YSD 53 anchored at the crash site on 8 January.



YSD 53 steaming through a typical section of the Intercoastal Waterway.

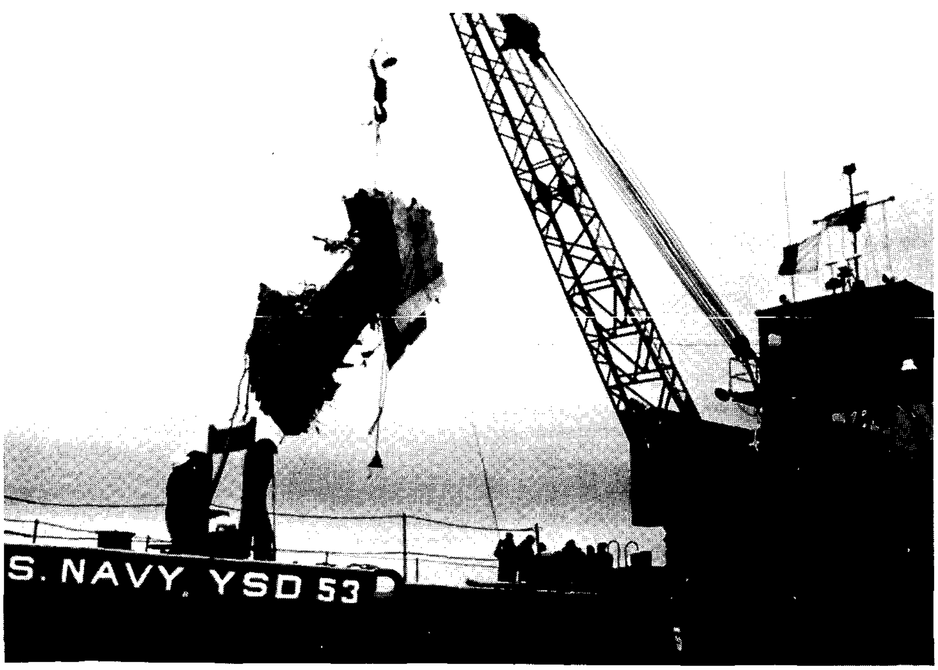
Meanwhile, the divers and EOD team had relocated their base of operation to the east bank of the river. With the help of a tracked vehicle known a "Go-Trak" and a North Carolina Park Services bulldozer, a long unused and overgrown road through the bombing range had been reclaimed from decay and made passable to four-wheel drive vehicles. An EOD vehicle and a truck borrowed from the bombing range staff transported divers daily through the backwoods road and muddy trails to a small canal one mile from the crash site. There the small boats were secured amid posted signs which declared the area a "North Carolina Bear Sanctuary." Thankfully, the local bears were apparently snug in their dens hibernating.

With YSD 53 on site the salvage progressed steadily despite freezing temperatures that caused problems for both the salvors and their equipment. Large pieces of the aircraft were easily lifted



The starboard landing gear is recovered.

Divers operated their boats from this small canal.

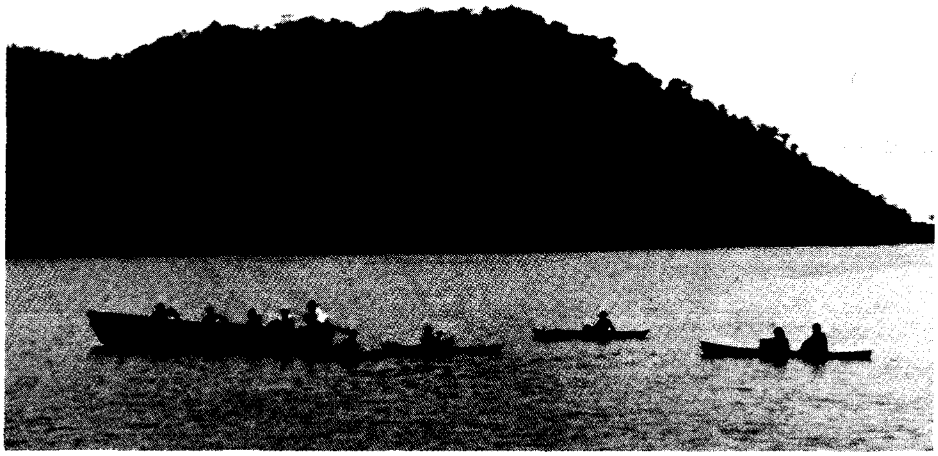


YSD 53 easily lifts their large wing section aboard.

and placed on deck. As work progressed the mountain of wreckage grew steadily higher.

After three weeks on the job, a severe winter storm struck the area. Two days of high winds and snow, coupled with sub-zero temperatures, left the divers and EOD personnel stranded ashore and the YSD 53 surrounded by miles of solid ice. The cold weather also caused problems for the craft, freezing the fresh water tank and clogging generator sea strainers. With no improvement in the forecast the YSD 53 and divers were recalled. For 20 long hours the sturdy 53 punched through ice two to four inches thick to reach the Coast Guard Station in Coinjock, N.C. in the early hours of the morning. There the salvage team waited until the ice had melted sufficiently to resume work. At this point the decision was made to embark the entire salvage team on the 53, increasing the productive work day and further demonstrating the effectiveness of YSD 53 as a self-sufficient salvage platform.

Once back on station after the ice had cleared, a few days work brought the recovery operation to a close. A total of 90,000 square yards of muddy river bottom had been searched under rugged conditions. Those involved in the salvage of the aircraft returned home carrying memories born in the brief hardships endured on the Alligator River. When future salvors hear tell of the Salvage Ice Breaker 53 they will know that this was not "Just Another Airplane Job!"



Central American Salvage

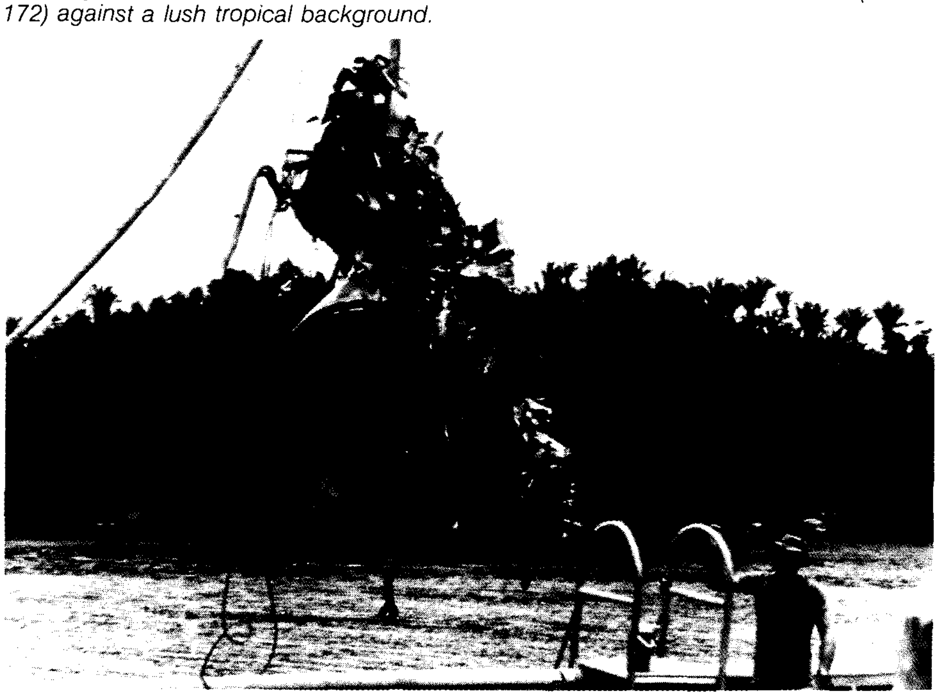
By LT P. B. Beierl, USN
Mobile Diving and Salvage Unit TWO

Local natives were the constant companions of the salvage team at Punta Sal, Honduras. (above)

Divers from Norfolk-based Mobile Diving and Salvage Unit TWO and Explosive Ordnance Disposal Mobile Unit TWO mixed salvage with cultural exchange when they journeyed to the lush tropics of Honduras to recover a crashed Air National Guard OA-37 aircraft. During what proved to be an otherwise routine aircraft recovery, the salvage team and the USNS APACHE (T-ATF 172) crew were kept constant company by a lively group of natives whose fleet of log canoes was never far from APACHE's fantail.

Two MDSU-TWO divers find that balancing a log canoe is not as easy as it looks.

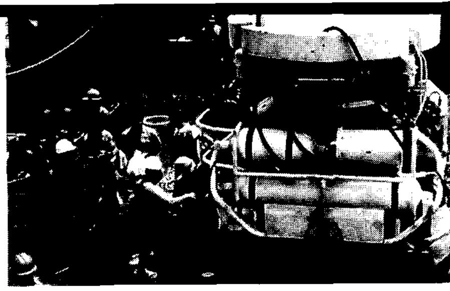
Wreakage of the Air National Guard OA-37 is hoisted aboard the UNS APACHE (T-ATF 172) against a lush tropical background.



The operation started three days after the crash with the mobilization of a Fly Away Dive System (FADS) and a salvage team composed of divers from MOBDIVSALU TWO and EODMU TWO. Side-scan sonar search support was provided by EOD Training and Evaluation Unit TWO. On 21 April 1985 an Air Force C-141 flew the entire team to LaMesa, Honduras where the search team disembarked, and then flew the salvage team on to Panama. In Cristobal, Panama the FADS II equipment was loaded aboard APACHE and the two-day transit to the crash site began.

When APACHE arrived at Punta Sal, Honduras, the team was greeted with an idyllic scene of white sand beaches studded with coconut palms and rock outcrops. The Master eased APACHE into a small cove and positioned the ship over the aircraft wreckage. The first divers had barely left the surface when the natives in dugout canoes began their tentative approach. Before long they were becoming fast friends with the divers and the ship's crew. Over the next few days, as most of the aircraft was recovered, the natives were regular visitors, trading shells and skins or cracking coconuts and giving canoe lessons. Their presence was a welcome diversion for the salvage team and APACHE's crew.

Within three days the cause of the crash was determined and the salvage operation was terminated. As departure preparations were made, there was a flurry of last minute trading. Soon the fleet of canoes pulled away and the Hondurans paddled back to their village while the salvors aboard APACHE headed out to sea for home.



Captain George F. Bond.

Bond's Legacy— A History of Navy Saturation Diving

By LCDR Christopher Nemeth, USNR-R

Ever since man dove to the ocean's depths, he has dreamed of living there. But a major obstacle stood in the way: decompression sickness, or the bends. As every working diver knows, the body's fatty tissues absorb nitrogen more readily under pressure. Brought to the surface too quickly after a long, deep dive, the diver experiences excruciating pain as nitrogen races to escape his body and forms bubbles in the bloodstream. It can cause paralysis or even death.

To avoid the bends, divers worked around the problem. They had to go to whatever depth the salvage or construction work was. To let the nitrogen they carried escape gradually, they stopped at predetermined depths on the way up, to decompress. Although it kept divers safe, lengthy decompression had its drawbacks. It meant long, boring and unproductive time spent hanging in the water. Shortening decompression time generally meant shortening the length of the dive, and cutting down on the amount of work a diver could accomplish.

Much thought and research were given to how to extend the time a diver could spend at depth. If only man could make the switch from visitor to resident, the solution could open up a wealth of opportunities.

One approach, the bathyscaph, put one or two men inside a tiny chamber and lowered them like a yo-yo into the cold darkness below. In the comfort and safety of a pressurized shell, bathyscaph riders could wander through depths never seen by surface-supplied or scuba divers. The tour, however, was always at arm's length. While they could marvel at the sea life around them, it was like walking through a candy store without being able to taste or smell the delights, just look at them.

George Bond's Idea

By the mid-1950's, a Navy diving medical officer had thought of an entirely different approach. Then, Commander George F. Bond was the Director of the Submarine Medical Center (SMC) at New London, CT. As author Sylvia Earle recounts, "Bond pointed out that once a diver's body was saturated with compressed gas—when tissues had absorbed all they could and equilibrium was reached—the decompression time would be the same whether the diver stayed underwater for a matter of hours, days, weeks, or even months. The amount of time necessary for decompression depended on the depth of the dive and on the gasses breathed".

A number of trends led to Bond's idea. In the early 1920's, the Navy and the U.S. Bureau of Mines were already experimenting on how breathing mixed gasses affected divers' performance. In 1925, they found that a diver on mixed gasses could go as deep as ever and return to surface pressure in one quarter of the normal decompression time. In 1927, the Navy created the Experimental Diving Unit (NEDU) which organized and pursued a scientific approach to studying the effects of diving on man. Navy doctors participated in experiments at Harvard School of Public Health to see how breathing mixed gasses affected behavior. Both military and commercial diving organizations "pushed the envelope" of limits to see how deep and how long man could stay below. Many won; some lost.

By 1928, British inventor Sir Robert Davis had developed the Submersible Decompression Chamber (SDC), a metal tube big enough for two men. It was designed to be hung from a diver's support ship on the surface to make decompression safer and more comfortable. Lowered to depth, a tender in the chamber would help the diver through the SDC's lower hatch, help him out of his diving dress and begin his decompression, safe from the ocean surrounding them. A few years later, Davis

Edwin A. Link.

devised a three-compartment Deck Decompression Chamber (DDC). The DDC made it possible to bring the diver in an SDC to the surface. He could then be transferred to a chamber on the support ship's deck to complete decompression, fully safe from the ocean's hazards.

Bond's concept electrified him. Think of man living — not visiting but living — on the ocean floor! Charged by the potential of saturating divers, he contacted the two other world figures in diving at the time: French Captain Jacques-Yves Cousteau and American inventor-engineer Edwin A. Link. With their encouragement and the resources of the Navy's SMC at his disposal, Bond began to turn his theory into reality.

Genesis I and II

Genesis I and II are formal names for informal tests that started on a shoestring. Instead of an inventor's garage, Bond and his crew had a number of treatment chambers. The largest was the SMC's main hyperbaric chamber, a long white cylinder capable of holding over a dozen men and pressure equal to around 250 FSW. Bond routinely worked around the clock with two other Navy officers. Commander Walter Mazzone was a Medical Service Corps physiologist and a former submariner. Commander Robert Workman was an Iowa country doctor who was Bond's decompression expert.

The first subjects in Genesis never swam, much less dreamed of living on the ocean floor. Mice, guinea pigs and goats led the way as Bond ran them to depth in the smaller training tank chamber. Fully saturated, they were brought up gradually on an estimated timetable. If any showed signs of distress indicating the bends, they were repressurized and another piece of data was added to the small, growing knowledge about this infant diving technique.

Sylvia Earle recalls that "Five years of data painstakingly produced in Navy laboratories preceded the first successful open water saturation dives." After the initial mammal experiments, "Bond successfully exposed human volunteers in a pressure chamber to a simulated depth of 200 feet for 14 days and communicated his results to Cousteau and Edwin Link."

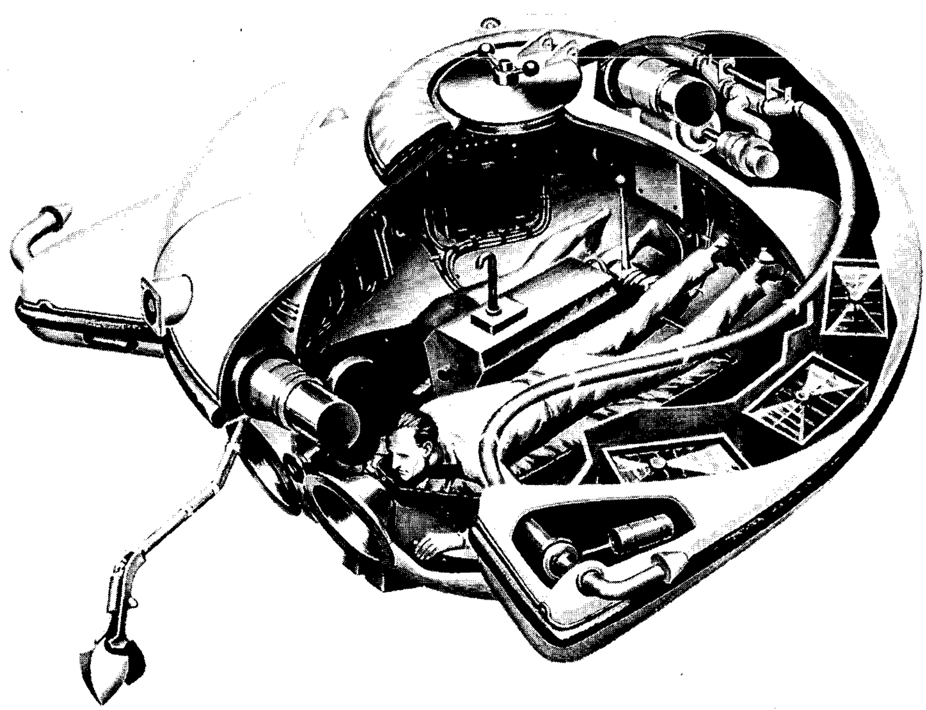
Bob Barth was one of the first team to try out Bond's idea. "I was a First Class Quartermaster in those days," he said. "I had met George Bond when he made a buoyant free ascent off the submarine ARCHERFISH." The idea of living at depth fascinated Barth and a handful of other divers at New London. They spent their off-hours with Bond just to be a part of it all. "We didn't really know exactly what we were getting into. We all knew what a pain decompression was and figured if you could put a bunch of divers on the bottom and have them run around without decompressing, that was a real bonus. Besides, Bond was the kind of guy that, if he said 'We're going to the moon' he'd have a bunch of guys ready to go. He always had something interesting going on."

In November 1962, the first men saturated in a chamber in the basement of the Bethesda, Maryland Naval Medical Research Institute (NMRI) for six days at surface pressure. Sophisticated electronics monitored each diver's brain waves and heart beat as he came off of the gas mixture. The results: each was normal, with no ill effects. Barth and Navy doctors Fisher and Bull joined in a pressurized dive in the Spring of 1963 at the Experimental Diving Unit, spending over a week at 100 feet. That fall, a third and final dive put Barth, a Navy doctor and corpsman at 200 feet in the Submarine Medical Center's new chamber for over two weeks. This time, Walt Mazzone added a new twist. Just after finishing the animal dives, Mazzone had read a 1935 article by Louis Shaw on continuous rate of descent decompression. "I checked with Bob

Workman to see if it would work on Genesis," he recalled. "Then, I quickly saturated a set of animals at Bethesda to prove the theory. We tried it on the third Genesis II dive. It shortened decompression from three days to 30 hours."

Bond had proven his idea. Armed with data from both sides of Genesis tests, he was ready to sell the Navy on the technique. He had a ready audience. In 1962, USS THRESHER was lost at sea. Speculation ran wild on how it happened. One thing was certain: sitting in over 8000 feet, she couldn't be reached using traditional diving techniques. Bond's saturation diving offered the Navy a way to reach subs with normal operating depths far outside the reach of standard bounce diving methods. By the time Bond had finished his Genesis data, the Navy had already asked him to launch an effort to create a way to rescue sailors trapped deep on the ocean floor.

Cousteau's Undersea Saucer. By David Meltzer, 1964. National Geographic Society.

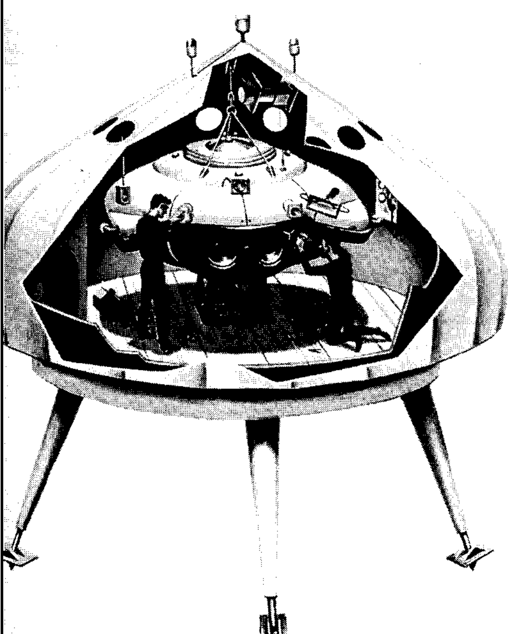


Man-in-Sea

In 1963, the Navy didn't expect to make an open sea test for five years. Bond got the go-ahead to develop a deep ocean habitat. He and Barth traveled to Panama City to see if an old net flotation buoy there could be converted into an undersea home. At the same time, the Navy provided supplies and expertise to support other research.

Inventor Edwin A. Link in his diving chamber, part of his Man-in-Sea program.

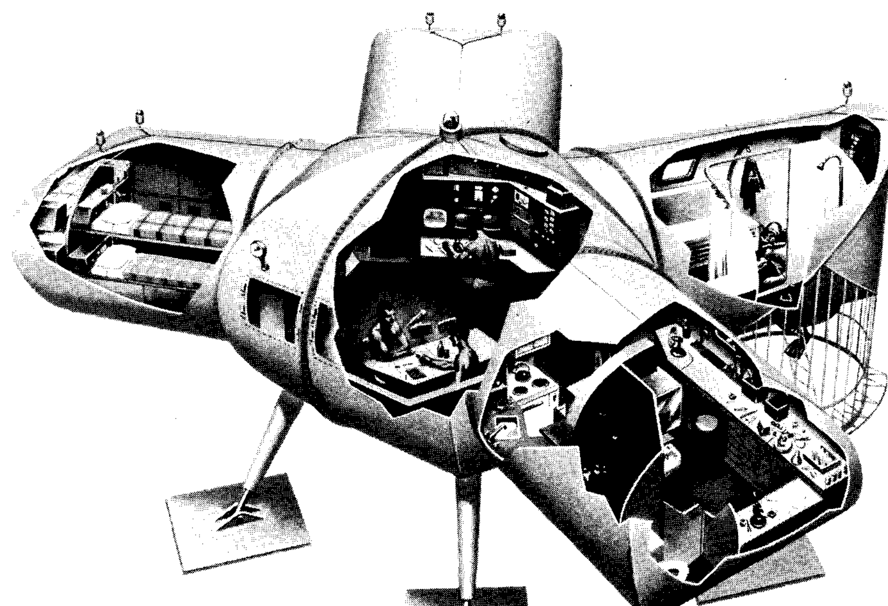
Cousteau with Conshelf aquanauts during the last week of the project. Photo by Robert Goodman, 1964. National Geographic Society.



Garage for Cousteau's Undersea Saucer. By David Meltzer, 1964. National Geographic Society.

Inventor Edwin Link was already well-known for his Link Trainer flight simulator. In 1962, he had built an 11 x 3-foot aluminum cylinder. Off Villefranche Bay, France in August, the 58-year-old inventor lowered the unit down its descent cable to 60 feet. He stayed there for eight hours, then decompressed for six.

Link intended to make it possible for men to live and work on the ocean floor at depths of 1000 feet or more for long periods of time. "The average depth of the continental shelf is 600 feet," he wrote. "If man could find a way to work there in safety and relative comfort, he would at once possess the key to more than 10,000,000 square miles of sea bed. He could tap the scientific secrets and mineral, animal and vegetable wealth of these immense submerged plains, exploring ancient wrecks, mining diamonds or gold, farming on the sea floor, feeding and herding fish like cattle." Through his Man-in-Sea program, Link wanted to combine the best of two worlds: submarines and self-contained diving.



Main living space aboard Conshelf project. By David Meltzer, 1964. National Geographic Society.

Conshelf habitat being worked on by support personnel prior to deployment site in the Red Sea. Photo by Robert Goodman, 1964. National Geographic Society.

With Navy LCDR Robert Bornmann acting as medical advisor, 29-year-old Belgian diver Robert Stenuit descended to 200 feet nine days after Link's trial run. Hanging in the Mediterranean waters breathing a mixture of helium and oxygen, Stenuit made excursions to 243 feet. After 26 hours, Link aborted the dive when a boat carrying a new supply of helium cylinders floundered in heavy seas and lost them overboard.

Link's experience confirmed lessons the Navy had learned earlier. He found the human body could stand high pressure and breathe helium for long periods with no ill effects. He also found that helium-affected "Donald Duck" speech ruined voice communication and that numbing cold at depth limited excursions to only a few minutes.

Also in 1962, in nearby waters off Marseilles, France, Captain Jacques-Yves Cousteau lowered a 17 x 8-foot steel cylinder 33 feet to the ocean floor. For a week, Continental Shelf Station One, or Conshelf I, housed Andre Falco and Claude Wesley, who descended to 85 feet on excursions. Following Bond's lead, Cousteau noted "Undersea exploration is not an end in itself. It must lead to scientific research, to prospecting for wealth, and to greater utilization of the oceans. Finally, it must lead to human occupation of the sea floor — not only for brief moments man has known before, but for days, weeks, even months at a time." With the success of these early experiments, saturation diving began to blossom.

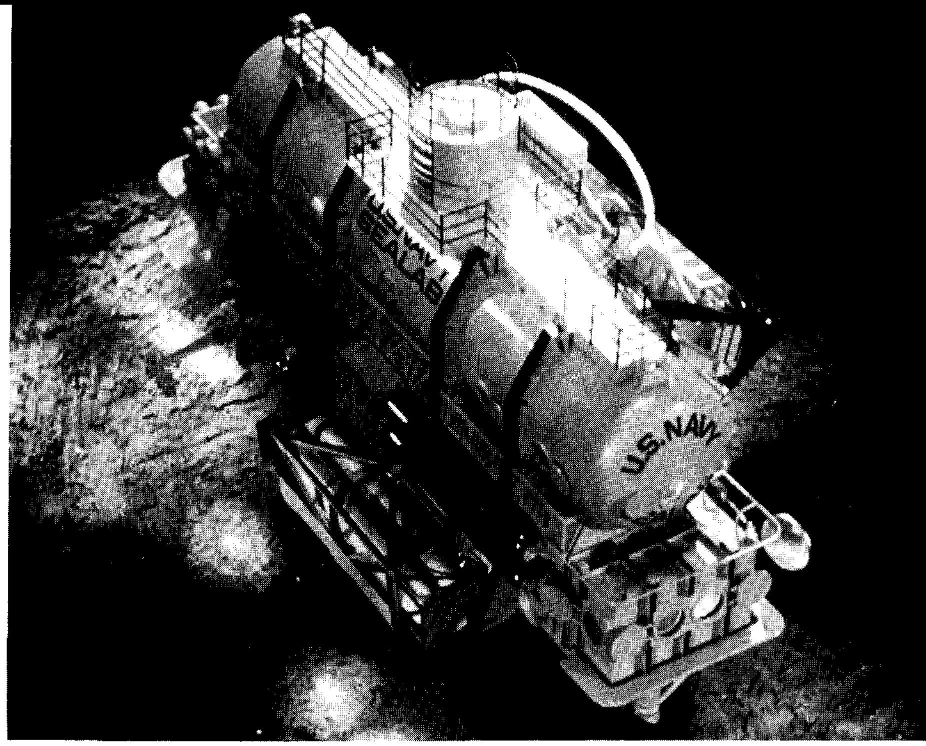
Cousteau's second underwater habitat followed soon afterward. In 1963, his converted minesweeper Calypso dropped anchor in the Red Sea off Port Sudan. In 36 feet of water, divers installed the three-wing Starfish House habitat to launch Conshelf II. Five men lived there for a month, making daily excursions to collect samples of fish and plant life. Andre Portelatine and Raymond Kientzy braved the hot, humid confines of Deep Cabin at 96 feet for a week, making excursions as deep as 165 feet.

Sealab I, II, and III

By summer of 1963, the Navy's Sealab I was ready to go. Sealab's crew felt more a sense of relief than a sense of history. "After working on the project for four years," Barth recalls, "we were just glad to get in into the water." By then a Chief Quartermaster, Barth was assigned to the team along with Navy doctor LCDR Bob Thompson, Senior Chief Corpsman Sanders "Tiger" Manning, and First Class Gunner's Mate Lester Anderson. The four lived at 193 feet near Argus Island, 30 miles off Bermuda, for eleven days in the 40 x 10--foot steel cylinder. The crew could see 200 feet through the sparkling Caribbean waters. In fact, so much sunlight filtered down that they could turn Sealab's lights off and read by it. Former WWII POW Bob Sheets, the crew's oldest diver, made Sealab I's deepest excursion to 230 feet.

Anderson, a First Class Diver, found saturation diving a huge improvement over what he was used to. "Before, you'd get on a job cold and wet. You'd have to hurry it up. Then your buddy would get down to relieve you and try to figure out where you'd left off. Saturation diving was more like home. No

U.S. Navy's Sealab III.



hurry. Dry and warm. TV. Hot coffee. Other divers down there with you to talk to. That's the way to go."

As Sealab I Project Officer, Mazzone saw an interesting pattern develop. "When the dive started, everyone on the bottom relied on the topside for support. Halfway through the dive, everyone got more independent, almost surly. Then, with a quarter of the dive left, they'd readjust. They'd realize that they'd need to rely on the topside crew to bring them back up. It happened on every dive we ran."

Each Sealab crew was closer. The crew's beagle mascot, George Foote (named after George Foote Bond) dogged their steps when they ran information ashore. Mission Commander Bond was never called Captain, always "Poppa Topside." Every crew could count on Mazzone and Bond to visit them at least once on the bottom.

Also in 1964, Edwin Link took the next step for Man-in-Sea. Off the Bahamas, Robert Stenuit and Jon Lindbergh lived for two days at 432 feet. In 1965, Cousteau and his crew launched the most ambitious Conshelf to date. Six oceanauts lived for six weeks with minimal surface support at 328 feet on the floor of the Mediterranean. In 55-degree waters, the Conshelf III team replaced a valve on a simulated oil well in 45 minutes — half the time a surface-supplied crew would take.

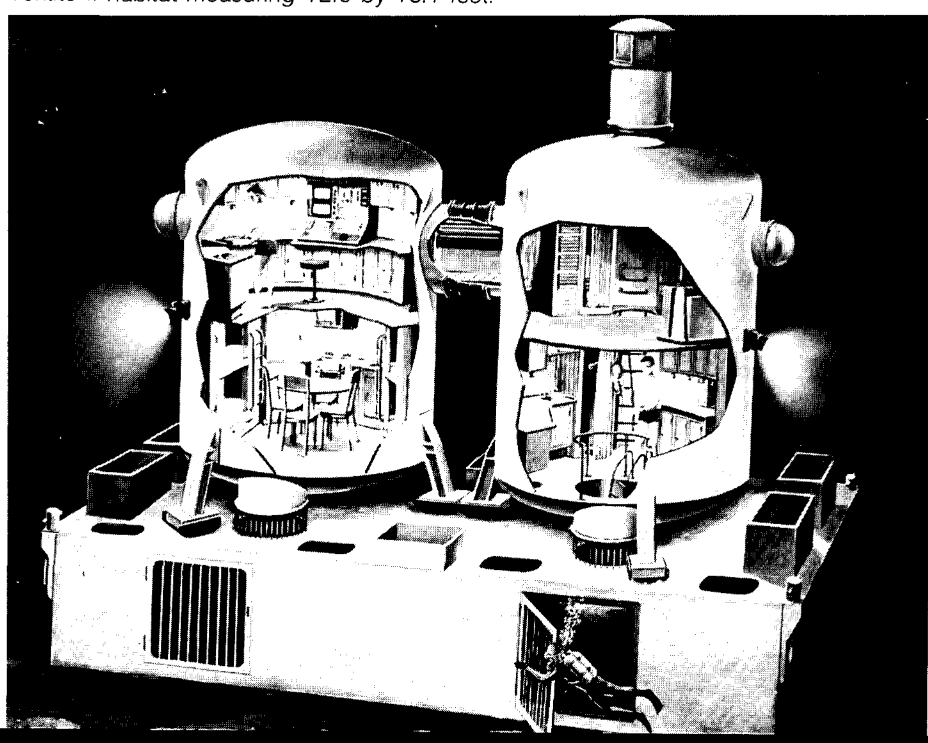
That same year, from 28 August to 12 October, the Navy operated Sealab II in California waters off the Scripps Oceanographic Institute in La Jolla. It stood in 205 feet of water in Scripps Canyon. Most of the topside crew this time had manned Sealab I. Barth was the only Sealab I crew also assigned to this bottom crew. Former astronaut and Navy Commander Scott Carpenter led the 45-man team. Three men stayed two weeks apiece. Carpenter remained below a solid month. Divers could see only 50 feet through the murky 48-degree waters as they tested the open water concept of saturation diving.

In 1969, Navy saturation diving successes struck a minor chord. Since 1966, the Navy had trained close to 100 crew members on new equipment at Ballast Point in San Diego, CA. Fifty divers were readied for duty as bottom crew to live and conduct scientific experiments at 610 feet in the waters off San Clemente, CA. Now, Chief Warrant Officer Barth was a team leader. Just before the first team would man Sealab III, it sprang a helium leak. Barth, Barry Cannon and two other divers were sent down to fix it. "We went down in the bell, put our gear on and headed out for Sealab," Barth recalled. "About the time we got down there, Barry's diving gear malfunctioned and he died." Within days, the Navy scrubbed Sealab III. The habitat was raised, the project shelved.

Mazzone was Diving Officer for Sealab III. For him, the project suffered from too much too fast. "Sealab I and II were run by small groups," he recalled. "But Sealab III was a large, funded, extremely ambitious project. Vendors were hurried to make deadlines. They had to build new, sophisticated equipment fast — maybe too fast. I think it lost a lot to committee design." Barth feels the loss was tragic, but not total. "Even though it ended on a kind of sad note, the program culminated in the acceptance of saturation diving as we know it today."

Navy interest in saturation diving shifted from underwater habitats to submarine rescue. Series of saturation dives were run ashore in safer chamber facilities, to fine-tune the work of Bond, Link, Cousteau and their crews.

Tektite II habitat measuring 12.5 by 18.1 feet.



Tektite and Deep Dive

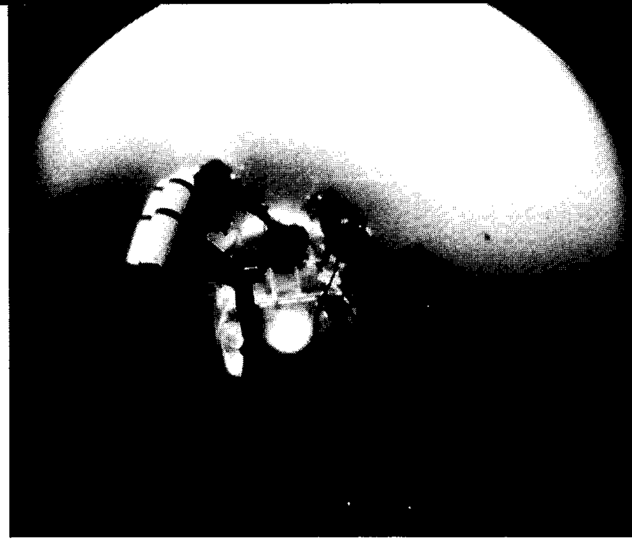
The Navy, Department of the Interior and National Aeronautics and Space Administration (NASA) co-sponsored the Tektite habitats. In 1969, four men lived for sixty days in Tektite I at 50 feet in the waters off the U.S. Virgin Islands. For seven months in 1970, 11 successive teams of five divers each spent from 14 to 20 days in Tektite II on a nitrogen-oxygen mixture. Both series were designed to gather information on how individuals could work in isolation in a hostile environment.

From 1970 on, NEDU ran regular dives to probe the limits of saturation diving. The first all-Navy 100-foot saturation dive proved conclusively how breathing a helium-oxygen mixture saps heat from a diver's body, even though his skin may be warm. In 1971, NEDU and the British Admiralty Experimental Diving Unit (AEDU) dove to 1000 feet at Portsmouth, England to demonstrate an electronically-controlled breathing unit's operation in cold water. In 1973, a NEDU dive to 1600 feet at Taylor Diving and Salvage in New Orleans, LA showed that man could work at extreme depths with no adverse effects.

Three years later, NEDU completed initial testing and evaluation of unlimited excursion saturation diving tables. The tables gave divers the security of knowing what had only been guessed at so far. Now, they had specific upper and lower limits to their excursions. They also had specific figures to follow for their maximum safety and ability to work at depth.

Also in 1976, NEDU began its Deep Dive series of experiments. Deep Dive '76 ran a 30-day mission to 1400 FSW in the huge new Ocean Simulation Facility (OSF) chamber at Panama City, FL. Deep Dive '77 ran for 37 days at 1500 FSW; Deep Dive '79 was a 37-day saturation dive at 1800 FSW. A year later, Deep Dive '80 tested a dry helmet for the Mark-11 Semi-Closed Circuit Underwater Breathing Apparatus (UBA). The 28-day 100 FSW dive also looked into the problem of diver thermal protection. Deep Dive '81 continued the thermal studies.

In 20 years, the Navy had come a long way from Genesis I. "Back then, we didn't have any sophisticated life support systems," Bob Barth recounted. "No comforts at all. Much of our gear was jury-rigged. We were just in treatment chambers, designed for only a few hours' stay. It wasn't comfortable. But it was fun — damn fun."



Mark I and II

The lessons the Navy learned in the Genesis and Sealab experiments lived on in the Navy's first operational Deep Diving System (DDS): Mark I. Introduced in 1970, it was basically a remote sphere six and a half feet across with tanks for compressed gas. A Sound-Power-Communications Cable (SPCC) linked it to the surface. Lowered from a support ship, it could house a team of three divers as long as 14 days, and as deep as 850 feet. Divers returned to a topside DDC to decompress.

Mark I was initially designed as a fly away unit, to be loaded onto a cargo plane and flown anywhere in the world to rescue sailors trapped on the ocean floor. In fact, it never found a home. Master Chief Machinist's Mate Charles Wetzel served two tours with Mark I, the second as its Master Diver. "FMC had built Mark I in San Jose to use aboard the USS EDENTON (ATS-1)," he said. "They had to shoehorn it in there below decks. But there wasn't enough room for support crew. And the crane to deploy it didn't do the job. We finally put it on a YFN barge in 1970." It stayed there. Later, the crew made experimental dives to record depths of 850 and 1140 feet. Plans for working dives never panned out. In 1979, the Mark I was retired to the Panama City diving museum.

The Navy had another larger system in the works at the same time: Mark II. Mark II had two Personnel Transfer Capsules (PTC), two DDCs and central control and supply systems designed to live aboard support ships dedicated to saturation diving. USS ELK RIVER (IX-501) carried Mark II during its operational testing. USS PIGEON and USS ORTOLAN are home for the Mark II now. In a real sense, they are the Navy's saturation diving fleet.

George Bond's hunch that a body would absorb only so much inert gas, like a sponge in a bucket of water, created a whole new world of diving. Commercial offshore diving took huge steps forward, led by former Navy saturation divers. Walt Mazzone reflected, "If Dr. Bond were alive today, he'd be really proud of his boys." Saturation divers could now live long enough in one place to get to know a lot about many things. For example, they came to know not just fish in general, but individual fish that lived at a particular shelf in a reef. Freed from the rigors of bounce dives, many civilian divers described the profound experience of life on the ocean floor in moving poetry and verse. Veteran Bob Barth coined the Navy diver experience in more terse but equally sincere terms: "You can work you tail off as a Navy diver and not have any fun. We did both."

For more information on saturation diving, read:

Carter, LT R.C., MC, USN. Pioneering Inner Space, NEDU Report 1-77. Navy Experimental Diving Unit, Panama City, FL (Navy report)

Cousteau, Jacques-Yves. At Home in the Sea. National Geographic. April, 1964. pp. 465-507. (Magazine article)

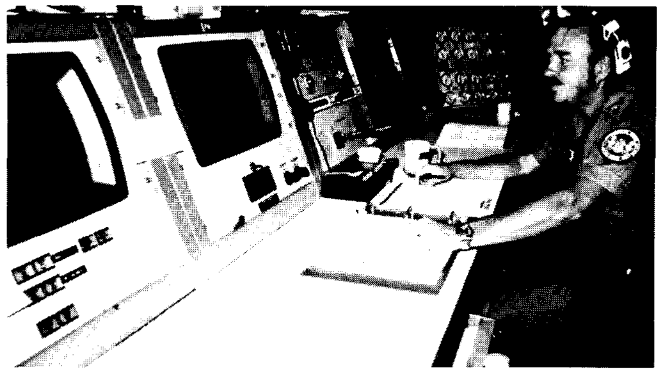
Earle, Sylvia and Giddings, Al. *Exploring the Deep Frontier.* National Geographic Society. Washington, D.C. 1980. pp. 125-159. (Book)

Link, E.A. Our Man-in-Sea Project. National Geographic. May, 1964. pp. 713-731. (Magazine article)

Marx, Robert F. *Into the Deep.* Van Nostrand Reinhold. New York, NY. 1978. pp. 178-189. (Book)

Stenuit, R. *The Deepest Days.* Coward-McCann. New York, NY. 1966. (Book)

NEDU Deep Dive: 85 Alpha & Bravo



Around the clock supervision is mandatory during saturation dives. HTCM/MDV Sam Huss is one of seven qualified Dive Watch Supervisors on the OSF.

By LT W.T. D'Amico, USN
Navy Experimental Diving Unit

All personnel at the Navy Experimental Diving Unit (NEDU) in Panama City, Florida experienced a great sense of satisfaction after completing Deep Dives 85 Alpha and Bravo, two back-to-back deep saturation dives. The exhaustive schedule concluded on 29 May 1985, ending five months of rigorous preparation and training.

Dive Objectives

Planning for Deep Dive 85 Alpha and Deep Dive 85 Bravo started back in August 1984. The primary objective of each deep dive was to gather manned data on the noise characteristics within the helmet assembly of the EX 14 MOD 1 UBA. To acquire all the necessary data, two dives were required.

On Deep Dive 85 Bravo, preliminary studies were also completed on the noise characteristics of the helmet assembly of the MK 14 MOD 0 Closed Circuit Saturation Diving System (CCSDS). This system is being designed for replacement of the MK 1 MOD S system on the ASR-21 class ship and the DTV ELK RIVER (IX 501). (Summer 1984, Vol. 15, No. 2)

In addition to measuring the noise characteristics in the EX 14 MOD 1 UBA and MK 14 MOD 0 CCSDS, several secondary tests were performed. These tests included a study of the MK 18 Emergency Breathing System (EBS), a semi-closed circuit system designed for chamber occupants in the event of atmosphere contamination; a test of revised upward excursion limits and the feasibility of doing staged decompression during saturation diving (5 to 10 FSW increment stops); and a study of temporary hearing losses (threshold shifts) on the diver-subjects while in a dry environment at 650 to 1000 FSW so that noise exposure limits for divers may be determined. There was preliminary evidence that current OSHA and Navy noise exposure limits were overly conservative in pressurized, non-air environments.

Screening Diver-Subjects

Selecting the diver-subjects for both dives presented a unique problem. Due to the nature of the dives, each diver-subject was required to possess excellent hearing so that even the smallest loss would be immediately obvious. Intensive tests were conducted by NEDU's Experimental Psychologist, LCDR Michael Curley, MSC, to ensure that each diver-subject was physiologically and psychometrically suited for the production of valid, reliable and accurate hearing data. Individuals with even moderate hearing impairment were rejected during the screening process. From more than 50 personnel that

Open water testing of the MK 14.

were screened, six diver-subjects were selected for each dive.

Deep Dive 85 Alpha

Training commenced for Deep Dive 85 Alpha on 28 January 1985. Three weeks were spent in NEDU's test pool to familiarize the diver-subjects in EX 14 MOD 1 diving procedures. The dive team consisted of:

HT1(DV) Tony Thompson
(Team Leader)
HT1(DV) Hugh Gither
(Asst. Team Leader)
EN1(DV) Bruce Watson
BM2(DV) Walter VanDyke
BM1(DV) Dale Sturms
(Commander, Submarine Development Group ONE)
GMG1(DV) Randy Welnetz
(Commander, Submarine Development Group ONE)

Training of the dive team and watchstanders was the responsibility of Mr. Jack Schmitt, NEDU's Deep Dive Liaison Officer, LT Bill D'Amico, NEDU's Operations/Training Officer, and BMCM(DV) Michael Hobbs, the Assistant Training Officer who would be the day watch supervisor throughout the 26-day dive.

At the conclusion of test pool training, four additional weeks of training were conducted in the Ocean Simulation Facility (OSF). These four weeks were used to refamiliarize three sections of OSF watchstanders in OSF diving and emergency procedures, and to train the diver-subjects in the use of unique sound equipment and data gathering techniques.

Deep Dive 85 Alpha commenced on 12 March. Upon arrival at 650 FSW, each diver-subject completed a two-hour dive in the EX 14 MOD 1 UBA over a period of three days. Noise levels recorded inside the EX 14 MOD 1 helmet and the temporary hearing threshold shifts recorded on the divers after each dive determined that dives of longer duration could be achieved. The data gathered suggested that four-hour dive profiles could be attempted without any permanent degradation in diver-subject hearing.

On a typical day, two hours each morning were spent preparing sound equipment for data collection. Diver sound technicians EN1(DV) Bruce Watson and HT1(DV) Hugh Gither assisted the topside sound team in the meticulous calibration of microphones and earphones. Electrostatic actuation methods were used to calibrate the microphones at depth. A one-half inch diameter microphone with accompanying heater and dehumidifier were fastened in the EX 14 MOD 1 helmet each day to record noise at the approximate location of the diver's right ear. The microphone signal was carried from the microphone, through a helmet port into the water and to the surface by a specially constructed water-blocked sound cable. At the surface the microphone's signal was fed into a digital frequency analyzer and into a computer where corrections to the noise spectrum were made for microphone attenuation and impedance at depth.

Before every dive an audiogram was administered to the diver. During each two- or four-hour dive in the closed-circuit mode the diver, outfitted in a Non-Return Valve (NRV) hot water suit, was required to pedal an underwater bicycle ergometer at 60 rpm against a load of 50 watts in 35°F water. Each diver alternated six minutes of work with four minutes of rest during the entire dive. All dive team members were able to fully meet this demanding requirement. Ten-minute sound samples from inside the helmet were taken intermittently during the dive and analyzed at the surface.

To measure changes in the diver's hearing threshold levels (HTLs) as a function of helmet noise, precise coordinated teamwork was essential. As soon as the diver was unhatted, the dive team had less than three minutes to fully undress the diver, place him in the audio booth, and hurry to their own bunks, as the OSF went into a silent running mode. The diver then proceeded to complete a temporary threshold shift test, followed immediately by a complete audiogram (500 Hertz-8,000 Hertz). Follow-up audiograms were again conducted before the diver went to sleep and twice the next day to assess the recovery of the diver's hearing to his pre-dive reference levels.

More than 60 hours of in-water sound measurement diving were completed at 650 FSW during Deep Dive 85 Alpha. Evidence was gathered which suggests that: (1) four-hour dives at 650 FSW using the EX 14 MOD 1 UBA pose acceptable risks to diver hearing, and (2) airborne noise standards at 1.0 ATA are very conservative when applied at depth in a helium-oxygen environment. Temporary threshold shifts in hearing were seen in all divers immediately post-dive; however, divers' hearing levels recovered to within +5 decibels of pre-dive audiograms within 24 hours. Upon reaching the surface after dive, no permanent auditory shifts were noted.

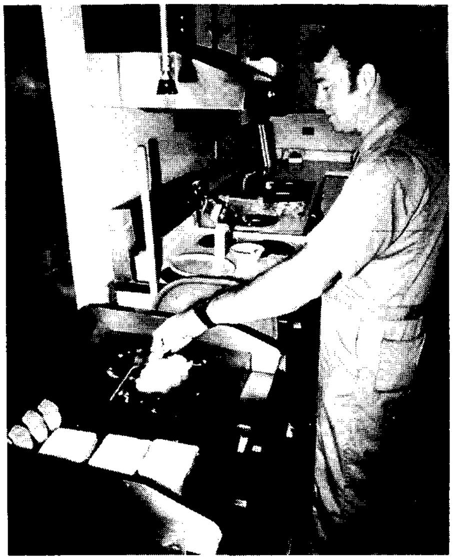
Test in progress on the MK 14 SSDS during Deep Dives Alpha and Bravo.

Deep Dive 85 Bravo

Training for Deep Dive 85 Bravo proved more difficult than Alpha because of severe time restraints. Test pool training was conducted during the decompression stages of Deep Dive 85 Alpha. Only three weeks were allotted between dives to train a new dive team and additional watchstanding personnel. Again, the task was given to Mr. Jack Schmitt. His ability to resolve dive equipment difficulties and act as liaison between four separate commands during the five months of operation proved invaluable. HTCM(DV) Crowder Gibson was selected to assist Mr. Schmitt in the training phase and would be the day watch supervisor throughout the dive. The Deep Dive 85 Bravo dive team was comprised of:

HMC(DV) Dennis Elsasser
(Team Leader)
EN1(DV) Kevin Lang
(Asst. Team Leader)
HT1(DV) Steve Wells
HT1(DV) Dale Gingrich
GMG1(DV) Doug Luther
(Commander, Submarine Development Group ONE)
BM2(DV) Joseph Warren

Unlike the diver-subjects on Deep Dive 85 Alpha, the Deep Dive 85 Bravo diver-subjects were trained in both the EX 14 MOD 1 UBA and the MK 14 MOD 0 CCSDS. The objectives of this second dive were to collect additional

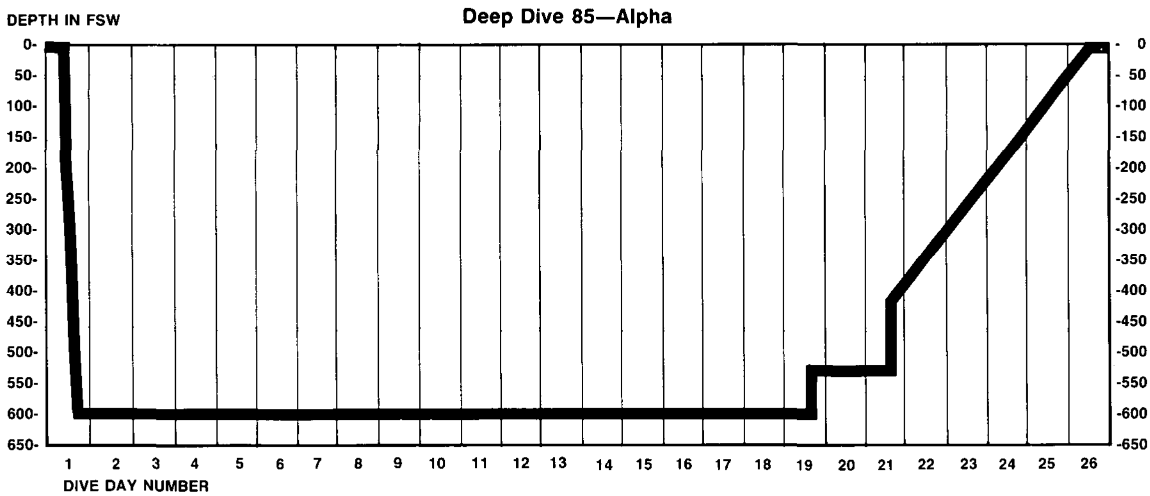


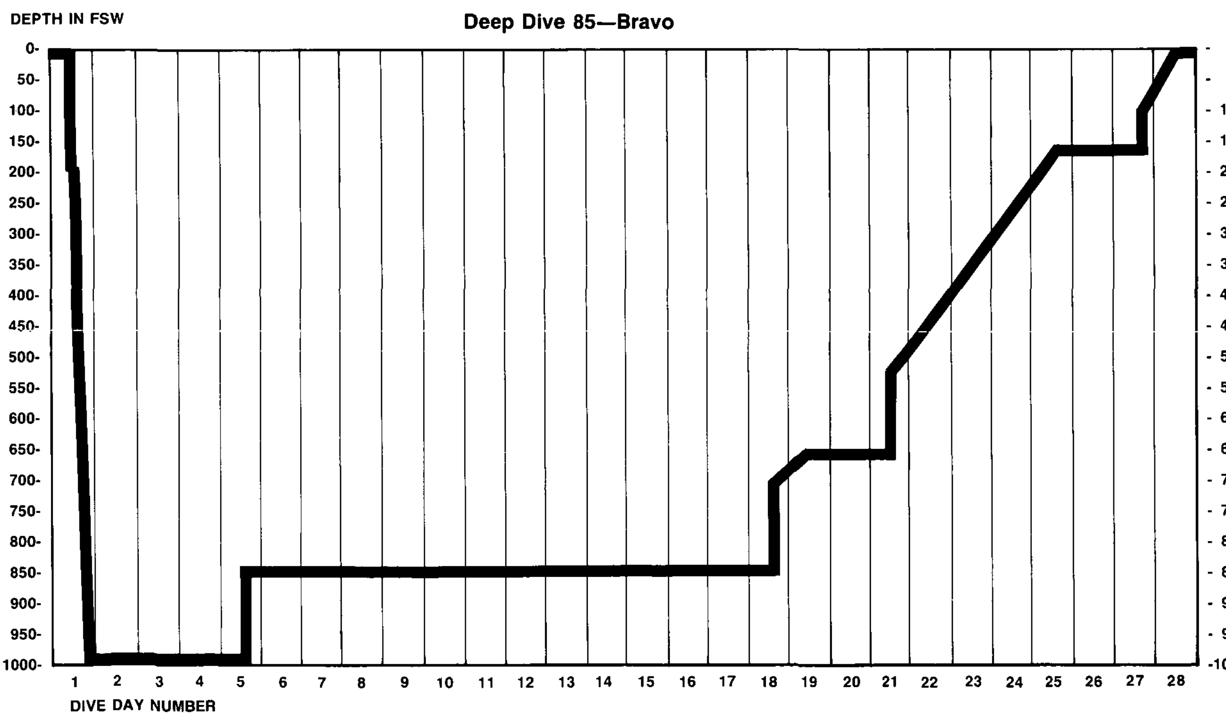
MSC/DV Larry Wariner prepares breakfast, one of over 160 meals prepared during the course of the two dives.

data on the noise characteristics of the EX 14 MOD 1 UBA and to make preliminary determinations of the noise characteristics of the MK 14 MOD 0 CCSDS at 1000 FSW and 850 FSW. (1000 FSW is the maximum operating depth of the MK 14 MOD 0 CCSDS.)

Deep Dive 85 Bravo commenced on 30 April. Like Deep Dive 85 Alpha, meticulous calibration of the sound equipment preceeded each wet excursion. EN1(DV) Lang and HT1(DV) Wells acted as diver sound technicians to assist the topside personnel. After a four-day stay at 1000 FSW, two- and four-hour dive profiles were conducted daily at 850 FSW using both diving systems in a manner similar to Deep Dive 85 Alpha. Decompression proceeded without incident and the dive surfaced on 28 May 1985. A series of four upward excursions were conducted throughout the dive. Three of the excursions were preceeded by staged decompression in five or ten foot increments (15.8 min per foot rate).

Members of both dive teams faced many real and varied risks including hearing damage, hypoxia, hypothermia and decompression sickness. The absence of any of these potential problems was attributed to the preparation of all hands involved and the professionalism displayed by all dive team members. The results realized will contribute immeasurably to enhance the U.S. Navy's ability to safely conduct deep, operational saturation diving, and will significantly influence the development of new and better saturation decompression procedures to meet future U.S. Navy Fleet diving requirements.





A FINISHING SCHOOL for Navy Divers

By HT2/DV Mark D. Faram, USN
NAVSEA OOC Photojournalist

At the end of the SEALAB III project in the early 1970s, the need arose for a school to train Navy divers in saturation diving, preparing them for deep dives over extended periods of time.

The scenic Point Loma Submarine Base in San Diego, California was chosen as the location and the DTV ELK RIVER (IX 501), a converted assault rocket ship that was the support vessel for SEALAB III, was designated as the training platform. Although no lesson plans or guidelines were available, classes began in late 1971. Students were recruited from the First Class Diving community because of their familiarity with mixed-gas diving.

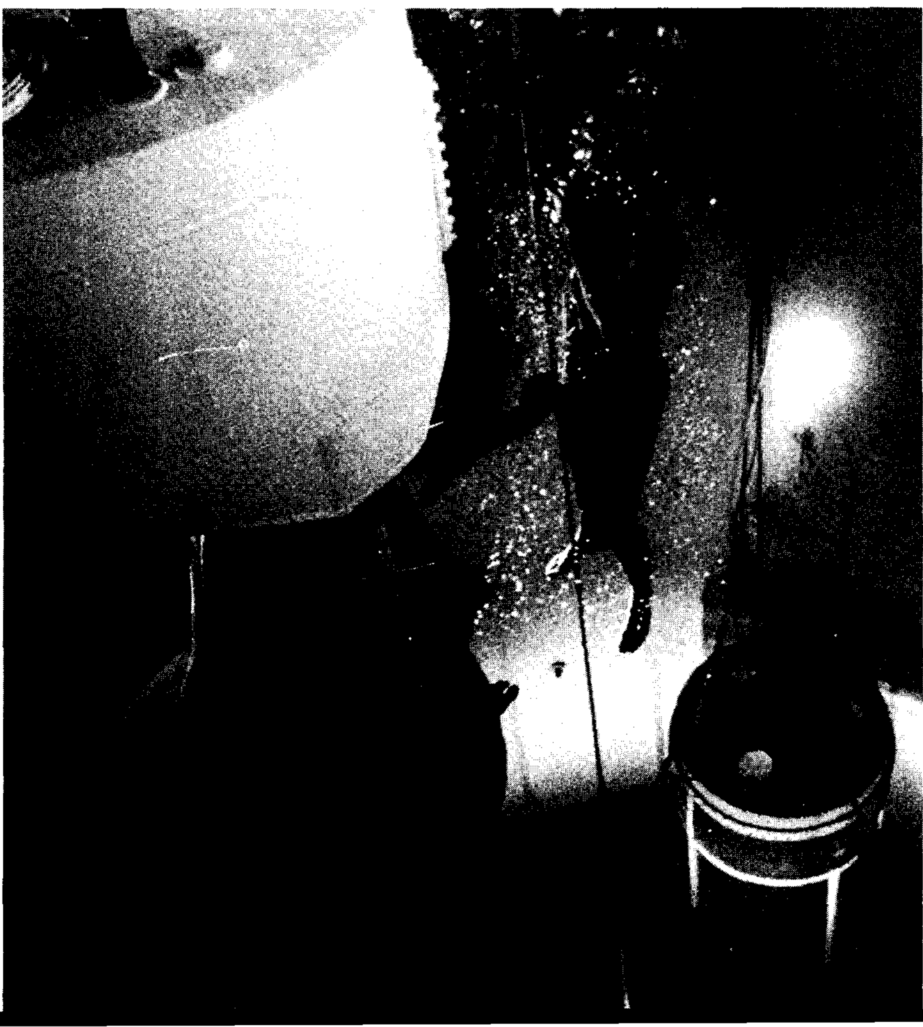
Through the years the school has evolved into a "finishing school" for U.S. Navy Divers. First class divers and HEO2 (Mixed Gas) Diving Officers study side by side. "There are no more diving schools for the Navy diver after this one," says GMGCM George Powell, the school's master diver. "That's why we call it the 'finishing school'. While a diver is here, we insure he receives the finest training. When returned to the Fleet, a graduate is one of the most qualified individuals in his field."

The course averages 17 weeks, varying with the size of the class, and convenes twice a year. The first phase teaches history of saturation diving, and the medical and physics theory associated with extended exposure to the hyperbaric environment. Students are then familiarized with the theory and function of the major components of a saturation diving system

Phase two takes the students to the training platform for actual hands-on training on a saturation system. During this phase of training the students perform centerwell dives, through which the students learn how to operate the Personnel Transfer Capsule (PTC), a vehicle used to transfer the divers from the hyperbaric complex onboard the support vessel to the work site on the ocean floor. The students perform shallow water simulations to practice operation of the system, both from inside the PTC and on the console inside the support vessel. Actual excursion dives are made, giving the divers the feel for the diving and support systems they will use in the Fleet.

The final phase is open water dives. Four students and two experienced saturation divers make up the dive team. Because of the length of decompression associated with saturation diving, the depth is kept shallow, from 150-250 feet. The highlight of this stage comes when the students in saturation ride the PTC to the bottom in open water and make excursion dives. During this segment, the consoles topside are manned by the students, qualifying them in the system.

Academic standards are high. Students must maintain a minimum three point four average on a four point scale. There is no flexibility; anyone who falls below this level is sent back to the Fleet. Written exams and oral examination boards are given weekly. The oral boards consist of three instructors firing questions at a student.



Students at the Saturation Dive School complete buoyant and free ascents in the BUDS training tower.

The philosophy behind these boards is to put the student in the position where he must recall information rapidly, as he must during an actual dive. Questions in the boards range from scientific and equipment theory to operational and emergency procedures. Besides testing the knowledge of a student, the boards also effectively test the ability of the student to communicate his thoughts clearly, an ability considered very important for a saturation diver. "Nobody likes oral boards or a written test," says HM1/DV Frank Meccoci from the Navy Medical Research Institute, a recent graduate. "But they give the instructors a good idea of how this 'prospective saturation diver will react in a stressful situation."

There are as many as 1,500 valves and 350 circuit breakers in a saturation dive system. Before a student touches a valve in practice, he has passed many written exams and orally communicated his understanding of the individual system component. Each student must qualify as a watchstander on three different systems prior to graduation.

Medical requirements for saturation divers are as tough as the academic standards. Fifteen to 20 percent of saturation dive candidates do not meet the established medical standards. Prospective students are asked to have a Diving Medical Officer review their records, and any history of high blood pressure, excessive joint problems or recent surgery is carefully evaluated. A chemistry panel (blood tests toensure the proper function of major internal organs), a long bone series (X-rays of all long bones and major joints to determine susceptibility to ostienonecrosis, a bone disease known to occur in saturation divers), are performed, as well as psychiatric tests to determine if the individual is suitable for long periods of isolation yet has the ability to get along with others. In addition, any major dental work should be completed prior to arrival. Proper prescreening can help to lower the number of people dropped during school.

The physical training (PT) in the saturation program is new to most divers arriving at school. PT in second and first class dive schools consists of calisthenics and running. At the saturation dive school, the SPARTEN (Scientific Program of Aerobic and Resistance Training Exercise in the Navy) program designed by Navy shipboard personnel is used. Every major muscle group is developed through a multi-station weight training program that, when per-

(Top): HT1/DV Mullen works with oxygen and carbon dioxide analyzers. (Inset): BM1/DV Bingham assists HMC/DV Cherry and (below) explains the main control console to HM1/DV Meccoci and MR2/DV Stoudt.

formed in rapid succession, develops the cardio-respiratory system.

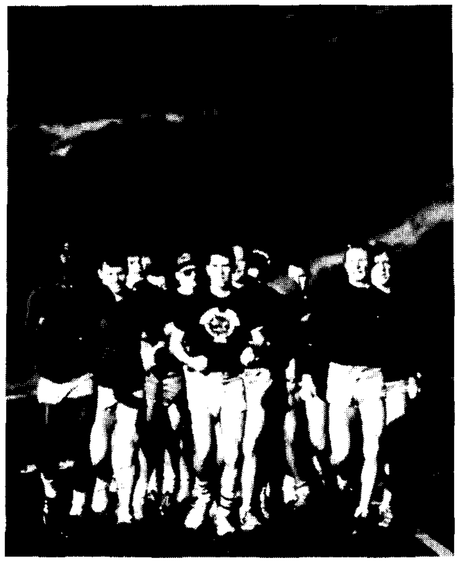
Mondays, Wednesdays and Fridays are maintenance days. A stretching program is strictly adhered to before the SPARTEN training. After lifting, the class goes on a run ranging from four to eight miles. Tuesdays and Thursdays, PT is an ocean swim, working from a half mile up to a mile and a half at graduation.

The use of the SPARTEN program benefits the students more than conventional physical training because the student progresses at his own pace while still participating with the entire class.

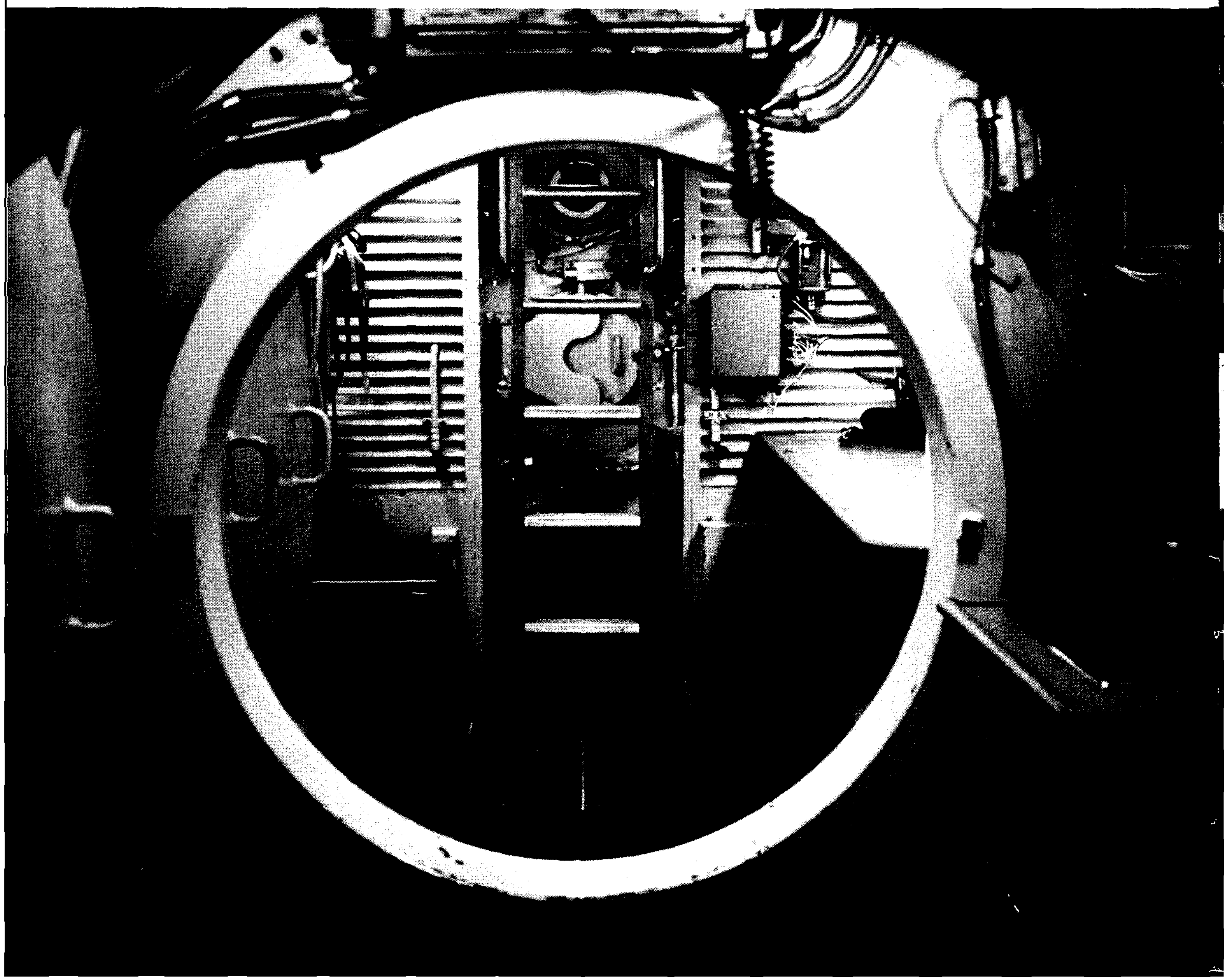
"We treat our students as professionals from the start," says Powell. "Most of our students have been diving a while when they arrive here. They are professionals and we treat them that way. We emphasize a close working relationship between the instructors and students, yelling has no place here, yet we also expect professionalism from our students." Many evenings are given up by instructors to help students who seek assistance. Friday afternoons, the staff and students loosen things up with a volleyball game.

"This program is on the same level as NASA's space program," concludes Meccoci. "The exploration of inner space is the most challenging facet of the U.S. Navy diving program. I wouldn't be anywhere else."

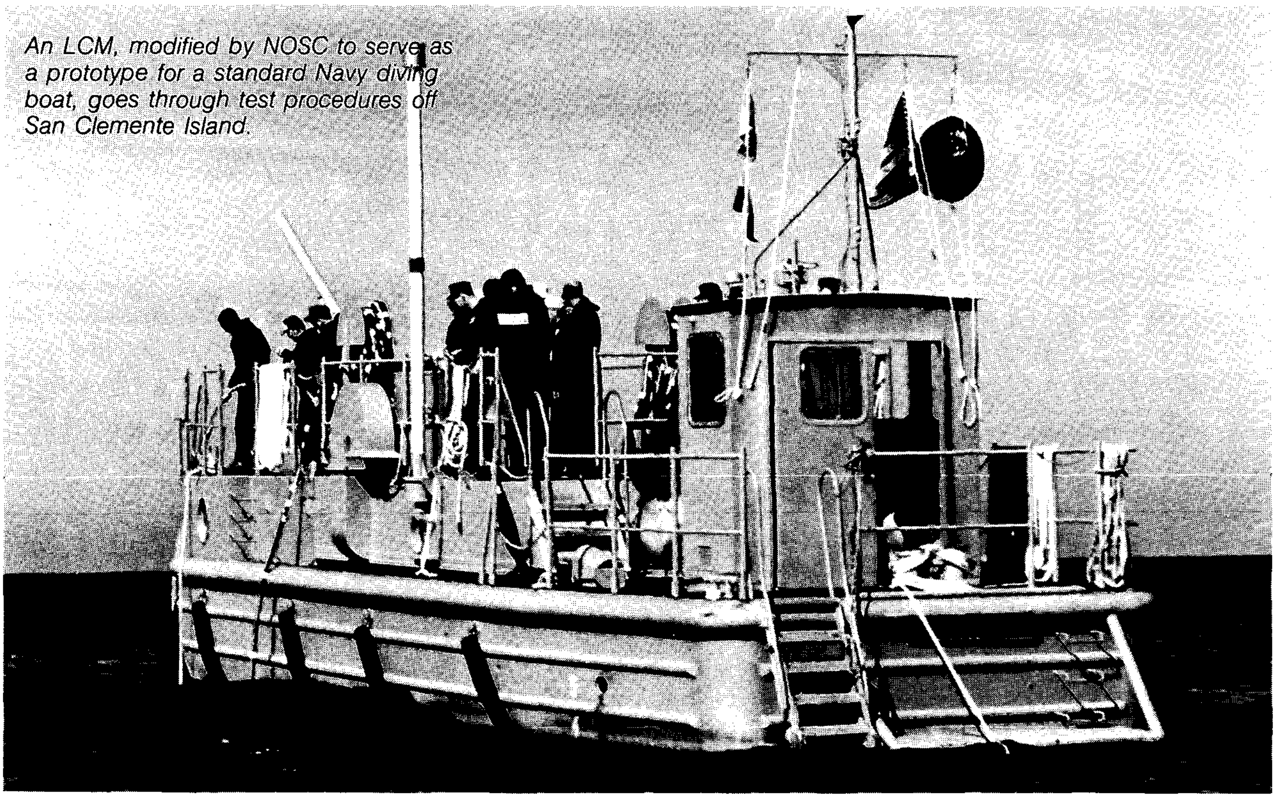
The standards are tough, designed to put only the highest quality of saturation diver in the Fleet. Any first class diver who is interested is encouraged to submit his paperwork to the Naval Military Personnel Command Code 401D. Some very challenging assignments go to saturation divers, so if you think you measure up—TRY!



Interior view of the deck decompression chamber of the USS PIGEON (ASR-21), temporary training platform for the school.



NOSC Developing Navy



An LCM, modified by NOSC to serve as a prototype for a standard Navy diving boat, goes through test procedures off San Clemente Island.

Standard Diving Boat System

By NAVSEA Staff Writer

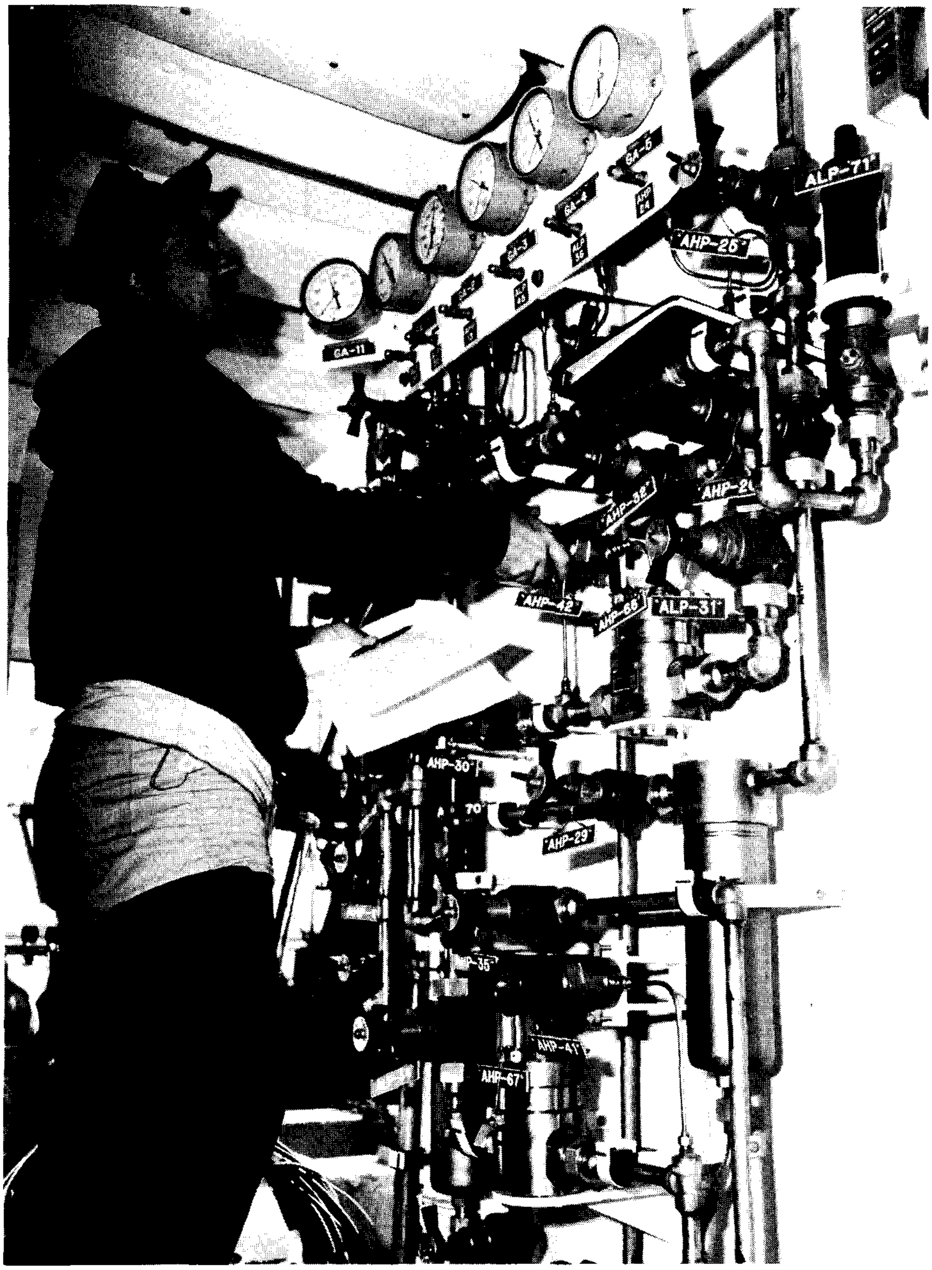
The Navy's first standard diving boat system is nearing completion at the Naval Ocean Systems Center (NOSC). The program was conceived and sponsored by Naval Sea Systems Command's Diving and Salvage Division. Navy plans call for procurement of about 23 of the systems from industry following NOSC prototype development.

The system is designed to fulfill a major need at commands, using small contingents of Navy divers performing ship husbandry type work. These units are normally found on destroyer and submarine tenders and at shore maintenance activities.

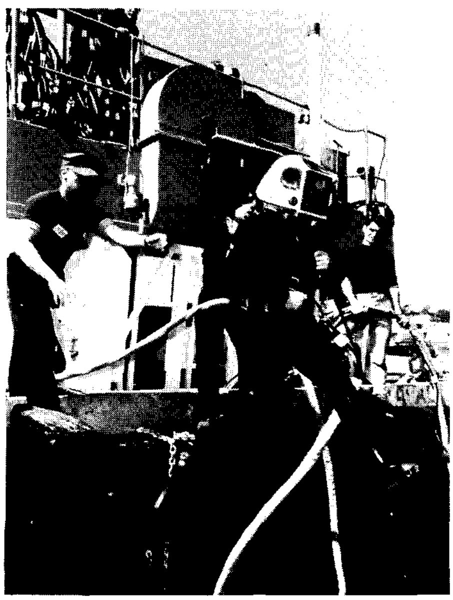
In the past, these units often had to build their own dive boats, using any available boat for their diving platform. To establish uniformity of boats and air systems and to insure adherence to strict quality assurance standards for diver safety, the Navy decided to develop a standard diving boat system. The system is modularized to allow tenders to load it on-board for deployments.

The design calls for a modified 50-foot LCM (landing craft, mechanized) workboat to be the basic platform for the Diving System Module (DSM). The DSM is a self-contained, surface-supported air diving system containing high-pressure storage flasks, a low-pressure air compressor, a diesel generator and associated air processing equipment. The system will support a maximum of two working divers and one standby diver.

Divers can use either the Mark 1 Diver's Mask or the Mark 12 Surface



NOSC diver MM1 (DV) Danny Jennings works the control station for the prototype Navy standard diving boat.

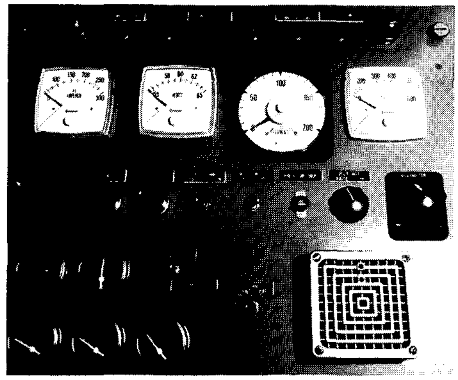


A Navy diver attached to NOSC goes off the NOSC pier in a shallow-water test of the air system for the Navy standard diving boat.

Supported Diving System (air mode). Provision for SCUBA charging is also available. The DSM is normally used in conjunction with the Standard Workboat, but can also be used as a stand alone system when the boat is not available.

The independent high- and low-pressure air systems will support both routine, husbandry type of dives and diving operations of long duration. The systems have been certified by NAVSEA System Certification Authority to 170 FSW (feet of sea water).

The original design for the system was developed by the Naval Surface Weapon Center (NSWC), Dahlgren, VA. Prime contractors assisting NSWC, and subsequently NOSC, are Sperry and Electronic Data Systems.



NOSC was tasked to complete the development and fabrication of the prototype system following the closure of a private West Coast shipbuilder that was working on the prototype. NOSC selection was based on past experience with the Navy Supervisor of Diving on other diver's air systems.

Randy Miller, head of the NOSC Support Engineering Division, is the program manager.

NOSC Navy divers spent several weeks in San Diego and at the offshore island of San Clemente running the boat through its paces during the technical evaluation portion of the program. Further testing (operational evaluation) is scheduled for this summer, followed by approval and production in the early fall.

"The Navy Standard Diving Boat will provide uniformity, versatility and increased reliability and safety for Navy divers," according to ENCM (MDV) Robert Cave, the Center's master diver.

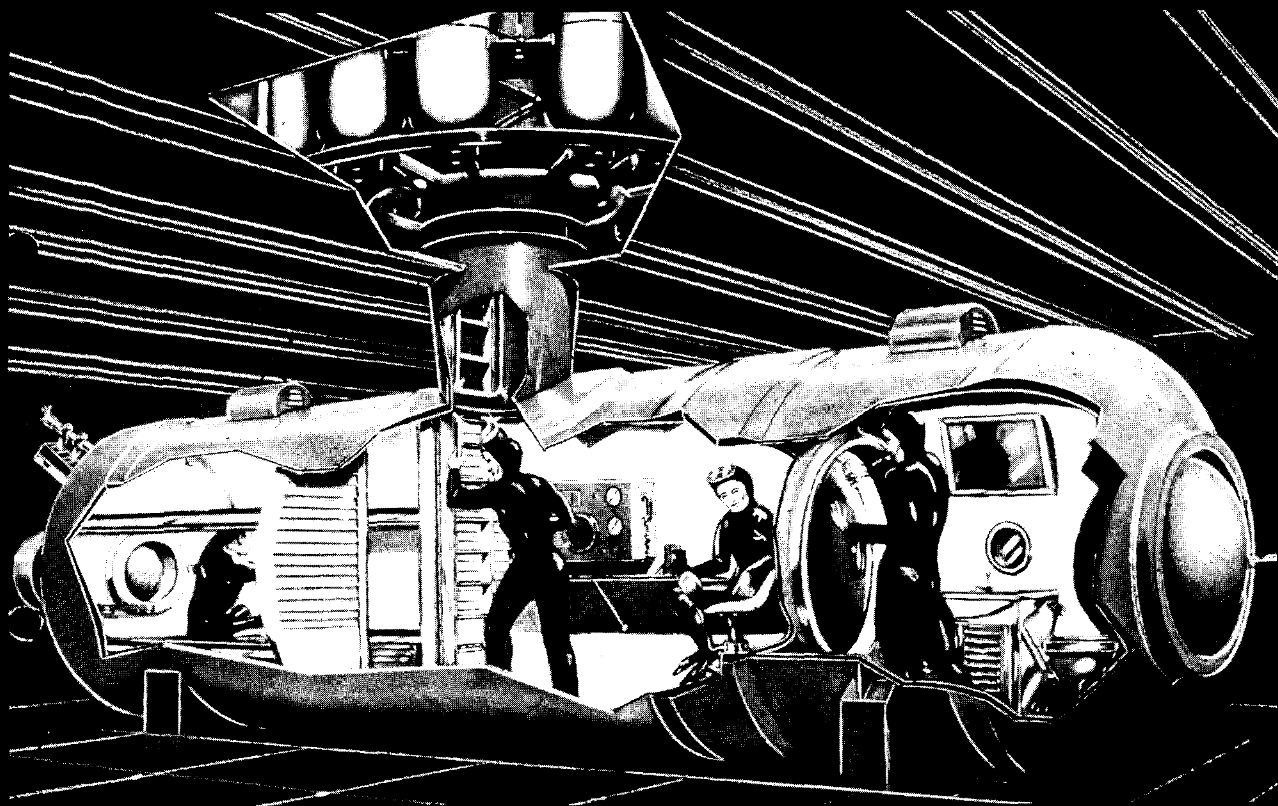
The OLD MASTER

As a continuation of the last Old Master, below are the names of the staff of the Underwater Husbandry Division and their responsibilities.

SEA-OOC5 MR. ERIC LINDBERG Division Head	General Information New Techniques and Procedures Underwater Non-Destructive Inspection
SEA-OOC5A MR. CLARK MALLDER Operations Specialist	Propeller Changes Dunce Cap Ship Alterations Auxiliary Propulsion Unit Changeouts Underwater Chain Hoists CP Propeller Blade Changeouts
SEA-OOC5B MR. DONALD KEANE Operations Specialist	Underwater Cutting and Welding Underwater Painting Underwater Ship Alterations Underwater Explosives Ship Inactivations
SEA-OOC5C MR. MICHAEL DEAN General Engineer	Hull and Propeller Cleaning Underwater Painting
SEA-OOC5D LT KARIN LYNN General Engineer	Diver Tools Ship Husbandry Training Sonar Dome Cleaning and Repair

The Mailing Address is:
Naval Sea Systems Command
SEA-OOC
Washington, D.C. 20362-5101
Phone Number (202) 697-7403 A/V 227-7403

In the next issue we will complete a description of who's who at NAVSEA-OOC.



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