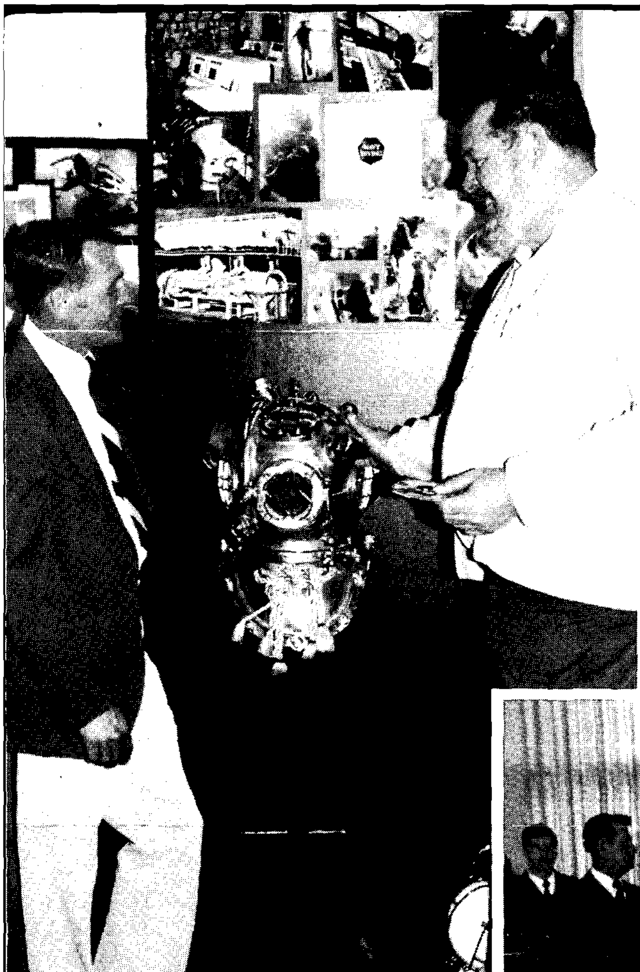
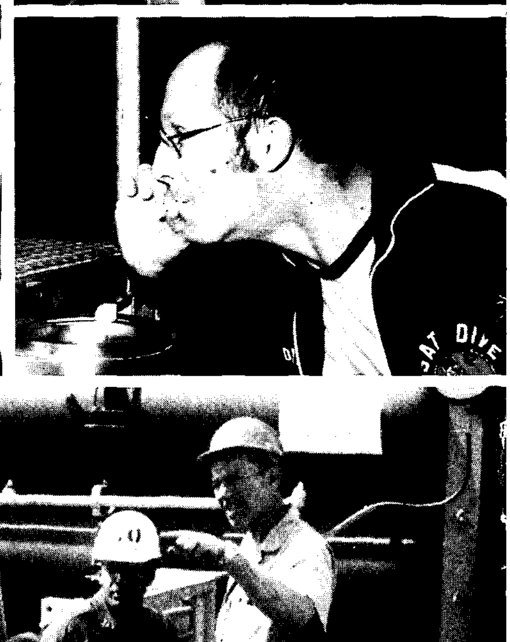
# The FACEPLATE

SPRING 1977

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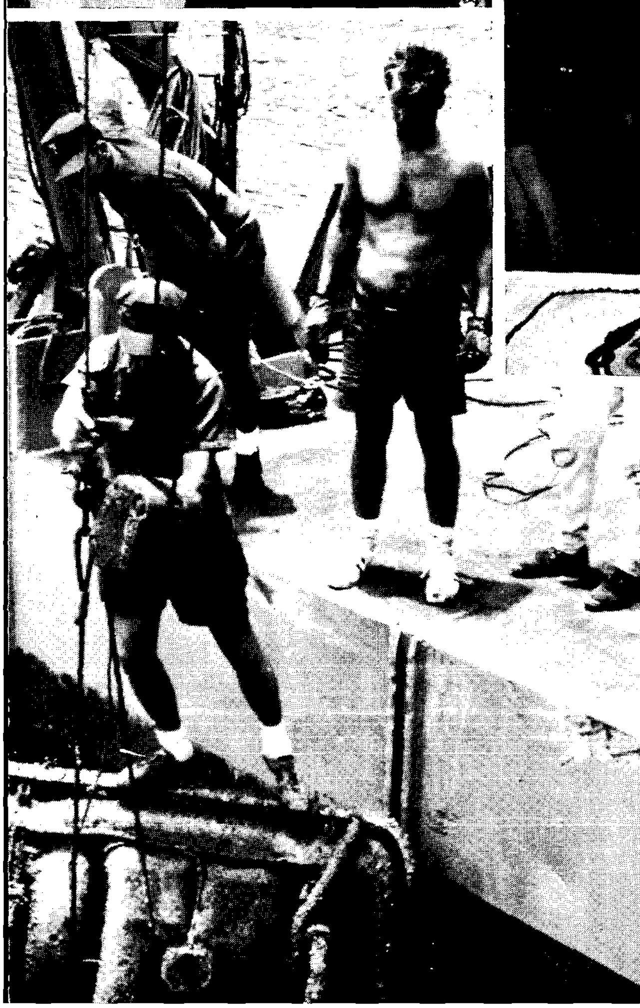

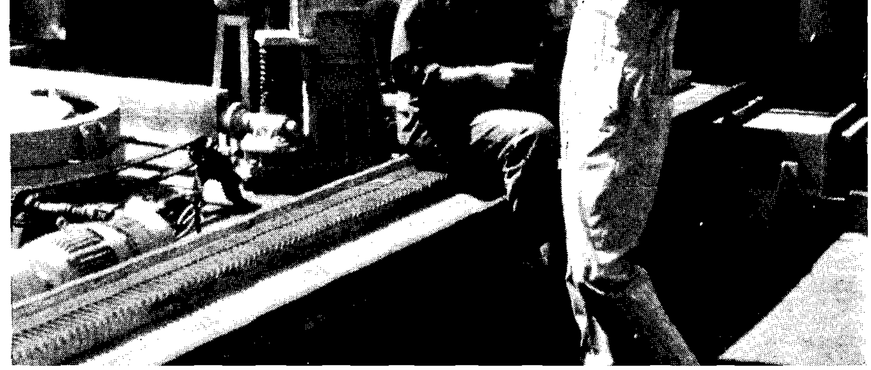

# FACEPLATE

*. . . the official magazine for the divers of the United States Navy.*

VOLUME 8, NO. 1



Front cover features artist's rendering of Mk 2 Mod O DDS at depth. Inside front cover shows scenes from various articles. Clockwise, from upper left: L-r: EMC R.A. Vendetto, USN, NEDU, and Mr. J.W. Manlove, Divers Institute of Technology, at second divers' reunion in Panama City, Florida; EOD diver tries the Mk 12 SSDS air mode; LCDR R.F. Demchik, USN, NEDU, takes that "last drag" before 2-week saturation dive in OSF; LT F.B. Fisher, USN, O-in-C of ELK RIVER, (left), and LTjg D. R. Goins, USN, O-in-C of Mk 2 Mod O DDS, during DDS certification dive; RHCU team trains off HCU-1 barge; and, center, l-r: CDR J.M. Ringelberg, USN, and CDR C.A. Bartholomew, USN, (former and present CO of NEDU, respectively) at change of command ceremony. Back cover features artist's rendering of diver wearing Mk 12 SSDS on underwater ergometer.

FACEPLATE is published quarterly by the Supervisor of Diving to bring the latest and most informative news available to the Navy diving 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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***Readers please note the new phone number listed above for the Supervisor of Diving.***

## CDR DUFF IS NEW SUPDIVE

CDR Franklin Duane Duff, USN, took over the duties of Supervisor of Diving in the Naval Sea Systems Command on February 4, 1977. He relieved CDR Charles A. Bartholomew, USN, who was detached to Panama City, Florida, to become the Commanding Officer of the Navy Experimental Diving Unit, (see page 12). CDR Duff came to this post from another position at NAVSEA, that of Assistant for Salvage, which he had assumed in October 1976 (once again relieving CDR Bartholomew).

After graduating from the United States Naval Academy in 1961, CDR Duff went aboard USS COONTZ (DLG-9) to serve as Electrical Officer and Damage Control Assistant from September 1961 to June 1963. From that duty he went to USS HENDERSON (DD-785) as the Engineer Officer from October 1963 to May 1965.

Following these two tours at sea, CDR Duff attended the Massachusetts Institute of Technology from June 1965 to June 1968, graduating with a Naval Engineering Degree and a Master of Science Degree in Mechanical Engineering. During this period (from June to August 1967) he also attended the E. D. Salvors course in Washington, D.C.

His next duties were as Ship Superintendent, COM 13 Salvage Officer, Shipyard Docking Officer, and Type Desk Officer at the Puget Sound Naval Shipyard, Washington. CDR Duff served at Puget Sound from July 1968 until May 1971, at which time he detached from duties there to go to the Naval Ship Repair Facility in Subic Bay, Republic of the Philippines. During his tour there, which was from June 1971 to June 1974, he was the Diving and Salvage Officer and Production Support Superintendent.

Before joining NAVSEA in 1976, CDR Duff completed a 2-year tour as Assistant Maintenance Officer on the staff of Commander Service Group One.

## SALVAGE OFFICERS'/MASTER DIVERS' CONFERENCES PLANNED

Plans are presently being formulated for back-to-back 3- and 2-day conferences, one for Master Divers and one for Salvage Officers. These meetings are currently scheduled for the week of September 19, 1977, in San Francisco, California. *Faceplate* will publish further details in the next issue.

## CANADIAN FORCES MEDICAL OFFICER JOINS NEDU FOR OJT

LCDR Ian P. Buckingham, MC, CF, a submarine diving medical officer, joined the Navy Experimental Diving Unit, Panama City, Florida, in December 1976 for a 1-year tour of on-the-job training. LCDR Buckingham was sent to Panama City from the Canadian Defense and Civil Institute of Environmental Medicine (DCIEM) in Toronto, Ontario as part of the Canadian-United States exchange program. His mission at NEDU will be to study the medical aspects of saturation diving in general and of operating a large, manned hyperbaric facility. This effort is in preparation for the completion of the 5,600-foot-depth hyperbaric chamber now being built at DCIEM. When the chamber is operational, it will provide the deepest diving capability in the world. LCDR Buckingham will return to DCIEM upon completion of this temporary duty assignment.

## LCDR ERWIN IS NEW CO OF HCU-1

LCDR Arthur R. Erwin, USN, relieved LCDR Paul W. Wolfgang, USN, as the Commanding Officer of Harbor Clearance Unit ONE, Pearl Harbor, Hawaii, on February 18, 1977.

LCDR Erwin's career includes duty as the Commanding Officer of USS MOCTOBI (ATF-105). He then served as the first Commanding Officer of USS BEAUFORT (ATS-2). Before arriving at HCU-1, LCDR Erwin was stationed at the Fleet Training Group in Pearl Harbor, Hawaii.

LCDR Wolfgang's next tour of duty will be as the Special Services Officer in Yokosuka, Japan. *(Editor's note: Articles appearing in this issue that are written by LCDR Wolfgang were written while he still held the position of Commanding Officer at HCU-1. He will be reporting to Yokosuka in the near future.)*

## INSTITUTE OF DIVING FORMED AT DIVER REUNION

The second diver reunion held in Panama City, Florida, also became the formation meeting of the Institute of Diving. On March 5, 1977, individuals representing all parts of the military, commercial, and retired military diving communities met in Panama City, Florida, and agreed to form a national diving organization called the Institute of Diving. This decision was made to fill a need for a single, overall forum that represents the entire diving community.

The Institute of Diving will be a voluntary, private, and nonprofit group dedicated to the advancement of professional, literary, and scientific knowledge about all human oriented activity under the surface of the water. The membership will consist of indi-

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viduals who have an interest in diving and diving related activities. The initial goal of the Institute will be to establish a Diving Museum in Panama City, Florida, the location of the Institute's headquarters. Longer range goals will be determined by members.

Dr. George F. Bond, CAPT, MC, USN (Ret.), was elected president of this new organization. Other elected officers include Mr. T. J. James, Vice President; BMCM W. M. Bruhmuller, USN, Secretary; and Mr. E. Wardwell, Treasurer. The executive committee consists of Mr. F. Anglin; BMC J. H. Bloechel, USN; Dr. R. A. Cooper; Mr. R. A. Driscoll; Mr. F. Looney; Mr. J. W. Manlove; Mr. E. L. Powell; Mr. D. E. Rayner; EMC R. A. Vendetto, USN; and Mr. K. Wallace.

All those interested in more information about the Institute of Diving can contact BMCM W. M. Bruhmuller, USN, the Institute of Diving, P.O. Box 876, Panama City, Florida, 32401.

The reunion banquet featured a brief history of the first 50 years of NEDU by LT R. C. Carter, Jr., MC, USN; a brief description by CDR F. Richards, USN (Commanding Officer of the Naval School, Diving and Salvage), of the Navy diving school to be built in Panama City when it transfers from the Washington Navy Yard; and a "roasting" of CDR J. Michael Ringelberg, USN, just detached from his duty as Commanding Officer of NEDU.

## DIVING SUPERVISOR'S BRIEFCASE

LCDR P. W. Wolfgang

As part of the mobile diving and salvage mission of Harbor Clearance Unit One (HCU-1), it is often necessary to deploy a dive team within minutes of receiving a call for help. For example, jobs such as emergency plugging of overboard discharges or suctions for ships in the local area occur frequently. In addition to determining the equipment needed, selecting a method of transporting men and equipment to the scene, and establishing communications, the Diving Supervisor must assemble the multitude of forms, logs, watches, charts, etc. that are required on the diving station. At HCU-1, every effort has been made to prepare for such emergency missions. This includes keeping the necessary equipment ready for immediate deployment at all times. One of the most useful facets in this pre-planning effort has been the preparation of "Diving Supervisor briefcases."

Considering the acknowledged difficulty of remembering all the administrative items necessary for a Dive Station, it was obvious that at least a check-list was in order. Going one step further, however, it was decided that assembling all of the required items in a briefcase with the check-list would be even more helpful. Two of these pre-loaded "briefcases" were assembled, and during the past 18 months they have proven so useful that they are now used on a routine basis and not just for emergencies. The material contained in these HCU-1 briefcases meets local area requirements (tide tables/charts). Thus, the list presented below is by no means intended to be the final word on content. The size and make-up of such briefcases are up to the user. It has been a helpful system of organization that has improved the readiness of the dive teams deployed from HCU-1. The material kept in HCU-1's Diving Supervisor briefcases includes: Table of contents, *Diving Operations Handbook*, *Air Decompression Tables Handbook*, *Recompression Chamber Operator's Handbook*, air dive sheets and repetitive dive sheets, OPNAV 9940-1 diving logs and overlays, command/team diving log, check-lists (scuba, Mk 1, Mk V, and Hull Inspection), information note (passed over ships 1MC when divers are in water), antiseptic ear drops, two stop watches, "ALFA" flag, tide tables, and notepaper/pens/pencils.

## DEEP SEA DIVERS NOTE

A new twist has been introduced by U.S. Navy deep sea divers. It's called the "ORTOLAN Toggle Team." Informed sources report that any Navy diver can join, but he must first prove that he has nerves of steel and a high resistance to pain. For additional details, ask any member.

## AIG MESSAGE SUMMARY UPDATE

NAVSEA 271617, DEC 76: USN Diver's Mask Mk1 Mod 0 Field Change Number One Clarification (AIG 239 FY77-13).

NAVSEA, 040430 JAN 77: Diving Equipment Authorized for Navy Use (AIG 239 FY77-14).

CNO 182145 JAN 77: AIG Modification 239/7 (AIG 239 FY77-16).

NAVSEA 251930 JAN 77: Diving Hose (AIG 239 FY77-15).

NAVSEA 16134 FEB 77: Stewart-Warner Charcoal Filled In-Line Filters (AIG 239 FY77-17).

CNO 172047 FEB 77: USS TRINGA (ASR-16) Hyperbaric Chambers (AIG-239 FY77-18).

CNO 182034 MAR 77: Additions to the AIG Message Distribution (AIG 239 FY77-19).

CHNAVMAT 281554 MAR 77: Diving Systems and Facilities (AIG 239 FY77-20).

NAVSEA 302329 APR 77: Diving Procedures for work in submarine mud tanks and confined spaces (AIG 239 FY77-21).

# New Underwater Pile Cutter Developed at CEL

An underwater pile cutter capable of shearing a 12-inch-diameter timber pile in less than 10 seconds has been developed by the Civil Engineering Laboratory (CEL), Naval Construction Battalion Center, Port Hueneme, California. A commercial tree shearer was modified to answer the need for a safe, practical, and economical tool for Navy divers to remove piles at the mudline (seafloor).

Removal of wood piles has long been a problem in waterfront maintenance and clearance. Unwanted or rotted timbers create navigational hazards, dangerously interfere with development of new piling systems, and frequently become breeding grounds for destructive marine borers that thrive on wood as a source of food. Typical removal methods have also been time-consuming and often expensive when large support equipment is needed.

The CEL prototype was developed at the request of the Naval Surface Weapons Center (NSWC). NSWC was responding to the Navy's Underwater Construction Teams' (UCT's) request for an improved tool and method. The pile cutter, which has 60,000 pounds of shearing force, has proven successful in tank and sea tests. Subsequently, the Naval Facilities Engineering Command (NAVFAC) has added the cutter to the UCT's tool inventory.

Major modifications were made to the commercial shearer before the underwater device finally was developed. The original shearer was designed to be mounted on the front of a bulldozer. The CEL version, developed under the supervision of Mr. W. R. Tausig, decreased the weight by approximately 400 pounds. Self-gripping blades were added as well as larger hydraulic rams, a reaction guide to prevent jamming, and a diver-operated control valve. The addition of gripper spikes to the two blades assures a firm hold on the timber before shearing starts.

The cutter weighs 480 pounds on land but only 30 pounds in water with the aid of a buoy. Two divers can easily maneuver the tool into position around a pile. A simple flip of the control valve sets the cutter into a shearing motion.

The "jaws" of the cutter are a pair of solid steel blades, each 22 inches long and 12 inches wide. Two rams (5-inch bore cylinders with a required pressure of 2,200 psi) close the blades in a scissoring action, crunching or shearing the pile into two pieces.

Removal of wooden piles from waterfront structures during demolition or repair is normally achieved by pulling with a large crane or cutting the pile at the mudline with power or hand saws. Air-driven and hydraulically powered chain saws and reciprocating saws have been used successfully under certain conditions. The chain saw cuts through a timber pile in approximately 3 minutes. However, for small jobs requiring removal of a few scattered piles, the hydraulic saw is more efficient. Laboratory tests have revealed that the chain saw is effective for light use, but lacks adequate power for heavier workloads. The CEL pile cutter is best suited for heavy jobs requiring removal of many piles. Blasting with small explosives has been used also. However, this method is hazardous and often environmentally undesirable.

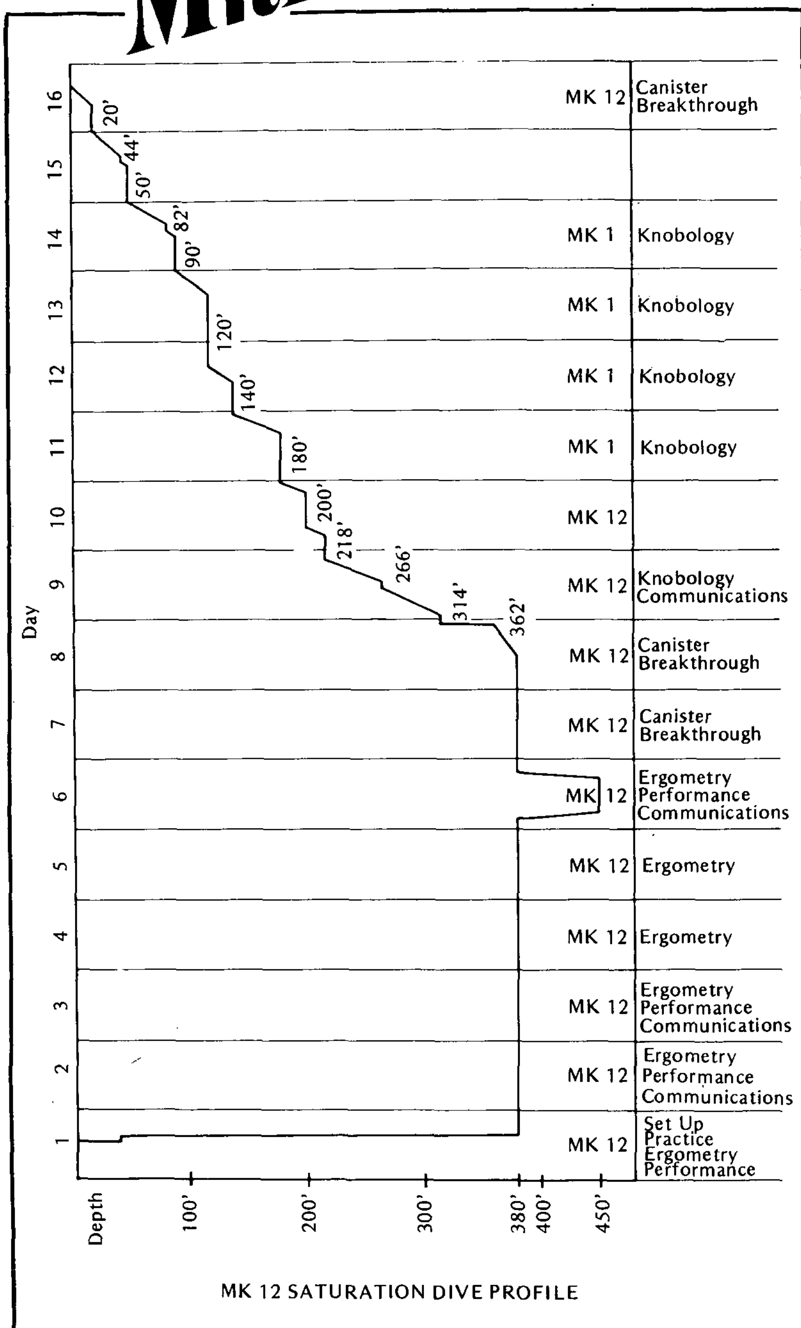
The pile cutter claims two other distinct advantages, safety and ease of maintenance. The chain saw is potentially dangerous in low visibility areas. At times, the diver is within inches of the pile and the cutting blade. The unguarded rotating chain plus the unpredictable lurch of the cut pile places a diver in an extremely hazardous position.

In designing the CEL cutter, the main safety consideration was removing the diver/operator from the hazard area. This was done by eliminating the need for the rotating chain saw blades and by placing the control valve at a remote distance from the pile cutter. However, during sea tests, divers preferred and felt safer with the control valve mounted directly on the cutter, enabling them to visually monitor the shearing operation.

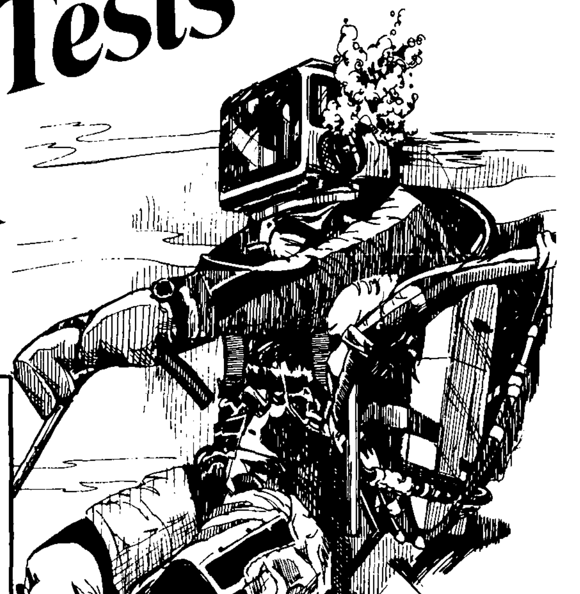
Therefore, the prototype cutter was designed for two modes of operation. The first, when diver/operators are in the water at all times, features the hydraulic control valve mounted on the cutter tool. A safety tagline must be attached to the pile to confine it before cutting and to maintain some control after it is sheared. The second mode of operation has divers positioning the cutter on the pile and then getting out of the water. The control valve is placed on the power source and controlled from the surface.

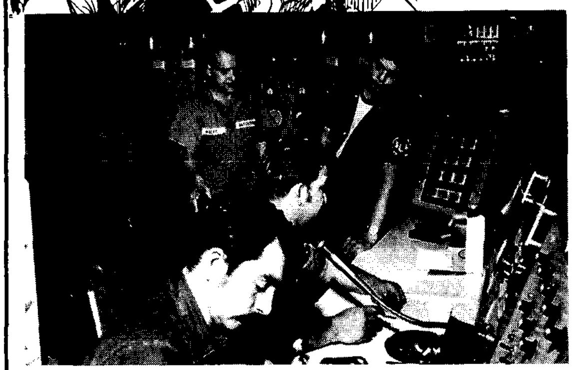
Because of the simplicity of design, preventive maintenance consists only of washing the cutter with fresh water after each use and lubricating the two grease fittings at the pivot points of each blade. The hydraulic control valve has been modified so that the spring housing and internal parts are always sealed.

# NEDU Sat. Dive Tests Mk12 and Mk1



MK 12 SATURATION DIVE PROFILE





The days of the helmet padeye and the 2-fold purchase on the diving stage are drawing to a close. The Mk 12 Surface Supported Diving System (SSDS) mixed gas mode is being tested successfully at the Navy Experimental Diving Unit (NEDU), Panama City, Florida. NEDU divers performed a series of tests in the Mk 12 SSDS mixed gas mode and also in the Mk 1 Bandmask during a saturation dive in the NEDU Ocean Simulation Facility from February 1-16, 1977.

The early portion of the dive, which went to depths of 380 and 450 feet of sea water (fsw), was spent evaluating the Mk 12 mixed gas mode's helmet ventilation and recirculation canister duration during heavy work periods. Mk 12 studies continued throughout the dive, though later testing at shallower depths (200 fsw and less), concentrated on the Mk 1 Bandmask. In

Station. In addition, previous problems in recirculator flow and canister sealing were proven to have been corrected. Lastly, the divers' overall evaluations were uniformly high. The primary negative finding was that canister duration did not equal the times demonstrated in previous unmanned testing. Developmental work on canister duration is continuing. The mixed gas mode technical evaluation and the operational evaluation have been delayed until the 4th quarter of FY77 and the 1st quarter of FY78.

The Mk 12 SSDS in the mixed gas mode is converted to a semi-closed-circuit breathing system by the addition of a back-pack recirculator assembly. The adjustable helmet exhaust valve and bottom configuration with dry suit are always used when diving in the mixed gas mode. The system operates with a 6 acfm circulatory flow through the helmet and recirculator, which is established and maintained by a 0.4 to 0.6 acfm flow supplied from the surface. The helmet $\Delta P$ varies from 0.3 to 2.5 psi by adjusting the exhaust valve, exhausting gas to ambient in an amount equal to the surface supply. The recirculator assembly consists of a $CO_2$ absorbent canister, an ejector assembly, a manifold assembly, and an emergency gas bottle, all mounted in an insulated fiberglass case. The recirculator assembly is secured to the diver by two straps that are snapped to the jocking harness shoulder straps and by a separate waist belt.

The work so far on the Mk 12 mixed gas mode development is very encouraging. Tethered divers of the near future will be able to decompress in more comfort from deep depths. The Mk 12 SSDS air mode, which has already completed its OPEVAL, is nearing production. The only steps remaining are the granting of approval for service use and the writing of a purchase specification. The first procurement of Mk 12 outfits for diving schools will then be authorized.

Photo on page 8 shows control room during dive. Photo above shows dive participants: Back to front: Sitting/kneeling--QM2(DV) Zawacki, LCDR Demchik, SW1(DV) Goerlich, BM1(DV) Lewis; standing--HT1(DV) Hammill, MMCS(DV) Yarley, BM1(DV) Larson.

the area of general research, "knobology" was emphasized. Knobology, a relatively new "science," is the study of handles on equipment to determine which handle size and shape is the easiest to use(in this case,under water).

This particular dive, which required 3 months of planning and diver work-up, proved to be almost a classic test series. There was no delay in starting the dive, and the emergencies that did occur were successfully overcome. For example, the emergency generator restored power in less than 30 seconds when shore power to NEDU was lost.

The substantial amount of data obtained from this dive is vital not only to current projects, but also for future studies in the OSF. The dive team performing the trials in the chamber were LCDR R. F. Demchik, MMCS (DV) W. E. Yarley, SW1 (DV) C. D. Goerlich, HT1 (DV) S. J. Hammill, BM1 (DV) D. D. Lewis, and QM2 (DV) J. M. Zawacki. BM1 (DV) S. M. Larson served as the alternate diver. Supervision and the OSF watchkeeping was conducted by the rest of the NEDU crew.

The Mk 12 mixed gas testing brought both "good news" and "bad news." On the positive side, helmet ventilation was excellent and within the required standards. Also, communications in the mixed gas mode were excellent with the Naval Coastal Systems Laboratory Communication

# BUDS Starts First SDV Training Class

JO3 G. R. Amato
*Navy Public Affairs Center, San Diego*

The operation of the combat swimmer delivery vehicle (SDV) is in the forefront of training at the Basic Underwater Demolition School at Coronado's Naval Amphibious Base, Coronado, California. It is there that the first U.S. Navy class in SDV training has begun. Under the instruction of BMC James Allgeier, the 10-week class was established in an attempt to take the burden of instruction off operational units. In the past, SDV techniques were taught by individual underwater demolition and sea-air-land teams. This class allows the teams to concentrate on advanced and mission training. Two weeks are spent in classroom instruction and the remaining 8 weeks are devoted to practical application in the water.

The Italian and the British Navies pioneered the use of SDV's during World War II. Their experiences clearly demonstrated the effectiveness of combat vehicles over combat swimmers. Obviously, a vehicle can go faster and farther than a swimmer. A person can only carry so much; and the SDV, weighing approximately 1½ tons, can easily handle much more. Another important aspect of using SDV's is that a swimmer is not tired from the effort of reaching his objective. Also, there is more time for performing the actual mission.

Historically, what has been the "actual job" of SDV's? During World War II, the pioneer SDV's were used for attacks on shipping. The Italians, for example, torpedoed the British battleships HMS VALIANT and QUEEN ELIZABETH at their moorings. The British SDV's scored successes against the German battleship TIRPITZ and the Japanese cruiser TAKAO. They were also used to cut the Saigon-Singapore and Saigon-Hong Kong telephone cables.

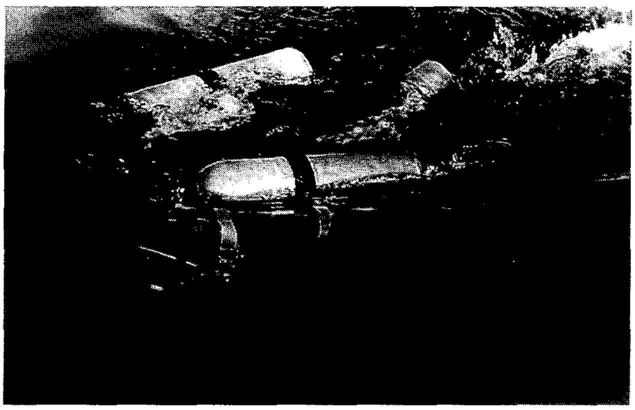
Until recently, the Navy purchased its SDV's from the Italians and the French. The latter model, dubbed Loral, was put in service in 1964 and used during the early years of the Vietnam conflict for combat operations.

The first American SDV, the Drut, was built in Coronado, California, from scrap parts gotten from the salvage yard at North Island's Naval Air Station. Its two scuba-equipped crew members rode astride the torpedo-like body as they gripped pegs on the side of the hull.

Effective as the early models were, they were still a far cry from the battery-powered Mark VII Model 6 currently in use. Its fiberglass body is capable of carrying a pilot, navigator, and two passengers.

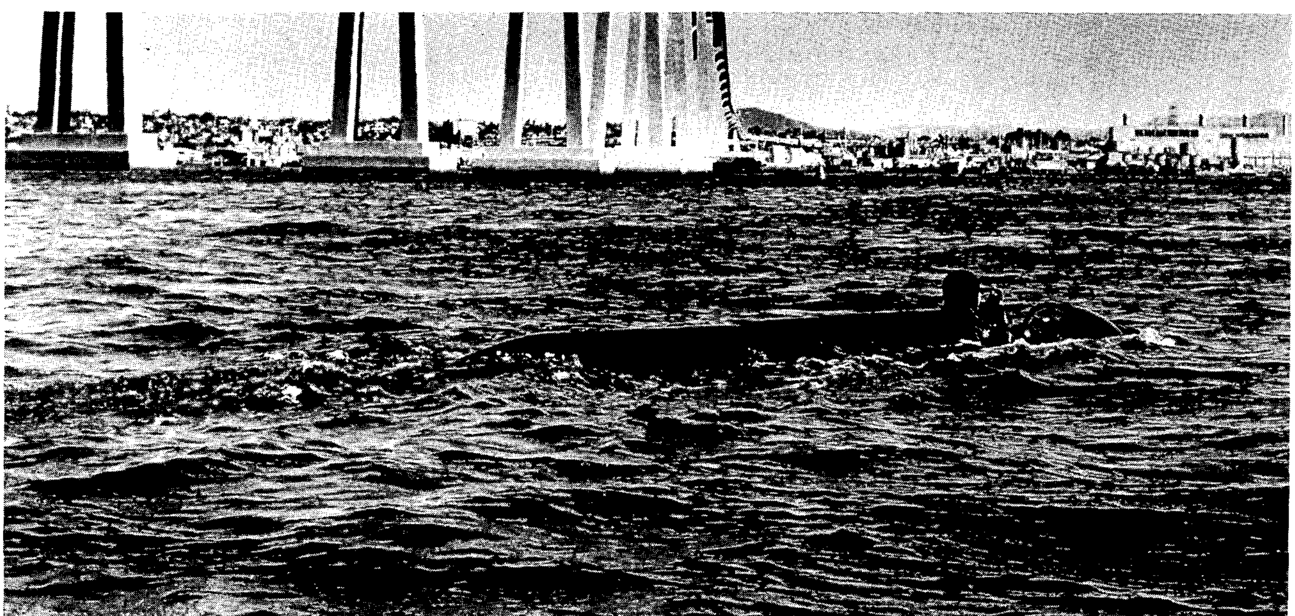
Each of the nine students in the new SDV class learns how to assume each of these roles that they someday will be assigned. BMC Allgeier also briefs the students on the SDV's ballast system (the components that raise and lower the craft) as well as obstacle avoidance, weight stability, navigational systems, mission planning, and health hazards. The most important health lesson an SDV student can learn is to breathe easily and regularly while he's in the craft. If he does not do so, the depth pressure may cause a heart embolism.

Since this is the first school of its type, there are, of course, a few "bugs" to be straightened out. The first class graduated in early April. This is being followed by a period spent in evaluating the course and making any necessary changes in the program before beginning again with a new group. Basically, however, the instructors feel confident that the course is on the right track and will yield successful results.



A student uses an acoustic receiver to track down a target, a task also included in the class instruction.

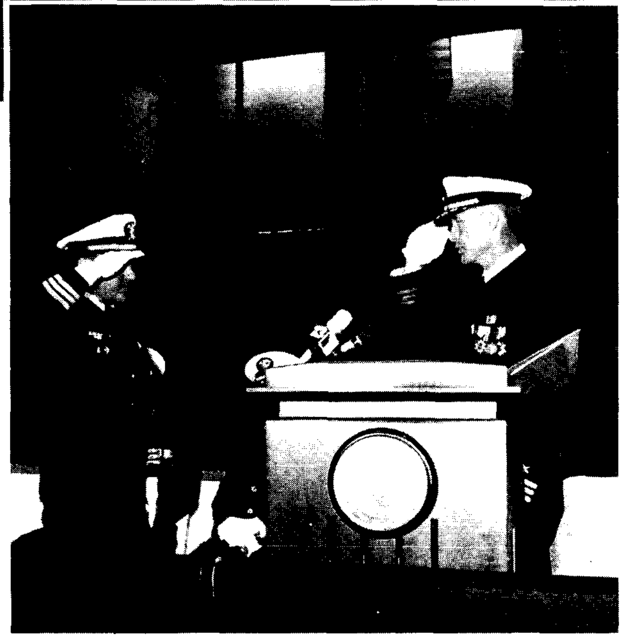
Members of the SDV class prepare the Mark VII Model 6 for launching in south San Diego Bay as part of their training.



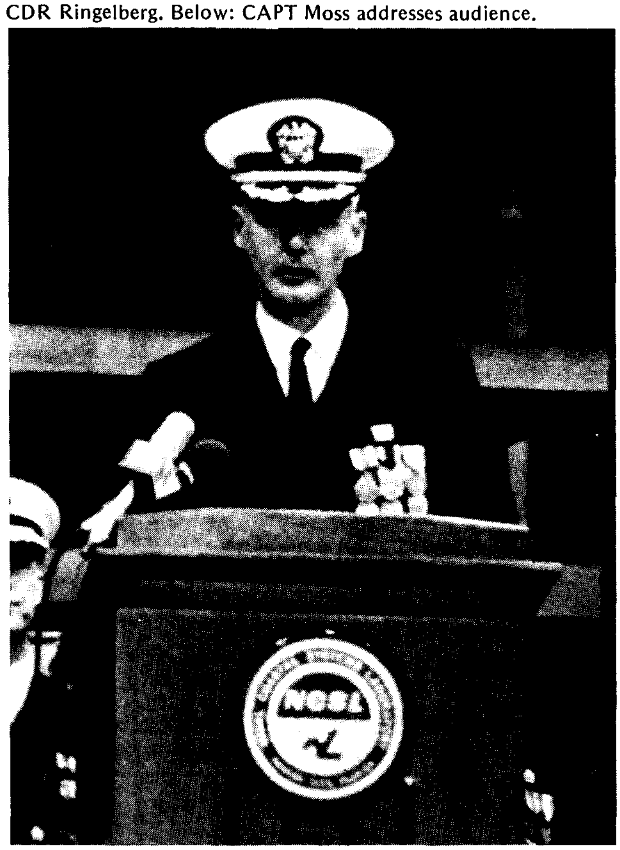
Students test an SDV in the San Diego Bay.

During a special ceremony on March 4, 1977, CDR Charles A. Bartholomew, USN, relieved CDR J. Michael Ringelberg, USN, as Commanding Officer of the Navy Experimental Diving Unit in Panama City, Florida.

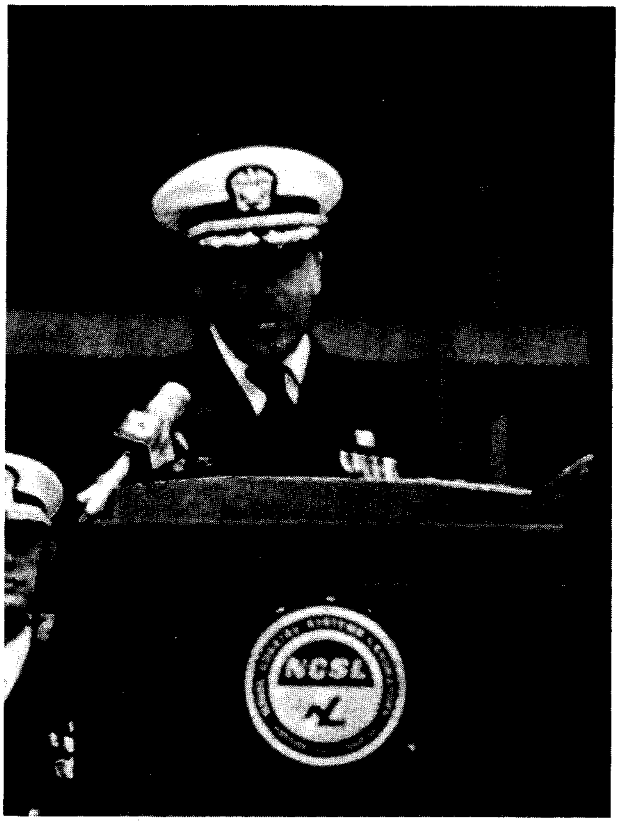
ADM Isaac C. Kidd, Jr., Commander in Chief of the U.S. Atlantic Fleet, was the scheduled guest speaker. However, his trip had to be cancelled because of inclement weather. Instead, CAPT James V. Jolliff, Commanding Officer of the Naval Coastal Systems Laboratory, delivered ADM Kidd's message to those attending. His remarks commented on how important the work done at NEDU is to the Navy, primarily because the results of NEDU's testing of man, equipment, and procedures go right into operational use in the fleet. A major recent example is the development of the new Mk 12 Surface Supported Diving System (SSDS), which has completed air mode testing at NEDU and is nearing completion in the mixed gas mode evaluation. Also mentioned was the certification of the Mk 2 Deep Dive System to 850 feet, which has been accomplished on the IX-501 in San Diego, California (see page 14). In closing, ADM Kidd's message gave tribute to the diving community as a whole, commended CDR Ringelberg for his outstanding duty tour at NEDU, and welcomed CDR Bartholomew to his new command.



Above: CDR Bartholomew (right) takes over command from CDR Ringelberg. Below: CAPT Moss addresses audience.



CAPT Robert B. Moss, USNR, Director of Ocean Engineering, next described the "dedicated professionalism" and the "considerable quality of leadership" that CDR Ringelberg has demonstrated at NEDU. He specifically praised CDR Ringelberg's efforts in maintaining an almost uninterrupted work schedule during the complex move of NEDU from the Washington, D.C. Navy Yard to Panama City. He also commended him for his role in expanding the exchange programs with other allied navies and with commercial and industrial groups. In his remarks to NEDU's new Commanding Officer, CAPT Moss described CDR Bartholomew's thorough familiarity with and complete understanding of diving and salvage and expressed his "complete confidence in and fullest support of" the CDR's endeavors at his new post. CAPT Moss concluded his remarks by reading a special congratulatory and welcoming message to CDR



Above: CDR Ringelberg comments on his tour at NEDU.
Below: CDR Bartholomew reads his new orders.

Ringelberg and CDR Bartholomew, respectively, from VADM C. R. Bryan, Commander, Naval Sea Systems Command.

Before making his remarks and reading his orders, CDR Ringelberg presented the Navy Superior Civilian Service Award to Mr. James McCarthy for his outstanding service as Special Assistant for Hyperbaric Systems at the Ocean Simulation Facility (see page 34). CDR Ringelberg also presented a Meritorious Civilian Service Award to Mrs. Lillian A. Owens for her "professional excellence" in her duties as NEDU's Technical Librarian.

CDR Ringelberg, who had been stationed at NEDU for a longer period of time than any of his previous positions, commented that he leaves what he considers one of his most challenging and rewarding tours; one that saw the fruition of several vital programs. These include the Mk 12 SSDS, which will provide a vast improvement over the traditional Mk V hard hat; the Swimmer Life Support System Mk 1, a new mixed gas self-contained scuba that is now nearing service approval; and the new Saturation Excursion Tables, considered to be one of the most significant diving technology breakthroughs in years. CDR Ringelberg credited the success of these and many other projects to the crew of "most dedicated sailors and civilian personnel" who man NEDU.

After reading his orders, which send him to the aircraft carrier USS JOHN F. KENNEDY (CV-67) to be Chief Engineer, CDR Ringelberg turned the Unit over in the traditional change of command format to the new Commanding Officer, CDR Bartholomew.

CDR Bartholomew, a native of Long Beach, California, is a graduate of the U.S. Naval Academy and holds a Bachelor of Science degree in Marine Engineering and a Master of Science degree in Naval Architecture from the Webb Institute of Naval Architecture.

He served aboard USS PROVIDENCE (CLG-6) and USS HOLLISTER (DD-788) before becoming an Engineering Duty Officer. He subsequently saw duty at the Long Beach, California, Naval Shipyard and aboard USS HECTOR (AR-7), the latter of which he served on as Repair Officer and Diving Officer. Since 1972, CDR Bartholomew has held various positions in the Naval Sea Systems Command in Washington, D.C. The most recent of these duties was as Assistant for Salvage and then as the Supervisor of Diving (see page 4).

CDR Bartholomew's decorations include the Navy Commendation Medal (two awards), Meritorious Unit Citation, National Defense Medal, Vietnamese Campaign Medals with four stars, and several lesser Vietnamese awards.

*Faceplate* extends best wishes to both CDR Ringelberg and CDR Bartholomew in their new duty stations.

# Mk2 Mod O DDS is Certified to 850 feet

LCDR Robert F. Goad, MC, USN
*Submarine Development Group One*

A saturation diving operation was successfully completed by the Mk 2 Mod O Deep Diving System, a unit of Submarine Development Group One in San Diego, California. The major purpose of the dive was to recertify the diving system to 850 feet. This was accomplished; the Mk 2 Mod O has been certified to the year 1980.

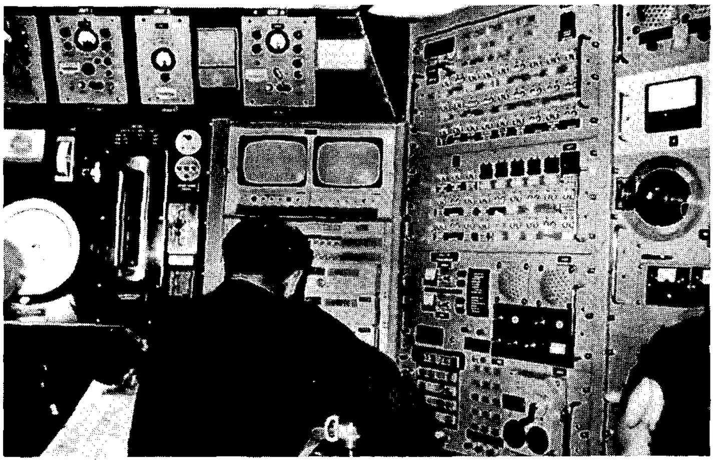
Compression of the 12 divers participating in this unprecedented "dual complex" dive commenced pierside on June 9, 1976 at the Naval Undersea Center. The support ship ELK RIVER (IX-501) then sailed for San Clemente Island off the Southern California coast, where the water was deep enough for the intended dive. The divers surfaced on June 24 having met all objectives, including system recertification, diver training, and extensive data collection.

Open-sea excursions were made by all participants. Modified band masks in an open-circuit mode and hot-water suits were used. (The modification consisted of an added-on heat exchanger for warming of breathing gases.) The longest in-water excursion time was approximately 1½ hours. Saturation depth was 850 fsw; and open-sea excursions were made to a maximum depth of 955 fsw, using the new saturation-excursion tables developed and tested at the Navy Experimental Diving Unit, Panama City, Florida.

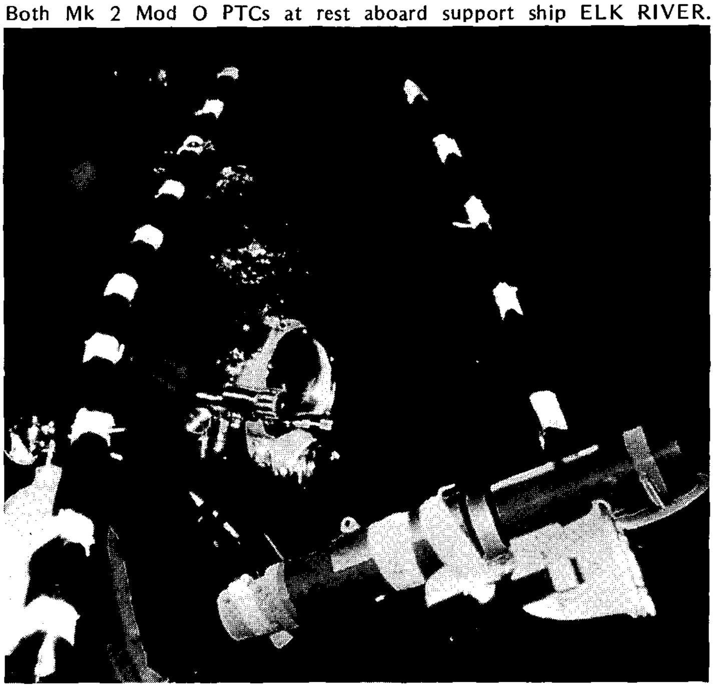
While previous dives have gone deeper and/or stayed longer, one of the most important aspects of this operation was the accomplishment of objective monitoring of work capacity in the open sea at nearly 1,000 fsw. The true basis for determining diving capability is how well the diver can perform his assigned work at a particular depth in comparison to his surface work capacity. As the divers performed a series of precalibrated and increasingly difficult work tasks in the open sea, they were physiologically monitored for heart rate and pattern, respiratory rate, core and skin temperatures, sea-water temperature, and inhalation gas temperature (development of $pCO_2$ and $pCO_2$ sensors that will interface with this system is currently underway). The data was acoustically telemetered to the surface for processing and real-time readout. The divers were able to undertake moderate work loads at these depths for significant periods of time. The telemetry package proved its value both in supplying this information and in its ability to give advance warning of potential problems. For example, some cardiac irregularities caused the Diving Officer and Master to return the diver to the personnel transfer capsule rather than continue his work task. Also, a gradual drop in core temperature occurred despite an adequate hot water temperature. On checking, it was discovered that the diver had not actuated his breathing gas heat exchanger.

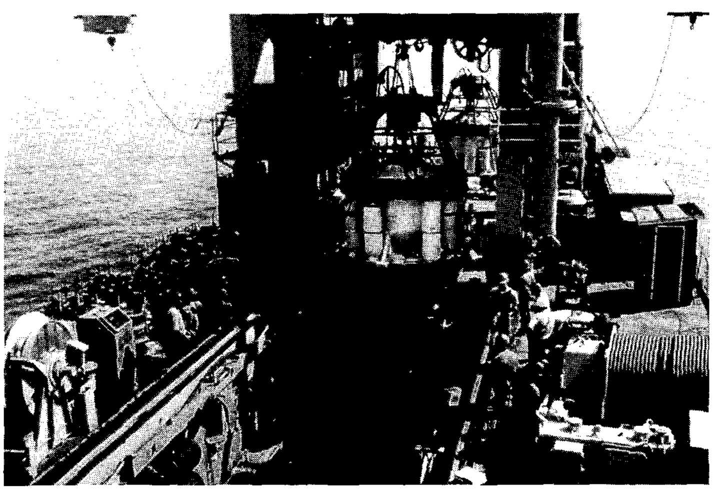
During compression, at depth, and during decompression, the divers underwent a demanding schedule designed both for safety monitoring of vital functions and for data collection to expand future knowledge of high-pressure physiology. Daily blood samples and body weights were taken, and fluid intake and output were measured. Urine samples were obtained four times daily and will be analyzed to gain insight into the patterns of body fluid exchange and weight changes during saturation diving. Sleep patterns will be studied by the analysis of electroencephalograms, which were continuously recorded and taped. Daily electronystagmorgraphy was performed to search for subtle vestibular changes. One chamber participated in preprogrammed exercises, while the other chamber participants did not do any specific exercises. Extensive pre- and postdive fitness testing results will be correlated to see if the future development of in-chamber fitness programs is warranted.

This dive provided strong evidence that productive work can be accomplished in the open sea at depths approaching 1,000 fsw using the U.S. Navy Bandmask Mk 1 Mod S and associated equipment. It is hoped that the numerous data from this dive will prove valuable in helping to provide a bridge between important experimental data and theories and the realities of man working within the hostile environment found under water.



Above: Mk 2 Mod O DDS main control console aboard ELK RIVER. Middle: Diver with underwater television outside PTC at depth. Bottom: Both Mk 2 Mod O PTCs at rest aboard support ship ELK RIVER.





The personnel participating in this dual complex dive (with some individual statistics) are listed below.

Diving Officer: LTjg D. R. Goins
Master Diver: BMCS (MDV) T. K. Goacher
Officer-in-charge of ELK RIVER (IX-501): LT F. B. Fisher

DIVERS AND DEPTHS

COMPLEX #1

| DIVERS: | DEPTH OF EXCURSION | WATER TIME |
|---|---|---|
| BMC (DV) J. Medina | 900 feet | 18 Minutes |
| EM2 (DV) T. Ostertag | 900 feet | 53 Minutes |
| SM1 (DV) J. Flores | 930 feet | 61 Minutes |
| HT1 (DV) M. Paxton | 930 feet | 11 Minutes |
| HT1 (DV) E. Lopez | 900 feet | 18 Minutes |
| MM1 (DV) J. Leland | 900 feet | 43 Minutes |

COMPLEX #2

| | | |
|---|---|---|
| HMC (DV) A. Cooper | 895 feet | 10 Minutes |
| MM1 (DV) R. Cadwell | 895 feet | 81 Minutes |
| BM2 (DV) J. Emery | 895 feet | 20 Minutes |
| EN2 (DV) D. Jennings | 895 feet | 53 Minutes |
| IC1 (DV) M. Jackson | 955 feet | 63 Minutes |
| HT 1 (DV) D. Beckert | 955 feet | 41 Minutes |

WATCH STANDERS

| | |
|---|---|
| LCDR Hall | MM1 (DV) Russell |
| LT Orzech, USNR | MM1 (DV) Reece |
| ENS Cullison, MC | MM1 (DV) Fair |
| HTCS (MDV) Alexander | EM1 (DV) English |
| MMCS (DV) Trujillo | HM1 (DV) Shurtz |
| ENC (DV) Miller | MRC (DV) Fowler |
| EM2 (DV) Stanton | BM1 (DV) Marsh |
| EN1 (DV) Walsh | ENC (DV) Cave |

STUDENT WATCH STANDERS

| | |
|---|---|
| LT Hatcher | EN2 (DV) Daigle |
| BM2 (DV) Wright | BM2 (DV) Rowland |
| MM1 (DV) Gaspar | HMC (DV) Holmes |
| MM1 (DV) Penn | EM1 (DV) Carrella |
| HM2 (DV) Brisse | EM1 (DV) Sykas |
| EN1 (DV) Bishop | QM1 (DV) Smith |
| HT2 (DV) Renhart | HT2 (DV) Shirley |
| HT2 (DV) Mason | EN2 (DV) Harkins |
| ETR2 (DV) Talbot | |

# Everything You Always Wanted to Know About

# SYSTEM CERTIFICATION

The "system certification process" is an often quoted and a very often misunderstood phrase. This process is a procedure for providing maximum assurance that all Navy Deep Submergence Systems are materially and procedurally adequate to safely operate in their intended mission ranges.

Certification is not a new idea. Certification requirements and criteria for Deep Submergence Systems (DDS) were first promulgated in 1968 in NAVSHIPS 0900-028-2010, "Material Certification Procedures and Criteria Manual for Manned Non-Combatant Submersibles." In 1970, NAVSHIPS 0994-007-7010 (NAVFAC P-422), "Hyperbaric Facilities, General Requirements for Material Certification" was published with requirements for chambers. Requirements for diver equipment were issued in 1971 in NAVSHIPS 0994-012-3010, "Diver Equipment, General Requirements for Material Certification." The increased complexity and interaction of the different components of Navy diving systems resulted in the consolidation of the three documents in 1973 into NAVMAT P-9290, "System Certification Procedures and Criteria Manual for Deep Submergence Systems." This manual was updated and reissued in July 1976.

The requirement for certification is clearly defined in OPNAVINST 9940.1F. This document assigns to the Chief of Naval Material (CNM) the responsibility for the certification of material and procedures for Deep Submergence Systems and for establishing material certification criteria for all such systems. CNM in turn assigns the responsibility (by NAVMATINST 9940.1B) to the Naval Sea Systems Command to perform the function of System Certification Authority (SCA) for non-combatant submersibles and afloat diving systems equipment.

The certification process and the assignment of responsibilities are defined in NAVMATINST 9290.1. The two principal organizations involved are the system sponsor and the SCA. The system sponsor may be identified as a type commander, commanding officer, officer-in-charge, or program manager of a command or activity that supports, operates, or develops deep submergence systems. The sponsor is responsible for ensuring that his system is certified in accordance with the established certification procedures. The SCA is responsible for conducting the certification review process, but he is not responsible for upgrading the sponsor's system to or maintaining it in a certified condition. He will, however, answer the sponsor's questions and conduct impartial technical reviews of the system and its documentation to determine if it is adequate and safe.

NAVMAT P-9290 and NAVMATINST 9290.1 constitute the procedural and technical guidance for the prosecution of certification. These provide guidelines to help the sponsor decide what type of supporting documentation should be provided for the materials, testing, and system operation and also how to prepare certification documentation. NAVMAT P-9290 is not a rigid document, but one that is flexible and subject to interpretation. Of primary concern to the sponsor is an understanding of the steps he must take to have his system certified. System certification can be achieved by following the logical sequence of events shown in figure 1.

The first task facing the sponsor is preparation of a Certification Milestone Event Schedule. The milestone schedule is a list of all the sequential events in the certification process with estimated dates of completion. A pre-printed Certification Milestone Event Schedule, shown in figure 2, is available upon request from NAVSEA OOC. The sponsor enters completion dates for the items applicable to his system and forwards it to the SCA for review. Following approval by the SCA, the sponsor maintains the schedule to provide himself and the SCA with a current status of the certification process. If changes are required the SCA must be advised to allow adequate time for the planning and provision of support services.

The next task in the certification process is the development of a certification scope for the system. The scope, developed by the sponsor, is a list of those subsystems required to ensure the safety and well-being of the system occupants and divers (these are defined in Chapter 2 of NAVMAT P-9290). The scope also includes the operating, emergency, and maintenance procedures for those subsystems as well as any emergency or back-up systems required to rescue and return the occupants to safety after a non-catastrophic accident. Examples of some systems within the scope are the pressure boundary, life support systems, fire fighting systems, and communications systems. The types of systems that are certifiable are too numerous to list. The sponsor must look at each of the subsystems within his system and evaluate the result if it failed during a mission. The SCA can provide assistance if the sponsor is not sure whether a subsystem should be included within the scope. There is no rigid format for presenting the scope; it can be a list of subsystems with detailed descriptions or a system schematic that has the scope shown as some type of boundary. The most important consideration is that the certification scope is clearly and explicitly defined. The sponsor should then submit the scope to the SCA for his review and approval.

After the certification scope has been defined, the sponsor must prepare a Pre-Survey Outline Booklet (PSOB). The PSOB takes each item within the certification scope and expands it into a checklist that indicates the type of recordable evidence the sponsor must provide for evaluation. The PSOB enables the sponsor to collect all of his data and to keep a record of those items that are satisfactory and those that are still pending. Three blank PSOBs are available from the SCA to assist the sponsor. They are as follows:

- NAVSEA 0994-LP-013-7010: "Pre-Survey Outline Booklet for Diver Equipment"
- NAVSEA 0994-LP-014-0010: "Pre-Survey Outline Booklet for Standard U.S. Navy Recompression Chamber Installations"
- NAVSEA 0994-LP-014-9010: "Pre-Survey Outline Booklet for Standard U.S. Navy Surface Supported Diver Equipment Systems"

These PSOBs are pre-printed in a format that follows a typical certification scope and includes typical requirements for recordable evidence (see figure 3). The sponsor prepares a PSOB for his system and submits it to the SCA for review. When the PSOB is satisfactory, the SCA approves it for use on the sponsor's system.

When the certification scope and the PSOB have been approved, the sponsor can start to assemble the documentation necessary to support his request for certification. NAVMAT P-9290 contains guidelines as to the type of documentation required. However, there are many deep submergence systems (DDS) now in service that predate the requirements for certification. Many of these systems can be recognized as standardized equipment married to various ship systems to provide a deep submergence capability. Many of the components of systems created in this manner have evolved in service and their capabilities and limitations have not been documented to the extent and in the form required by NAVMAT P-9290. However, they may have a history of safe operation. Major concerns with systems of this nature are whether components are presently safe in their intended mode of operation, whether their integrity has been compromised, whether components have been mismatched, and whether the actual composite capabilities and limitations have been recognized. Some of the documentation the sponsor of this type of DSS should try to gather to substantiate these aims include operating records, maintenance records, test data, re-entry control forms, and repair work documents. Any document in addition to those listed above that provides information as to the replacement of a part, repair of a part, and the operating and testing of a part should also go into the sponsor's file of certification documentation.

The sponsors of newly developed and constructed DSS's must provide the documentation required by NAVMAT P-9290. This consists of the various design, construction, fabrication, assembly, and quality assurance documents required by Chapters 3 through 8 of NAVMAT P-9290.

Procedural adequacy is as important to achieving certification as material adequacy. The sponsor should also collect the typical documents that are used in the day to day operation of the DSS. These documents include the system drawings that define all of the functional components in the certification scope; the step by step operating and emergency procedures used to line up, operate, and correct anticipated malfunctions; and the technical manual for the system. Also included are the test procedures used to test the entire system or any repaired component within the system, the cleaning procedure used on those components requiring specialized levels of cleanliness, and the maintenance procedures used to repair and replace components. The documents or drawings that the sponsor provides must be up to date and reflect the system as it exists. However, the condition of the documentation should not delay the pursuit of certification.

When the sponsor has all of the above documentation, he can request an on-site survey by the SCA. However, before requesting the survey, the system should be checked and any known discrepancies should be corrected. Many of these discrepancies may be small items such as a missing nameplate or a missing handwheel on a valve. They should be corrected before the survey to lessen the number of discrepancy cards written during the survey. The correction of a subject of a discrepancy card will require much more effort after the survey than if it had been corrected earlier.

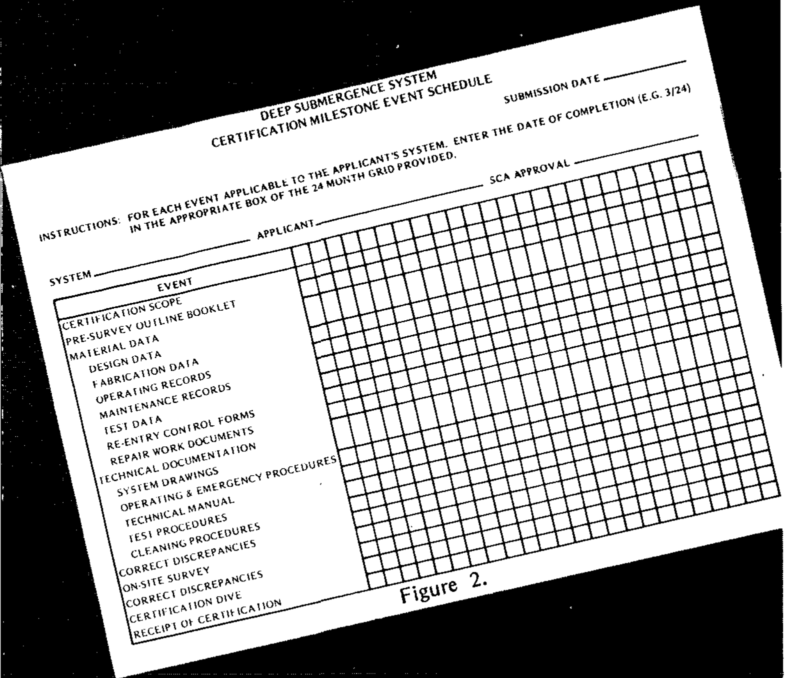
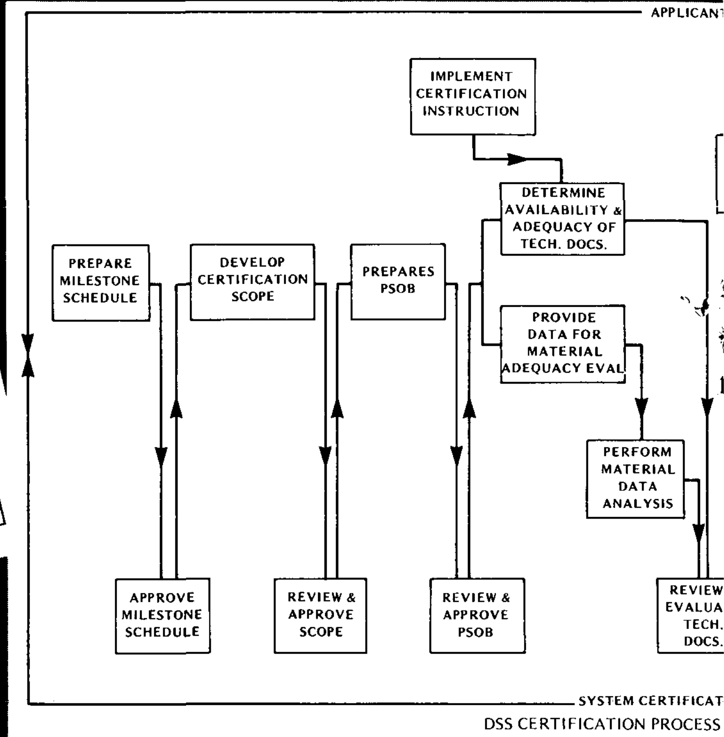



Figure 2.

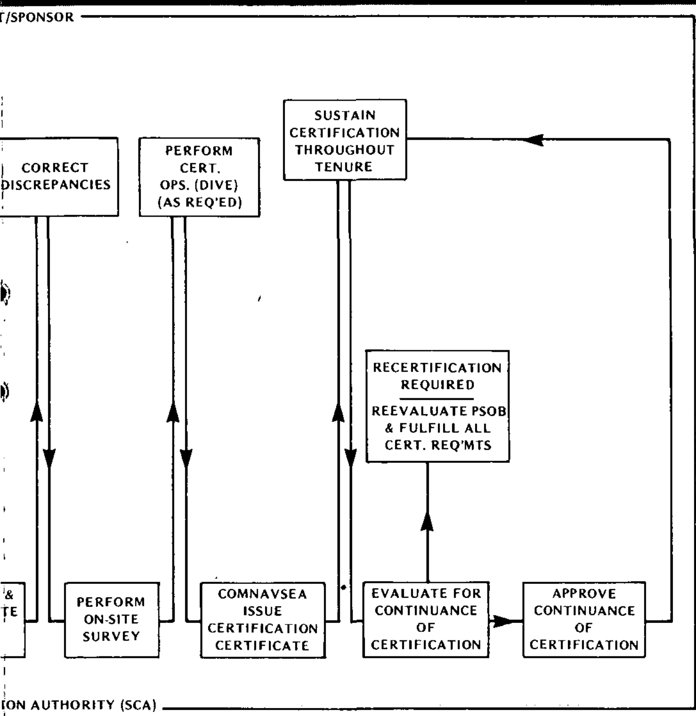



DSS CERTIFICATION PROCESS
Figur

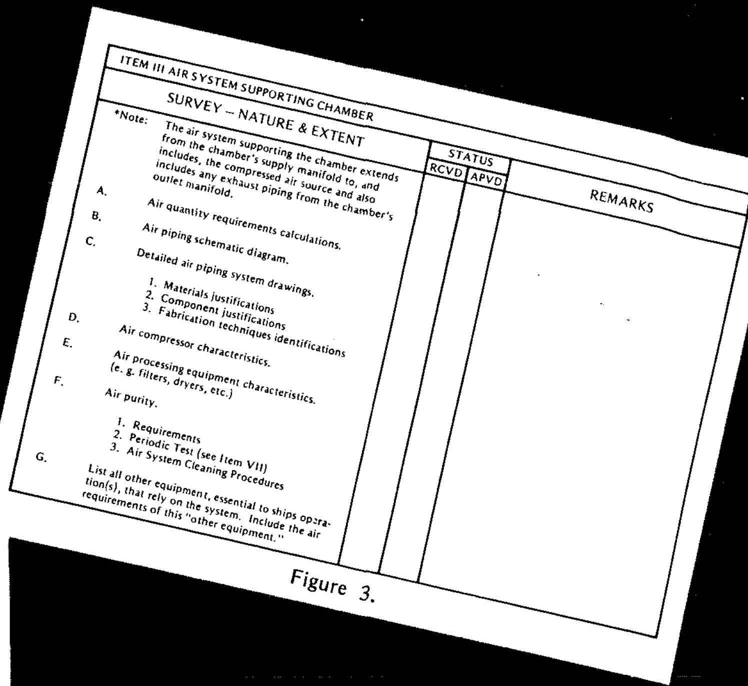
Once all the discrepancies known are corrected, the sponsor contacts the SCA and requests an on-site survey. The SCA sets a date and comes to the sponsor's DSS with a survey team composed of personnel knowledgeable in the different subsystems comprising a DSS. The survey team first examines the files of certification data the sponsor has amassed. They inspect the system and compare the hardware to the documentation. They may request the sponsor to operate portions of the system or the entire system. During the course of the survey, the members of the survey team prepare survey discrepancy cards for any items they find to be less than satisfactory. The discrepancy may be classified as category "IA," "IB," or "II," depending upon severity. All "IA" discrepancies must be corrected before further manned use of the system; and all "IB" discrepancies must be corrected before the DSS is certified. OPNAV INST 9940.1F requires that the system sponsor ensure that "prior to manned diving of any diving system ashore or afloat, that system must either be currently certified in accordance with established system certification procedures, or a vigorous certification program must be in process with no discrepancies existing that prohibit manned use." All discrepancies that are classed "II" (desirable) can be corrected at the sponsor's option and do not delay his achievement of a certified system.

When the "IA" and "IB" discrepancies have been corrected, the SCA may request an operational demonstration of the system. This exercise takes the DSS to its depth and pressure limits to the satisfaction of the SCA. After a successful demonstration and correction of any discrepancies, the sponsor is granted *U.S. Navy Certification of System Adequacy* by the Commander, Naval Sea Systems Command. This certification, however, is not a lifetime certification. The tenure of the certification is determined by the SCA and is based on the system complexity, the mission profile of the DSS, and historical data taken on similar systems. Certain events, such as a major overhaul of the DSS or major deviations from the conditions of certification, require the sponsor to apply to the SCA for recertification.

Achieving certification for a DSS does not end this process. The sponsor is also responsible for keeping or sustaining the system's certification. The SCA may revoke the DSS's certification for failure to adhere to the appropriate guidelines. The sponsor should ensure that he stays within the operational limits of the system and that he notifies the SCA of any situation that could cause him to exceed those limits. The scheduled main-




FUNCTIONAL FLOW DIAGRAM
e 1.


ITEM III AIR SYSTEM SUPPORTING CHAMBER

SURVEY – NATURE & EXTENT

| | STATUS | | REMARKS |
|---|---|---|---|
| | RCVD | APVD | |
| *Note: The air system supporting the chamber extends from the chamber's supply manifold to, and includes, the compressed air source and also includes any exhaust piping from the chamber's outlet manifold. | | | |
| A. Air quantity requirements calculations. | | | |
| B. Air piping schematic diagram. | | | |
| C. Detailed air piping system drawings. 1. Materials justifications 2. Component justifications 3. Fabrication techniques identifications | | | |
| D. Air compressor characteristics. | | | |
| E. Air processing equipment characteristics. (e.g. filters, dryers, etc.) | | | |
| F. Air purity. 1. Requirements 2. Periodic Test (see Item VII) 3. Air System Cleaning Procedures | | | |
| G. List all other equipment, essential to ships opera-tion(s), that rely on the system. Include the air requirements of this "other equipment." | | | |

Figure 3.

tenance developed for the system, whether it is a regular PMS program or not, must be performed; and the maintenance records must be kept up to date. Whenever the sponsor intends to alter or modify the system, he must notify the SCA before taking any action and then send the SCA all the documentation (e.g., design calculations, drawings, etc.) necessary to evaluate the effects of the proposed alteration. The SCA must also be notified when any unsafe or emergency conditions exist that prevent the sponsor from operating the system on its intended mission that he cannot correct by a simple repair or replacement "in kind" of material.

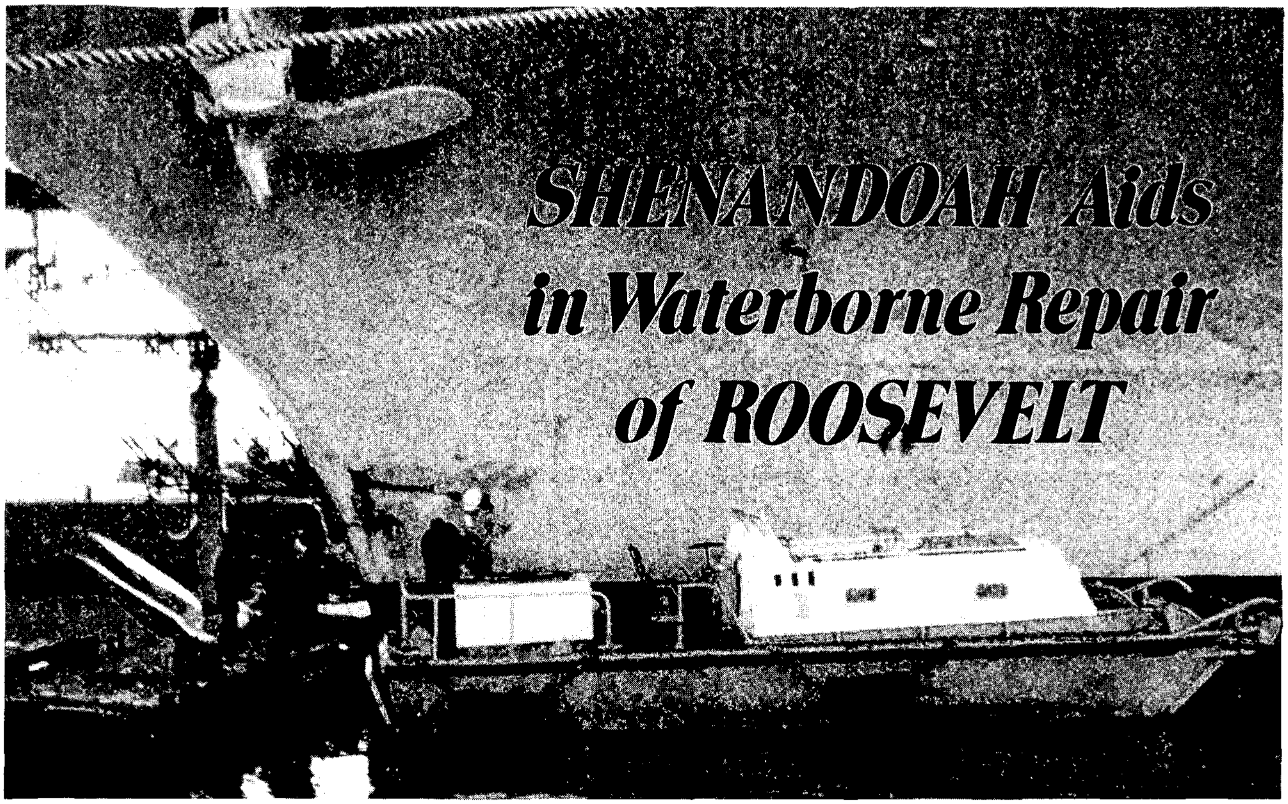
The SCA plans to issue a Certification Management Procedure as a NAVSEA instruction to help sponsors maintain the correct documentation once the DSS is certified. The procedure will show the sponsor when to fill out certain forms, who fills them out, and how to do it. It will define and explain the Re-Entry Control procedure invoked by the sponsor whenever the certified boundary is breached for a repair or maintenance action. Re-Entry Control is a program that provides for positive control of items such as the following:

who authorized the work,
what is the task,
why is it being done,
where and by whom is the work done,
what is the supporting documentation.

A Re-Entry Control form will be provided that, when completed in accordance with the applicable instructions, will comprise a complete history of entry into the system. An important consideration in sustaining certification is the use of proper repair parts. The use of an unauthorized replacement part can invalidate the sponsor's certification. The instruction will explain how to establish a repair parts control program for those components within the certification boundary. The instruction will also define the sequence of events to be followed when the sponsor proposes a modification or alteration to the DSS. The aim of the certification management procedure is to provide the sponsor with a file of documentation that can support a certification survey at any time and with a controlled, safer system.

In summary, this article has attempted to explain the workings of the certification process. Hopefully, it dispels any misconceptions that may exist. The office of the SCA is currently engaged in giving a series of presentations on the system certification process to various major commands involved in the Navy diving program in an effort to further clarify the certification process.

# SHENANDOAH Aids in Waterborne Repair of ROOSEVELT

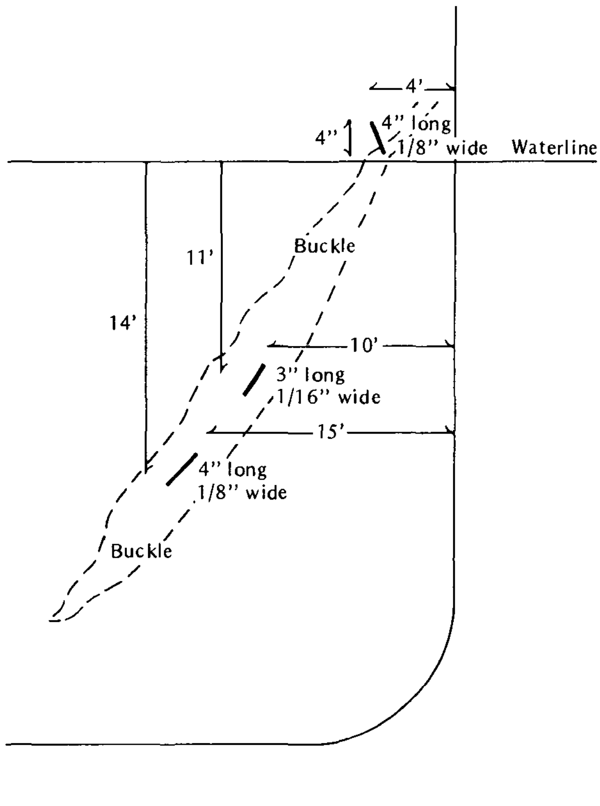


Mr. James C. Bladh
*Office of the Supervisor of Salvage*

SHENANDOAH (AD-26), a destroyer tender in the Atlantic Fleet, was called upon earlier this year for welding repair services to repair the damage done to USS ROOSEVELT (CV-42) after it had been involved in an at-sea collision. In an effort to cut down on time and cost, it was decided to make the repairs at the S.E.B.N. shipyard in Naples, Italy, without placing the ship in drydock.

SHENANDOAH's crew first rigged scaffolding to the port and starboard side of the bow in order to repair the hull damage located just above the waterline. Repairing this damage required considerable welding and patching, which was accomplished quickly and efficiently.

By ballasting ROOSEVELT, SHENANDOAH personnel were also able to repair two additional areas of damage that had been originally designated as underwater tasks and not within their responsibility. One patch 5 feet long, 10 inches wide, and 3/8 inch thick was welded across the bow and onto the port side 2 feet above water. The second patch, which was 2 feet long, 8 inches wide, and 3/8 inch thick, was welded onto the bow section 8 inches above the water. This effort further reduced the time and cost of the repair operation.




Sketch of damage at waterline and underwater

Under the supervision of BMC (DV) B. W. Griffith, the SHENANDOAH crew members participating in the successful repair were: EN1 (DV) P. A. Schwartz, MM1 (DV) S. R. Arsenault, HT1 (DV) M. L. Harrison, HT2 (DV) F. R. Josenhans, EM3 (DV) P. S. Groth, HTFN (DV) R. Wysong, HTFN (DV) J. R. Webb, HT1 Parr, and HT3 Hubbard.

SHENANDOAH was supported in this operation by the SUPSALV diving services contractor, Oceaneering International, Inc., who was tasked to repair the damage requiring underwater welding. There were three cracks involved in their task, all located on the starboard side of the ship. Two were 4 inches long and 1/8 inch wide (at maximum width); the third was 3 inches long and 1/6 inch wide (at maximum width). Oceaneering set up its diving station on board SHENANDOAH's dive boat and lowered divers on a stage to "grind down" and then clean each crack. Holes 1/4 inch in diameter were drilled at both ends of each crack to prevent spreading. The cracks were then covered by several weld passes that extended well onto the surrounding hull metal.

Although the underwater repairs were temporary, the savings in cost were significant. In addition, ROOSEVELT was able to meet operational commitments that would have been missed if the ship had been drydocked.

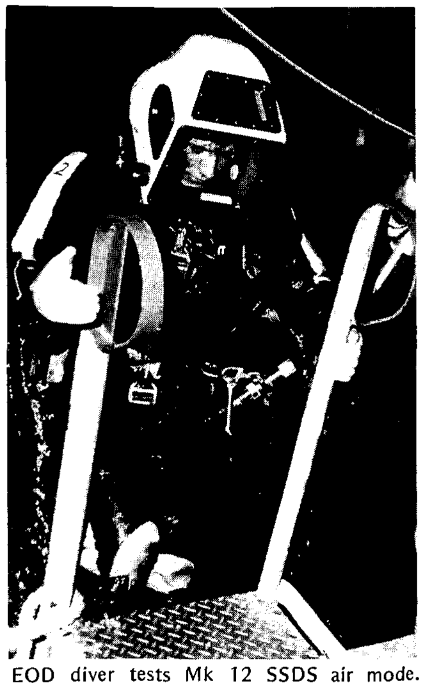
SHENANDOAH crewmember inspects patch on hull.

BMC(DV) J. H. Bloechel
*Navy Experimental Diving Unit*

The U.S. Navy School of Explosive Ordnance Disposal (EOD), Indian Head, Maryland, hosted the Navy Experimental Diving Unit's Mk 12 Surface Supported Diving System (SSDS) on November 22-23, 1976. Divers from EOD units, EOD Groups ONE and TWO, the EOD Facility, and the U.S. Navy School of Diving and Salvage were acquainted with the Mk 12 during a 4-hour classroom familiarization session and 1½ days of orientation dives.

LT Joe Mares, EDU's EOD Liaison Officer; LT Gordon Rank, CF, EDU's Canadian Exchange Officer and Mk 12 Project Officer; and MMCS(DV) Bill Yarley, Assistant Mk 12 Project Officer; presented the U. S. Navy-developed Surface Supported Diving System (air mode) to 26 divers from five commands. The expertise of these divers ranged to over 20 years of diving experience. Their qualifications varied from Diving Officer through Second Class—including Master, First Class, and EOD.

The EOD Underwater Training Facility was used to provide maximum exposure for the 2-day Mk 12 familiarization. Sixty-two dives were conducted in both the wet and dry modes, giving all divers the opportunity to objectively evaluate the Mk 12 SSDS air mode. Their general opinion was that the Mk 12 is an outstanding diving system. All are eagerly awaiting the delivery of the Mk 12 Surface Supported Diving System to the fleet.



EOD diver tests Mk 12 SSDS air mode.

# PULLING BARGE: A Salvor's Tool

LCDR P. W. Wolfgang

During the initial training session that was held for three of the new Reserve Harbor Clearance Unit's from the U.S. west coast (approximately 2 years ago), the main thrust was directed toward giving them techniques that could be used in the operating environment of their own home ports. Since there are no ATS/ARS-type salvage ships homeported on the west coast, it seemed worthwhile to work on developing a method of pulling with beach gear that could be put together with the assets at hand. Since the chances were good that a YC-type barge would be available if needed, it was decided to teach the RHCU's the mechanics of a simple "pulling barge." Using HCU-1 assets, including an inhouse YC, half of the reserve salvors spent their first week of active duty building a pulling barge and outfitting it with two legs of beach gear. This barge was then used twice during the next week for training to pull the BUTTERNUT (ex-ANL) off the shoals in Pearl Harbor, Hawaii. The barge proved to be completely successful and has become a mainstay in the HCU-1 assets used for both training and for actual salvage operations.

More recently, following the passage of typhoon Pamela through Guam, a much more pressing need for a beach gear pulling barge arose when none of the Pacific Fleet salvage ships were available for immediate movement to Guam. After an initial assessment of the salvage task revealed the definite need for beach gear, a YC was requested from the Naval Station in Guam and the required fittings were placed on the barge. Using the industrial support of Ship Repair Facility (SRF) Guam and ESSM Base equipment and by applying the lessons learned during operations with the HCU-1 barge, an extremely workable beach gear pulling barge was put together quickly. Again, this barge proved to be highly flexible and has been used repeatedly during the Guam harbor clearance operations (See *FP*, Fall 1976, for phase 1 of Guam clearance). The experience gained during the development and use of these two barges has confirmed the advantages of these salvage tools. It is hoped that it will also prove useful to other salvors faced with similar situations.

The reason for building a pulling barge usually falls into one of three categories. First, as was the case in Guam, there is not a ship with a beach gear capability readily available. Second, the water in the vicinity of the wreck may be too shallow for the draft of a salvage ship. Third, the barge may be needed to augment a salvage ship's pulling power with additional legs of beach gear. While there are probably several other reasons for using such a barge, they are normally involved in some way with one or two of the above conditions. Any barge can be used that is basically seaworthy and has a large open working area with free access over each end. A standard U.S. Navy YC, of which there are several types, averages approximately 110 feet in length and 30 to 35 feet in beam and meets the requirements quite well. The key factor involved, after the availability of open space, is the ability to make a continuous pull of 80 to 90 feet before having to fleet-out the purchases.

Once the barge has been selected, the lay-out of padeyes/fittings can be accomplished. This is similar to any other beach gear setup and is simplified by the absence of the numerous fittings and appendages that are normally in the way on a ship's deck. The only significant difference to be considered is whether one or two winches will be used to heave on the purchases (since additional fairleads are needed if only one winch is used). The use of two winches on the barge is a much preferred method because it not only allows the heaving of both purchases simultaneously, but it also provides flexibility and back-up in case of a winch failure. With proper positioning and with the use of one additional fairlead to the operational winch, each winch can pull either leg. Suitable foundations for the winches can be made from appropriately heavy angle iron welded to the deck of the barge.

Slightly more difficult is the installation of padeyes that are capable of withstanding the strains experienced in beach gear pulling operations. These padeyes can be grouped according to their use into three categories as follows: (1) 120-ton, used at attachment point(s) for the "bullrope(s)" to the wreck, capable of holding the strain of two legs of beach gear; (2) 60-ton, used for attaching the standing purchase blocks and the holding stoppers for each single leg of beach gear; and (3) 10-ton, used for attaching fairleads for the 5/8-inch purchase wires and the nylon work lines used to fleetout the purchases between pulls. If industrial assistance is available through an SRF or shipyard, design assistance will normally be used to determine the material and techniques used in building these padeyes. Under field conditions, or in an emergency, padeyes can be manufactured and installed by the metalworkers in the ship's company. However, extreme care is necessary to ensure quality workmanship; and all personnel must be kept clear of the beach gear components when under strain.

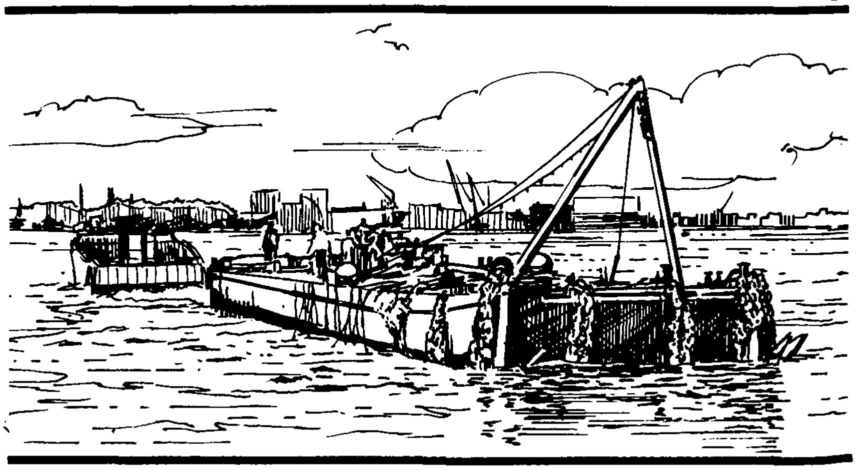
Attaching the legs to the padeyes is usually accomplished through the use of standard plate shackles. It should be remembered that in the case of tandem legs there is a requirement for several additional plate shackles. Also, if the attachment to the wreck involves chain, there may be a need for extra plate shackles that can not be supplied by an ESSM Base. While most of the PACFLT salvage ships have an abundant supply of plate shackles, the ESSM Bases are changing over to poured sockets on the beach gear wires; and there may not be enough plate shackles in the inventory to cover all of the above requirements. If an attempt is made to substitute screwpin or safety shackles for the plate shackles in a beach gear leg, then only shackles that meet the safety requirement of the working load expected to be put on the purchases and beach gear legs can be used. Fifty- to 75-ton screwpin shackles can be found in use in shipyard rigging lofts, etc.

Once the problem of attachment points on the barge is solved, the problem of wires chafing over the ends of the barge must be considered. Since the end toward the wreck will have the "bullrope(s)" (and these wires do not normally move during pulling operations), not much chafing can be expected in this area; and it usually can be handled with 4-inch by 4-inch wood shoring. On the other hand, wires of the beach gear legs usually tend down over the edge of the barge and chafe badly on rough or sharp edges, severely damaging wires. As a method of correcting this problem, large diameter pipe (10- to 12-inch) can be split and used to manufacture an effective fairing that will prevent damaging the working wires. These should be approximately 6 to 7 feet in length to allow for alignment of the beach gear legs and positioning of the barge. They also should have upright sections on the ends to contain the wires during movement of the barge during pulling operations. It should be remembered that the horizontal portion of the fairing will crush if it is not strengthened with internal bracing on approximately 1-foot centers.

The preceding information is based on the use of standard material found in the ESSM System and on salvage ships. There is no restriction, though, on the type of equipment that is used as long as safe rigging practices are followed and the equipment in use is capable of the pull required. Shipyard rigging lofts, ship chandlers, dredging companies, etc. have useful items of equipment that can be used in an emergency; however, use of the ESSM-type equipment is more desirable because the salvor is working with material of known capacity and strength. The main point to remember is that salvage is innovation; and when the time comes to make the "pull," the name on the equipment or its color is not important. What counts is the knowledge and expertise of the salvors and their ability to put it all together in the right order at the right time.

Several different type craft have been used successfully to tow/push the barges along an intended track while laying the beach gear leg. These craft have varied from a YTB to a single LCM-8, depending on maneuvering room and existing weather conditions. With the ells anchors stopped off upside down on the sides of the barge, the chain either hung over the end or on deck, and with the 1-5/8-inch wires "figure-eighted" on deck, no problems should be encountered in laying up to two legs of beach gear (single or tandem) simultaneously.

Standard beach gear rigging procedures should be followed throughout. In fact, in many ways the procedures are simplified on a barge because of the amount of open deck space available. Experience has shown that the YC-type pulling barge is in reality a most effective tool for the working salvor in many otherwise impossible situations.



CDR Ricks (left) congratulates HM1 Robison and LT Ulrich (right).

Reserve Harbor Clearance Units all over the country have already demonstrated their versatility and usefulness in numerous situations since they were formed in 1974. One outstanding example is the participation of HCU 1210, located in Corpus Christi, Texas, in a perilous rescue operation off the coast of Texas in the Gulf of Mexico. Two divers from the unit, LT Bernhard C. Ulrich, USNR-R, and HM1 Clois C. Robison, USN, were each recently awarded the Navy Commendation Medal for their role in the attempted rescue.

The drilling rig OCEAN EXPRESS capsized and sank in the Gulf of Mexico on the evening of April 15, 1976, at a location approximately 40 miles east of Port Aransas, Texas. Reports from Coast Guard aircraft and oil company vessels on scene had initially indicated that all personnel aboard the OCEAN EXPRESS had been safely evacuated. Subsequent reports, however, disclosed that one of the survival capsules from the rig had capsized.

Commercial vessels in the area were unable to right the vessel; and the status and number of the personnel inside the inverted capsule were unknown. Weather conditions at the scene severely hampered rescue efforts. Winds were gusting up to 60 knots, seas were up to 25 feet, visibility was limited, and a squall line had been reported moving through the area.

The Coast Guard Air Station in Corpus Christi requested assistance from the Commanding Officer of the Corpus Christi Naval Reserve Center, CDR R. R. Ricks, USN. Subsequently, two divers from the center, HM1 Clois C. Robison, USN, and LT Bernhard C. Ulrich, USNR-R, volunteered to accompany a Coast Guard helicopter to the scene and attempt to locate survivors and/or to help right the capsized survival craft.

Despite great personal danger, the first diver, HM1 Robison, entered the water to attempt to fasten a line to the capsule. Because of the severe conditions, he was unable to reach the capsule; and, in fact, had difficulty swimming to the nearest tug. The second diver, LT Ulrich, was then deployed somewhat closer to the capsule. Failing to locate a suitable purchase for the righting line, he attached it to the only available point (a handrail) and then returned to a waiting tug boat while a lift was attempted. The handrail proved to be too frail to take the strain and it snapped.

At dawn the next day, a second attempt was made by LT Ulrich to attach a line; but, again, the rail was the only available point to which a line could be made fast. Once again, the attachment failed. LT Ulrich then returned to the capsule to investigate its condition and found open hatches and evidence that there were probably no survivors.

The efforts of LT Ulrich and HM1 Robison were instrumental in the determination of the fate of the crew trapped in the OCEAN EXPRESS capsule. In addition to receiving the Navy Commendation Medal, both divers were also commended by the Commander, Eighth Coast Guard District, RADM W. W. Barrow, USCG; the Commanding Officer of the USCG Air Station, Corpus Christi, H. B. Thorsen; and the Commanding Officer of the Naval Reserve Center, Corpus Christi, CDR R. R. Ricks. The actions of these two divers in the face of gale force winds, hazardous seas, darkness, and the uncertainty of their being recovered safely "reflected credit upon [themselves] and upheld the highest traditions of the United States Naval Service."

# HCU-1: A Small Command with a Big Job

LTJG Timothy B. Stark, USN
*Harbor Clearance Unit ONE*

Harbor Clearance Unit ONE (HCU-1) is just one small element of the U.S. Navy salvage forces operating in the Pacific. Homeported in Pearl Harbor, Hawaii, HCU-1 comes under the operational control of Commander, Naval Surface Forces U. S. Pacific Fleet (NAVSURFPAC) and under the immediate control of Commander, Service Squadron FIVE (SERVRON-5). Its area of operations range from the north and south Pacific Ocean to the Indian Ocean. At this writing, HCU-1 has a team of diving and salvage personnel conducting major salvage operations in Guam, which was recently stricken by the savage Typhoon Pamela. There is also a group of personnel rendering support assistance to the Navy Arctic Research Lab in Point Barrow, Alaska. HCU-1's mission is vast in scope. "Salvage" to the men of Harbor Clearance Unit ONE has encompassed the entire spectrum of the tasks one could squeeze into a definition of the word.

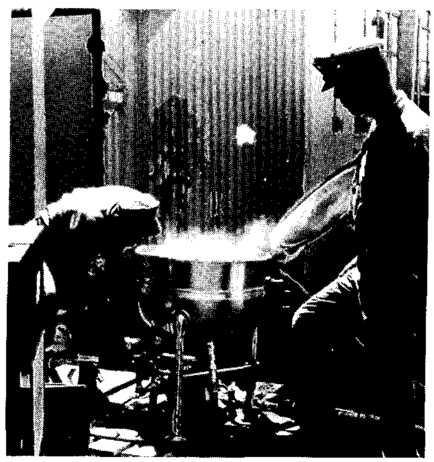
HCU-1 is composed of a small cadre of salvage personnel that is highly trained and seasoned in all phases of diving and marine salvage. Commanded by LCDR Arthur E. Erwin, a man that is no stranger to the salvage business, HCU-1 has 50 officers and men assigned to it. Because of the small number of personnel, the individual demands imposed on its men are great.

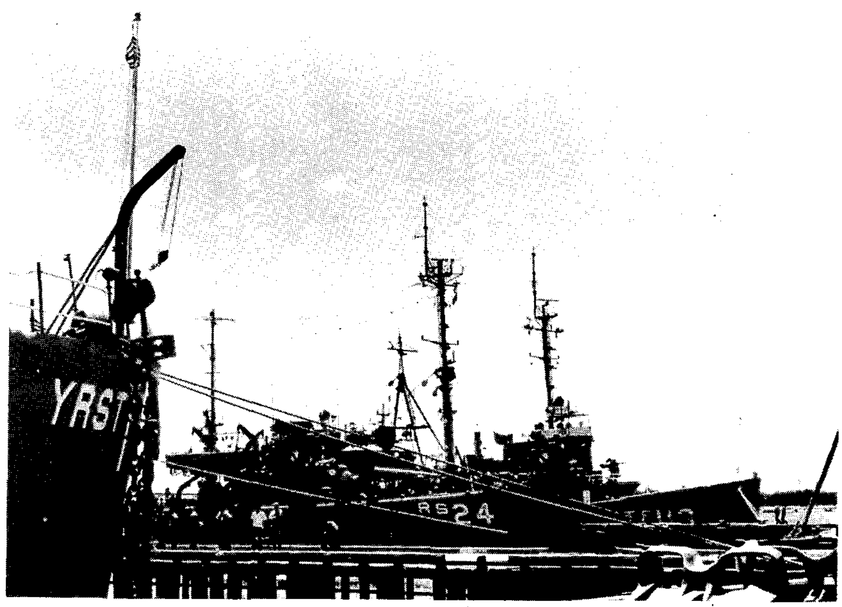

Bow view of YRST-1, home of HCU-1.

HCU-1 is required to maintain the majority of its personnel and diving and salvage assets in a "rapid deployment" fly-away status because of its geographic location. Since the majority of operations take HCU-1 to various parts of the western world, all the tools of salvage are maintained in readiness for aircraft transportation. Beach gear, salvage pumps of various sizes, air compressors, welders, generators, a hydraulic tool package, roving bell, Underwater Damage Assessment Television (UDATS), portable recompression chamber, and Fly-Away Mixed Gas System are ready for deployment on short notice. The Fly-Away Mixed Gas System is completely air transportable to any location and is capable of deployment from any platform of opportunity to conduct deep diving operations as required. The fly-away concept has made HCU-1 an effective rapid response salvage unit.

As one of its regular duties besides assisting in salvage operations, HCU-1 conducts and supervises salvage training with the towing and salvage ships of SERVRON-5. The training consists of numerous diving and salvage oriented exercises. These include the rescue and assistance fire-at-sea exercise; retraction of a stranded vessel exercise; emergency pumping exercise; bow lift exercise; demolition training; UDATS training; hydraulic tool package training; and, recently, air and mixed gas diving training using the roving bell and the Fly-Away Mixed Gas System. Salvage training is conducted in 3-week periods. HCU-1 personnel work closely with the personnel undergoing training to ensure that all basic training requirements are met. Any additional training that the ship's crew feels is required to improve their diving and salvage stature is also scheduled during the training period. In addition to training the men of SERVRON-5, HCU-1 has been conducting salvage training with the Reserve Harbor Clearance Units (RHCU) from the west coast and from as far east as Texas. The reserve salvors receive the same basic training as the towing and salvage personnel, from beach gear to recompression chamber operation (except that their training lasts 2 weeks instead of 3). These training periods with the reserve salvors have yielded two-fold results: Improving the salvage expertise of the RHCU's, and creating a strong comradeship between the active duty and reserve salvors. The men of HCU-1 look forward to the arrival of the reserve groups to Hawaii.

In mid-December 1975, HCU-1 divers determined that a need for a mixed gas diving capability was urgently needed in the Pacific Fleet. All the parts and pieces required for a mixed gas system were available within the SDS-450 control console van and gas supply quads. The only remaining requirement was a little ingenuity in developing a viable manifold system

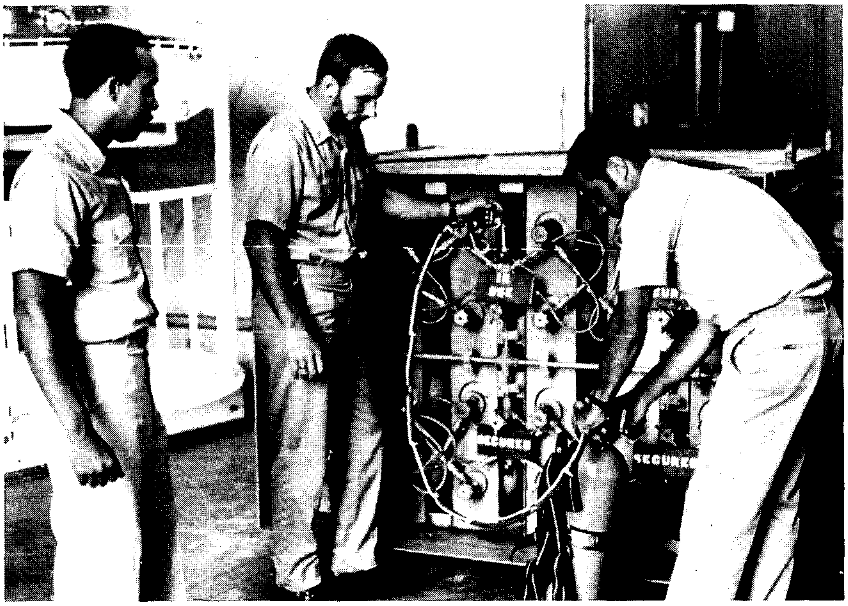






Above: LCDR Wolfgang, CO of HCU-1 when this article was written, with YRST-1 in background.

Left: HMC(DV) M. Gibney and LTJG T. Stark check out cleaning pot.

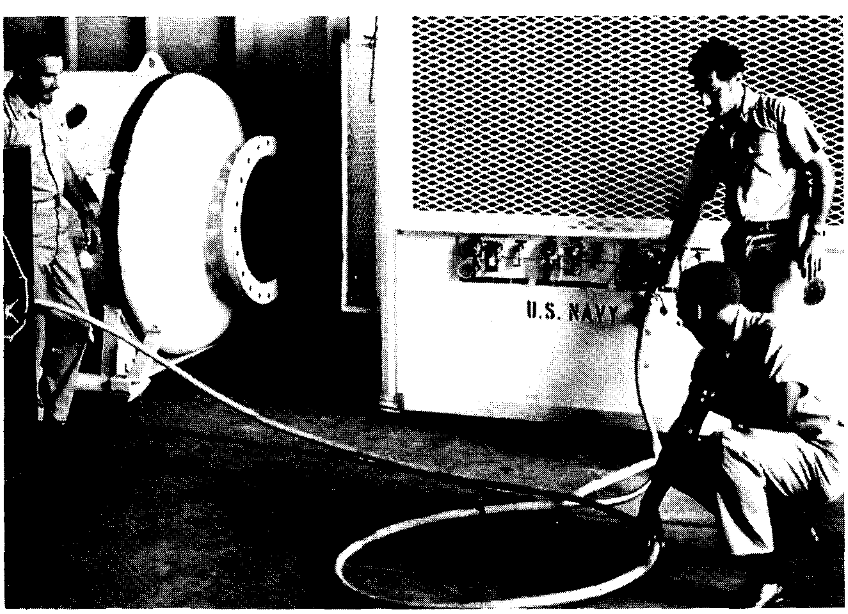
Below: GRASP (ARS-24) and TAKELMA (ATF-113) dock next to YRST-1 when not out at sea.



Above, l-r: QMCS (MDV) J. Fenwick, HMC(DV) M. Gibney, and BMC(DV) W. Gutirrez check out the mixed gas quad, which consists of 24 bottles divided into six banks.

Right (l-r):LTJG T. Stark, EM1(DV) S. Knight, and HMC(DV) M. Gibney with open bell, which features a gate *modification for diver comfort.*

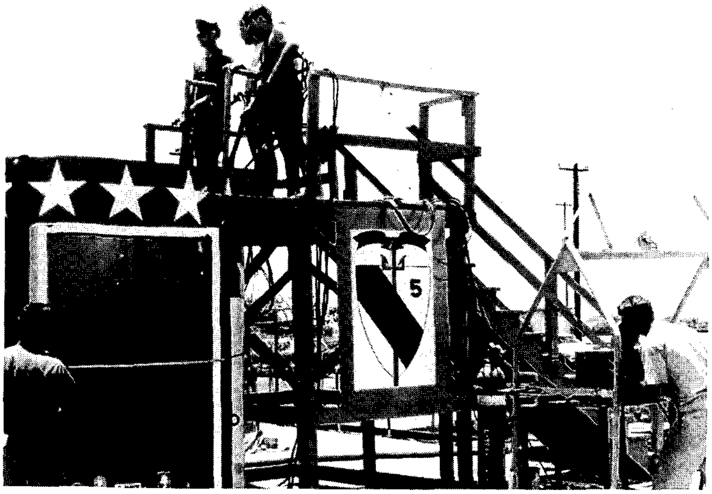
Below: HMC(DV) Gibney, QMCS (MDV) Fenwick, and BMC(DV) Gutirrez test the SDS-450 control console, used as the main control unit for mixed gas flyaway ops.

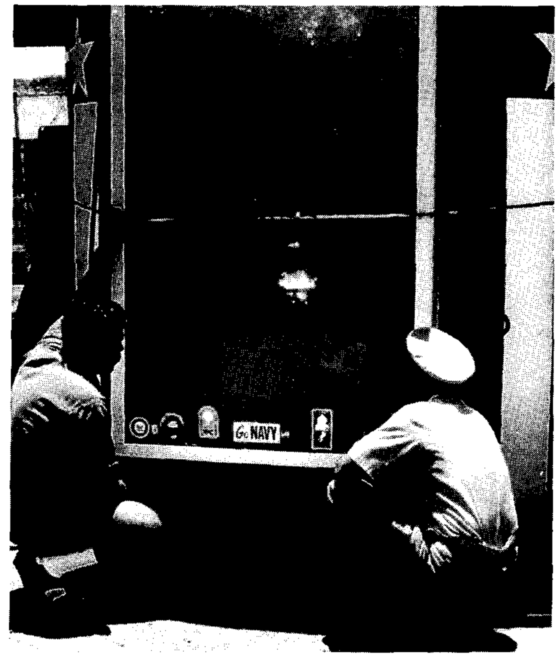



for the gas stowage quads. The project was started in January 1976, and completed in mid-February 1976. It was decided to make the system air transportable to meet the rapid response criteria of the command. After manufacturing the gas manifold and oxygen-cleaning all piping, hoses, and diving outfits, the system was ready to be loaded for an at-sea test. It was loaded on HCU-1's LWT, a 90-foot aluminum warping tug, and taken to sea where the system was tested in 150 feet of seawater (fsw). The entire dive sequence was filmed on video tape (using UDATS) by one of the divers from the roving bell (who was breathing an He-$O_2$ mix). The advent of the Fly-Away Mixed Gas System has made every towing and salvage ship in the Pacific a potential 300-foot mixed gas diving platform.

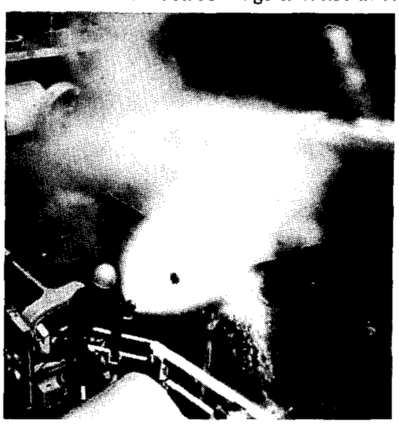
The system was first deployed for actual salvage onboard USS RECLAIMER (ARS-42) in May 1976 for a helicopter salvage operation that required a diving capability of between 100 and 275 fsw. The system also is used quarterly during the Master Diver Candidate Screening conducted at HCU-1. The use of mixed gas while diving the Mk V hard hat and the Mk 1 Diver's Mask gives the Master Diver candidates a "hands-on" experience in running He-$O_2$ diving operations. The system consists of mixed gas stowage quads, the SDS-450 control console van (used as a gas console), a portable double lock recompression chamber, HP air stowage flasks, HP oxygen stowage quads, the roving bell, and Mk 1 diving outfits.

Under the direction of the NAVSURFPAC Salvage Officer, HCU-1 commenced the screening of Master Diver candidates in September 1975. The 2-week screening period includes a written examination to determine the candidate's knowledge of air and He-$O_2$ diving procedures, the medical and physical aspects of diving, the diagnosis of diving related emergencies, and hyperbaric treatments. It






Above: TAKELMA (ATF-113) personnel during underwater welding training exercise at HCU-1. Top right, l-r: BM1(DV) C. Cabral and BMCM(MDV) R. Villasenor (of HCU-1) oversee the exercise. Photo below left shows firefighting exercise during salvage training. Below right: Chief Villasenor confers with LCDR Nugent (HCU-420) during RHCU ACDUTRA salvage exercise at HCU-1.



also includes observation of the candidate's ability to ably command a diving station and to handle diving related casualties and emergencies. The evaluation board consists of the NAVSURFPAC Salvage Officer and Master Diver, HCU-1's He-$O_2$ Diving Officers and Master Divers, the SERVRON-5 Diving Medical Officer, and any He-$O_2$ Diving Officer and Master Diver in the area that have observed the candidate's performance during the 2-week screening period. Basically, the screening scenario is simple. The first week is geared to correct diving procedures without imposed casualties. The second week features a series of simulated casualties designed to test the candidate's ability to make correct decisions under stress conditions. The Master Diver Screening Program has been very successful thus far. From it, five candidates have been recommended for the Master Diver course in Washington, D.C., all of whom have become Master Divers.

This has been a brief introduction to Harbor Clearance Unit ONE. Salvage is the main purpose of this unit; however, the term has many meanings to many people. To the men of HCU-1, it has many sensory connotations relating to its sounds, its smells, and its feel. These include the whine of pumps; the shouts (often with great emotion); the smell of diesel fuel, black oil, and gasoline; the sweat and hot sun; the bitter cold; the shear physical effort; and the meticulous plotting and planning. Also a part of the meaning is the discomfort of skin mercilessly exposed to wind, salt spray, and sun; the aching muscles from a hard day's work; and a satisfying cup of coffee (or something else) with amiable companions at a day's end, sharing the day's experiences and retelling adventures of good times past. Obviously, the word "salvage" has a special meaning to the salvors of Harbor Clearance Unit ONE.

# NEW EXCURSION TABLES: A Milestone in Saturation Diving

*(From Change 1 to Volume 2 of the* U.S. Navy Diving Manual, *which is presently at the Government Printing Office.)*

## HELIUM-OXYGEN SATURATION DIVING

The primary advantage of saturation diving is that the total decompression time is constant for any depth, no matter how extended the dive. This allows divers to remain at working depths for durations that are not limited by decompression considerations. Also, by using the Unlimited Duration Excursion Tables and Procedures for Saturation Diving, a diver is allowed a wide vertical range of working depths without time limits or additions to the decompression time.

### Saturation DDC or Habitat Depth

The most convenient depths for the saturation DDC or habitat should be selected by comparing the planned working depths with the Ascent and Descent Limit Line graph of the Unlimited Duration Excursion Tables. The depth of the saturation DDC or habitat may be varied as convenient during a dive within the limits of the Unlimited Duration Excursion Tables and Procedures.

### Emergency Gas Mixtures

The following gas mixtures (having a range of oxygen partial pressure from 0.16 to 1.25 atmospheres) should be available for emergency use:

| Depth | Mix |
|---|---|
| 0–200 | 84/16 percent $He\text{-}O_2$ |
| 200–400 | 95/ 5 percent $He\text{-}O_2$ |
| 400–1,300 | 97/ 3 percent $He\text{-}O_2$ |

### Treatment Gas Mixtures

For treatment use, the following gas mixtures, having a range of oxygen partial pressure from 1.5 to 2.5 atmospheres (pure oxygen is used to the depth of 60 feet), should be available:

| Depth | Mix |
|---|---|
| 0-60 | 100 percent $O_2$ |
| 60-100 | 40/60 |
| 100-200 | 64/36 |
| 200-350 | 79/21 |
| 350-600 | 87/13 |
| 600-1,000 | 92/8 |
| 1,000-1,600 | 95/5 |

### Underwater Breathing Apparatus Oxygen Partial Pressure

The gas mixture supplied to a diver by his underwater breathing apparatus should be helium-oxygen with oxygen partial pressure varying according to the type of equipment. With semiclosed-circuit equipment, the oxygen percentage and flow rate should be selected to maintain an oxygen partial pressure in the inspired gas generally between 0.8 and 1.0 atmosphere (608 to 760 mmHg). Fluctuations of the inspired gas in semiclosed-circuit apparatus in the range between 0.5 atm and 1.5 atm (380 to 1140 mmHg) are acceptable. With a closed-circuit rig, the apparatus should be adjusted for an oxygen partial pressure in a range from 0.4 to 1.2 atm (304 to 914 mmHg). When a diver is wearing demand open-circuit equipment, an oxygen percentage should be chosen to provide an oxygen partial pressure in the range of 0.4 to 1.2 atm (304 to 912 mmHg).

### Minimum Safe Inspired Gas Temperature Limits

As discussed in Chapter Nine of the *Navy Diving Manual*, the temperature/depth line shown in Figure 1 (page 30) is the limit for the minimum safe inspired gas temperatures for use in operational dive planning.

This limit specifies the *minimum* temperature for breathing gas being delivered to a diver at each depth and assumes that all other measures are being taken to keep the diver warm. The level of respiratory heat loss at these depths and temperatures is thought to be tolerable with some degree of safety; however, it must be pointed out that temperatures only 2° and 3° Celsius colder are considered *hazardous*.

When a system that does not heat the breathing gas is used, it should be assumed that the gas is at water temperature. Therefore, the minimum safe inspired gas temperature curve sets a limit on diving depth in a given temperature water.

| FSW | °C | °F | FSW | °C | °F |
|---|---|---|---|---|---|
| 600 | −1.0 | 30.1 | 850 | 9.4 | 48.9 |
| 650 | 1.7 | 35.0 | 900 | 10.8 | 51.5 |
| 700 | 4.0 | 39.2 | 950 | 12.1 | 53.8 |
| 750 | 6.0 | 42.9 | 1000 | 13.3 | 55.9 |
| 800 | 7.8 | 46.1 | | | |

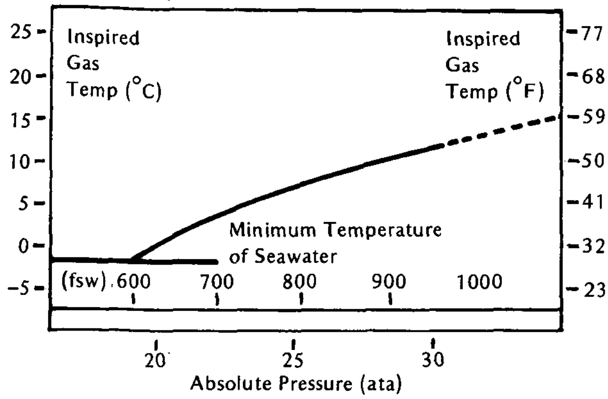



Figure 1: Minimum safe inspired gas temperature limits

Fire Protection

As a precaution against fire, the following procedures must be followed:

The fire suppression system must be in automatic at all times when in the fire zone, except during the showing of movies (see paragraph 7).

In the fire zone (shallower than 170 fsw), all non-essential items will be kept at a minimum and, when not in use, kept in a metal container.

While the chamber is between 170 fsw and the surface, reading material must be limited to one book per person.

Clothing must be limited to one set of personal clothes (in addition to flame-proof shirts/pants and coral shoes) when deeper than 170 fsw. Dry clothing will be exchanged for wet items as required via the transfer lock. When in the fire zone, flame-proof pants and shirts and coral shoes must be used. All personal clothing shall be locked out upon reaching 170 fsw during decompression.

Shallower than 170 fsw, all electrical equipment requiring higher than signal voltage/current must be secured.

Combustible items should be logged in the Service Lock Log as they go in and out of the chamber.

While showing movies, the Fire Suppression System must be in manual.

Personal effects shall be limited to tooth brush, tooth paste, razor, non-aerosol shaving cream, soap dish and soap, comb or brush, dental floss, writing material (10 sheets of paper), and pencil or pen.

DDC, Habitat, and PTC Atmosphere Control

The hyperbaric atmosphere in the saturation chamber and PTC should be controlled to maintain the gaseous components as follows:

Oxygen Partial Pressure—0.35 to 0.40 atmospheres (266 to 304 millimeters of mercury).

Carbon Dioxide Partial Pressure—Less than 0.0050 atmospheres (3.8 millimeters of mercury).

Nitrogen Partial Pressure—1.5 atmospheres (1,140 millimeters of mercury) or less.

Helium—Balance of total pressure.

Temperature—Should be regulated to the comfort of the divers. The transfer of heat away from or into the skin and respiratory tract of a diver at depth in a helium-oxygen environment is extremely rapid.

Relative Humidity—Should be maintained between 50 and 80 percent; 50 to 60 percent is the most desirable range for diver comfort and carbon dioxide scrubber performance.

Excursion Limits

The *Unlimited Duration Excursion Tables and Procedures for Saturation Diving* were developed to allow the diver a wide vertical range of working depths during a saturation dive. Within the depth limits of the tables, a diver may ascend or descend without regard to the number or duration of these excursions. The tables have no time limits, only depth limits.

The tables and procedures are for use with saturation diving depths between 150 and 1,000 feet of sea water. Excursions shallower than 150 feet have not been investigated and risk decompression sickness.

The rate of descent or compression should not exceed 60 feet per minute during an excursion. The rate of ascent or decompression during an excursion *must* not exceed 60 feet per minute. Whenever it is detected that a diver is ascending faster than 60 feet per minute, the diver should stop his ascent immediately and wait the time that should have been taken. He may then recommence his ascent or decompression at a rate not to exceed 60 feet per minute from that depth.

Two tables are provided for unlimited duration excursions. The first lists the limits for excursions *deeper* than a "chosen depth." The first column lists the diver's initial depth. The middle column lists the corresponding deepest excursion distance that the diver may descend from that initial depth. The third column is the sum of the initial depth plus the deepest excursion distance and *is the deepest excursion depth permitted.* To determine the deepest excursion distances for depths that lie between the initial depths listed, one should use the initial depth that corresponds to the shorter deepest excursion distance and the shallower deepest excursion depth.

EXAMPLES:

Problem 1: If a diver were at 370 fsw, how deep could he descend to work and return directly to 370 fsw?

Solution: 370 fsw has been chosen as the initial depth, and the unknowns are the deepest excursion distance and the deepest excursion depth. Reading across from 370 fsw in the initial depth column, the deepest excursion distance is 109 feet—the distance the diver may descend from his initial depth and return again. The diver may descend 109 feet deeper for any period of time and return directly to 370 fsw. His deepest excursion depth would be 370 + 109 feet or 479 fsw.

**UNLIMITED DURATION EXCURSION TABLE**

**Limits for Excursions DEEPER than a Chosen Depth**

| Initial Depth (FSW) | Deepest Excursion Distance (ft) | Deepest Excursion Depth (FSW) | Initial Depth (FSW) | Deepest Excursion Distance (ft) | Deepest Excursion Depth (FSW) |
|---|---|---|---|---|---|
| 150 | 75 | 225 | 490 | 128 | 618 |
| 160 | 77 | 237 | 500 | 130 | 630 |
| 170 | 78 | 248 | 510 | 131 | 641 |
| 180 | 80 | 260 | 520 | 133 | 653 |
| 190 | 81 | 271 | 530 | 135 | 665 |
| 200 | 83 | 283 | 540 | 136 | 676 |
| 210 | 84 | 294 | 550 | 138 | 688 |
| 220 | 86 | 306 | 560 | 139 | 699 |
| 230 | 88 | 318 | 570 | 141 | 711 |
| 240 | 89 | 329 | 580 | 142 | 722 |
| 250 | 91 | 341 | 590 | 144 | 734 |
| 260 | 92 | 352 | 600 | 146 | 746 |
| 270 | 94 | 364 | 610 | 147 | 757 |
| 280 | 95 | 375 | 620 | 149 | 769 |
| 290 | 97 | 387 | 630 | 150 | 780 |
| 300 | 99 | 399 | 640 | 152 | 792 |
| 310 | 100 | 410 | 650 | 153 | 803 |
| 320 | 102 | 422 | 660 | 155 | 815 |
| 330 | 103 | 433 | 670 | 156 | 826 |
| 340 | 105 | 445 | 680 | 158 | 838 |
| 350 | 106 | 456 | 690 | 160 | 850 |
| 360 | 108 | 468 | 700 | 161 | 861 |
| 370 | 109 | 479 | 710 | 163 | 873 |
| 380 | 111 | 491 | 720 | 164 | 884 |
| 390 | 113 | 503 | 730 | 166 | 896 |
| 400 | 114 | 514 | 740 | 167 | 907 |
| 410 | 116 | 526 | 750 | 169 | 919 |
| 420 | 117 | 537 | 760 | 171 | 931 |
| 430 | 119 | 549 | 770 | 172 | 942 |
| 440 | 120 | 560 | 780 | 174 | 954 |
| 450 | 122 | 572 | 790 | 175 | 965 |
| 460 | 124 | 584 | 800 | 177 | 977 |
| 470 | 125 | 595 | 810 | 178 | 988 |
| 480 | 127 | 607 | 820 | 180 | 1000 |

**UNLIMITED DURATION EXCURSION TABLE**

**Limits for Excursions SHALLOWER than the Deepest Depth of the Dive**

| Deepest Depth (FSW) | Shallowest Excursion Distance (ft) | Shallowest Excursion Depth (FSW) | Deepest Depth (FSW) | Shallowest Excursion Distance (ft) | Shallowest Excursion Depth (FSW) |
|---|---|---|---|---|---|
| 150 | 0 | 150 | 580 | 123 | 457 |
| 160 | 10 | 150 | 590 | 124 | 466 |
| 170 | 20 | 150 | 600 | 126 | 474 |
| 180 | 30 | 150 | 610 | 127 | 483 |
| 190 | 40 | 150 | 620 | 129 | 491 |
| 200 | 50 | 150 | 630 | 130 | 500 |
| 210 | 60 | 150 | 640 | 131 | 509 |
| 220 | 70 | 150 | 650 | 133 | 517 |
| 230 | 76 | 154 | 660 | 134 | 526 |
| 240 | 77 | 163 | 670 | 135 | 535 |
| 250 | 78 | 172 | 680 | 137 | 543 |
| 260 | 80 | 180 | 690 | 138 | 552 |
| 270 | 81 | 189 | 700 | 139 | 561 |
| 280 | 82 | 198 | 710 | 141 | 569 |
| 290 | 84 | 206 | 720 | 142 | 578 |
| 300 | 85 | 215 | 730 | 143 | 587 |
| 310 | 87 | 223 | 740 | 145 | 595 |
| 320 | 88 | 232 | 750 | 146 | 604 |
| 330 | 89 | 241 | 760 | 147 | 613 |
| 340 | 91 | 249 | 770 | 149 | 621 |
| 350 | 92 | 258 | 780 | 150 | 630 |
| 360 | 93 | 267 | 790 | 152 | 638 |
| 370 | 95 | 275 | 800 | 153 | 647 |
| 380 | 96 | 284 | 810 | 154 | 656 |
| 390 | 97 | 293 | 820 | 156 | 664 |
| 400 | 99 | 301 | 830 | 157 | 673 |
| 410 | 100 | 310 | 840 | 158 | 682 |
| 420 | 101 | 319 | 850 | 160 | 690 |
| 430 | 103 | 327 | 860 | 161 | 699 |
| 440 | 104 | 336 | 870 | 162 | 708 |
| 450 | 105 | 345 | 880 | 164 | 716 |
| 460 | 107 | 353 | 890 | 165 | 725 |
| 470 | 108 | 362 | 900 | 166 | 734 |
| 480 | 110 | 370 | 910 | 168 | 742 |
| 490 | 111 | 379 | 920 | 169 | 751 |
| 500 | 112 | 388 | 930 | 171 | 759 |
| 510 | 114 | 396 | 940 | 172 | 768 |
| 520 | 115 | 405 | 950 | 173 | 777 |
| 530 | 116 | 414 | 960 | 175 | 785 |
| 540 | 118 | 422 | 970 | 176 | 794 |
| 550 | 119 | 431 | 980 | 117 | 803 |
| 560 | 120 | 440 | 990 | 179 | 811 |
| 570 | 122 | 448 | 1000 | 180 | 820 |

The second table lists the limits for excursions *shallower* than the deepest depth of the dive. The first column lists depths between 150 and 1,000 fsw, defined as the deepest depth attained at any time during the dive. The middle column lists the corresponding shallowest excursion distance the diver may ascend from the deepest depth of the dive. The third column is the deepest depth of the dive minus the shallowest excursion distance and is the shallowest excursion depth permitted. To determine the shallowest excursion depth for depths that lie between the deepest depths listed, one should use the deepest depth that corresponds to the deeper shallowest excursion depth.

EXAMPLES:

Problem 1: If a diver is at 270 fsw and has been no deeper during the entire saturation dive, what is his limit for an excursion ascent?

Solution: The diver's deepest depth of the dive is 270 fsw. Reading across to the shallowest excursion distance column, the limit is a distance of 81 feet. This is 81 feet shallower than his starting depth of 270 fsw and corresponds to the shallowest excursion depth limit of 189 fsw. The diver may make excursions to 189 fsw without regard to the number or duration of these excursions.

Dive operations and DDC or habitat depths should be planned using the graph of the Unlimited Duration Excursion Tables (Figure 2). Normally, the saturation chamber (DDC or Habitat) will be at a depth convenient for the work site depth, planned excursion distances, and umbilical lengths. The PTC should be as close to the work site as possible and umbilical lengths should be chosen so that uncontrolled ascents, such as loss of buoyancy control, will not allow the diver to ascend above the limits for excursions *shallower* than the deepest depth of the dive.

Figure 3 illustrates in Cases 1 and 2 how the PTC can be positioned at a depth such that the length of umbilical will prevent the diver from exceeding the shallowest excursion depth. For example, the deepest depth of the dive has been 260 feet. The PTC may be positioned anywhere in the water column from 260 feet to the shallowest excursion depth—180 feet. If an 80-foot horizontal excursion were required, the PTC should be positioned at 260 feet. In this case, if the diver ascended out of control, he could not exceed the ascent limit. More practically, the PTC will be positioned near the middle of the water column, allowing both ascents and descents as required. Case 3 illustrates the worst case. The PTC is located at the shallowest excursion depth. The diver making an 80-foot descent from the PTC could rise 80 feet above the ascent limit if his ascent were uncontrolled.

UNLIMITED DURATION EXCURSION TABLES

Limits for excursions DEEPER than any chosen depth are measured downward from that depth on the ASCENT LIMIT LINE to the DESCENT LIMIT LINE.

Limits for excursions SHALLOWER than the deepest depth of the dive are measured upward from that depth on the DESCENT LIMIT LINE to the ASCENT LIMIT LINE.

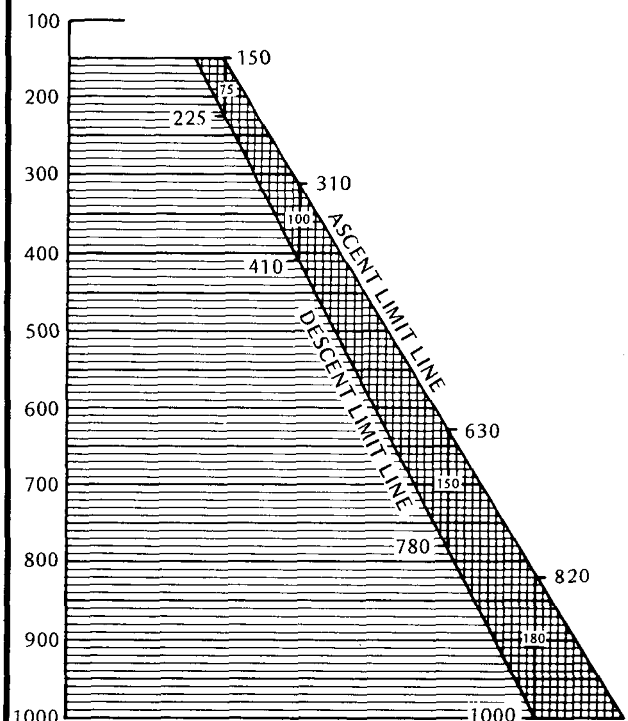



Figure 2: Unlimited Duration Excursion Tables.

Standard Saturation Decompression

Standard saturation decompression may commence without delay following any excursion deeper or shallower within the limits of the excursion tables. Additionally, saturation decompression may be initiated by an ascent within the limits for excursions *shallower* than the deepest depth of the dive. For example, if the deepest depth attained by any diver during the course of a saturation dive were 1,000 feet, saturation decompression may be initiated by an ascent to 820 feet at a rate not to exceed 60 feet per minute. Following an excursion shallower than the deepest depth of the dive, standard saturation decompression rates and schedules govern the remainder of the decompression.

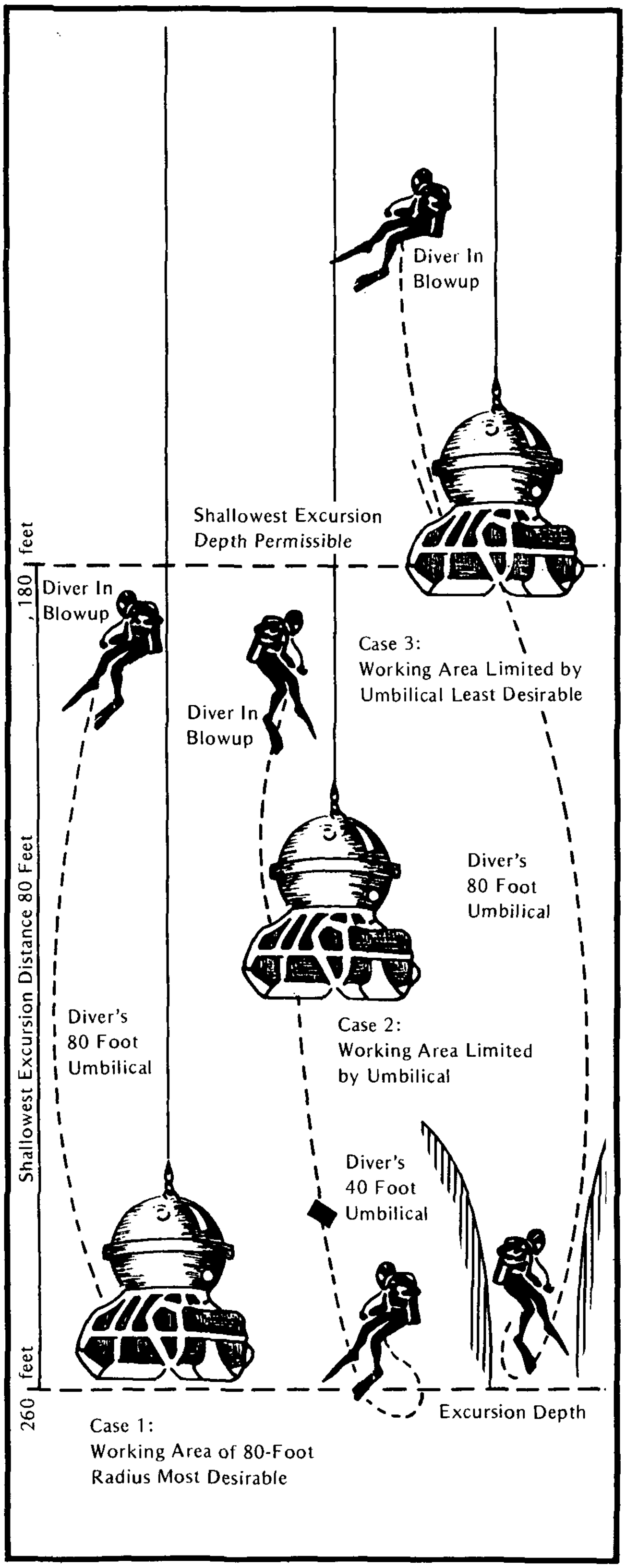



Figure 3: Diver blowup relative to PTC depth and shallowest excursion depth.

## Decompression Sickness Treatment

Decompression sickness during saturation diving may result from excursion ascents or may be associated with the Standard Saturation Decompression. In the U.S. Navy, decompression sickness manifesting during saturation decompression is common and has been characterized by musculoskeletal pain alone. The onset is usually gradual and generally occurs while the diver is still under pressure. However, decompression sickness resulting from excursion ascents may be more severe and may involve the cardiorespiratory system, the central nervous system, and the organs of special sense.

Serious decompression sickness resulting from an excursion ascent should be treated by immediate recompression at 30 feet per minute to at least the depth from which the excursion ascent originated. If there is not complete relief at that depth, recompression should continue deeper until relief is accomplished.

Decompression sickness manifested only as musculoskeletal pain and occurring during Standard Saturation Decompression should be treated by recompression in increments of 10 feet at 5 feet per minute until distinct improvement is indicated by the diver. In most instances, improvement continues to complete resolution of the symptoms. Recompression more than 30 feet is usually not necessary and causes increasing pain in some cases.

During recompression and at treatment depth, a treatment mixture may be given by mask to provide an oxygen partial pressure of 1.5 to 2.5 atmospheres. Pure oxygen may be used at treatment depths of 60 feet or less. The mask treatment should be interrupted every 20 minutes with 5 minutes of breathing the chamber atmosphere.

A stricken diver should remain at the treatment depth a minimum of 12 hours in serious decompression sickness and a minimum of 2 hours in pain-only decompression sickness. The Standard Saturation Decompression Schedule can then resume from the treatment depth. However, excursion ascents must not be performed.

*WARNING*

*RE SATURATION EXCURSION DIVING TABLES*

*It is important to note that only limited operational experience has been attained with these innovative tables and procedures. Operational planning must include provision for handling possible casualties by experienced personnel.*

LTJG T. B. Stark
*Harbor Clearance Unit One*

BMCM(MDV) Richard "Blackie" Villasenor retired from the U.S. Navy on December 30, 1976, after completing over 32 years of service. The retirement ceremony was conducted at Harbor Clearance Unit ONE, Pearl Harbor, Hawaii, aboard YRST-1.

Chief Villasenor (r.-center) says farewell.

Master Chief Villasenor's past contributions to and accomplishments in the area of diving and salvage are numerous. Perhaps his most noteworthy personal achievement was his record open sea dive to 440 feet of seawater in the Advanced Diving System IV (ADS-IV), which earned him the Navy Achievement Medal. Master Chief Villasenor was assigned to Harbor Clearance Unit ONE in December 1974. His duties at HCU-1 were primarily concerned with organizing and supervising the salvage and diving training of all the salvage ship personnel under the command of Commander, Service Squadron FIVE. Attendees at Master Chief Villasenor's retirement ceremonies included the Commander, Naval Surface Group MIDPAC; Commander, Service Squadron FIVE; Commanding Officer, Harbor Clearance Unit ONE; Commanding Officers of most of the diving and salvage ships in port at the time; all of the Master Divers in the area; and numerous Chief Petty Officers who have known "Blackie" for many years. "Blackie" plans to remain in Hawaii; where he is currently awaiting a position in the Pearl Harbor Naval Shipyard.

L-r: Mr. J. McCarthy and CDR Ringelberg.

Mr. James W. McCarthy, Special Assistant for Hyperbaric Systems at the Navy Experimental Diving Unit in Panama City, Florida, was presented with the Navy Superior Civilian Service Award during the NEDU Change of Command ceremony on March 4, 1977 (see page 12). CDR J. Michael Ringelberg, USN, NEDU's outgoing Commanding Officer, awarded the medal to Mr. McCarthy in recognition of his outstanding contributions in all aspects of NEDU's Ocean Simulation Facility and Experimental Diving Facility. His efforts have been instrumental in the progress of these two facilities from the time of their initial construction through present manned diving experiments.

Mr. McCarthy has performed as designer, test engineer, and construction supervisor; and he has also been involved in related planning on all dives. In addition, he has been an integral figure in the extensive liaison efforts with other Navy activities and industrial concerns that have been necessary in the construction, test, and operation of the NEDU complex.

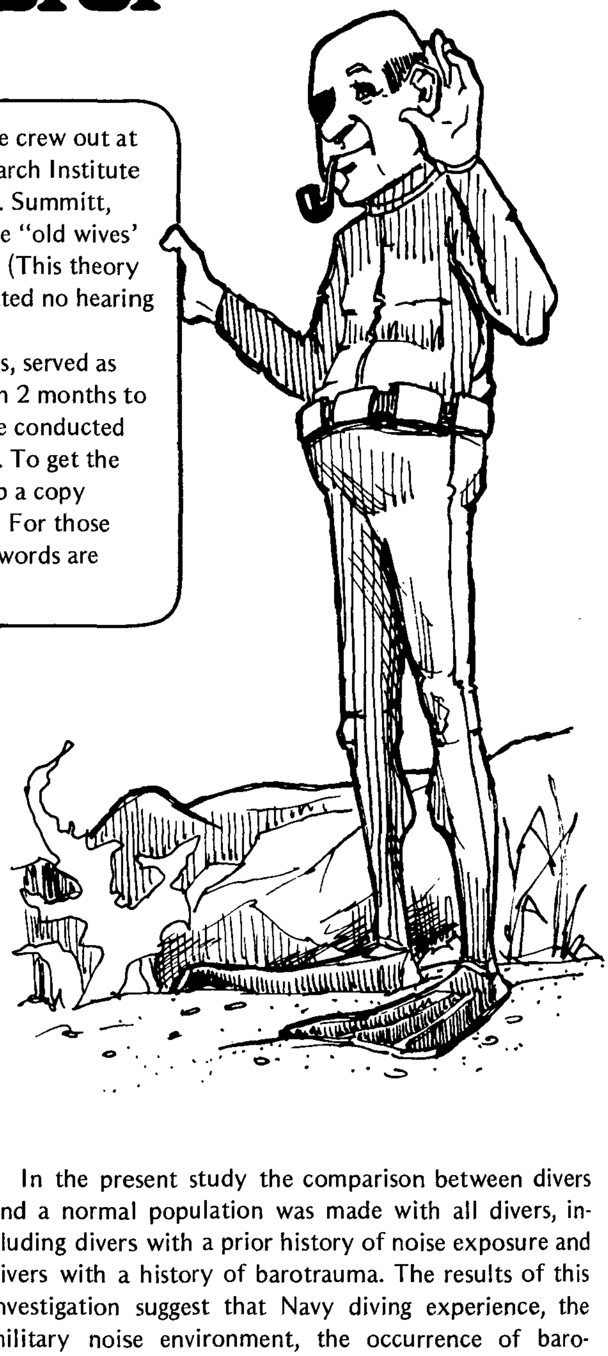
He was the key figure in the reconfiguration of the OSF in order to obtain certification. This project was estimated, scheduled, and executed under his direction, using Navy in-house capabilities with moderate contractor support. The cost of the project was within the estimate; and the accomplishment was 6 months earlier than the estimated time. This enabled NEDU to continue its work without delay on a series of programs vital to the Navy's diving mission.

Mr. McCarthy is also credited with the management and execution of the system certification requirements of the OSF. He has contributed significantly to the continuing maintenance and upgrading of the facility to keep it current with the state-of-the-art in test and evaluation and to keep it responsive to varying requirements.

The citation, which was signed by VADM C. R. Bryan, Commander Naval Sea Systems Command, included the following remarks:

> You are the single key figure responsible for attaining this unique testing facility and maintaining it so it is supportive of ongoing research and development. Your tireless dedication is appreciated and you are deserving of the Navy Superior Civilian Service Award. 'Well Done!'

# The Old Master



I received a real interesting research report recently from the crew out at the Behavioral Sciences Department at the Naval Medical Research Institute in Bethesda, Maryland. It seems that Mr. J. I. Brady, CDR J. K. Summitt, and LCDR T. E. Berghage have done some good research on the "old wives' tale" that all of us divers have a high frequency of hearing loss. (This theory has persisted even though two previous studies have demonstrated no hearing loss in *select* diver populations.)

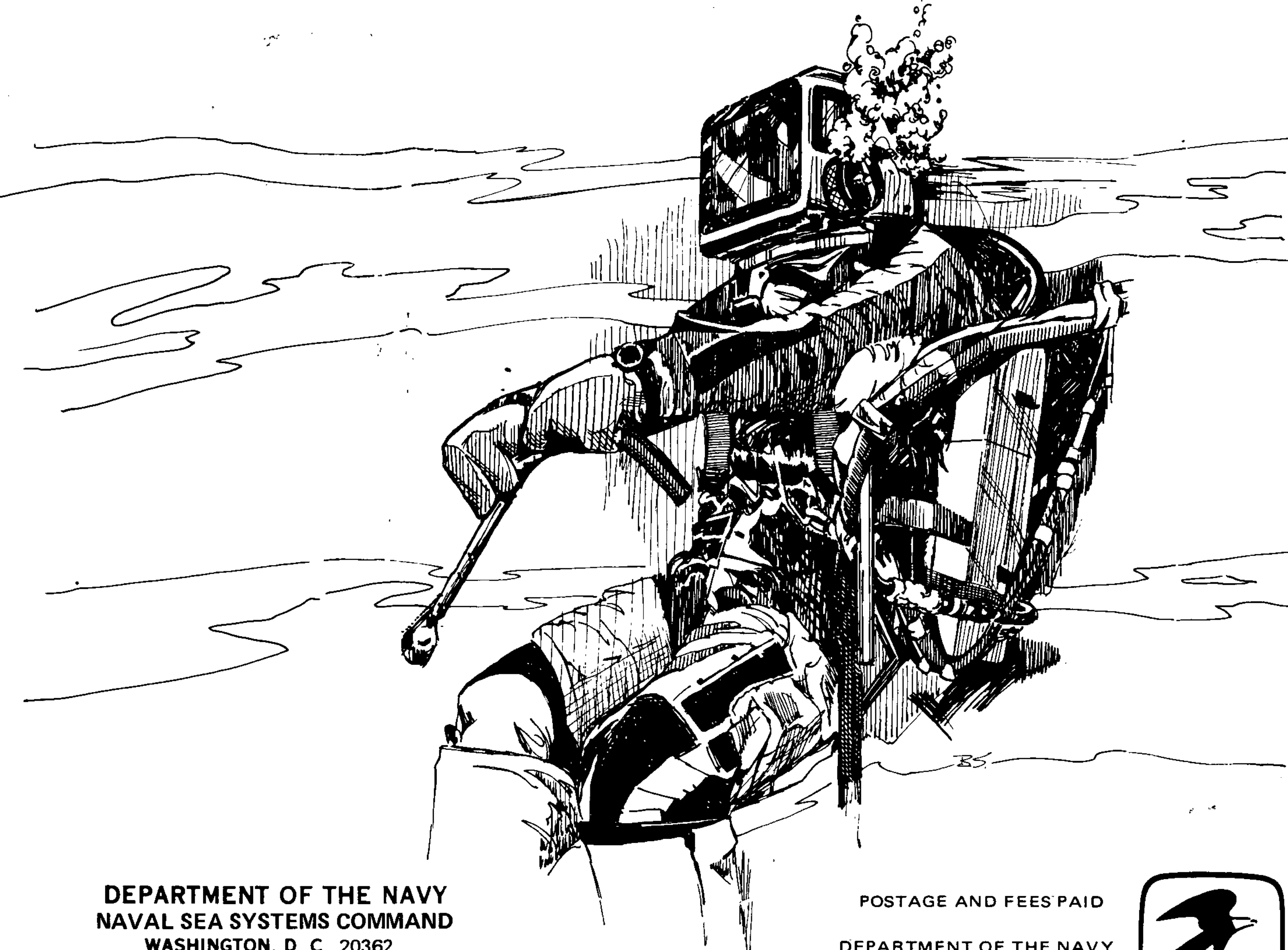
Ninety-seven Navy divers, ranging in age from 20 to 43 years, served as the subjects in their study. This group included individuals with 2 months to over 10 years of diving experience. All of the hearing tests were conducted at the Navy Experimental Diving Unit in Panama City, Florida. To get the complete story on the details of this study, y'all should pick up a copy of *Undersea Biomedical Research* (Vol. 3, No. 1, March 1976). For those interested in just the conclusions, read on, the following good words are straight from the authors' pens:

Although the number of years of diving experience is related to hearing sensitivity, *it has a minor effect*. Also, *previous noise exposure had little effect on the present measured thresholds of these divers*. Thus, the findings of the present study differ from that of Coles (1963) in that Coles achieved audiometric equivalence in both a diving population and a normal population *only* when those individuals with considerable prior noise exposure were removed from the diver sample.

Investigators in the present study did not detect a significant difference in divers with a prior history of barotrauma and those without such a history. This suggests that, while acute barotrauma may affect auditory sensitivity, it does not permanently retard the hearing of divers unless the injury is severe. This finding is consistent with the results of a study by Coles and Knight (1961).

This survey indicated that the type of diving equipment used has no effect on the subsequent hearing sensitivity of the divers who use it. A general comparison of these divers with a normal population determined that this sample of divers *did not differ significantly from a normal sample of nondivers matched by age*. This is interesting in light of the study by Shilling and Everley (1942) in which only "pure" divers—that is, divers with a negative history of acoustic trauma—were found to be equivalent to a normal group of nondivers.

In the present study the comparison between divers and a normal population was made with all divers, including divers with a prior history of noise exposure and divers with a history of barotrauma. The results of this investigation suggest that Navy diving experience, the military noise environment, the occurrence of barotrauma, and the type of diving equipment used can all affect the auditory sensitivity of U.S. Navy divers; however, *this change in sensitivity is relatively unimportant from an audiometric standpoint*. These variables, either alone or combined, did not produce a deviation of sufficient magnitude to differentiate divers from a normal population.



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