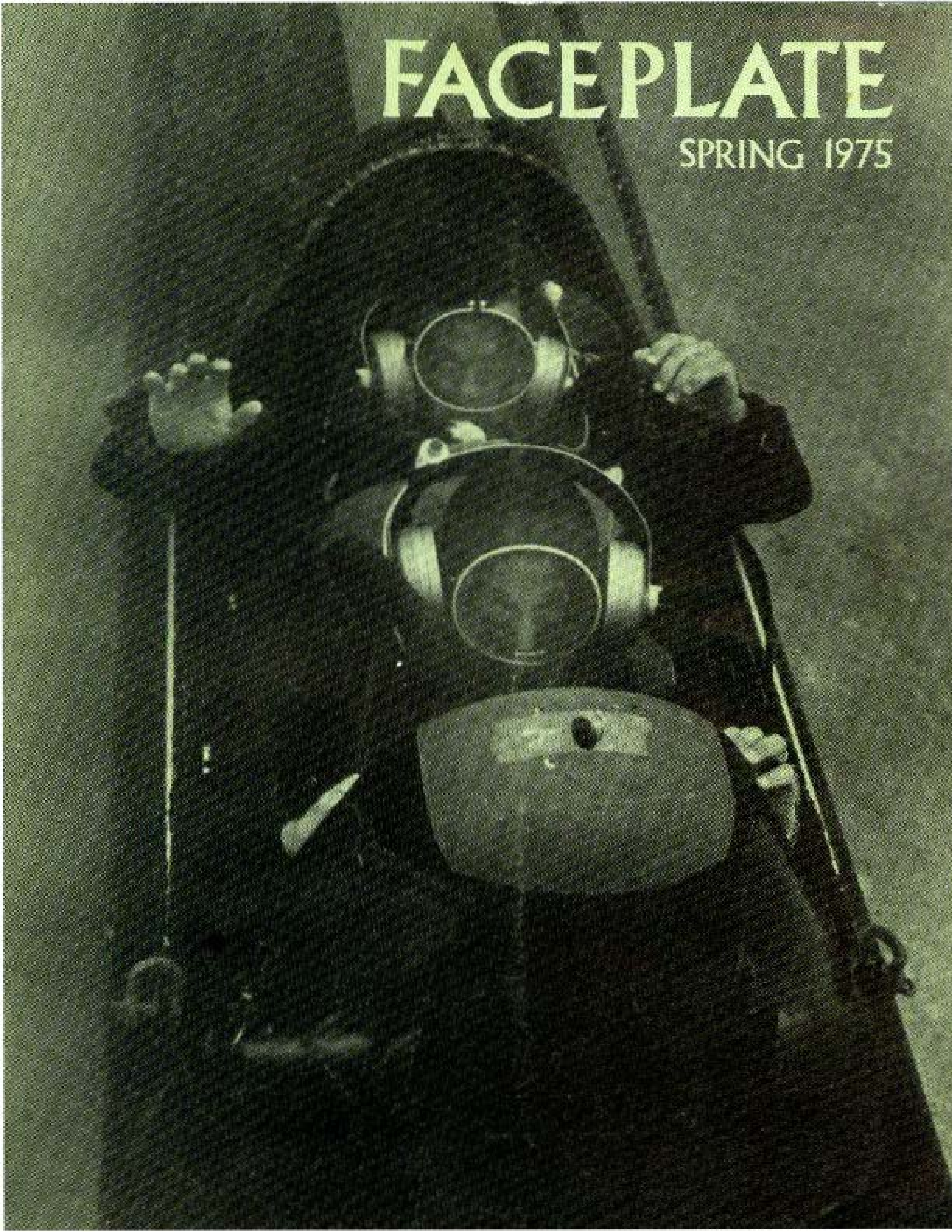
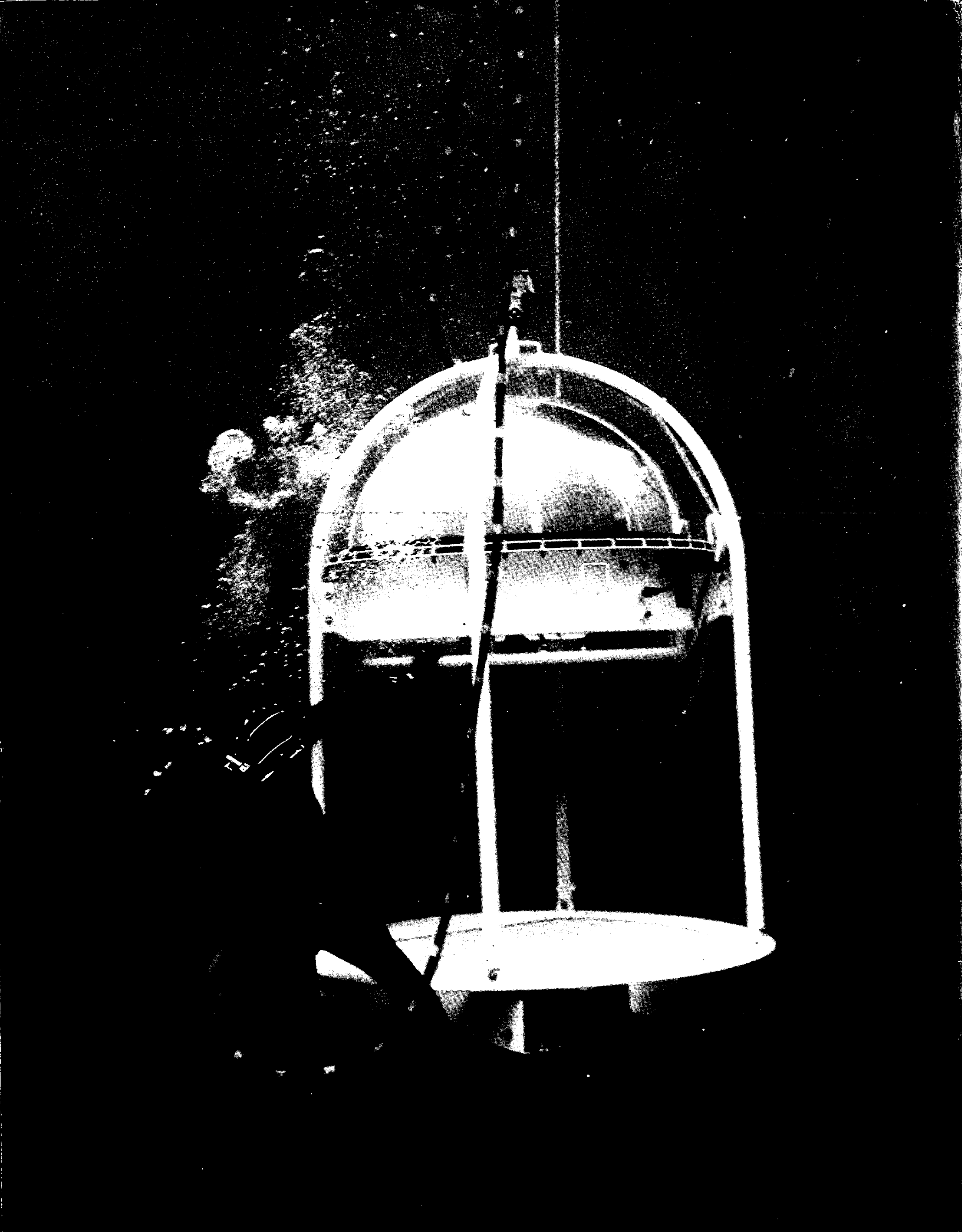
FACEPLATE

SPRING 1975





FACEPLATE

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

VOLUME 6, NO. 1

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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The front cover shows two divers in the SDV Mk VII, using the prototype MOD 1500 UBA and SUBCOM communicator. See story on page 26.
The inside front cover shows an Open Diving Bell with its occupants exiting the vehicle at depth. See story on page 20.

SOUNDINGS

AN OPEN LETTER TO ALL DIVERS:

As the focal point for all diving activities within the diving community, the Office of the Supervisor of Diving assumed the responsibility of publishing *Faceplate* and expanding the magazine's format to provide broader coverage of Navy diving efforts. Since that time, the magazine has steadily grown in size and improved in appearance and technical content. However, there should be two general areas of coverage presented in each issue – the "headquarters" news of Washington, D.C., and the "field" news of fleet efforts. The quantity of this second, but most important, area is determined to a great extent by you out in the fleet. We need to hear from you – perhaps about a program your unit is involved in, or an individual in your outfit who has received special recognition, or the role your activity plays in the U.S. Navy diving community.

Faceplate will continue to publish the latest information on diving technological progress and new equipment and procedures; but your news input of experiences and fleet efforts must also be an integral component of the magazine. Don't wait to be contacted; *Faceplate* is *your* publication, and we must and should have your continuous active response.

Don't rule out critical or editorial type inputs!

J.H. Boyd Jr

J.H. Boyd, Jr.
CAPT, USN
Director of Ocean Engineering,
Supervisor of Salvage

DIVING SYMPOSIUM DISPLAYS TECHNOLOGY ADVANCEMENTS

The Fifth Annual International Diving Symposium was held on January 21-22, 1975, in Morgan City, Louisiana. Co-sponsored by the Marine Technology Society and the Association of Diving Contractors, the program featured a wide range of topics relevant to the recent developments in diving technology.

Papers that were presented dealt with subjects such as diver training, insurance, emergency medical treatment, diving operations (including construction procedures), deep diving technology, equipment, and safety standards—federal and state.

Two papers were presented on the Suez Canal clearance. CAPT J.H. Boyd, Jr., discussed the wreck removal operation, and CDR D. Moody spoke on the EOD efforts involved in the overall Canal clearance project.

UCT-1 KEEPS 94.3% OVER 2 YEARS

Eight men from Underwater Construction Team ONE (UCT-1) collected $55,500.00 for reenlistment bonuses, which represents a 94.3% retention rate over a 2-year period. Pictured right, left to right: Standing: LT M.E. Weyler, OIC; BU2(DV) John H. Bond; CE1(DV) William H. Blanchard; BU2 (DV) Robert J. Polley; BU2(DV) Phillip M. Pronia. Kneeling: BU1(DV) James H. Mills; BUC(DV) Richard B. Scott; BU2(DV) Gerald J. Butler; SW2(DV) Ernest E. Ward.

LCDR HAWKINS DEPARTS NEDU

Effective March 31, 1975, LCDR Thomas L. Hawkins, USN, detached from the Navy Experimental Diving Unit to assume the duty of Executive Officer, Underwater Demolition Team 21, Little Creek, Virginia. Since April 1972, LCDR Hawkins has served as the UDT/SEAL Liaison Officer at NEDU. While stationed at NEDU, he also took on the duties of Officer-in-Charge (Acting) from September 1974 through December 1974. LCDR Hawkins terminated his tour in Washington, D.C., as the Assistant for Special Units in the Office of the Supervisor of Diving, Naval Sea Systems Command.

Faceplate extends best wishes to its former Assistant Editor-in-Chief in his new position in Little Creek, Virginia.

IT'S A BOY(S)!

Congratulations go in triplicate to ENC(DV) Edward Landstra and his wife Nancy. On February 25, 1975, Patrick Edward, Bryan Edward, and Michael Edward Landstra were born at the Bay Memorial Hospital in Panama City, Florida. The Landstras already have a 17-month-old daughter, Kelly Lynn. ENC(DV) Landstra is on duty at the Navy Experimental Diving Unit Detachment, Panama City.

HTC PULLIAM RETIRES

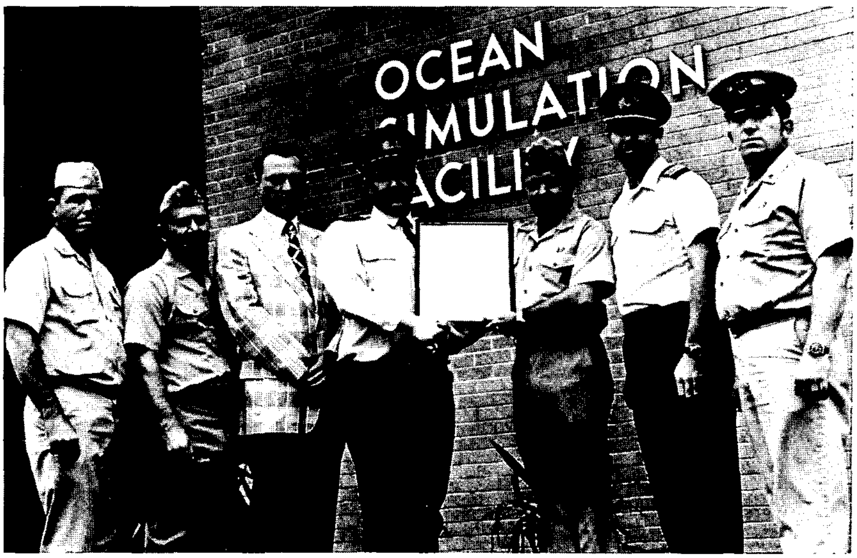
After 20 years of service in the United States Navy, HTC Larry Pulliam retired on February 7, 1975. During the ceremony, plaques were presented by LCDR John F. McColgan, Commanding Officer of Harbor Clearance Unit TWO, and by Master Diver Tyrone Goacher, Officer-in-Charge of the YDT-16/Mk 1 DDS. Shown below, LT Robert Lusty, RN, United Kingdom Exchange Officer, awarded the Navy Achievement medal to HTC Pulliam for his dedicated service as Engineer Officer, YDT-16/Mk 1 DDS, for the past 5 years.

CANADIAN OFFICERS MEET AT NEDU DETACHMENT, PANAMA CITY, FLORIDA

Four Canadian Diving Officers met with USN Officers at NEDU, Panama City, Florida, from January 6-10, 1975. Representing the Canadian Forces were: LCDR Frederick E. Cox, CF, Officer-in-Charge of the Diving Division of the Canadian Defence and Civil Institute of Environmental Medicine in Toronto, Ontario, Canada; LCDR Ferguson Finlay, CF, on the Canadian Defense Liaison Staff, Washington, D.C.; and LT Peter E. Hill, CF, Canadian Exchange Officer assigned to the U.S. Navy Explosive Ordnance Disposal Facility, Indian Head, Maryland, as Director, Diving Operations Division. These three officers joined LCDR Barry A. Ridgewell, CF, an Exchange Officer assigned as a Project Manager with NEDU, Panama City, for an in-depth review of existing joint diving projects.

The visiting group participated in the Underwater Ship Husbandry Workshop, which was held at the Naval Coastal Systems Laboratory on January 7 and 8, 1975 (see page 6), and attended the Experimental Diving Facility ground-breaking ceremony on January 8 (see page 18). In addition, they met with senior U.S. Navy officials of Naval Sea Systems Command, who also attended the Workshop and Ceremony, and with their counterparts in NEDU Det., Panama City, and NCSL.

Below: LCDR Cox (center, left) presents the insignia of the Canadian Defense Research Institute to LCDR J.M. Ringelberg, USN, Officer-in-Charge, NEDU Detachment, Panama City. Left to right: HMCM(DV) P.J. Heckert, USN, NEDU; LCDR M.A. Paul, USN, Executive Officer, NEDU; LT P.E. Hill, CF; LCDR F.E. Cox, CF; LCDR J.M. Ringelberg; LCDR B.A. Ridgewell, CF; and EMCM(DV) R.K. Merriman, USN, NEDU.

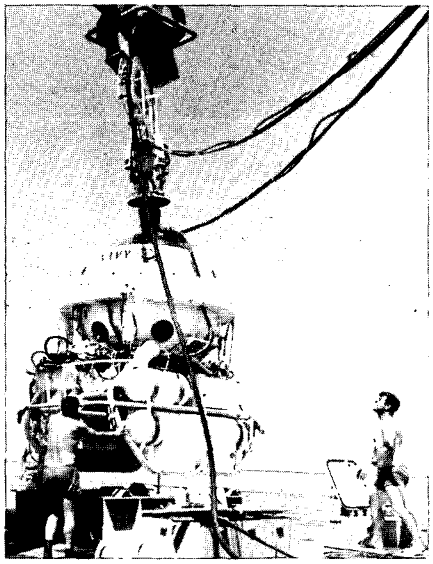


ACTIVE SUMMER PLANNED FOR MK 1 DEEP DIVE SYSTEM

One-thousand-foot certification and combining United States and United Kingdom diving operations as part of an information exchange program are the goals as Harbor Clearance Unit TWO prepares to deploy the YDT-16/Mk 1 Deep Diving System (DDS) to the Gulf of Mexico off Panama City, Florida.

Under the guidance of exchange officer LT Robert G. Lusty, RN, and Master Diver BMC(DV) Tyrone Goacher, the YDT-16/Mk 1 DDS is scheduled to deploy in March and receive final certification to 1,000 feet by May 1975.

Upon completion of certification, the U.S. Navy crew will be joined by the British Saturation Diving Team, led by LCDR Peter Cobby, RN, LT Robert Wells, USN, and Fleet Chief Nobby Clark, RN. LCDR Cobby was a former Officer-in-Charge of the Mk 1 DDS, and Fleet Chief Clark participated in the Sea Lab program. The combined operations period will occur from May through September 1975, and will include operational dives as well as the exchange of concepts and information.



Right: Mk 1 DDS undergoes a workout aboard YDT-16.

NAVSEA Underwater Ship Husbandry Workshop-1975

The Naval Sea Systems Command's Underwater Ship Husbandry Workshop, sponsored by the Supervisor of Diving, convened at the Naval Coastal Systems Laboratory, Panama City, Florida, January 7 and 8, 1975. Featuring the latest tools and techniques used in underwater ship support, the 2-day workshop was well-attended by military and civil service personnel involved in waterborne ship repair, maintenance, and inspection. Navy activities around the world were represented, affording an exchange of ideas among old friends as well as an opportunity to meet others in the same areas of interest.

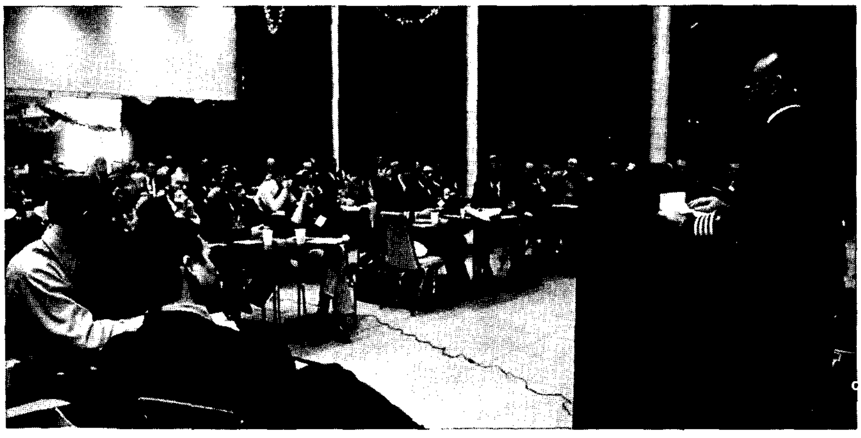
NCSL and SUPDIVE personnel are now compiling the great amount of information, conclusions, and recommendations generated by the eight working groups in the following areas: Diver tools; underwater cutting and welding; cleaning of hulls and sonar domes; propeller changes; underwater paint and adhesives; shallow water diving gear and inspection systems; zinc changes, blanks, and cofferdams; and submarine work and ship design changes.

The information gathered will form a guideline for management and technical personnel in planning future underwater ship husbandry programs. Hopefully, the data from the Workshop will help solve existing problems in the field and increase the capabilities of the working diver.

All attendees will receive a copy of the minutes of the workshop. Others who wish to receive a copy of the minutes should direct their request to: Commanding Officer, Naval Coastal Systems Laboratory, Code 710.5, Panama City, Florida 32401.

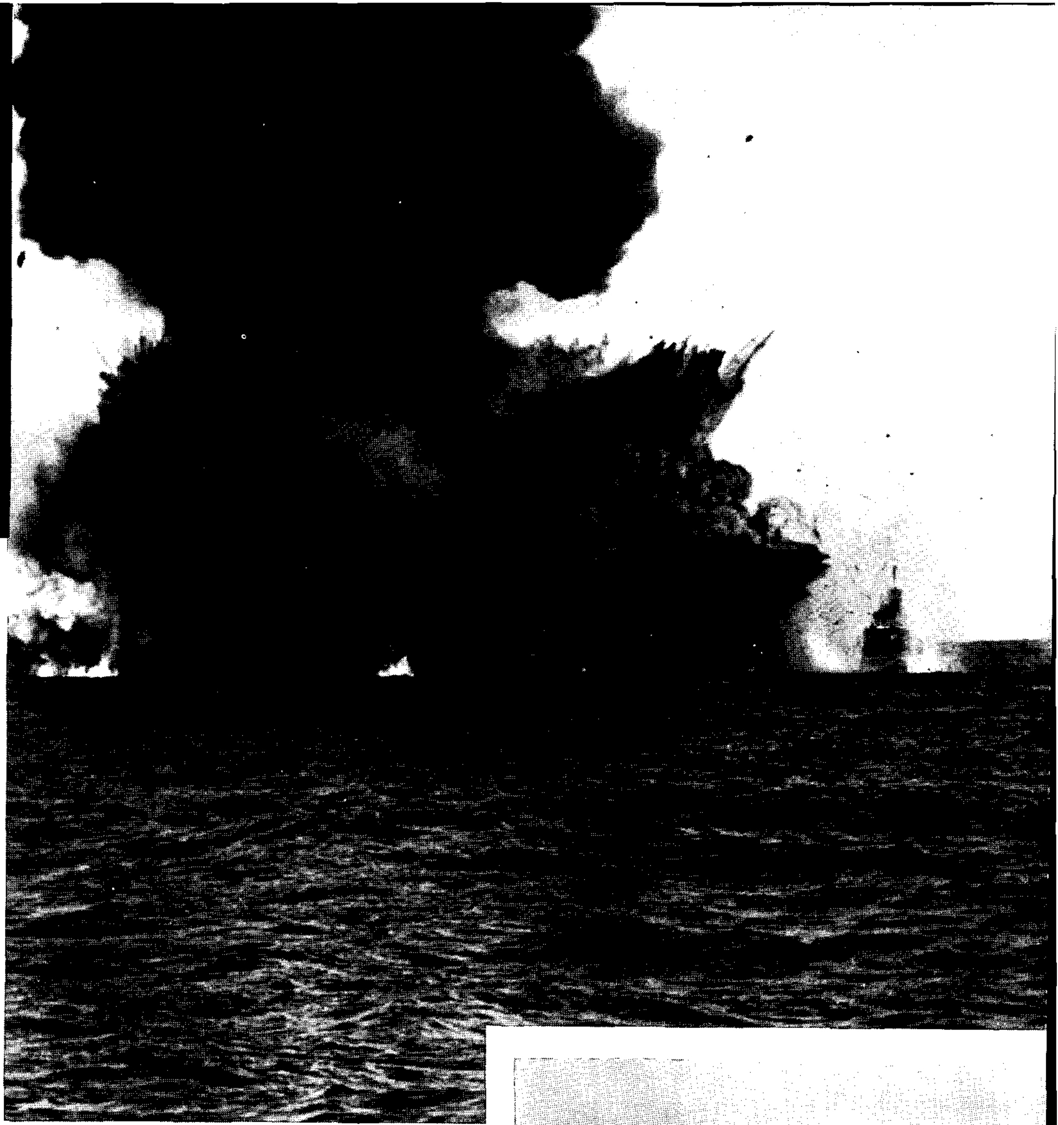
A summary of the Workshop's findings will be presented in the next issue of *Faceplate*.

Below: CAPT J. H. Boyd, Jr., addresses workshop attendees in Panama City, Florida.



HCU-2 Sinks Ships

LT Glenn D. Thomson
Harbor Clearance Unit TWO



Harbor Clearance Unit TWO has been sinking ships off the coast of Virginia. As part of a community interaction program, the Virginia Marine Resources Commission and HCU-2 are building artificial reefs from old LIBERTY hulls in hopes of attracting fish for both commercial and sport fishing interests.

The two sites selected for the reefs have each received one hull to date. One site is 8 miles east of Watchepreague, Virginia, off Virginia's eastern shore, which will receive another hull. The other is 35 miles east of Cape Henry Light, and will receive three more ships. The six LIBERTY hulls were donated from the Naval Reserve Fleet.

Preparation of the hulls includes removal of the superstructure and first deck, and thorough cleaning and purging of all spaces and tanks. This creates an ecologically safe structure on which marine growth may propagate. Inspection by the Environmental Protection Agency after the hulls are cleaned is mandatory.

Precision placement of the hulls is required for hydrographic reasons; and this is accomplished by holding the hull in a presurveyed area with a stern anchor and a commercial tug. Charges are then placed to penetrate the sides and bottom of the hull below the waterline. This placement of charges allows a safety zone forward of the bow for the tug and one aft of the stern for the demolition team and observation boats.

Studies done on other artificial reef sites in Alabama, Florida, Georgia, and North Carolina, indicate that it takes approximately 1 year for a reef to "mature." This maturation is achieved when sufficient marine growth has become available to sustain small fish indigenous to the area. Small fish attract larger fish, and the result is a predictable concentration in and about the artificial reef, thus enhancing the commercial and sport fishing industry.

HCU-2 personnel involved in the latest sinking were LCDR J. F. McColgan, Commanding Officer; LT Glenn D. Thomson, Executive Officer; BMCS (DV) John B. Davis; HTC(DV) Arthur Connors; HT2(DV) Jack A. Neal and EM1(DV) Ronald N. Scribner.

Photo above shows the detonation of charges on the hull.
Photo at right shows the hull beginning to disappear below the surface.

RUWS to Extend Navy's Depth Capability

In an effort to respond to fleet needs, the U.S. Navy's Deep Ocean Technology Project has developed technologies and systems required to perform work, search, recovery, and documentation in a deep ocean environment. The Remote Unmanned Work System (RUWS) represents one of the recent advances of this program. RUWS is an unmanned, cable-tethered work system designed to perform a variety of engineering and scientific tasks at depths to 20,000 feet. Features of the system include a 20,000-foot operational depth, an ability to operate from ships of opportunity (primarily specific classes of ATS, ARS, and ATF ships), rapid deployment, and a 5-day endurance capability in sea state four conditions. Further, RUWS may be transported aboard C-141 aircraft.

The RUWS design emphasizes the extension of man's senses to the seafloor environment. The simulation of man's presence in the vehicle is accomplished primarily through the use of head coupled television (the TV camera on the vehicle follows the head motion of the operator); force feedback from the manipulator so the operator can "feel"; and integrated displays and controls allowing the operator to control movement of the primary cable termination and the vehicle with a minimum of learning or conscious thought. The controls of the system are located in and operated from a van situated on the support ship. Normal operation of the vehicle requires two trained personnel.

The system is divided into the following five major subsystems: Motion compensated deck handling system (MCDHS), primary cable, primary cable termination (PCT), vehicle tether, and the vehicle.

Located on the deck of the support ship, the motion compensated deck handling system is responsible primarily for the launch and recovery of the system. The crane of the MCDHS is a rotating gantry with traveling carriage. The compensating feature enables operational effectiveness in up to sea state five conditions.

The 22,500-foot cable, which has a breaking strength of 80,000 pounds, is an armored electromechanical cable with a single coaxial core. This allows simultaneous transmission of power and control data between the support ship and the vehicle. The commercial name of the primary cable strength member is KEVLAR-49.

The primary cable termination (PCT) has several essential functions. The PCT serves as a docking/undocking platform for the vehicle, providing an efficient launch/recovery package and allowing a flexible work unit for bottom operation. The PCT provides transition from the primary cable to a flexible tether; the required weight at the end of the cable; position control and station; and storage for some components of the system, which results in a lighter and more flexible vehicle. The PCT measures 75 inches high by 58 inches wide by 115 inches long, and has an in-air weight of 5,000 pounds.

The vehicle tether is an oil-filled 850-foot flexible, lightweight, power-conducting cable. The tether allows free movement of the vehicle while on the ocean bottom, and provides the capability to transmit the necessary data between the vehicle and the support ship.

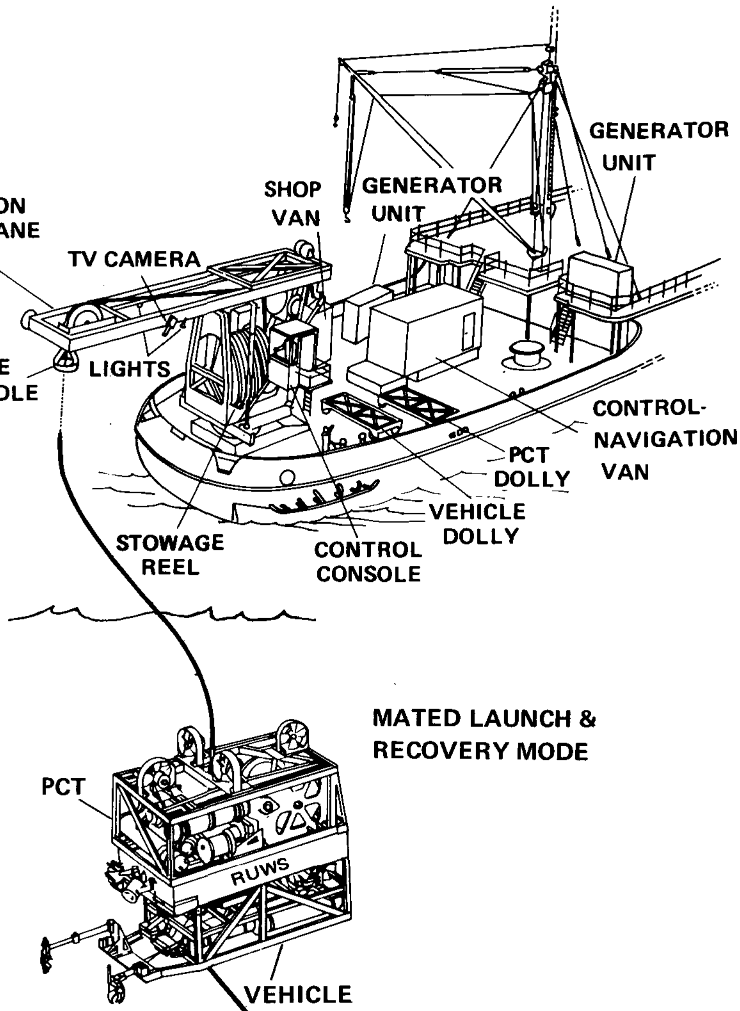
The vehicle is the "work suit" of the system, and it serves as an ocean floor extension of the operator. The vehicle is 57 inches high by 55 inches wide by 132 inches long, with an in-water weight of 10-20 pounds. Being the work unit of the system, the vehicle is equipped with several sophisticated sensors and equipment to carry out its tasks. Included among the features of this unit are 4 degrees of freedom maneuverability, inspection with real time TV, documentation with a

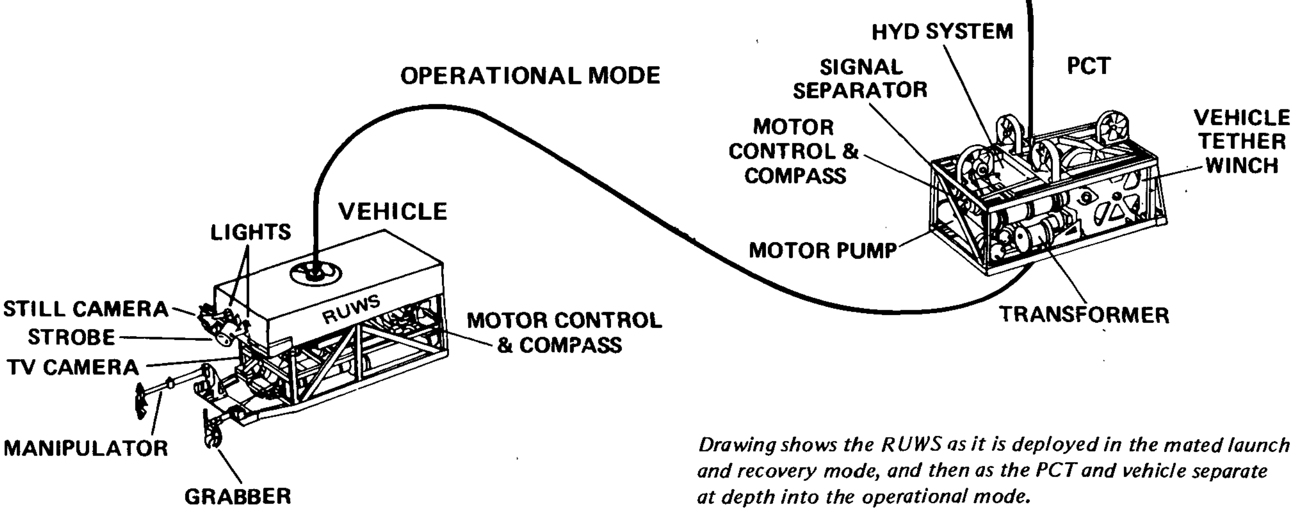
to 20,000 Feet

70-mm camera, and acoustic search with high resolution sonar. It also has the operational capability in a 1-knot current; it may work with manipulators and tools; and it is able to perform small-object recovery.

The RUWS is launched in the mated mode. Once at depth and on site, the vehicle is released from the PCT and connected only by the tether. Operated by trained personnel in the control van, the RUWS vehicle is controlled by a command control center, navigation equipment, and power generator units located on the support ship.

The vehicle, PCT, and the cable have undergone pressure testing in Annapolis, Maryland, to simulated depths of 20,000 feet. The entire length of primary cable and the handling system are scheduled for delivery in late 1975. Operational dives to 10,000 feet and 20,000 feet are scheduled in 1976. Once the test and evaluation is completed, documentation and training will be provided for fleet use. The system is tentatively scheduled for delivery to the Submarine Development Group, San Diego, California, in 1978.





Drawing shows the RUWS as it is deployed in the mated launch and recovery mode, and then as the PCT and vehicle separate at depth into the operational mode.

New SCUBA Bottles Tested for EOD Divers

LT Raymond P. Swanson
Office of the Supervisor of Diving

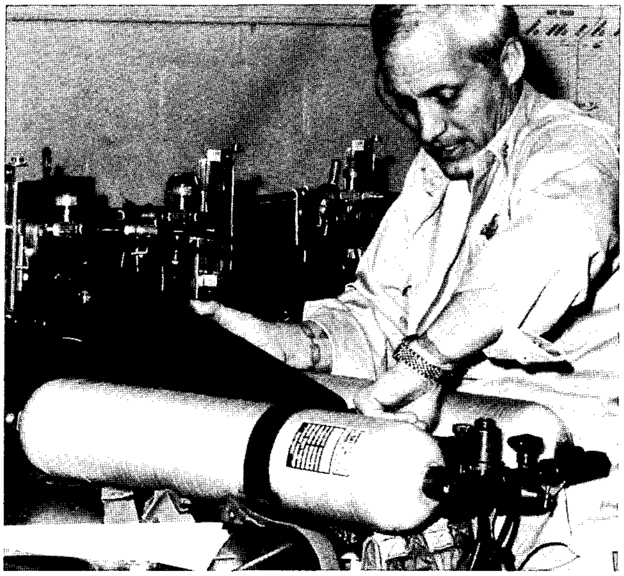
The Explosive Ordnance Disposal (EOD) diver traditionally has been confronted with the threat of diving on magnetically-functioned ordnance. Providing him with the lowest magnetic signature equipment has been a continuing effort that recently resulted in a study of filament-wound fiberglass/epoxy (referred to here as fiberglass) cylinders. It was expected that a cylinder constructed of this type of material would provide an additional margin of safety when used in situations where encounters with magnetically influenced ordnance could be expected. Consequently, Battelle-Columbus Laboratories, Columbus, Ohio, was contracted by the U.S. Navy Supervisor of Diving to perform the necessary research. Resultant studies, which began in July 1973, were completed in December 1974.

Although industry employs pressurized fiberglass bottles for a variety of applications, the use of this material for divers' gas supply cylinders is considered unique. Therefore, extensive research and testing was required to assure safe application to diving. Eighty-four cylinders were procured by Battelle-Columbus Laboratories for the studies. These cylinders were similar to existing Mk VI SCUBA cylinders in both dimension and operating pressure. Each cylinder was fabricated from S-glass/epoxy composite, with end boss fittings of inconel and a compression-molded butyl rubber liner for gas containment. The studies encompassed the following three major areas of investigation: cylinder strength, breathing gas compatibility, and magnetic signature properties.

During the strength tests, 55 of the 84 cylinders were intentionally destroyed or sufficiently damaged to preclude further use. Pressure tests established a minimum burst pressure of over 12,000 psig, several thousand psi above the burst pressure of aluminum open-circuit SCUBA cylinders. Repeated pressure cycles, however, progressively reduced the burst pressure, resulting in a dramatically shorter cyclical life than that of aluminum cylinders. Tests indicated that 100 pressure cycles would be the maximum safe amount of cycles to which these cylinders should be subjected. It was anticipated from the outset of the program that the fiberglass cylinders would have a limited cyclical life and be severely restricted in application. However, a trade-off was considered acceptable in view of the additional magnetic safety provided.

Storage of cylinders at high pressures and/or in high temperature/high humidity environments also has a detrimental effect on cyclical life. Maximum storage life is obtained from these cylinders if stored in a cool, dry environment with a charge of 100 psig of dry nitrogen. Further, it has been verified that these fiberglass cylinders are highly susceptible to impact damage. A drop from a height as low as 2 feet, or impact with hard or sharp objects, is cause for serious concern. This type of damage can be visually detected as crazing, delamination, fiber breakage, or denting. The disposition of cylinders subjected to such damage will be made known to concerned activities.

The compatibility tests checked the gas compatibility with both the rubber liner and the cylinder material. Since the object of this was to provide cylinders with the smallest magnetic signature obtainable, a rubber liner was selected instead of a metallic one because it minimized the magnetic signature of the cylinders. However, butyl rubber is an organic material that has a potential for reacting with oxygen. During these tests, a 68/32 percent He-O_2 gas mixture was used. Two cylinders, one fiberglass and one stainless steel (used as the test control cylinder), were charged to 3,000 psig. After 1 month of



Photos by Navy School, EOD

Above left: TMC Ralph E. Vahle assembles new SCUBA backpack. Above: direct view of new bottles during test swim by TMC Vahle. Below: TMC Vahle (facing front) and LT Swanson during testing.

containment, mass spectrometer and gas chromatography analysis indicated no difference between the samples. A more definite test was conducted after a 4-month period with similar results. Although no reaction was evidenced during these tests, it was noted that helium/oxygen mixtures stored at high pressures for long periods (days) permit the helium to permeate the butyl rubber liner and cylinder wall, thereby effectively altering the ratio of helium to oxygen in the gas mixture.

The final and perhaps the most important tests were the magnetic effects tests. These were conducted in accordance with MIL-M-19595B (OS) at the Naval Explosive Ordnance Disposal Facility's magnetic effects laboratory. Magnetometer results were as expected. Readings during both the standard magnetic test and the eddy current effects test were so low that they were essentially undetectable.

Because it is envisioned that these cylinders will be used only for EOD operations requiring magnetic precautions, a limited quantity is being sent to the Naval Explosive Ordnance Disposal Facility at Indian Head, Maryland. Although these cylinders provide an additional magnetic safety margin for the EOD diver, it is apparent that concessions had to be made to obtain this margin. The attainment of the extremely low magnetic signature was at the expense of cylinder life. Storage conditions must be rigidly adhered to, and extra caution against cylinder damage must be exercised. Any weight advantage is negated because the buoyancy of the cylinders must be compensated for in the water by the addition of weights. However, when all these conditions are met, the EOD diver can be assured his equipment will function properly while providing the lowest signature nonmagnetic diving cylinders available.

The Navy Experimental Diving Unit has completed a new milestone in their recent relocation to the Ocean Simulation Facility in Panama City, Florida. On March 11, 1975, the first NEDU-controlled manned dive was carried out successfully in the OSF hyperbaric complex. The dive, which went to a depth of 30 feet, was the first in a series of dives being conducted in preparation for saturation dive experimentation and evaluation in the OSF.

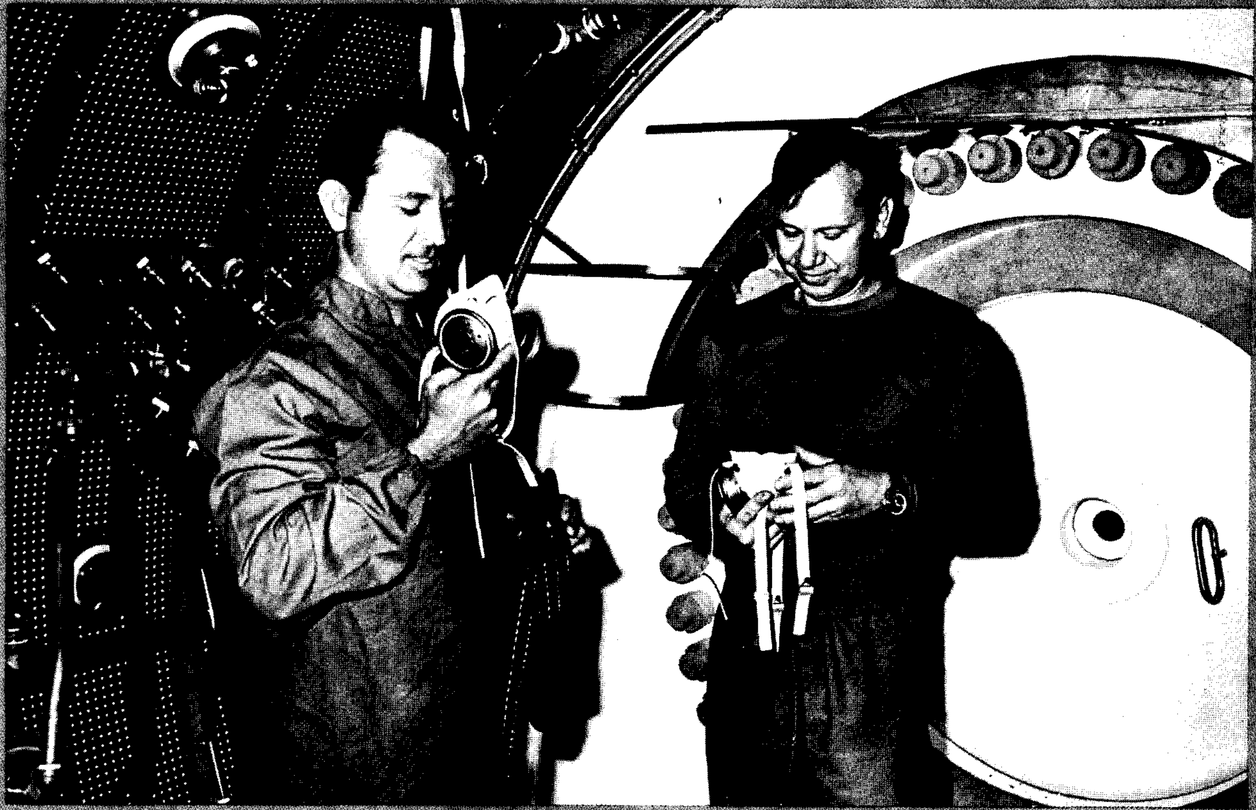
The diver/subjects in the dive were LCDR Martin A. Paul, USN, Executive Officer of NEDU, and HMCS(DV) Terrell W. (Jack) Reedy, USN, Senior Saturation Diving Medical Technician for NEDU. The Diving Officer for this first series of dives was LCDR Bryan N. Barrett, RN, British Exchange Officer at NEDU. EMCM(MDV) Robert K. Merriman, USN, was the Master Diver, and LCDR Edward D. Thalmann, MC, USNR, served as the Medical Officer.

As a training and equipment check-up dive, all systems pertinent to saturation diving (except the "wet-pot" chamber) were operated, including using both the automatic and manual modes in compression/ decompression, and testing the communication, breathing, and atmospheric control systems. Compression started at 9:51 a.m., reaching the 30- foot bottom depth at 9:57 a.m. The divers remained "on bottom" for 1 hour and 45 minutes before surfacing at 11:36 a.m.

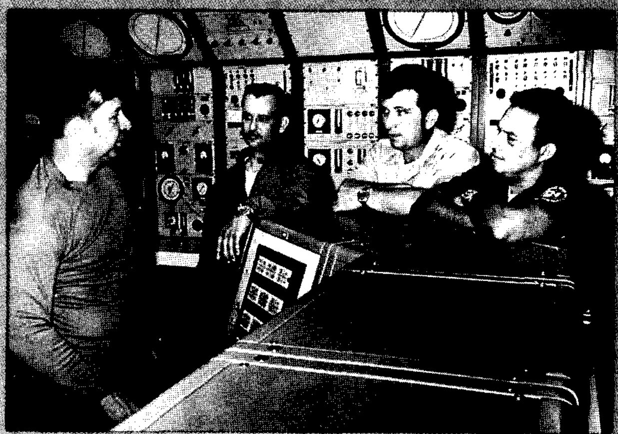
One previous manned dive had been made in the facility, under the control of the Naval Coastal Systems Laboratory. On July 9, 1974, CAPT George F. Bond, MC, USN, and LT George C. Green, USN, completed a 60-foot dive in the OSF complex (without using the wet-pot chamber). That dive was also a test and evaluation project.

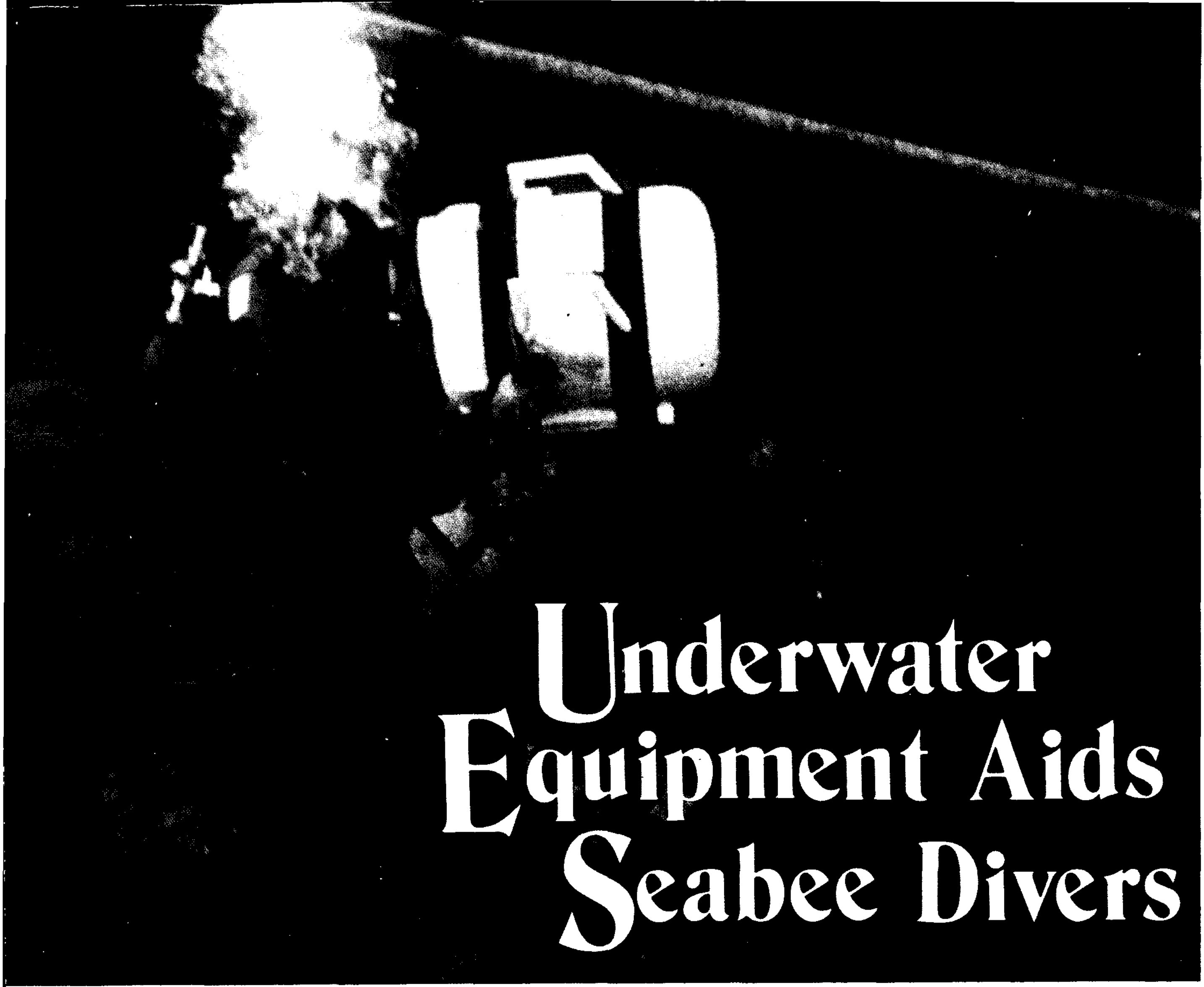
Future NEDU plans for the OSF include conducting saturation dives to 300-foot depths in April 1975. The primary purpose of these dives will be to develop new saturation excursion tables. Also scheduled are unmanned and manned Mk XII SSDS test dives and extensive testing of the Mk XIV Push-Pull System. The components and assemblies of both of these systems will undergo detailed evaluation.

By the end of 1975, the OSF facilities will be available to commercial and educational activities for equipment and/or procedure testing, subject to negotiation with NEDU Detachment, Panama City.



Above: HMCS(DV) Reedy (left) and LCDR Paul check the emergency breathing system. Below: LCDR Barrett, RN, (left) and CDR Spaur, NEDU's Senior Medical Officer, read gages on control panel during dive. Below left, left to right: EMCM(MDV) Merriman explains operational checks to MM1 (DV) Hester and ST1(DV) Cross. Left, left to right: Paul, Reedy, Merriman, and BMC(DV) Ramos in predive discussion.





Underwater Equipment Aids Seabee Divers

LT G. Scott Guthrie, CEC
Naval Facilities Engineering Command

The increasing needs for site surveys, site preparation, and actual construction in the hydrospace environment, although similar in concept to terrestrial construction, demand specialized tools and equipment. Two new pieces of equipment have been added to the Naval Facilities Engineering Command's Ocean Engineering and Construction Equipment Inventory to aid the Underwater Construction Teams (UCTs) in fulfilling the Navy's mission of underwater construction.

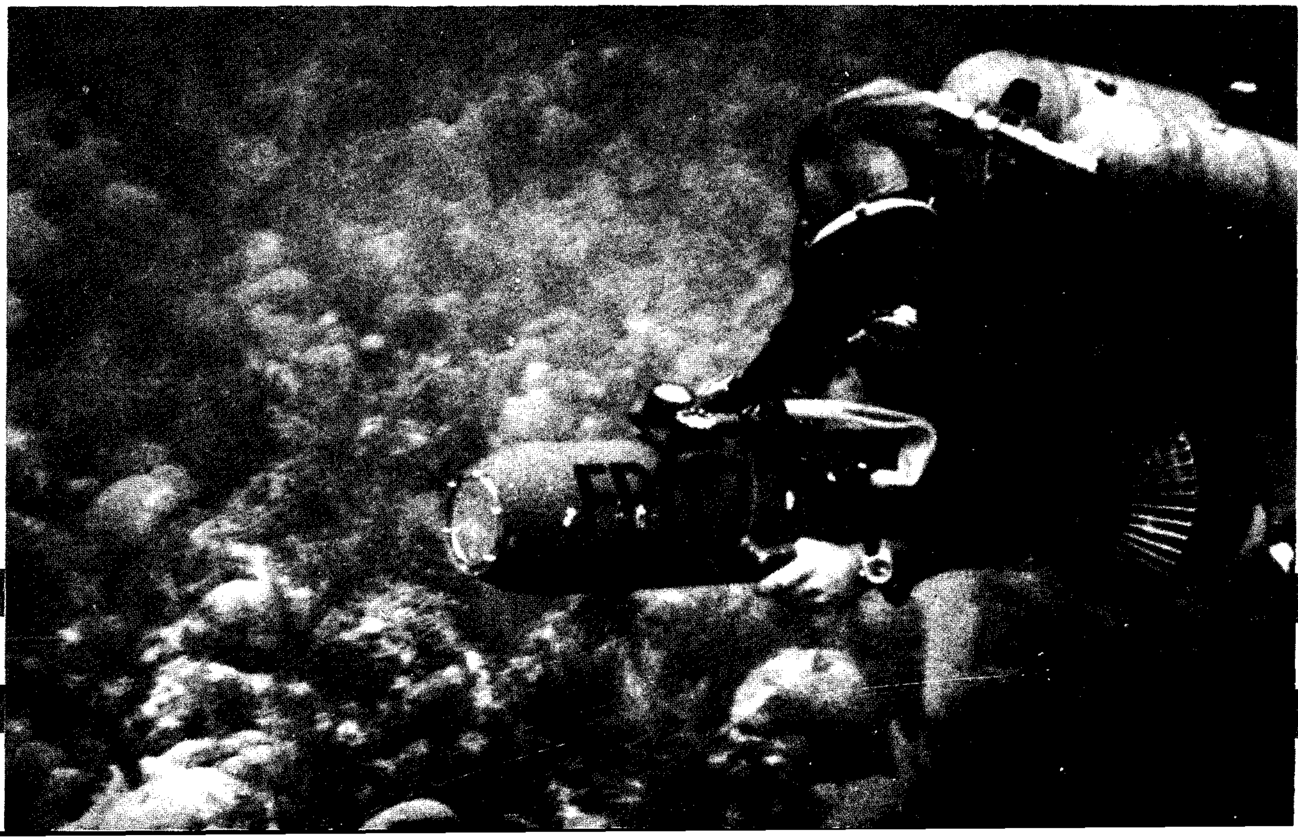
A diver propulsion vehicle (DPV) has been approved by the Naval Sea Systems Command for use by UCTs in specialized construction. This vehicle, while commercially available, has been modified to meet the Navy's standards for operational safety and project support requirements. As with the terrestrial constructor, the underwater constructor must be concerned with the selection and surveying of the construction site. The DPVs are utilized in this effort to expedite the scanning of the ocean floor. With a top speed of 3 knots, the DPV enables a diver who is limited by depth and time to search with a minimum expenditure of energy approximately three times the area he could normally swim. In addition, preliminary inspections for damage to existing cable systems and pipelines can be performed more efficiently using the DPVs. Their efficiency allows more of the diver's time to be concentrated on documentation of damage, resulting in more expeditious repairs.

The second item of new equipment aids in this documentation process. It is a self-contained, underwater video recording system. The video system has the distinct advantage over ordinary underwater video systems in that it requires no umbilical to the surface. This allows extended freedom for the diver in recording the necessary information. However, in rare instances when direct top-side supervision of an underwater construction task is necessary, the unit can be cabled to a surface monitor. This capability provides real time information to the supervisor and enhances his ability to control the operation. The video system, as built, contains a low light level camera that can automatically focus from 6 inches to infinity, and which often "sees" things that the diver cannot. With the aid of a 3-inch monitor built into the unit, the diver can see exactly what is being recorded on video tape, as opposed to a still camera system in which pictures are not available until they have undergone customary processing. The diver can also rewind the tape and play it back under water for viewing on his monitor. Therefore, segments may be reshot immediately, if necessary, to provide complete and accurate documentation coverage.

Finished tapes can then be used to guide the designer and explain underwater situations to nondivers. They also present a most accurate record of work performed or quantify a system's condition to a project customer. Further, video records of underwater work serve as valuable training aids for the improvement of construction techniques, the disclosing of possible discrepancies in method or design, and in demonstrating to new construction divers how a task should be performed.

Currently, the Equipment Inventory contains six DPVs and two underwater video systems (with a third unit on order). Each Underwater Construction Team has two DPVs and one video system under its cognizance for use in performing underwater construction tasks. The other two DPVs and video system will be held in the Equipment Inventory by the Inventory Manager, Chesapeake Division, Naval Facilities Engineering Command, Ocean Engineering and Construction Project Office, Washington, D.C.

Photo at left shows a SEABEE diver using a new self-contained, underwater video recording system.
Photo below shows testing of new diver propulsion vehicle for use by Underwater Construction Teams.



Mk XII SSDS: Quiet and Working

Left to right: LCDR B.A. Ridgewell, CF, BM2(DV) R.N. Green, USN, CDR C.M. Jones, USN (in Mk XII suit), and HTC R. Jones, USN, during testing of Mk XII.

USN Photo, PH2 B.D. Douthit, USN.

"If you want a hat that meets the noise level and flow characteristic standards set by our doctors, the Mk XII is it!" This statement, which was made at a recent program review by LCDR B.A. Ridgewell, CF, the NEDU Project Officer for the Mk XII Surface Supported Diving System (SSDS), came after a long project effort. In a program that was sometimes rewarding and sometimes frustrating, the modifications to the prototype Mk XII assemblies have now passed through the design, initial test, design refinement, and shallow depth test phases. Though a few rough edges remain, the basic modified prototype equipment equals or exceeds the design characteristics for the system. A detailed production package for advanced development model (ADM) procurement is scheduled for issue in mid-1975, and the first production contract for certified and service-approved equipment is expected to be awarded in mid-1976. Distribution to the fleet will be in early 1977.

Bringing the system to its present status has required the work of many talents and organizations. The Naval Coastal Systems Laboratory was the engineering development center for the helmet and recirculators. The Naval Medical Research Institute's Department of Behavioral Science provided a human engineering look at all parts of the system and guided some phases of the dress-component development. Four contractors have given excellent help in solving dress problems: R & D Design Corporation; Rubber Fabricators, Incorporated; Converse Rubber Company; and Parkway. Three others have acted as consultants on specific subjects: General Electric Company; Deepwater Development Corporation; and Divex, Incorporated. All of this support activity is being coordinated by individuals in the Project Office at the Navy Experimental Diving Unit.

Much of the effort has been focused on the helmet assembly in two interrelated areas, breathing medium flow and helmet noise level, as a function of gas flow. To obtain the flow required for difficult underwater work at depth, as determined by the NEDU Medical Staff, a new off-the-shelf supply valve was selected. (According to NEDU Report 16-74, light work requires a flow of 2 actual cubic feet per minute (ACFM); medium work requires 4 ACFM; and hard work requires 6 ACFM.) Tests show that the valve and a new downstream filter provide the right flow at all depths while making less noise. A new NCSL-designed exhaust valve completes the breathing control package. The net result is a reduction in noise levels from above the standard of 90 dbA (decibels on the A-weighted scale) to below 70 dbA, with a breathing medium flow rate that meets medical requirements. (A reduction of 8 dbA reduces the noise level 50 percent.)

This concern for proper flow has lead to an innovation in the system. When the Mk XII reaches the fleet, the topside control station will be provided with a deck edge flow meter. Monitoring the meter will help to determine whether the diver is receiving the proper amount of gas for any given work situation.

The breech ring sealing system and the breech ring latching mechanism have been improved; but more work is still required in this facet of development. Several new concepts are being examined, and a simplified attachment method will be evaluated during diving tests this spring.

Communication between diver and topside has been improved dramatically with the reduction of helmet noise, so that the only noise heard is low-frequency exhaust bubble noise in the background. Diver communication with surface personnel is now equivalent to a telephone call with a good connection.

More recently, a task has been started to reduce helmet buoyancy. Presently, the Mk XII helmet is 12 pounds positively buoyant, which almost equals the buoyancy of the Mk V helmet. It is anticipated that by reducing helmet volume, and perhaps by adding weight, the positive buoyancy can be drastically reduced. The effect of this modification will reduce diver fatigue by reducing the buoyancy righting moment, allowing work with less effort in an attitude other than vertical. It may make the system more swimmable as well.

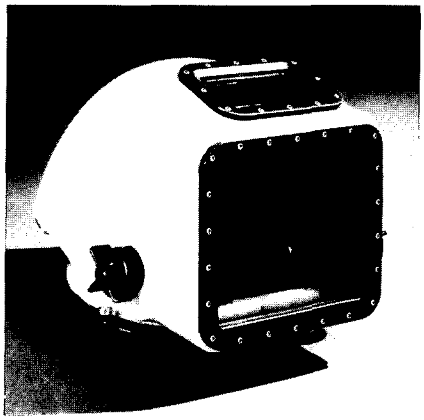
The recirculator modifications have been extensive. They include Lexan covers for the baralyme bed container to permit quick inspection; a new cover fastening and sealing system; a noise muffler around the venturi; and a redesigned manifold for breathing medium control. At the same time, a new recirculator concept is being examined, and an experimental design model will be tested this spring. The design is simpler than the prototype, and may also result in more weight reduction for the overall system.

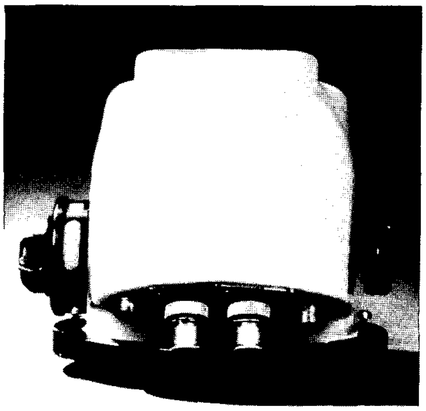
New materials and component parts are still being identified for the diving dress and outer garment, and several different experimental models are being fabricated for testing. The diving boot design is "frozen," featuring a boot that laces up the back, is interchangeable left and right, and has weighted rubber inserts for buoyancy control. The basic goal behind dress development has been to produce a dry, comfortable suit that allows maximum mobility. This goal is being met.

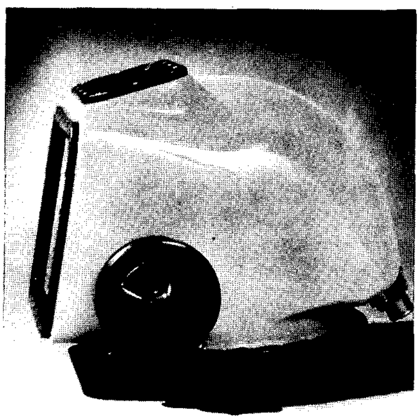
Future plans for the Mk XII SSDS include manned and unmanned testing in the NEDU Ocean Simulation Facility, Panama City, Florida, in March and April 1975. Additional manned testing will be conducted in May 1975, from one of the NCSL stages located off the Florida coast in the Gulf of Mexico. Based on the test results, the overall design will be frozen; and up to six ADMs will be procured for TECHEVAL/OPEVAL and system certification. These operations are scheduled for early 1976.

As it exists now, the Mk XII SSDS could go into production with only minimum effort. However, because of the delayed production/procurement schedule, further refinements are possible, which will result in a most current state-of-the-art diving system. Certainly, the Mk XII program is alive and well in Panama City, Florida, the new home of the Navy Experimental Diving Unit.

The photos below show three different views of the Mk XII SSDS helmet.







Left: Speakers at the ceremony were (left to right, clockwise): CAPT J.H. Boyd, Jr., LCDR J.M. Ringelberg, CDR C.M. Jones, Senator R. Stone, and CAPT R.T. Quinn. Right: Shovel-wielders for the ground-breaking were, left to right, Senator Stone, CAPT Quinn, CDR Jones, CAPT Boyd, Mr. G. Gould, Mayor M.B. Miller, Mr. E. Hutto, and Mr. C. Whitehead.

A Good Day for

The Navy Experimental Diving Unit, already an active tenant at the Ocean Simulation Facility, has now officially initiated the construction of a second NEDU installation at the Naval Coastal Systems Laboratory in Panama City, Florida. A ground-breaking ceremony was held on January 8, 1975, for the new Experimental Diving Facility (EDF), which will serve as a laboratory support building for the OSF.

Following the Call to Order, LCDR J.M. Ringelberg, Officer-in-Charge of NEDU Detachment Panama City, began the introduction of speakers. CAPT R.T. Quinn, Commanding Officer of NCSL, and CDR C.M. Jones, Commanding Officer of NEDU, each welcomed the assembly to the OSF and to the ceremony.

CDR Jones described his NEDU command as "a carefully conceived mix of Navy operational divers, their officers, Master Divers, and diving medical staff." He then noted that when fully staffed, NEDU will have 14 officers, 64 enlisted personnel, and 18 civilians in Panama City.

The Honorable Richard Stone, U.S. Senator for the state of Florida, discussed the importance of underwater research and the development of underwater resources. The ground-breaking address was then given by CAPT J.H. Boyd, Jr, Director of Ocean Engineering and Supervisor of Salvage.

In his address, CAPT Boyd commented that the ceremony was "a very significant milestone for diving in the U.S. Navy" in several respects, including the facility's location, design, and the personnel it will serve.

Regarding the location, CAPT Boyd remarked that "in effect, the move brings together the working diver and the diving engineer scientist." He went on to explain that NEDU and NCSL have been working together over the past year on the Mk XII Surface Supported Diving System and the Mk XIV Push-Pull System for saturation diving. These cooperative efforts will benefit from the new proximity of the two commands at a location that features year-around excellent diving test sites and facilities.

The design plans for the facility are based on "62 years of naval and commercial diving research experience," and include laboratories, medical treatment facilities, offices, and a small hyperbaric chamber for medical usage.

Navy Diving in Panama City

As for personnel, CAPT Boyd referred to the ceremony as being also a final event of the well-attended 2-day NAVSEA Underwater Ship Husbandry Workshop at NCSL (see page 6). The support of and the equipment development for the working divers and the underwater engineer/technicians represented at the conference are major tasks of NEDU. In closing, CAPT Boyd emphasized that the new facility "is another step in the bringing together of the Navy diving expertise. It is a major evolution in diving research facilities . . . ." The actual ground-breaking was then performed at the EDF site, which is adjacent to the OSF location.

The EDF will be built under a contract administered by the Southern Division of the Naval Facilities Engineering Command. The 2-story building will contain 13,300 square feet of laboratory, office, and storage space, and 2,500 square feet of hyperbaric treatment chamber and support equipment. Offices for NEDU administrative, medical, and project officers, as well as the library and data processing equipment, will be located on the second floor. The first floor will house various laboratories and the hyperbaric medical treatment chamber for use in operational diving research and experimentation.

Functions to be performed at the EDF include developing, testing, and evaluating diving systems, components, underwater swimming equipment, and operational procedures. It is also tasked to conduct experimentation in diving medicine, decompression tables, treatment tables, physiological effects of breathing gas mixtures, and related studies as directed by either NAVSEA, the Bureau of Medicine and Surgery, or other agencies upon their request of services.

The EDF will maintain a deep dive team of specially trained and qualified divers and medical personnel for rapid deployment on special fleet diving and salvage operations, including SUBMISS/SUBSUNK. In addition, specialized training and requalification in deep diving equipment usage and procedures, diving physiology, and medicine will be provided by this new facility.

The Experimental Diving Facility will be operated in conjunction with the Ocean Simulation Facility to ensure a quick, expert response capability to current and anticipated requirements of fleet diving and salvage activities. The bringing together of the diving technology expertise of NEDU and NCSL will aid both to meet their assigned tasks.

In an effort to improve and modernize the U.S. Navy's lightweight diving equipment, the Supervisor of Diving sponsored the development of Open Diving Bells for use in dives to intermediate depths. (See *FP*, Spring 1974). Recent progress in this program includes the distribution of four prototype units to designated operational activities for evaluation. Recommendations from these trials will then be forwarded to SUPDIVE for consideration in the final modifications, before large scale procurement of these units is made for the fleet.

The Open Diving Bell was designed to support three divers using the Divers Mask USN Mk 1. Primarily, it serves to provide a vertical transport vehicle and a semidry underwater refuge enclosure for divers. Manufactured by Perry Submarine Builders, Riviera Beach, Florida, the diving bell is constructed according to specifications developed jointly by SUPDIVE and Perry. The final prototype design varies only slightly from the initial configuration (illustrated in *FP*, Spring 1974, page 6).

The ballast system includes 24 lead bars, each weighing approximately 130 pounds. A removable securing bar fastens each ballast bar to a mounting tray that is attached to and below the deck.

The Open Diving Bell is 102 inches in height and 72 inches in diameter. Its weight in air is 4,300 pounds with all ballast in place, and 1,200 pounds with no ballast. The buoyancy of a fully ballasted bell in water is a negative 1,500 pounds; however, this may be varied to meet individual operational requirements.

After fabricating the first bell, Perry conducted a series of dockside tests to determine its handling and stability characteristics. Upon the completion of these trials, the bell was placed aboard M/V UNDERSEA HUNTER for a series of fully operational dives to various depths offshore Grand Bahama Island. Every aspect of the test profile was completed satisfactorily with the exception of the bell's communication system. Audio distortion/reverberation was discovered during the testing and will be reduced to meet acceptable standards.

Going Down in

The bell is composed of four major steel weldments: Frame, skirt, deck, and ballast support. The frame structure is the main component, connecting the skirt and deck and providing the lifting point for the vehicle.

An acrylic dome is mounted on the skirt weldment. The dome, which is constructed of 1/2-inch-thick plastic, provides the passenger-divers with a partially enclosed refuge that allows almost unrestricted visibility.

Gas and communication systems are also mounted on the skirt weldment. The gas system, for either air or mixed gas, is arranged in three modules. Each module is attached to the interior of the skirt and consists of a gas admission vent and an emergency breathing mask. Gas passes through a skirt penetration point and is distributed to the modules through 1/2-inch copper tubing. At four points in the lower portion of the skirt, there are vent tubes by which expelled gas is carried to the apex of the support frame, preventing escaping bubbles from obscuring the divers' visibility. The communication system features a waterproof speaker that has interconnecting wiring to a connector on the exterior of the skirt. The speaker is mounted on the ring of the skirt.

An interesting phenomenon was encountered during rapid ascent trials in the bell. Because of the rapid decreases in pressure and the accompanying decrease in the temperature of the gas in the dome, heavy fogging was present in the bell's atmosphere, with condensation on the acrylic hemisphere. This condition was corrected easily, however, when the ascent was stopped and the bell was ventilated.

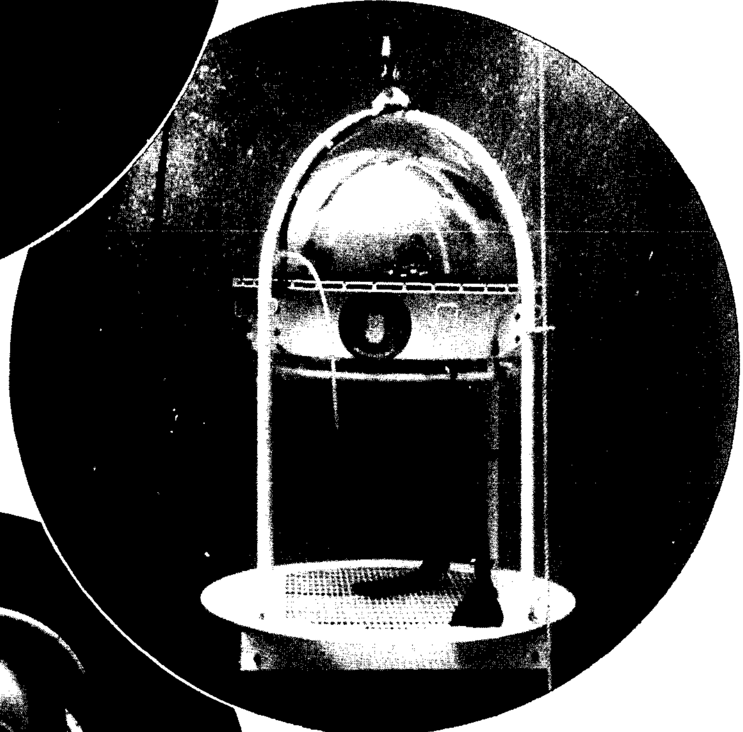
Another characteristic revealed during the testing is that the curvature of the acrylic hemisphere causes a slight optical distortion; objects appear to be foreshortened in their vertical dimension. This should not present a problem, however, once the divers in the bell become accustomed to this condition.

Procurement plans for additional Open Diving Bells have been altered from the original concept. Instead of supplying "kits" to be fabricated by the receiving activities, SUPDIVE plans to procure constructed diving bells for distribution to the fleet, as funds permit, in the coming years.

It is hoped that the Open Diving Bell will satisfy the Navy's need to increase safety and mission capability in diving operations of intermediate depth.

n Style

Mr. Alan J. Dietrich
Office of the Supervisor of Diving



Photos show various views of Diving Bell descending with its occupants.

F-4B Recovered By USS SAFEGUARD

The F-4B crashed in Japan's Inland Sea, south of the main runway at MCAS IWAKUNI.

As a newly overhauled [illegible] took off on a test flight from the Marine Corps [illegible] Station (MCAS), Iwakuni, Japan, on October 19, 1974, one of its engines caught fire, and it crashed in 65 feet of water approximately 2,200 yards south of the main runway. The pilot and navigator both ejected and were recovered without injury. However, they reported that the navigator's ejection handle, when pulled, had unaccountably caused both seats to "punch out" simultaneously. In view of these circumstances, the Base Commander requested a U.S. Navy salvage vessel to recover the debris for evaluation.

Two days later, USS SAFEGUARD (ARS-25), en route from Kaohsiung, Taiwan, to Yokosuka, Japan, was diverted to Iwakuni and tasked with recovery of the debris. Meanwhile, LCDR H.M. Oien, SEVENTH Fleet Salvage Officer, departed Sasebo for Iwakuni to assume the duties of Salvage Master.

On October 2, LCDR Oien rendezvoused in Iwakuni with HTCS(MDV) J.A. Ortiz, who had been assigned to SAFEGUARD from Harbor Clearance Unit ONE, and three divers from USS AJAX (AR-6), BM2 Paul Johnston, MM2 Eugene Sherman, and BM3 Cecil J. Barber. This team commenced the preliminary survey, dragging for wreckage in the vicinity of the impact buoy and diving from a pair of LCM-6 boats from MCAS Surface Operations. This support from the MCAS Iwakuni rescue unit was invaluable and continued throughout the operation.

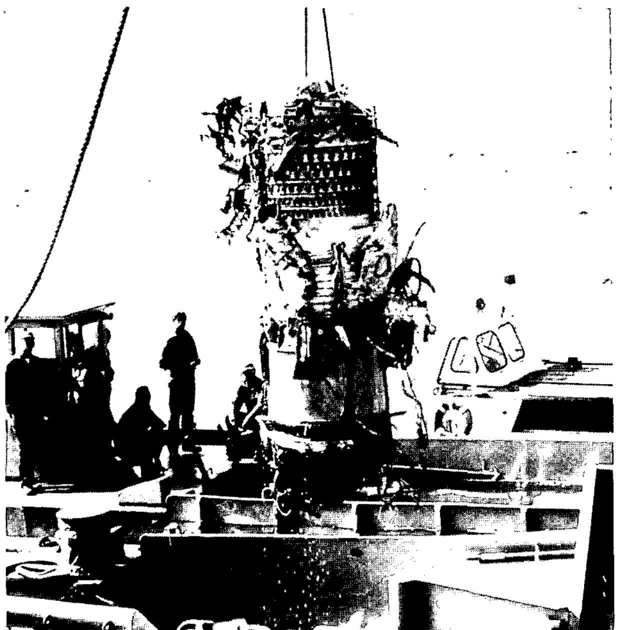
SAFEGUARD, under the command of LCDR J.B. Lasswell, arrived on the scene at 4:00 p.m. on October 25. Since the preliminary survey team had had minimal success in locating the wreckage, SAFEGUARD planted six crown buoys with its workboats on October 26 to define the area of previous dragging operations and to facilitate further dragging. After another day of unproductive dragging efforts, it was decided to request side-scanning sonar services to assist in locating the wreckage.

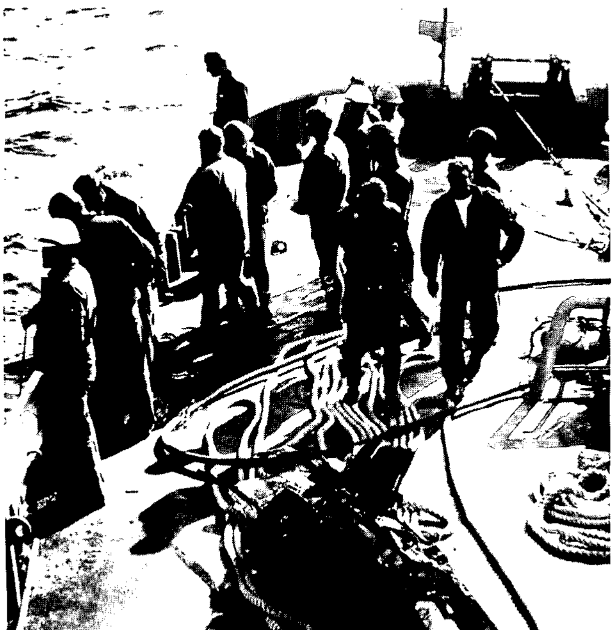
The wreckage site was discovered on the morning of October 27 in an area where local fishermen had reported fouled nets. At this time the request for side-scanning sonar was cancelled. By noon, SAFEGUARD had gone into a two-point moor over the site, and diving operations commenced using the KMB-8 under the supervision of HTCS(MDV) Ortiz and ENS D.S. Hunt, the ship's Salvage Officer. The first significant piece of wreckage, the outer port wing section, was raised on a wire sling attached by LTjg R.C. Gillis. The first injury of the operation occurred later that afternoon, when ENS R.E. Simpson cut his right knee on jagged debris on the bottom and had to be hospitalized for 2 days.

For the next 6 days, divers wearing SCUBA dove on the primary wreckage site and brought up wreckage using the aforementioned wire sling for large fragments and a submerged hatch basket for smaller debris. Recovered debris was identified by USMC representatives and taken ashore by boat, where it was assembled into a mock-up by investigators. Bottom visibility was poor throughout the diving phase, and divers also complained of stinging from aircraft fuel present in the water. Weather throughout the operation was excellent with the exception of winds that occasionally shifted SAFEGUARD off of her station. Jagged wreckage continued to be a hazard, and BM3 Larry Crawford was also sidelined after cutting his knee during a dive. By twilight on November 2, the determined SAFEGUARD divers had recovered 90 percent of the wreckage, including the entire port and starboard engines and cockpit wiring sought by USMC investigators. Credit for the speedy completion of this part of the operation goes to the following SAFEGUARD divers: SN Tim Adelsberger, BMSN Frank Costa, QM3 Eugene Hartman, HT3 Bill Huston, HTFN Jeff Krouse, ENFN Bill Maddick, MM1 Dave Glaser, ENS A.H. Rose, and HMC Wykoff.

On November 3, General Electric technical representatives, Mr. Bowen and Mr. Lachappelle, arrived on board SAFEGUARD to assist the salvage divers in identifying those missing pieces still desired by the investigators. Specifically, these pieces were the two fuel pump gearboxes on the starboard engine. At this point, the contribution of the three AJAX divers, BM2 Johnston, MM2 Sherman, and BM3 Barber, and one SAFEGUARD diver, HTC(DV) J. Searcy, played a vital role in the recovery. Their performance throughout the diving operation was outstanding, but on the final day of diving they exhibited an uncanny ability to go to the bottom in limited visibility and bring back exactly those fragments sought by the technical representatives. With the recovery of the gearboxes, the technical representatives decided that no additional wreckage was required for the investigation of the crash. Salvage operations were then secured; and on November 4, SAFEGUARD moved into port at MCAS Iwakuni for a well-deserved liberty for all hands.

Left: Starboard engine is transferred to waiting LCM-6 boat for transport to shore. Right: Members of SAFEGUARD's salvage crew on fantail. Included in photo are BM2 Crehan, HTCS(MDV) Ortiz, SN(DV) Adelsburger, ENFN(DV) Maddick, HTC(DV) Searcy, QM3(DV) Hartman, BM3(DV) Crawford, BM2(DV) Johnston, CWO-2 Petchesky, Major Sites (USMC), and HTFN(DV) Krouse.

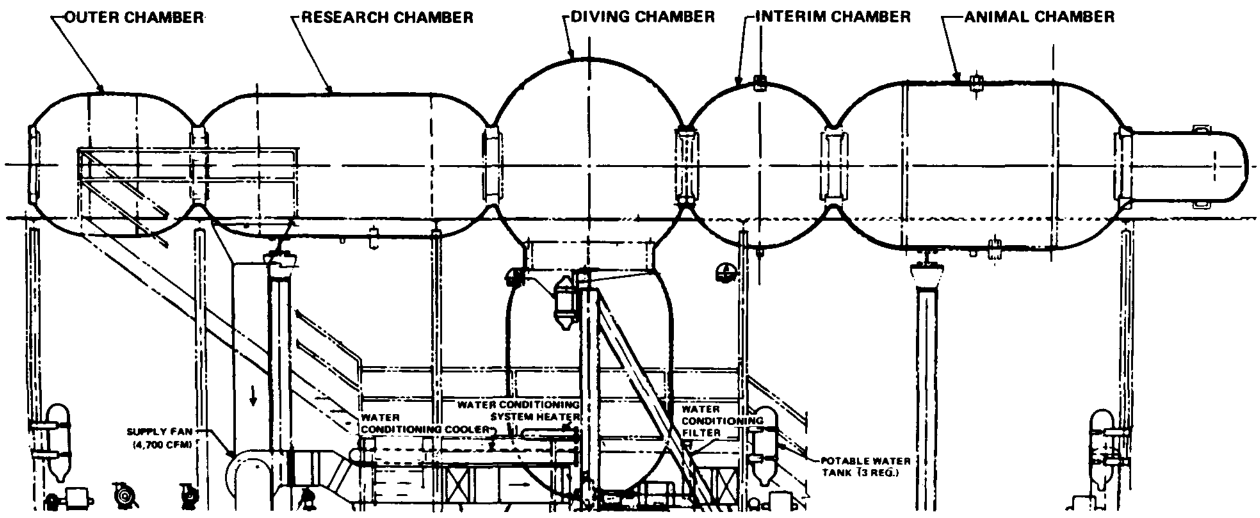




New Hyperbaric System Under Development

E-H-E-L Spells "Research" at NMRI

LT Don Chandler, MSC, USN
L. "Chips" Hurley, MDV (Ret.)
Naval Medical Research Institute



Shown above is an artist's rendition of the hyperbaric complex that will be a major component of the Environmental Health Effects Laboratory (EHEL) at the Naval Medical Research Institute in Bethesda, Maryland. The five chambers will be located in the basement of a two-story building, with the "wet-pot" area of the diving chamber below the main structure in the subbasement. Each of the five chambers will be constructed to handle a specific area of research. Laboratories, office space, and work areas will be located on the floor above the complex. The facility is scheduled for completion by mid-1977.

The mention of Navy medical research causes most nonresearch people to form a mental picture of a test-tube-filled laboratory with a bespectacled individual in a white coat perched on a stool, peering intently into a microscope. To a Navy researcher, however, Navy medical research usually creates a mental picture of a diver submerged in the depths of the ocean; or a lonely figure in the cold Antarctic, with eyes squinting from under the hood of a fur-lined parka; or even a perspiring khaki-clad individual deep in the equatorial plains of Africa. Extreme? Possibly. All these illustrations, however, are represented in the broad spectrum of medical research that the Navy relentlessly pursues.

Fortunately, not all Navy research is conducted in remote, and often hostile, parts of the earth. Likewise, not all diving medical research is conducted in the depths of the ocean. Much of the basic diving medical research, in fact, is conducted at geographic locations far removed from the ocean. For example, inland, approximately 60 miles up the Potomac River, bordering the northwest corner of Washington, D.C., is Bethesda, Maryland. The Naval Medical Research Institute (NMRI), where 90 percent of all basic diving medical research is conducted, is located there as a tenant activity to the National Naval Medical Center.

Why would the Navy want to conduct diving medical research so far removed from the ocean? Why, also, would the Navy prefer a location not conducive to comfortable year-round diving? The answer to these and many similar questions is obvious when one considers that Washington, D.C., and its environs has a world-renowned scientific community. Within 1 hour from Bethesda there are 49 research-related facilities, ranging from biomedical to academic to marine oceanographic activities.

Because of the accessibility to this scientific community, the Navy selected NMRI as the site to construct a new diving research facility sponsored by the U.S. Navy Bureau of Medicine and Surgery. The name by which the facility is currently identified is the Environmental Health Effects Laboratory (EHEL).

The EHEL, which will be located in a two-story building, will be approximately 280 feet by 100 feet, and will provide an overall area of 60,000 square feet. Because of the weight and size of the hyperbaric system to be installed, and to achieve maximum accessibility in terms of conducting and monitoring research experiments, the chamber complex will be located in the basement and subbasement of the building. The floor space above the chamber will house supporting laboratories, offices, and work areas.

The hyperbaric complex will consist of five HY-80 steel pressure vessels totaling 3,630 standard cubic feet (surface). All five vessels will be equipped with receiving ports, service locks for food and supplies, feed-through connections for monitoring instruments, and communication penetrations. Each of the five pressure vessels will be fabricated for different purposes: An outer chamber to be used for "lock-in/lock-out" access; a research chamber, where most of the dry environment monitoring will be conducted; a diving chamber, part of which will be used as a "wet-pot" for in-water research; an interim chamber that will be used as an inside lock and access to the animal chamber; and the animal chamber, which will be used primarily for animal research. The diving chamber (wet-pot) will be equipped to maintain any water temperature between 28°F and 85°F.

Specifically, the EHEL staff will be concerned with research on the physiological, psychophysiological, and toxicological effects experienced in underwater depths to 3,350 feet of seawater as well as in all closed systems environments. The unique nature of the work to be conducted requires that the total system be man-rated and, therefore, supported with sophisticated subsystems.

These subsystems will include a controlled atmosphere system for heating, cooling, filtering, and CO_2 removal; a contaminate injection system for controlled experimentation; a sensing and control system for monitoring and controlling the hyperbaric atmosphere; a data recording system for on-line monitoring and data storage; and a helium reclaim system.

In addition to the man-rated complex, there will be a battery of 57 animal chamber units, each unit consisting of two interconnected but separate chambers. These small animal chambers will be used by the Navy Toxicology Unit for their basic research programs.

The new facility is scheduled for completion by mid-1977. Optimally, when completed, the EHEL will be staffed by both military and civilian employees. When it is operational, the EHEL will be one of the most sophisticated hyperbaric systems in the world that is totally dedicated to the basic research necessary to extend man's time and depth mobility beneath the oceans.

SDVs: Underwater Transit for a Chosen Few

omas E. Haw

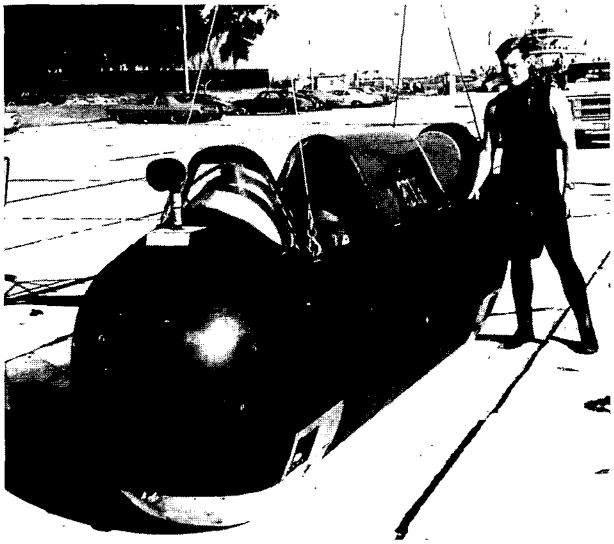
he Supervisor o

Pilot with SDV Mk VII prepares to submerge.

The term "swimmer delivery vehicle" may be new to some; they are also referred to as diver propulsion vehicles and swimmer propulsion units. Within the Navy, these swimmer delivery vehicles (SDVs) play a combatant role by doing exactly what their name implies; they deliver combat swimmers to and from military objectives. SDVs are small submersibles that are very similar to the fleet's larger submarines. SDVs, however, are much smaller; and they are free-flooding, which means the divers being transported are actually surrounded by water.

The SDV pictured on the front cover of the magazine is the fleet operational SDV Mk VII, which is a four-man vehicle. The Mk VII is common to the inventories of Naval Special Warfare divers of Underwater Demolition Teams and SEAL Teams of both the Atlantic and Pacific Fleets. SDVs are used to improve the range and expand the operational capabilities of combat swimmers. The primary advantage of using an SDV is its ability to transport divers faster, farther, and with less exertion than is possible by swimming. Also, greater amounts of cargo may be carried by an SDV than by a swimmer. The disadvantages of using this vehicle include the greater amounts of maintenance and training time involved and the increased possibility of being detected because of acoustic and magnetic signatures.

SDVs are battery-powered and use an electric motor for propulsion. They employ a variable water ballast system and have an inherent positive buoyancy. This requires the pumping of seawater into closed ballast tanks to make the vehicle neutral. Negative cargos may be carried by pumping in a lesser amount of seawater. The SDV actually moves on a bubble of air.



LT Al Horner, USNR, stands beside an SDV Mk VII.

The Mk VII SDV is enclosed by canopies, which improve the hydrodynamic configuration of the craft and reduce drag. The canopies also protect the passenger/divers from the flow of water created by the vehicle's speed. In addition to carrying an on-board life support system, the Mk VII SDV may also carry a considerable amount of instrumentation to be used as subsystems to aid navigation.

Free-flooding submersibles are used as combat craft in the Navy because of the economic savings involved and the simplicity of design. Major limitations of the vehicle's capability are actually imposed by human factor considerations of the diver, such as water temperature and type of protective dress. Because UDT/SEAL

Diver/occupant exits SDV at depth, while pilot remains at controls.

divers must swim considerable distances, even if propelled to an objective area, they are limited to those types of diving dress that permit extensive freedom of movement and still keep them relatively warm. Such factors must be considered throughout operational planning, and each has a different value according to the water climate involved. Temperature also influences the depth at which operations are to be conducted. These are just a few of the factors that affect operational planning.

The idea of using small submersible vehicles for combat operations is not new and was not originated in the U.S. Navy. Italian surface swimmers accomplished the first successful military mission by sinking the ship, URIBUS UNITS in 1918 at Pola, Yugoslavia. Throughout the next several years the Italian Navy continued to develop techniques of underwater warfare, including the idea that divers could be transported by midget submarines, proceed under water to nearby enemy ships, attach mines, and then return via the submarine to a safe area.

During World War II, Italian operational concepts were utilized with devastating results. They later expanded their activities to include limpet swimmers and other similar operations that resulted in the sinking or severe damaging of 265,352 tons of enemy shipping, a total of 31 ships. The total cost involved in these activities was amazingly low: 100 men (20 of whom became casualties and 50 of whom became prisoners), 17 mother craft, 20 torpedo boats (SDVs), and approximately 100 limpet mines of various designs.

The British Navy (which had been the target of most of the Italian exploits) directly copied, improved, and developed new equipments for their own combat swimmer force. The results of their use of submersibles, which they called "chariots," were equally impressive. It is their success that initiated the U.S. Navy's involvement in underwater warfare. Teams of American UDT swimmers began training with the British at Normandy, France. Many of the tactics and equipment concepts used today mirror those pioneered by the British and Italians during World War II.

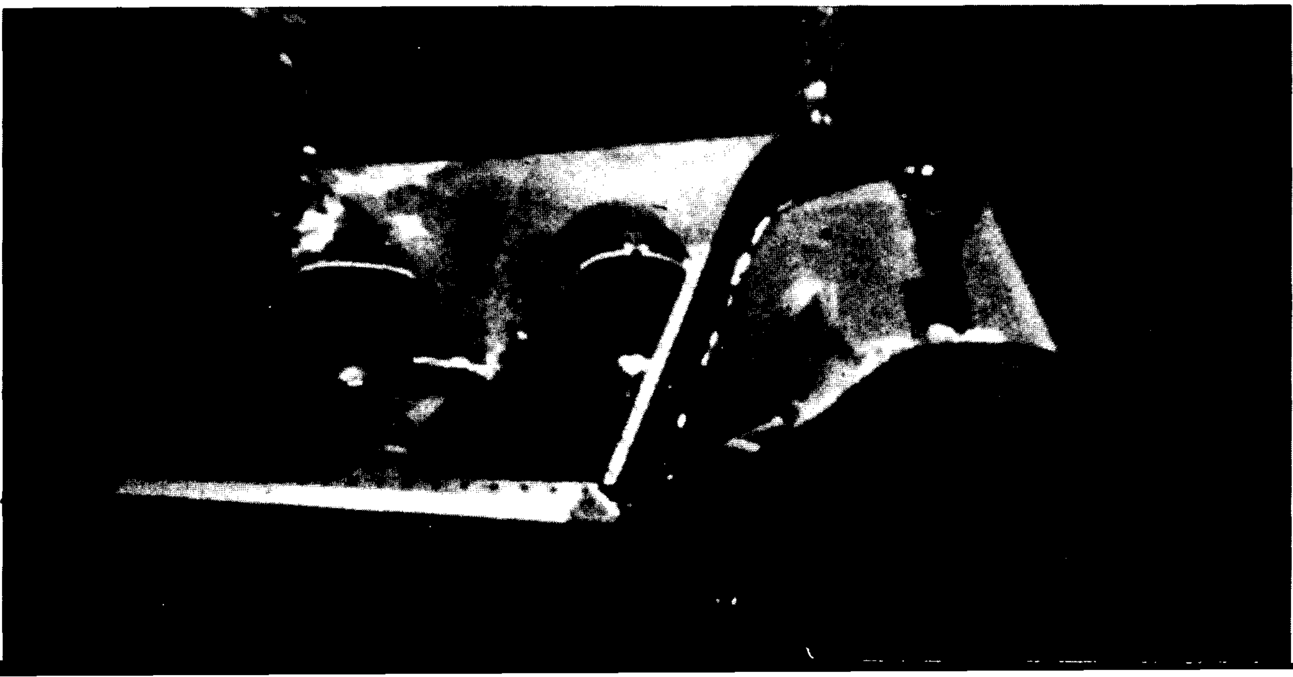
Submersible vehicle development in the U.S. Navy was extremely slow in progressing. In fact, early efforts were limited to purchasing submersibles from abroad. Most of the USN attempts to develop vehicles were unsuccessful for various reasons until the development of the SDV Mk VII.

Many factors are involved in the development and production of a submersible. Considerations of operational environment, diver performance and limitations, reliability, and maintainability are just a few examples.

Not all divers are able to "pilot" a submersible, and the screening process is extremely difficult to pass. Given enough time and experience in the learning phase, most divers can master navigational accuracy and depth control; however, it takes many more hours of in-water operator time to reach even a minimum proficiency level. The crucial factors include the required expertise necessary to use various subsystems that require much more concentrated operator attention. In addition, a most important element is acquiring a "feel" for handling an SDV and judging its location in the ocean as it moves toward a specific objective area.

Dedication is a necessity for participants in the fleet SDV program; many hours are spent in developing operational and maintenance skills. However, once a diver masters these skills and becomes a qualified SDV operator, he is forever "hooked" on the desire to get behind the controls and make it perform. Individual pride of accomplishment along with the dedication required during training result in a unique type of operational readiness to support fleet missions and tasks.

Submerged SDV transports divers under water.



CAPT Moss Receives Meritorious Service Medal

The Meritorious Service Medal was presented to CAPT Robert B. Moss, USNR, for "outstanding meritorious service from March 1974, to December 1974." VADM R.C. Gooding, USN, Commander, Naval Sea Systems Command, awarded the medal in a special ceremony on April 10, 1975. CAPT Moss, as the Deputy Director of Ocean Engineering in NAVSEA, was a key figure in two complex salvage operations during the 10-month period.

During the Suez Canal clearance operations, CAPT Moss directed the planning effort required to ascertain salvage contractors and Navy equipment required to remove ten sunken wrecks blocking the waterway. Also, in March 1974, he undertook the in-depth research necessary to uncover all available information concerning the ten craft, which proved invaluable for the subsequent salvage operations.

Within the same time span, CAPT Moss also was in charge of the planning efforts required in the removal of the U.S. Army Corps of Engineers' dredge MACKENZIE. MACKENZIE sank in the Galveston, Texas, main shipping channel, blocking the northbound land and causing a serious navigational hazard to this highly industrialized area. (See *FP*, Fall 1974.) His direction of a team of salvors and oil pollution containment specialists resulted in the successful removal of the dredge and the reopening of the channel to its normal ship traffic capacity.

As stated in the citation, "CAPT Moss's dynamic leadership, knowledge of salvage procedures, and managerial ability reflected great credit upon himself and the United States Naval Service."

VADM R.C. Gooding (right) presents award to CAPT R.B. Moss.

RHCU Update

The newly formed Reserve Harbor Clearance Unit Team 321 (based in San Diego, California) has not wasted any time in moving into action. HCU 321 participated in the 1974 Navy Birthday Celebration held in San Diego, which featured a wide display of ships, aircraft, computers, and various hardware items from many local naval commands.

Three other San Diego Naval Reserve Units, all concerned with diving, joined with HCU 321 to demonstrate underwater equipment and diving techniques. Members from Inshore Undersea Warfare Units 3019 and 3021, Underwater Demolition Team 119, the Second Class Diving School at the San Diego Naval Station, and HCU 321 performed in a truck-borne tank measuring 8 feet by 10 feet by 14 feet. The tank was fitted with plexiglass panels in front to allow clear viewing of the activities by the audience.

Various performances detailed the history and accomplishments of underwater units. Divers in the tank engaged in such efforts as raising an anchor with air-filled bags, "salvaging" goldfish, and demonstrating rebreathing equipment.

The Navy Birthday 1974 Celebration provided an opportunity to demonstrate that the Reserve diving program is a viable and effective arm of the U.S. Navy.

LCDR T. Ingersoll, USNR, Commanding Officer of the newly formed Harbor Clearance Unit 321, and BM2 J. Richards, USNR, of Inshore Undersea Warfare Unit 3021.

Distinguished Service Medal Awarded to CAPT Boyd

The Distinguished Service Medal was awarded to CAPT John H. Boyd, Jr., USN, Director of Ocean Engineering and Supervisor of Salvage, Naval Sea Systems Command, in a special award ceremony on April 10, 1975. VADM R.C. Gooding, USN, Commander, Naval Sea Systems Command, presented the medal to CAPT Boyd for his "exceptionally meritorious service to the Government of the United States in a duty of great responsibility as Commander, Task Group 65.7 from March 1974, to December 1974."

During this period, CAPT Boyd "demonstrated his exceptional managerial ability, technical knowledge, and operational experience in carrying out a salvage operation of international importance." His planning, organization, and supervision of the Suez Canal salvage clearance resulted in the successful return of the waterway to a navigable shipping route.

VADM R.C. Gooding (right) awards medal to CAPT J.H. Boyd, Jr. at ceremony,

In early 1974, the U.S. Government agreed to assist the Egyptian Government in reopening the Canal, which had been closed to traffic since 1967. The U.S. Navy, as executive agency for the Department of Defense, was assigned with the removal of ten sunken wrecks that blocked the channel. CAPT Boyd was then tasked with the direction and supervision of the project, utilizing the standing Navy contract with its primary salvage contractor, Murphy Pacific Marine Salvage Company.

In March 1974, CAPT Boyd commenced the planning phase of the operation. This included planning various options for the overall operation and reviewing the contractor's detailed plans for each wreck. It also involved choosing and readying the necessary salvage equipment to accommodate the extremely complex task.

When authorized to proceed in May 1974, CAPT Boyd and his small staff travelled to Egypt to begin the clearance operations. His extensive background in salvage engineering enabled him to evaluate salvage plans after the required underwater inspections were conducted. In order to obtain first-hand knowledge of existing conditions, CAPT Boyd personally conducted underwater surveys. Although hindered by strong currents and the ever-present possibility of unexploded, unreported ordnance detonating, all surveys were accomplished expeditiously and without injury to any diving personnel.

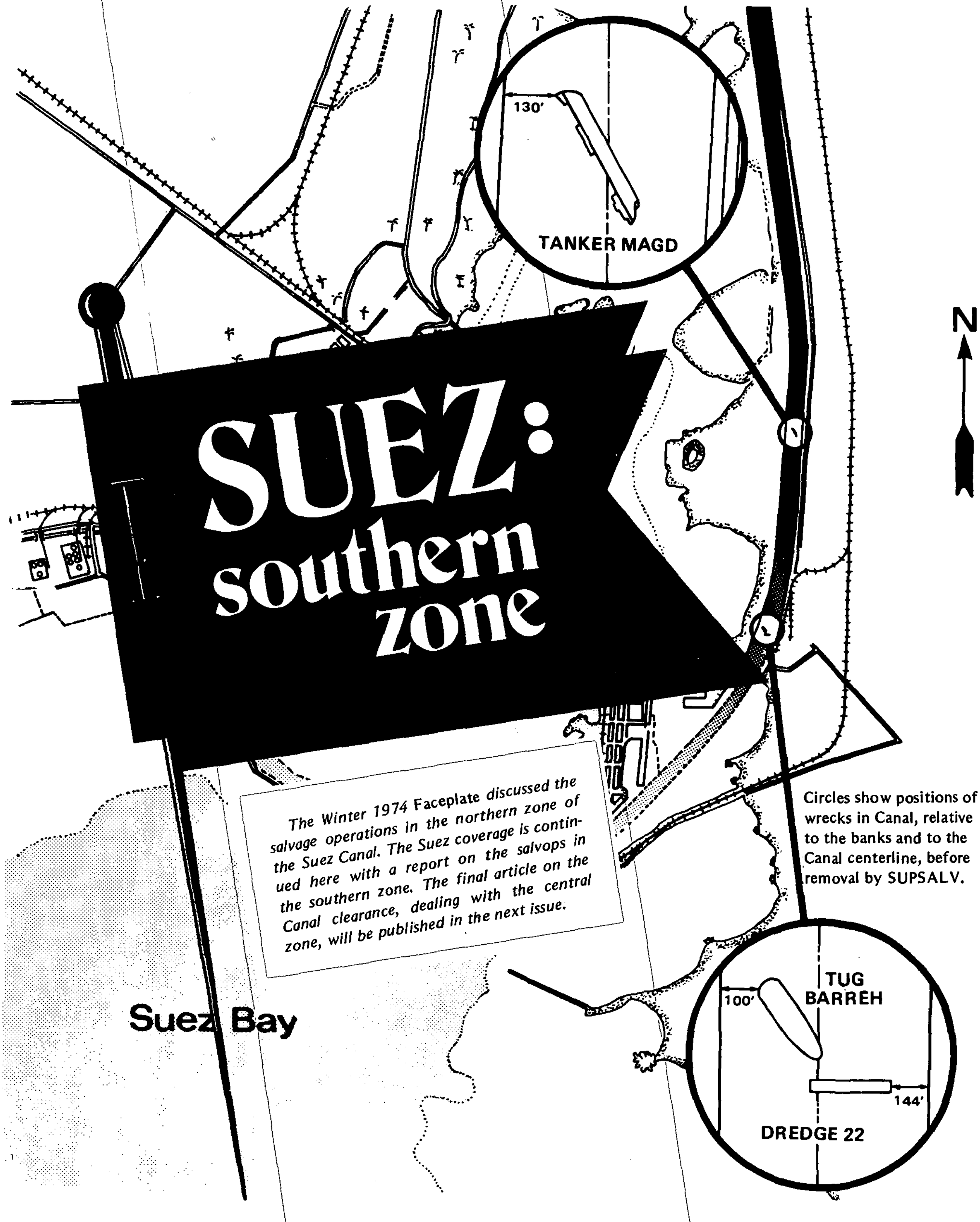
During the clearance operation, CAPT Boyd also sponsored on-site, on-the-job training for salvage officers stationed throughout the Navy, ashore and afloat. This training permitted a broad segment of the diving and salvage community to participate in a major ship salvage/clearance operation, thus providing invaluable experience.

The successful removal of the ten wrecks by December 20, 1974, permitted the transit of the entire length of the Canal by selected Egyptian ships. CAPT Boyd's leadership ability in directing an engineering effort of such great proportions, which included utilizing personnel from three different nations, lead to the successful completion of this monumental task.

As stated in the citation, "By his outstanding organizational ability, perseverance, diplomacy, and inspiring dedication to duty, CAPT Boyd reflected great credit upon himself and upheld the highest traditions of the United States Naval Service."

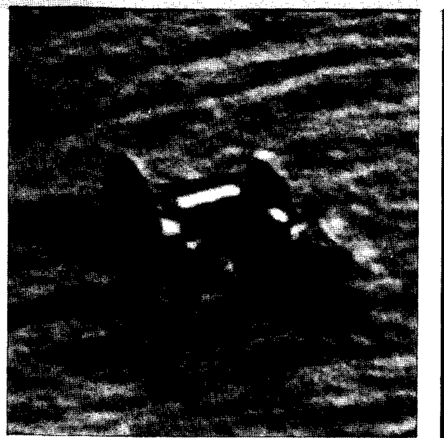
ADM I.C. Kidd congratulates CAPT Boyd after the award presentation.

SUEZ: southern zone

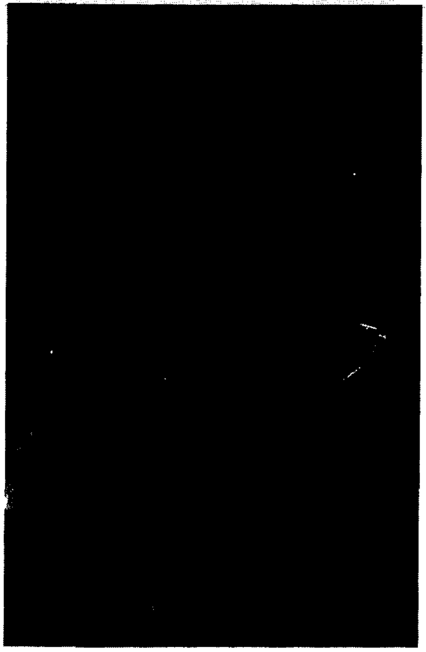


The Winter 1974 Faceplate discussed the salvage operations in the northern zone of the Suez Canal. The Suez coverage is continued here with a report on the salvops in the southern zone. The final article on the Canal clearance, dealing with the central zone, will be published in the next issue.

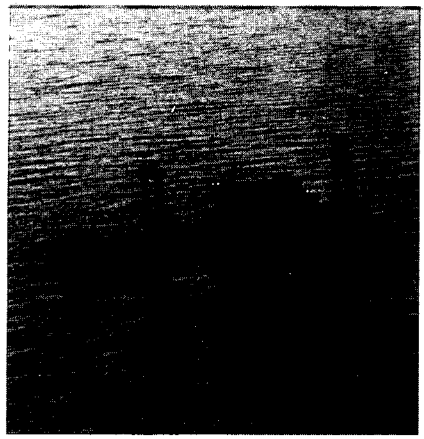
Circles show positions of wrecks in Canal, relative to the banks and to the Canal centerline, before removal by SUPSALV.



Dredge 22 as it lies in Suez Bay dump area.



Tug BARREH as it lay before removal.



MAGD bow as it lies in Suez Bay dump area.

Three wrecks blocked the Suez Canal in the southern zone. Two of these vessels, tug BARREH and dredge 22, were sunk as a combined block across the waterway just 2 kilometers north of the city of Port Taufiq, at the southern entrance to the Canal. The third wreck, tanker MAGD, was sunk approximately 1 kilometer north of BARREH and dredge 22. Salvage operations on these three wrecks began on October 6, 1974, when the trim and rig team prepared BARREH for lifting; they ended on November 22, when the bow section of MAGD was deposited in the Suez Bay wet dump area.

Salvage surveys on the southern zone wrecks were conducted from July 19 through July 29. Salvage plans, however, were revised on several occasions because of various developments during the Canal salvops. One major change in the original plans was that the YHLCs would not be used immediately upon their arrival to clear the wrecks in the southern zone before proceeding north to aid in the removal of the wrecks in the central zone. This was the result of several developments.

The first unexpected revision arose early in the project. During the salvage survey, dredge 22 was found lying on its side instead of in an upright position (as had been reported in the Suez Canal Authority (SCA) Survey). This meant that the heavy lift cranes, THOR and ROLAND, would have to parbuckle the dredge before it could be lifted. After parbuckling, the cranes could also then lift the wreck as well. This would eliminate the delay incurred by removing the cranes after parbuckling and then rerigging the wreck for the originally planned lifting of the dredge by the YHLCs, CRANDALL and CRILLEY.

In addition to the requirement to parbuckle dredge 22, several other factors further affected the utilization of the YHLCs in the southern zone. The close proximity of dredge 22 to tug BARREH would have interfered with the positioning of the heavy lift craft. Also, the swift tidal current around the two wrecks would have hampered the mooring of the YHLCs normal to the current to make a side lift. In view of the situation, it would be easier to moor the lift cranes, since they usually operate parallel to the current.

Another influential factor was that the plan to section MAGD required either extensive trimming of the superstructure to permit lifting by the YHLCs, or parbuckling and lifting of the sections by the cranes, which was the most expeditious alternative. One of the primary determining factors, however, was the difficulty being encountered by the YHLCs in lifting the concrete caisson, which was located in the central zone. This required the employment of the YHLCs on that wreck for a longer time than was planned originally, precluding their availability for the southern zone operations.

After the original plan to use the YHLCs immediately upon their arrival in the southern zone was abandoned, the emphasis shifted from the lift craft to the cranes as the primary operational tool in that area, and revised salvage plans evolved as a result. Basically, however, the same approach was used to remove all three wrecks. The techniques employed were to parbuckle the wreck, if not upright, using the cranes THOR and ROLAND; to section the wreck if it were too heavy for lifting by the cranes; and then finally to lift the wreck as a whole or in sections, using THOR and ROLAND. Oil removal plans were not developed since two of the wrecks would be lifted intact, and the third (MAGD) would be sectioned in an area where no oil was present, with both ends lifted intact.

Salvage Survey

The bucket dredge 22 displaced 1,200 tons. Located southeast of tug BARREH, dredge 22 rested on its starboard side at approximately 22° past the horizontal. Its bow was 144 feet from the east bank and its stern was 150 feet from the west bank. The dredge lay normal to the Canal centerline in an average depth of 52 feet of water.

The hull was in poor condition from rusting and from damage by scuttling charges. There were numerous holes in both the port and starboard turn of the bilge, and sections of the main deck had been blown open and rusted through. In addition, the shelter deck had been carried away, leaving only steel framing.

THOR and ROLAND parbuckle dredge 22 before lifting it.

Salvage Operations

The trimming of dredge 22 commenced on October 15. Removing the dredge ladder and buckets, which was accomplished during the period of October 15-22, was the most difficult and time-consuming part of the trimming operation. Also undertaken at this time was the removal of the dredge's fenders, which was performed using primarily oxy-arc cutting with the occasional usage of explosive shape charges and primacord.

Since the amount of silt present in dredge 22 was not significant, silt removal operations were not undertaken. The salvops moved on to parbuckling operations after the completion of the trimming work.

ROLAND and THOR moored over dredge 22 on October 23 to commence passing parbuckling wires under the dredge. In addition, bolsters were fitted to the turn of the bilge and the deck edge to prevent crushing the hull. THOR and ROLAND completed the parbuckling operation expeditiously and without incident on October 27.

After parbuckling was completed, it was discovered that the 3/8-inch-thick by 4-foot-long steel bolster at the turn of the bilge had crushed into the hull approximately 4 feet. The possibility existed of a more severe recurrence of this during application of the heavier lifting loads, especially in view of the poor condition of the hull. Precautions were taken to distribute the lifting loads over a wider area by constructing larger bolsters of 3/8-inch plate, stiffened with five sections of railroad rails welded to the plate. Two 6-meter-long bolsters were fitted on each side at the stern, and two 10-meter-long bolsters were fitted similarly at the bow.

The preferable, and the originally planned, method of lifting would have used ROLAND and THOR on the same side. However, the lift points had to be shifted to avoid the area damaged by the parbuckling forces, and thus it was necessary to move THOR to the opposite side of the dredge.

After THOR and ROLAND were moored in position, work commenced, using two SCA barges, to rig the heavy lift wires. Two parbuckling wires were used as lift wires, and two other wires had to be repositioned. One of these required 4 days of considerable effort by divers to tunnel through the hard sandstone under the hull. Since ROLAND did not have to shift appreciably from the parbuckling position, the parbuckling wires were used as lift wires.

Four bolsters on each side of the hull were jetted into position at the turn of the bilge in way of the lift wires. The lifting arrangement for dredge 22 utilized the main hooks and gin tackle of ROLAND and THOR. Lifting commenced on the ebb tide on the morning of November 4 and proceeded smoothly as the dredge was lifted to the water's edge and then transported to and deposited in the wet dump area south of the southern entrance to the Canal. The cranes then returned to the BARREH site to commence rigging for the subsequent lift of that wreck.

Salvage Survey

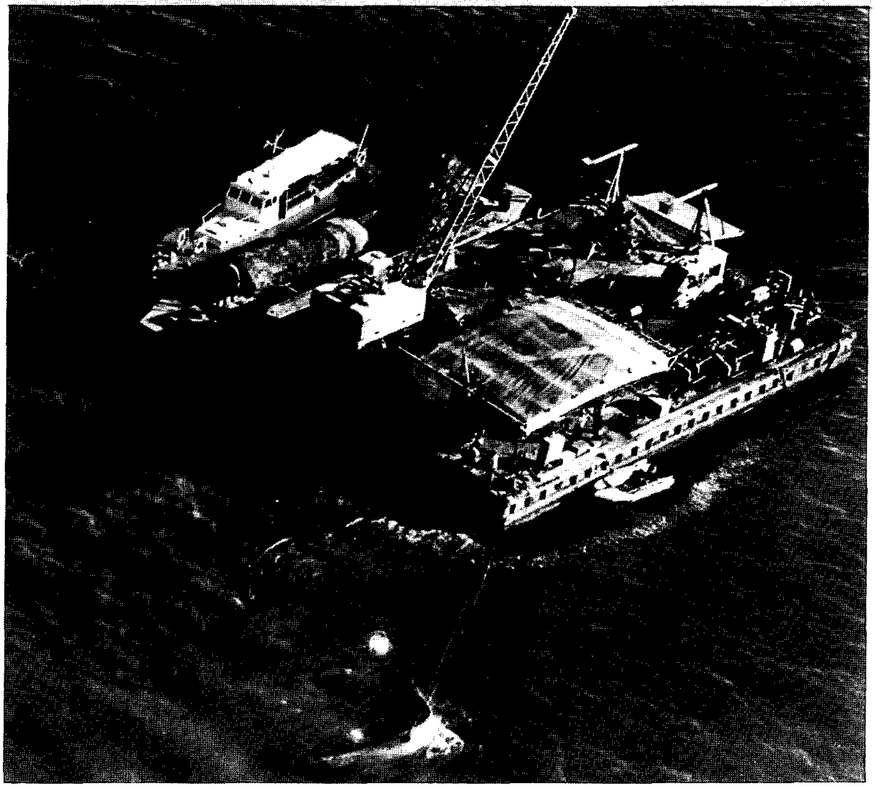
Tug BARREH had a displacement of 1,200 tons, and was 165 feet by 32 feet in dimension. It lay with its stern 100 feet from the west bank, at a 10° port list, and at an angle of 66° to the Canal centerline.

The hull was sound; however, the stack and superstructure above the 01 level had fallen to port, and the wheelhouse lay on the Canal bottom. Eight portholes (four on each side) were broken, open, or missing. The hull was silted to a depth of 4 feet in the engine room and 3 feet in the boatswain locker and the compartment aft of the engine room.

Salvage Operations

Trim and rig operations began on BARREH on October 6, after the SCA crane and diving barge were moored together in a four-point moor over the wreck. BARREH, resting on the inclined revetment, was securely moored to the west bank of the Canal to prevent her from slipping into deeper water during the salvage operations. The after stack of BARREH, which had fallen over to port, was the first piece lifted to the surface and placed on the deck of the derrick barge. Trimming operations continued with the clearing of loose wreckage on the deck of the tug, cutting and removing the anchor chains, and then rigging and lifting the upper bridge structure on October 13.

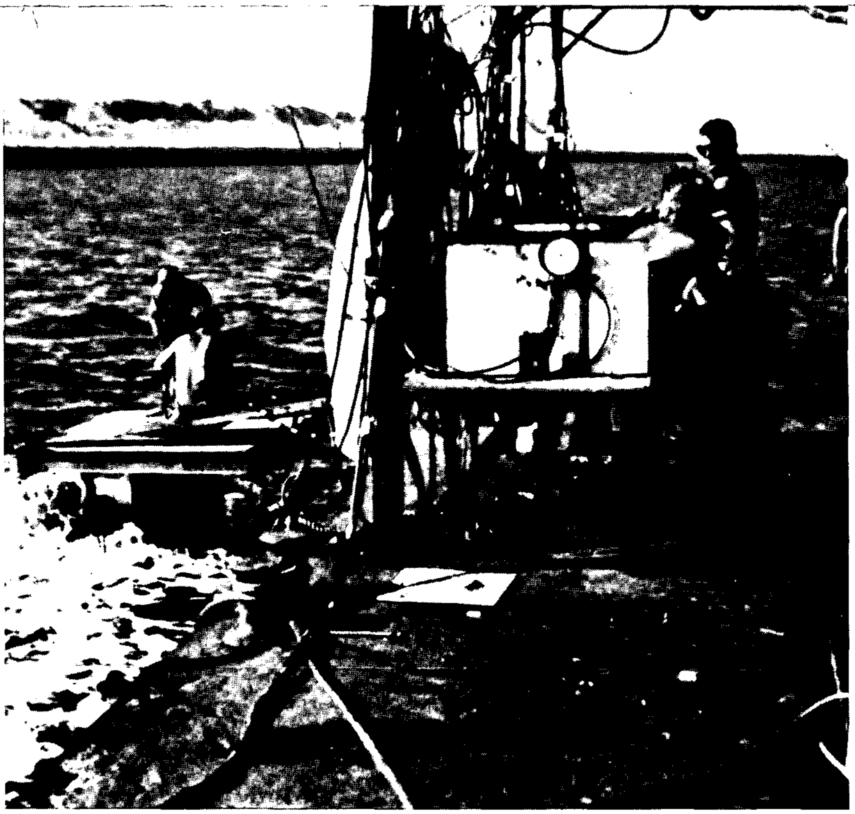
At the time of rigging the messenger wires on October 8, it was considered desirable to keep open the option of using either THOR and ROLAND or CRANDALL and CRILLEY to lift BARREH. The use of the YHLCs required the greatest number of lift wire messengers; therefore, eight messengers were passed under the wreck to provide for that alternative.



Salvage work barge initiates preparations for removal operations on tug BARREH.

The quantity of silt in BARREH was of concern because it added appreciably to the lifting force required to remove the wreck. Silt removal operations were conducted from October 8 to October 13. Divers used a 4-inch air lift to clear the after berthing compartment of silt, after which multiple air lift operations commenced. One diving team worked in the forward berthing compartment with a 6-inch air lift, and a second team used a 4-inch air lift in the engine room. During these operations it was frequently necessary to use a high pressure water jet to break up the packed silt prior to removal. The after boiler room was not evacuated because of the suspected presence of undetonated explosives.

After depositing dredge 22 in the wet dump area south of Suez City on November 5, THOR and ROLAND moved to the BARREH site and moored alongside each other to port (north) of and over the tug. Rigging of lift wires commenced shortly thereafter. Each crane was rigged in the 1,000-ton lift mode, with the main hooks of each lifting on the starboard (far) side of the wreck, and the gin tackle rigged to the near side. This 2,000-ton lift capacity proved adequate for the 1,200-ton predicted lift weight of BARREH. As the wreck was lifted on the afternoon of November 7, an out-of-position 2nd lift wire placed by ROLAND was adjusted appropriately. The wreck was lifted clear of the bottom, moved to the center of the Canal, and set down. On the early morning slack tide of November 8, BARREH was raised, transported to the wet dump area without incident, and placed on the bottom. During the lift and transit, ROLAND carried 800 tons while THOR carried 600 tons. Both cranes were unrigged and returned to the MAGD salvage site the following morning.



Divers prepare to descend in cofferdams during removal operations on tanker MAGD.

TANKER MAGD

Salvage Survey

Tanker MAGD, the northernmost of the three wrecks in the southern zone, displaced 2,400 tons. Though reported in the SCA survey to be resting on its starboard side, it was actually found on its port side, with its bow toward and approximately 130 feet from the west bank. It lay at an angle of 30° to the Canal centerline. MAGD had sunk into approximately 10 feet of mud on the Canal bottom, and had 14 feet of water clear over it.

Generally, the hull was in poor condition. Cargo tank tops were buckled, and plating and rivets were missing. The superstructure was intact, but damage in the tankage was widespread. The wreck was silted to a depth of 2 to 4 feet in the starboard and center tanks, and 4 to 6 feet in the port tanks. Mud was pocketed throughout the engine room, with depths varying from 3 to 10 feet.

Salvage Operations

The salvage operations on MAGD, which commenced on October 17, were somewhat more complex than those of dredge 22 and tug BARREH.

The restrictions on diving caused by swift tidal currents, coupled with the requirement for extensive diving operations in severing the hull and removing large quantities of silt from the wreck, led to the decision to use cofferdams. This allowed diver access to the interior of the hull, where operations could be conducted out of the current. Thus, the placement of cofferdams was of first priority as operations commenced; a total of nine cofferdam holes were cut along MAGD's hull.

Using the SCA 80-ton crane, rigging and placement of the first two cofferdams was accomplished during the period of October 20-21. The procedure for setting the cofferdam consisted of cutting an access opening for the cofferdam on the up (starboard) side of the wreck and an additional opening alongside for the air lift. Once the cofferdam was lowered into the starboard tank, an area was cleared by air lift to enable lowering the cofferdam into the center tank. The cofferdam was lowered no further than the center tank and was fitted with a window to allow diver access to both the starboard and center tanks.

After completion of silt removal in the engine room, cofferdams were moved forward along the hull as removal work proceeded. As a general practice, divers started removing silt in the starboard tank and moved down through the center to the port tank. In way of the planned cut at number four port tank (frame 43), however, the divers cleared the port or bottom area first to facilitate an early start of cutting there. (Cutting operations commenced when silt removal was completed from number four port tank on October 28.) Silt removal operations were completed on November 12.

After the cofferdam had been placed and the silt removed in way of the cut at frame 43, cutting operations commenced. Oxy-arc torches were used exclusively, with the exception of the use of heavy-duty primacord to clear the cut line of scale and marine growth along the starboard (or up) side.

Sectioning of the hull commenced on October 25, when divers began cutting the port (or downward) side of the wreck from the inside. The cut progressed to the port bilge area, across the bottom of the ship, and to the starboard bilge area. The main deck cut was completed on October

31. The starboard side remained intact until November 7, to permit the placing of parbuckling and lifting wire messengers. When this side was cut, the stern section slid to the south approximately 15 feet and the forward end of the stern lifted 6 feet off the bottom and rolled 12° toward the upright.

THOR and ROLAND moored over MAGD on November 9 in preparation for parbuckling the stern section, which then lay with a 78° port list. THOR maneuvered into position over the forward end and ROLAND moored over the after end of the stern section. THOR was rigged to use deck tackle only in this operation. Two 3-inch straps were rigged over the bow rollers, down across the deck of MAGD, under the port side, around the keel, and up across the starboard side to parbuckling hooks rigged on the starboard deck edge. ROLAND used one parbuckling wire rigged from her port hook with the wire rigged in the same manner as THOR's. Parbuckling was completed after 27 minutes of pulling effort on October 10. THOR exerted a force of 350 tons, and ROLAND exerted 160 tons. Upon completion, the stern section was sitting upright with approximately 15 feet of stack watching.

On November 11, THOR and ROLAND commenced rigging for lift operations on the stern section. ROLAND shifted around parallel to THOR on the same (west) side of the wreck. THOR picked up the forward edge of the stern to provide the clearance needed to rig the port lift wire on ROLAND. With each craft rigged to lift 1,000 tons each, using the main hooks and deck tackle working together, the stern section was lifted during the afternoon slack tide. The lift weight was 1,200 tons; 650 tons was lifted by ROLAND, 550 tons by THOR.

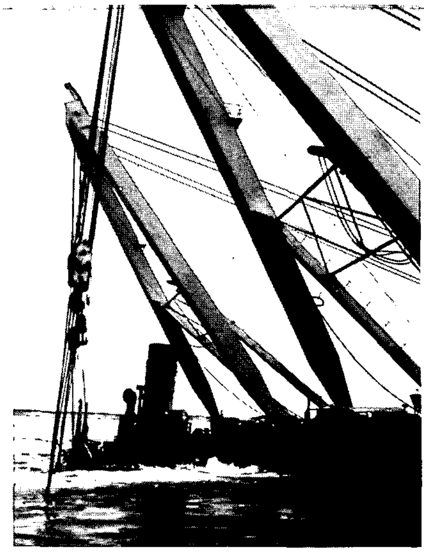
While under tow to the dump site, the wreck grounded unexpectedly near Port Taufiq. As a result, the outboard starboard wire of ROLAND parted, leaving the wire under the wreck. The second wire from ROLAND also parted and was pulled from under the wreck as ROLAND separated from THOR and lurched forward. THOR remained grounded to the wreck. Both purchase wires on ROLAND's deck gear were crushed when the lift wire parted. A day was spent in rerigging after the damage. An additional heavy lift wire was re-run, using a spare messenger that was still rigged to the stern of MAGD.

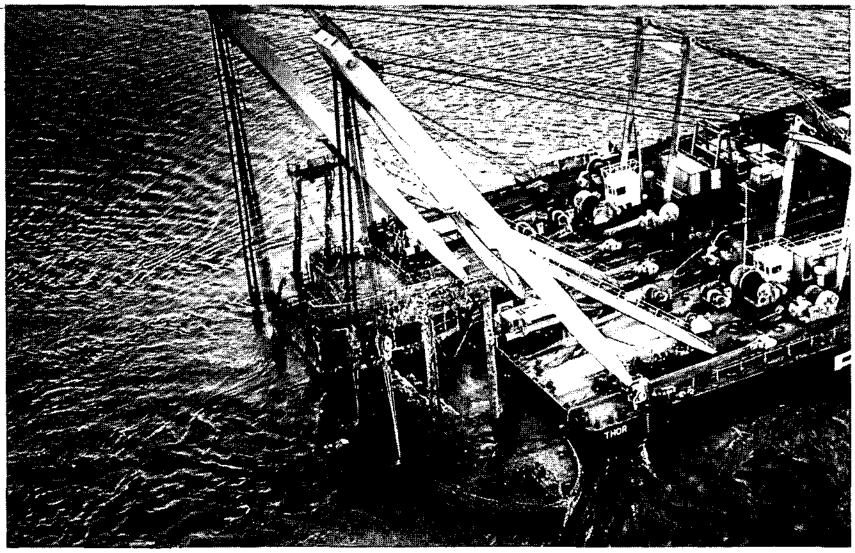
As before, THOR lifted the forward end of the section to permit ROLAND to complete rigging. On November 14, with both wires rigged, the section was lifted and put under tow to the dump site. ROLAND and THOR were towed stern first by the tugs BUGSIER 26 and KADER. At the end of the day, the shear legs had passed landfall and set the wreck down for the night. The next morning, THOR and ROLAND commenced picking up the wreck but encountered problems. When the wreck was set down the night before it had rolled slightly toward the shear legs, and on lifting, the deck edge impinged on ROLAND and tended to crush the lift wire. The second lift attempt brought the section up satisfactorily, and it was towed to the wet dump site and placed on the bottom south of dredge 22. The funnel and the top deck were above water.

After depositing the MAGD stern, ROLAND and THOR returned to the MAGD bow on November 16 to commence parbuckling efforts. It was decided at that time to parbuckle the bow rather than perform the more time-consuming alternative of removing the superstructure for lifting. In addition, it was determined that the bow section would be lifted by the cranes, since the heavy lift craft were still employed in lightening the west section of the concrete caisson in preparation for a side lift of that structure. This decision was influenced by the fact that once the cranes were used to parbuckle, they could make use of parbuckling wires as lift wires.

The cranes positioned themselves at the ends of the bow section, with THOR to the north and ROLAND to the south. Divers commenced rigging parbuckling wires and parbuckling anchors, and early November 18, parbuckling commenced. ROLAND, exerting a force of 500 tons, appeared to be lifting. THOR, exerting a force of 80 to 120 tons, appeared to be pulling the wire through the hull. After rotating the bow 20°, the parbuckling effort was suspended temporarily. Divers sent to inspect the section reported that the forward parbuckling wire from THOR had been improperly placed in a weaker area away from its prescribed position. The wire was bearing against the forecastle deck, and had cut that deck completely and all but 10 feet of the main deck. The longitudinal bulkhead dividing the forward ballast tanks was ripped 15 feet down from the main deck, and the side was cut down to the heavy strength members near the keel. The cut down side crossed the transverse bulkhead. This bulkhead, the standard side plating, and stiffeners provided sufficient strength to keep the section together.

It was decided to add an additional parbuckling wire and hook forward, and also retain the existing hook, but to run the wire in the originally prescribed position forward of the cut. On November 20, after rigging the forward wires, the parbuckling effort commenced once more. With 450 tons of force exerted by ROLAND, and


Cranes lift MAGD stern.


Cranes complete lift of MAGD bow.

320 tons by THOR, the bow section was righted properly.

One parbuckling wire from ROLAND was used as a lift wire; the other had to be moved to provide the necessary wire spacing. Both of THOR's parbuckling wires had dug approximately 15 feet into the hull and had to be relocated. Lifting preparations were interrupted on November 20 to permit the passage of four Mecca-bound pilgrim ships. These were the first ships to transit the Canal since 1967. After passage of the convoy, THOR and ROLAND positioned themselves in the lift position to the west of the MAGD bow section. On the following morning, after the remaining lift wires were passed, THOR applied 600 tons and ROLAND applied 550 tons to lift the section.

Once under way, with the cranes being towed stern first to the dump area by BUGSIER 26 and MARINER, it was discovered that the anchor from MAGD was dragging the bottom. Motion was halted, and the anchor was buoyed and removed. The wreck was placed back on the bottom late in the afternoon to await a daylight transit to the dump site the following morning. Forward transit to the dump area resumed at high tide early November 22, and was completed without incident. The bow section was finally placed on the bottom early November 23, after waiting overnight en route.

Depositing MAGD's bow section in the Suez wet dump area concluded the southern zone salvage operations.

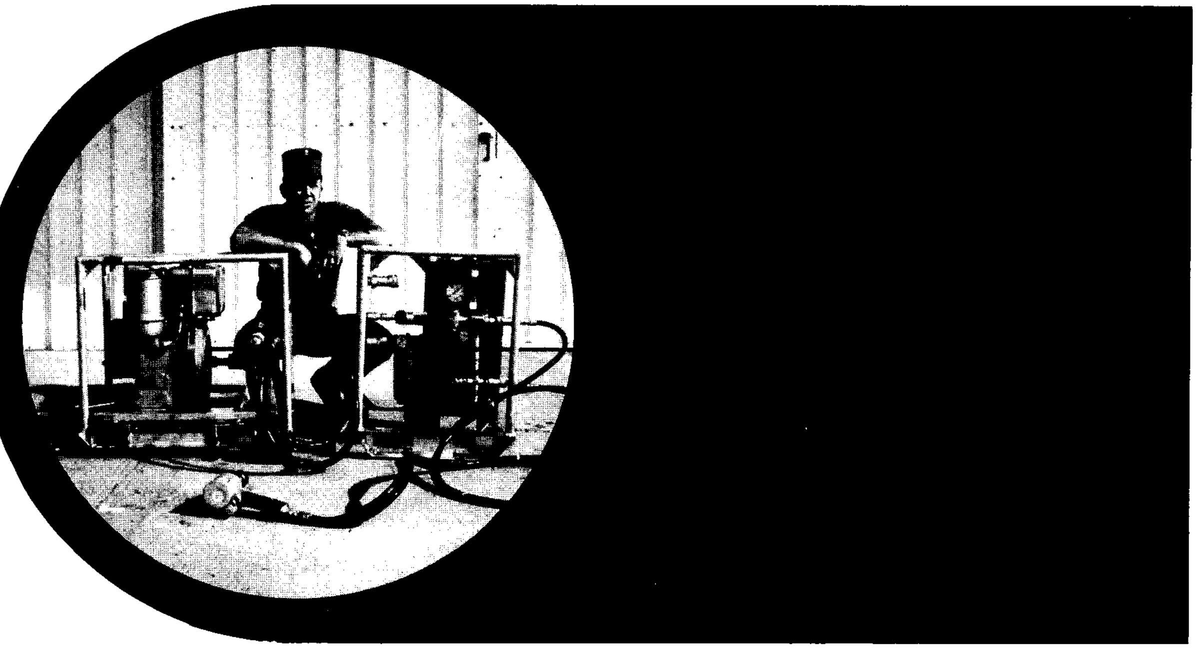
SUMMARY

Tidal currents in the southern zone were extremely strong, frequently exceeding 2-1/2 knots. This situation restricted diving operations to 3 to 5 hours per day. However, although currents played an important part in the decisions in this section of the Canal, salvage operations in the southern zone were among the simplest in the entire operation. They were classic examples of the use of lift equipment for righting and removing wrecks. The difficulties encountered in passing wires under wrecks, cutting the hull by wires, and out-of-position wires were typical problems encountered in heavy-lift operations.

Sectioning and lifting operations were relatively simple, with no unnecessary sophistication. The most prominent feature of the efforts in the southern zone was the continuing flexibility of the salvage plan, which was modified several times to adapt to changing conditions. This ability to adapt the salvage plan as necessary was a major factor in the expeditious completion of the operation.

SUMMARY OF SALVAGE OPERATIONS – SOUTHERN ZONE

Wreck	Started	Completed	Method of Removal	Dump Area
MAGD	Oct. 17	Nov. 22	Cut into two sections, each parbuckled, and lifted with THOR and ROLAND.	Wet dump, Suez Bay
DREDGE 22	Oct. 15	Nov. 4	Parbuckled and lifted with THOR and ROLAND	Wet dump, Suez Bay
BARREH	Oct. 6	Nov. 8	Lifted with THOR and ROLAND	Wet dump, Suez Bay



QMC (DV) W. Wilson with power unit

Now that hydraulic tools are becoming commonplace for divers, many are familiar with the Diesel Hydraulic Power Unit, NAVSEA Model 1. This unit is rugged, reliable, and versatile, but weighs over 1,300 pounds, a weight that might qualify the unit for the label "mobile," but not "portable." Since divers often operate from vessels of opportunity, which frequently are small craft, and are usually required to go *to* their work instead of having it come to them, the need for a truly portable diver tool power unit is apparent.

The Supervisor of Diving, U.S. Navy, has recognized this need, and is finding a solution for this situation via the Naval Coastal Systems Laboratory, Panama City, Florida. The Diver Tool Group at NCSL has developed a modular portable unit, and has other ideas for even smaller and better equipment. One of the primary problems in this development is the restriction against using a gasoline prime mover. Basically, this requirement is imposed for safety reasons. In addition, diesel-type fuels are more readily available in the Fleet.

In order to satisfy this major constraint, NCSL conducted a market survey to find the lightest diesel engine in the power range required. It then decided to go to a modular concept in order to keep each piece of gear handleable by no more than two men. The prototype unit illustrated in this article was fabricated by QMC (DV) Warren Wilson. The diesel engine and hydraulic pump are in one module, weighing under 250 pounds, and the hydraulic reservoir and the control circuitry are in another module, weighing approximately 175 pounds. The two modules are connected by two hydraulic hoses with quick-disconnects.

This portable unit generates up to 7 gpm at 1,500 psi, approximately one-half the capability of the NAVSEA Model 1. This reduced capability is adequate to operate all of the present hydraulic diver tools, although some of the tools may not quite reach top performance. The prototype unit has passed all of its laboratory tests (Code Alfa), and will soon go out to a fleet activity for a brief field test. After the field test is completed and any discrepancies in the design are corrected (probably during summer 1975), the unit will be ready for the fleet.

As mentioned earlier, NCSL has ideas on improving diver tool power units even further. Presently, NCSL has a rotary engine powered by diesel fuel. If testing continues to progress as well as it has to date, within 1 or 2 years a unit smaller than the portable one described here may be available, with capabilities greater than the big NAVSEA Model 1 unit.

Any questions concerning diver tools or difficult underwater work tasks may be directed to either Bob Elliott or John Mittleman at NCSL, Panama City, Florida 32401, Autovon—436-4388, Commercial—(904) 234-4388.

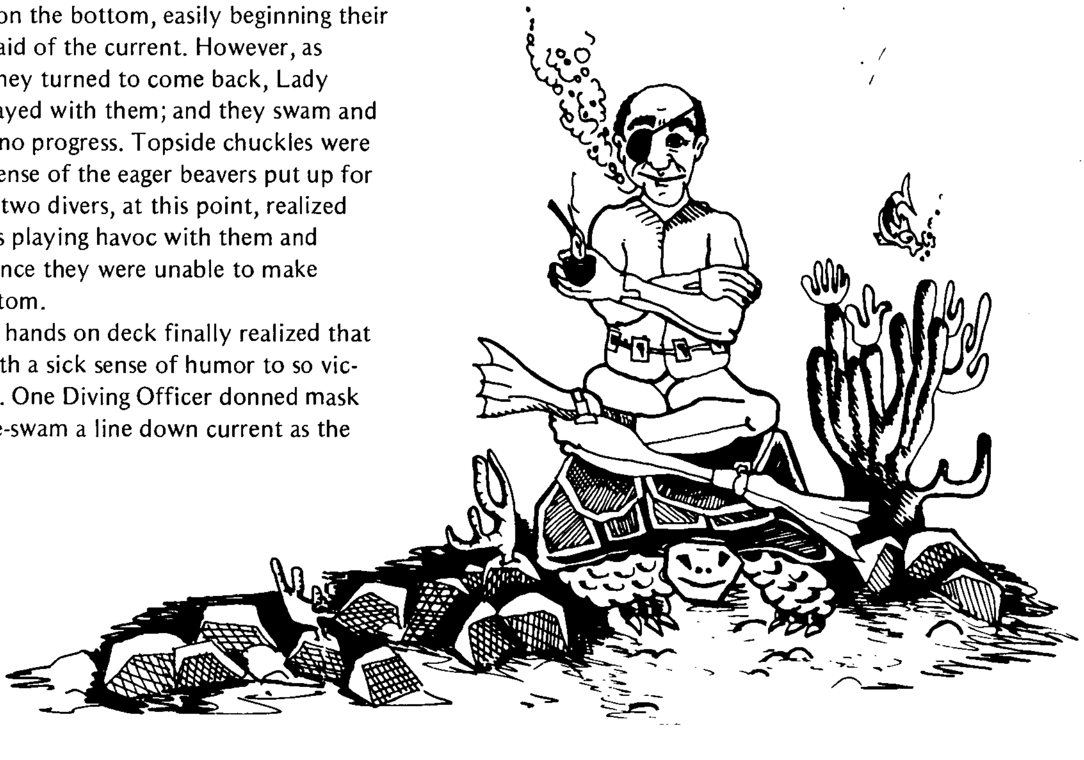
The Old Master...

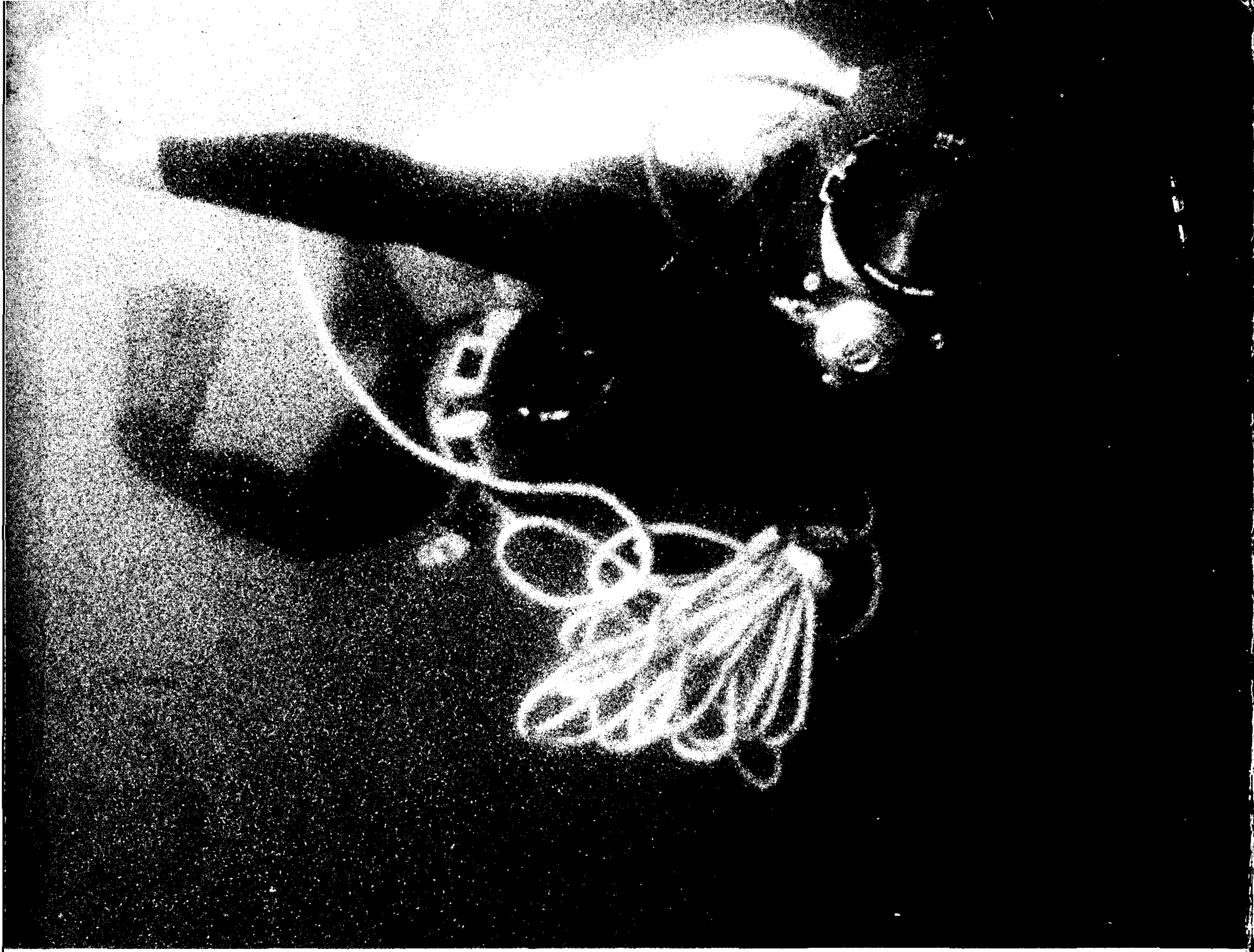
Outside the normal professional requirements of diving, the old Navy term "shipmate" and the obligations thereof should be closely intertwined and not treated lightly. The illustration I have in mind took place in sunny Florida. Five Diving Officers and four divers were en route to an operational area for shallow water indoctrination runs with an experimental swimmer delivery vehicle (SDV). Upon arrival at the ops area, the craft was anchored with the SDV and recovery sled streamed astern. The depth of water in the area was 35 feet, and the visibility was excellent. While preparing the SDV for launch, one of the operators lost his watch. In light of the cost of the watch, it was requested that someone suit-up in SCUBA gear and attempt to recover it. Immediately, one of the junior divers and a relatively new Diving Officer suited-up to make the dive. The other, more experienced, Diving Officers smiled, because while riding at anchor and taking a casual look over the side, they saw that at least a 1.5-knot current was running.

After the two eager volunteers were in the water, they could be seen on the bottom, easily beginning their search aft with the aid of the current. However, as predictable, when they turned to come back, Lady Current toyfully played with them; and they swam and swam with little or no progress. Topside chuckles were plentiful at the expense of the eager beavers put up for sacrificial bait. Our two divers, at this point, realized that the current was playing havoc with them and started to surface since they were unable to make progress on the bottom.

The experienced hands on deck finally realized that they were acting with a sick sense of humor to so victimize fellow divers. One Diving Officer donned mask and fins and surface-swam a line down current as the two divers surfaced. No one was hurt (with the exception of pride), and they were easily retrieved with the use of the line. The outcome was that two men were very tired and no watch was recovered.

What's the old master trying to say?. . . On the professional side, the Diving Supervisor's role was at best loose; and, though excessive current was evident to all, the volunteer divers' eagerness to get in the water overtook their good judgment. The Supervisor shirked his responsibility by not fully supporting his divers and pre-briefing them on current conditions. On the shipmate side – is this any way to treat a fellow diver? A sense of humor is great, but joking like this is foolhardy. In the end, it really was not funny at all. Each of us had to learn lessons as we began, but callously executing a "learn it the hard way" attitude is incompatible with the term shipmate.





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