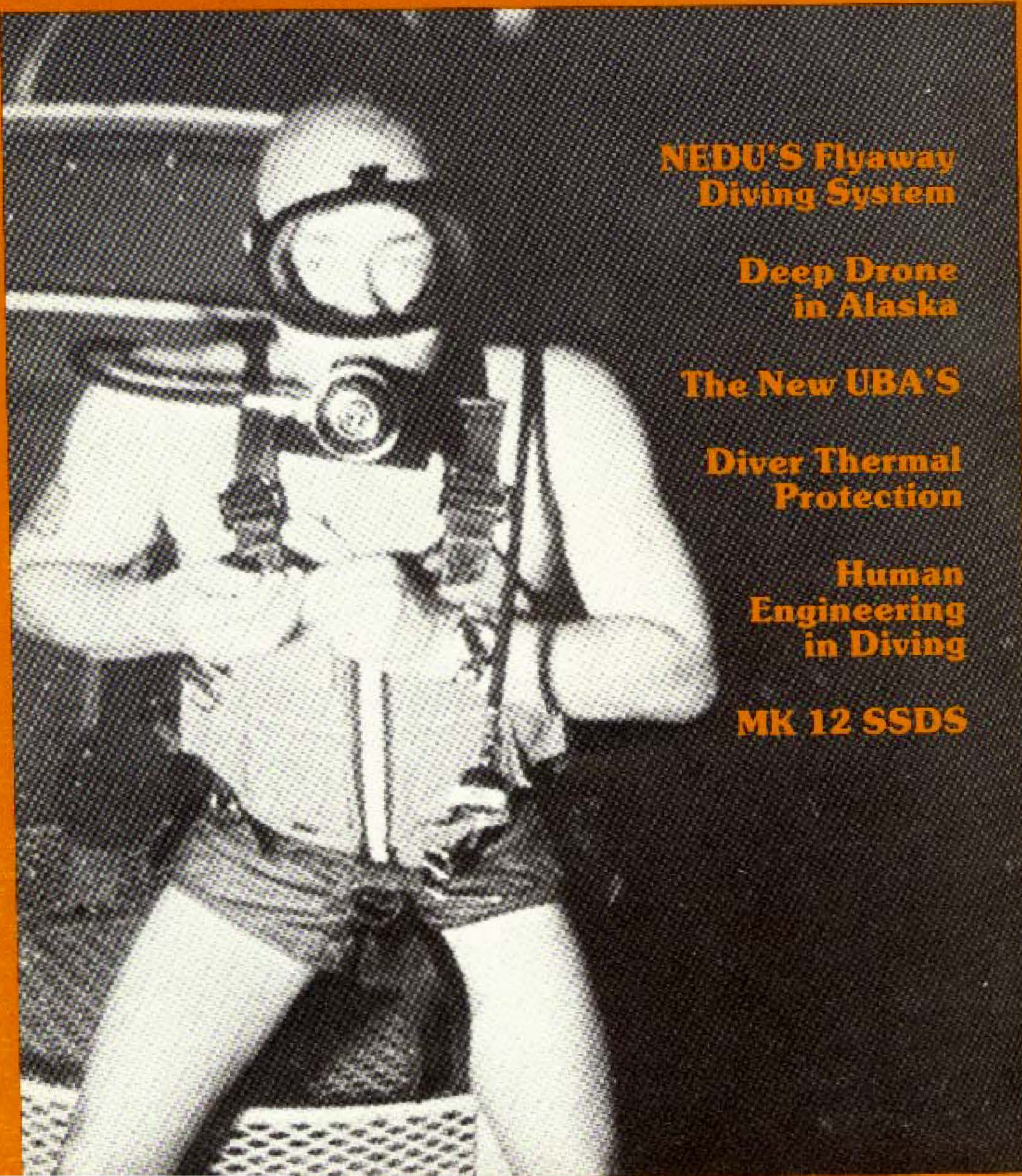
FACEPLATE

SUMMER 1978



NEDU'S Flyaway Diving System

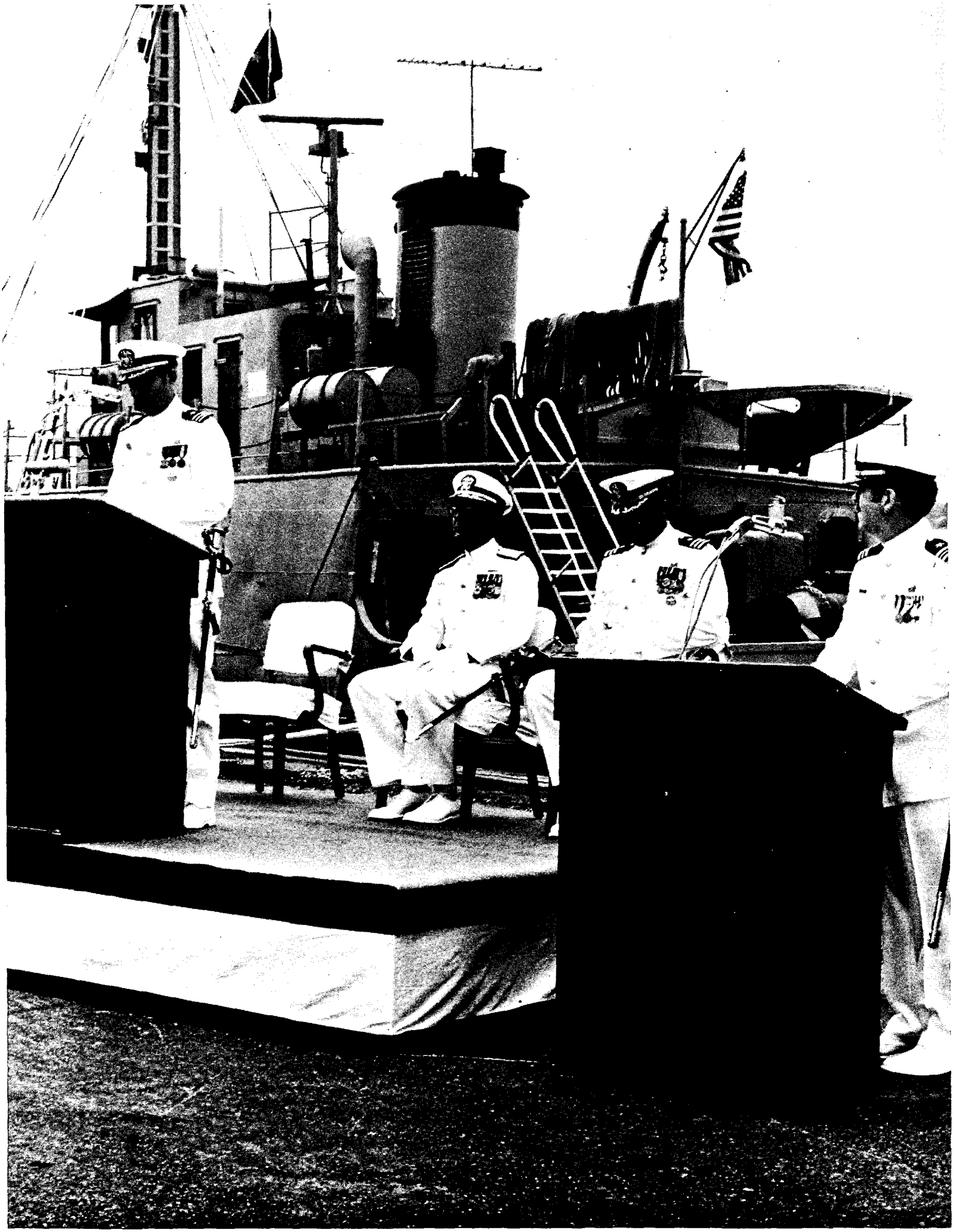
Deep Drone in Alaska

The New UBA'S

Diver Thermal Protection

Human Engineering in Diving

MK 12 SSDS



FACEPLATE

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

VOLUME 9, NO. 2

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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Front cover shows diver at start of timed doffing experiment for Navy Experimental Diving Unit human engineering program. See story on page 21.

Inside front cover shows NSDS change of command ceremony with (l-r) CDR Richards, RADM Baciocco, CDR Roper and LCDR Allen. See story on page 6.

Back cover shows diver during cold water tests at Navy Experimental Diving Unit.

CALL FOR PHOTOS

The Fall issue of FACEPLATE will feature the 50th Anniversary of the Naval School, Diving and Salvage. Readers who would like to share personal photographs or information about the school and its people and events through the years are invited to submit them for publication to FACEPLATE, Supervisor of Diving, Naval Sea Systems Command, Washington, D.C. 20362. All materials will be returned, but must reach us by September 21, 1978.

FACEPLATE TRANSITION

Since the Fall of 1973, the publishing of FACEPLATE has been under the leadership of Managing Editor Joanne Wills. During this period, the magazine increased in size and improved in overall appearance while maintaining its standard of technical accuracy. Upon completion of the Spring 1978 issue, however, Joanne left for new endeavors and the duties of Managing Editor were turned over to Mr. Stephen Person. The FACEPLATE staff joins the Navy diving community both in extending a hearty "Well Done" to Joanne for her untiring efforts on the magazine and in welcoming Steve aboard.

DIVING MANUAL CHANGE 2 AVAILABLE SOON

Change 2 to the U. S. Navy Diving Manual - Volume 1 (Air Diving) is currently being printed and should be ready for distribution in December. Among the highlights of Change 2 are a completely revamped chapter on surface-supported air diving (including the MK 12 SSDS), a new section on Arctic diving, new thermal discussions, and new information on recompression chamber treatment.

LCDR BANKS TO USS RECLAIMER (ARS-42)

Since May 1976, LCDR Bruce C. Banks has served as executive officer of the Navy Experimental Diving Unit and Assistant Editor of FACEPLATE. During this time, LCDR Banks was instrumental in the development and testing of the Flyaway Diving System, the MK 12 SSDS, the MK 14 CCSDS, MK 15 UBA, and EX-17 UBA, and in the successful accomplishment of NEDU's 1400' and 1500' dives at the Ocean Simulation Facility. Also during this time, LCDR Banks fostered closer liaison between system commands and fleet users, and stimulated the production of substantial changes to the U. S. Navy Diving Manual. After attending Prospective Commanding Officer's School in Newport, LCDR Banks will relieve LCDR L. G. Long as commanding officer of USS RECLAIMER (ARS-42) at Pearl Harbor.

RHCU SEMINAR HELD AT NEDU

The 1978 RHCU Diving and Salvage Safety and Training Seminar was hosted by the Navy Experimental Diving Unit in Panama City, Florida, on April 28, 29, and 30, 1978. Attending the meeting were some 50 representatives from various harbor clearance unit detachments, plus representatives from the Naval School of Diving and Salvage, and the Office of the Supervisor of Diving and Salvage. Greetings and opening remarks were delivered by Capt. Thomas V. Petzinger (C.O., NAVSEA Det 1006), Capt. Robert Moss (Director of Ocean Engineering), and CDR C. A. Bartholomew (C.O., NEDU). Captain William Cleary (X.O., NAVSEA Det 1006) delivered a review of RHCU objectives and program identification, after which CDR Frank Richards (then C.O., NSDS), LT R. Jones (CNTT Staff), and CDR R. Bornholdt (Fleet Salvage Officer Pacific) addressed the attendees on professionalism in Navy Diving and Salvage Programs. In addition to attending various discussion groups on topics ranging from operational readiness to female diving trainees, the representatives took part in a number of equipment demonstrations and training sessions.

U.S. AND BRITISH DIVERS MEET AT NEDU

Each year, key members of the United States Navy and Royal Navy diving communities meet to discuss progress in diving research and topics of mutual interest in diving. This year's Information Exchange Project (IEP) B-12 meeting was held from August 22 - 24 at the Navy Experimental Diving Unit, Panama City, Florida. NEDU commanding officer CDR C. A. Bartholomew hosted the meeting. CDR F.Duane Duff and CDR Guy Worsley acted as project officers for the U. S. and Royal navies, respectively.

SPECIAL OPERATIONS OFFICER DESIGNATOR ESTABLISHED

Approval has been given to form a separate category of unrestricted line officers termed "Special Operations Officers" - a further step in the Navy's move to specialize its officer communities. Secretary of the Navy W. Graham Claytor, Jr., authorized the new designator (1140) which will cover duties formerly performed by the surface warfare and engineering duty communities. Special Operations Officers will conduct operational diving and salvage, explosive ordnance disposal (EOD), and expendable ordnance management (EOM).

Approximately 335 Special Operations Officers will be assigned to salvage ships, in ordnance-related jobs aboard carriers, amphibious and service force ships, and on EOD teams. Initially, newly selected officers will be designated 1190 for training until they have met the necessary experience and qualifications for 1140.

Active duty LCDRs and above may request 1140 designation if they are diving and salvage or EOD qualified or possess significant experience in EOM. Interested active duty LTs and below should request 1140 designation if they are already qualified in diving and salvage or EOD. They should request an 1190 designation if they are qualified to enter into training for either diving and salvage or EOD.

All 1140/1190 requests should include grade/name, SSN, current designator, designator applying for, total active commissioned service, CO's endorsement, and qualifications. Additional information will be forthcoming in a NAVOP.

INTERNATIONAL PHOTO COMPETITION

The Underwater Photographic Society in conjunction with the Los Angeles County Museum of Natural History and the University of South Carolina Sea Grant Program announces the Sixteenth Annual Underwater Photographic Competition. All entries must be received by September 30, 1978. The entries will be judged in Los Angeles, California, between October 7 and October 14. Awards will be given in the categories of black and white prints, color prints, color slides, and motion pictures. The competition is open to all underwater photographers in the world. For further information, write to Annual International Underwater Photographic Competition, P. O. Box 7088, Van Nuys, CA 91409.

CORRECTION

FACEPLATE regrets the implication in the Spring 1978 Soundings column that J. & J. Marine Diving Co. is defunct or has been absorbed by J. & J. Machine and Welding Co. Both companies are indeed still active and have independent facilities.

NEDU Reports

Navy Experimental Diving Unit Report 3-78. *Evaluation of a Full Face Mask for Incorporation into the Swimmer Life Support System MK 1.* R. K. O'Bryan

Abstract: The SLSS MK 1 (now the MK 15 UBA) with the Full Face Mask (FFM) was tested for its ability to support a diver performing sustained heavy work at operational depth. During exercise sequences, measured parameters were the divers' heart rates, oral-nasal mask differential pressures, and the oxygen and carbon dioxide fractions of inspired and expired gas. Analysis of the data clearly demonstrates that the system supports a working diver without causing either a decrement in work performance or abnormal retention of carbon dioxide. In addition, it was demonstrated that the external resistance to breathing was significantly lower with the FFM-hose assembly compared with similar data obtained with the MK VI Mod O mouthpiece-hose assembly.

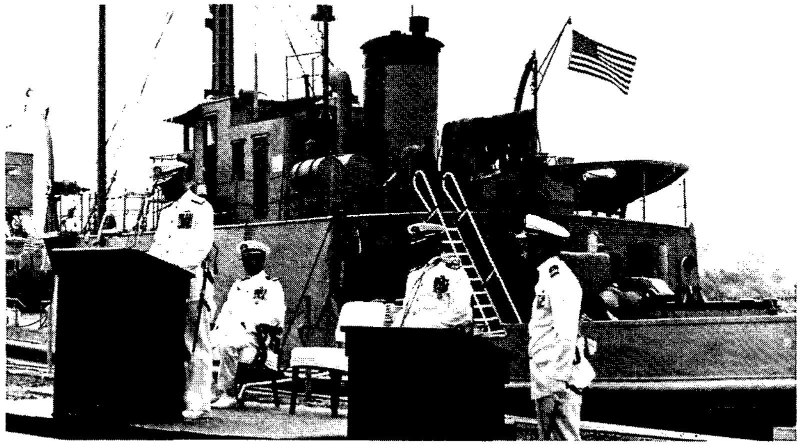
Navy Experimental Diving Unit Report 21-73. *Temperature Requirements for the Maintenance of Thermal Balance in High-Pressure Helium-Oxygen Environments.* E. T. Flynn, J. Vorosmarti, Jr., and H. I. Modell.

Abstract: Using a mathematical model of human thermal exchange, the range of environmental temperatures consistent with the maintenance of thermal balance was computed for helium-oxygen dives up to depths of 5000 fsw. In agreement with the trend of empirical data obtained during shallower dives, the required environmental temperatures decreases. The greatest changes occur in the first 1000 feet of descent. According to the model, sweating will become an ineffective means of extending the upper limit of environmental temperature at depths beyond 2000 feet. Conversely, if chamber temperature falls below the lower limit, body temperature will fall at a rate which becomes more rapid with increasing depth. The normal increase in metabolic rate which serves to limit the fall in central temperature during cold exposure will be attenuated at depth due to a higher mean skin temperature.

HOW TO ORDER:

These research reports have been issued by the Navy Experimental Diving Unit, Panama City, FL. Non-DOD facilities desiring copies of reports should address their request to National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22151. DOD facilities can obtain copies from the Defense Documentation Center (DDC), Attn: DDC-TSR-i, Cameron Station, Alexandria, VA 22314. Prices vary according to the individual report.

Change of Command at NSDS



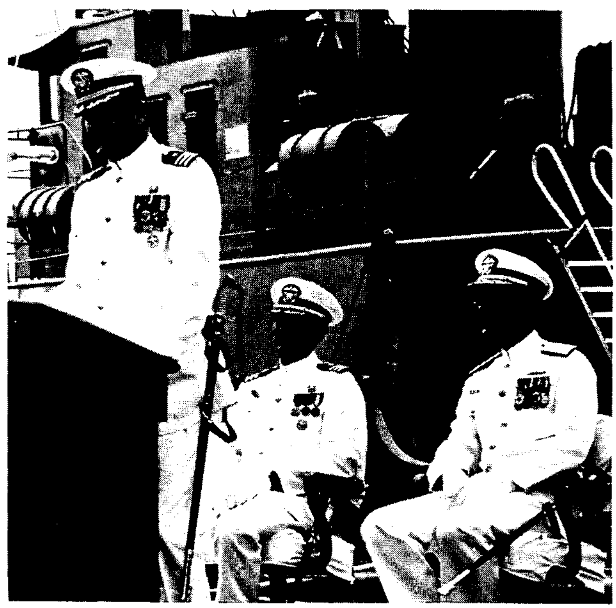
L-R: Guest speaker RADM Baciocco, CDR Richards, CDR Roper, LCDR Allen. Below: CDR Roper reads orders making him new commanding officer.

During change-of-command ceremonies on June 1, 1978, Commander Frank M. Richards was relieved by Commander James E. Roper as Commanding Officer of the Naval School, Diving and Salvage. The School, now in its fiftieth year at the Washington Navy Yard, is the largest and most advanced of its type in the world. The School trains selected officer and enlisted personnel in all phases of diving, salvage, and submarine rescue.

The change-of-command ceremony featured remarks by guest speaker RADM A. J. Baciocco, Director of the Deep Submergence Systems Division for the Chief of Naval Operations. RADM Baciocco praised CDR Richards' dedication and accomplishments during his two years as commanding officer of NSDS; notably, the in-house program to refurbish diving systems aboard diving craft, an improved training curriculum, and the enhancement of the prospective commanding officer course by instituting within the curriculum visits to Fleet diving ships and observance of salvage and recovery operations.

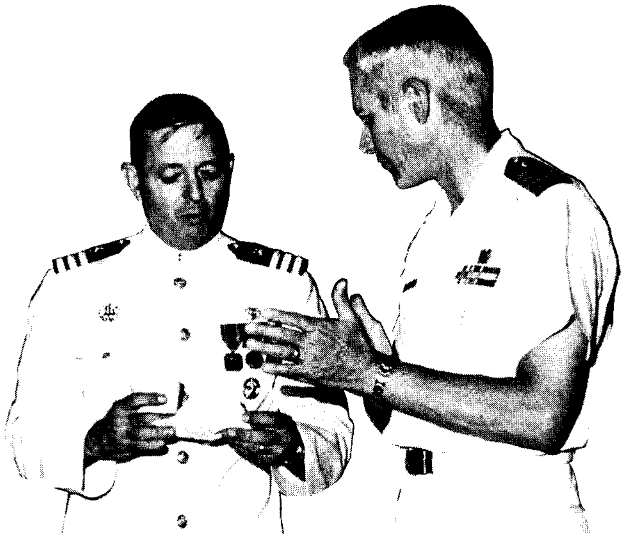
CDR Richards was highly instrumental in the establishment of the Special Operations Officer Community (designator 1140) which will provide the Navy with a ready capability in the functional areas of operational diving and salvage, explosive ordnance disposal (EOD), and expendable ordnance management (EOM). These functions previously were aligned with the surface warfare and engineering duty communities. Creation of the 1140 officer community will, for each functional area, ensure career development emphasis, promote higher levels of expertise, and offer Special Operations Officer candidates a diverse, yet specialized range of assignments.

RADM Baciocco praised CDR Jim Roper's outstanding professionalism earned at Harbor Clearance Unit Two and expressed his confidence that the new commanding officer's tour at NSDS will be both challenging and successful. CDR Roper has served on the following ships and duty stations: Deck Department, USS BAYFIELD (APA-33); Operations and Diving Officer, Naval Ordnance Laboratory Testing Facility, Solomons Is, Maryland; Executive Officer, Diving and Salvage Officer, USS ARIKARA (ATF-98); Operations Officer, USS COWELL (DD-547); Commanding Officer, River Patrol Division 514; Commanding Officer, River Patrol Division 572; Training Support Officer, Service School Command, Great Lakes, Illinois; Commander Coastal River Division 21; First Lieutenant, USS MIDWAY



(CV-41); and Commanding Officer, Harbor Clearance Unit Two. A native of Golconda, Illinois, he was commissioned an Ensign in 1962 via Officer Candidate School. He is a graduate of Southern Illinois University with a Bachelor of Science Degree in Education.

CDR Frank Richards was born in Bonifay, Florida, and enlisted in the Navy in January 1949. Upon completion of Boot Camp and Basic Submarine School he was assigned to USS SEA CAT (SS-399). After serving almost five years on board SEA CAT he served at USNRTC, Riviera Beach and Daytona Beach, Florida, USS CHOPPER (SS-342), and Commander Submarine Squadron Four Staff, where he was selected for Ensign (LDO). After commissioning in June 1960 he served as Communication Watch Officer Submarine Commander Force Atlantic Fleet and Operations Officer USS KITTIWAKE (ASR-13).



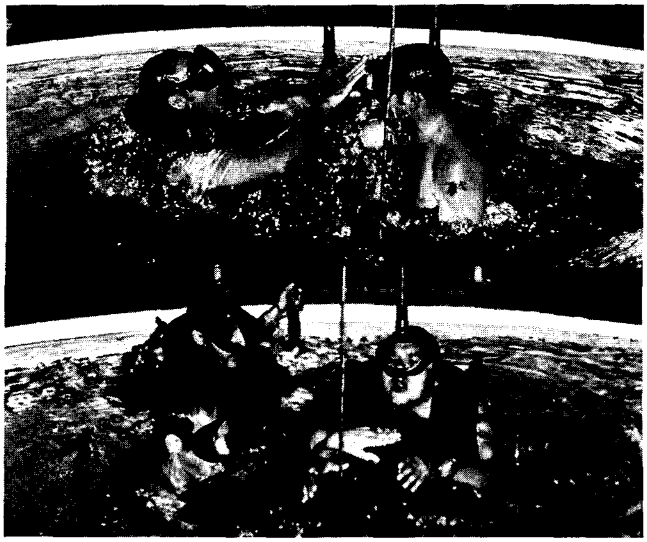
CDR Richards and CDR Roper following ceremony. Right: CDR Richards with CAPT Moss, Director of Ocean Engineering.

After graduation from Deep Sea Diving School in June 1964, CDR Richards served as First Lieutenant and Diving Officer USS TRINGA (ASR-16), Executive Officer USS KITTIWAKE (ASR-13), and Operations, Navigation and Diving Officer USS ORION (AS-18). After 27 months as Commanding Officer USS PETREL (ASR-14) he reported to USS HOLLAND (AS-32) as Operations, Navigator and Diving Officer. Prior to his command at the Naval School, Diving and Salvage CDR Richards served as SSBN Test Operations Branch Head, Naval Ordnance Test Unit, Patrick Air Force Base, Florida. CDR Richards relieves LCDR Bruce Banks as Executive Officer of the Navy Experimental Diving Unit in Panama City, Florida (see Soundings).

Coming: A Standard Life Preserver for Scuba and Special Warfare Diving

Navy divers have long used the MK 3 Life Preserver, or any of several commercially available life vests. None, however, has been ideally suited to meet the requirements of the wide range of scuba and special warfare missions being conducted by the Navy today.

Soon, a new vest - the Life Preserver MK 4 - will become the Navy's standard life preserver for use with scuba and the special warfare MK 15 UBA.

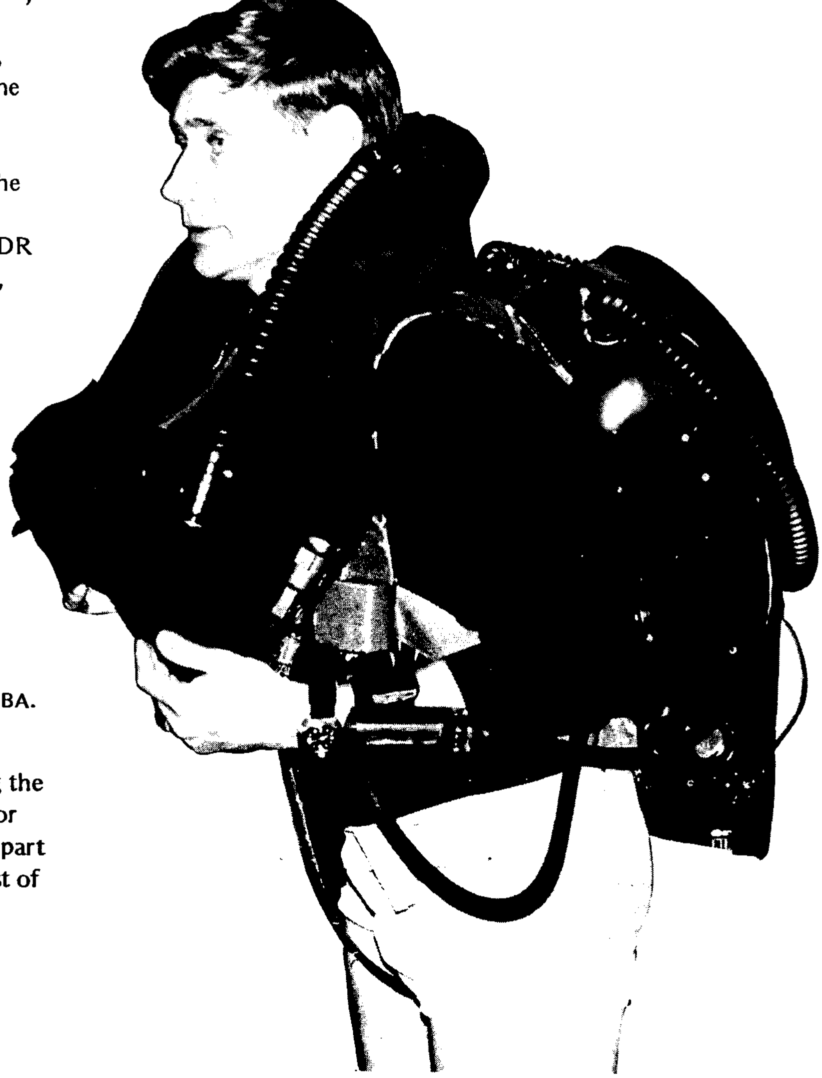


The MK 4 will provide increased buoyancy (44 pounds displaced) at the surface and is inflatable by four CO_2 cartridges, either the 25- or 32-gram type. A full 50 percent of the buoyancy is provided at the diver's neck area. At 200 feet, and with all four 32-gram cartridges released, the preserver provides enough buoyancy to lift 20 pounds.

The preserver will be non-magnetic (as are the 32-gram cartridges) and feature a large oral inflation hose, a pressure relief valve, and a roomy storage pocket.

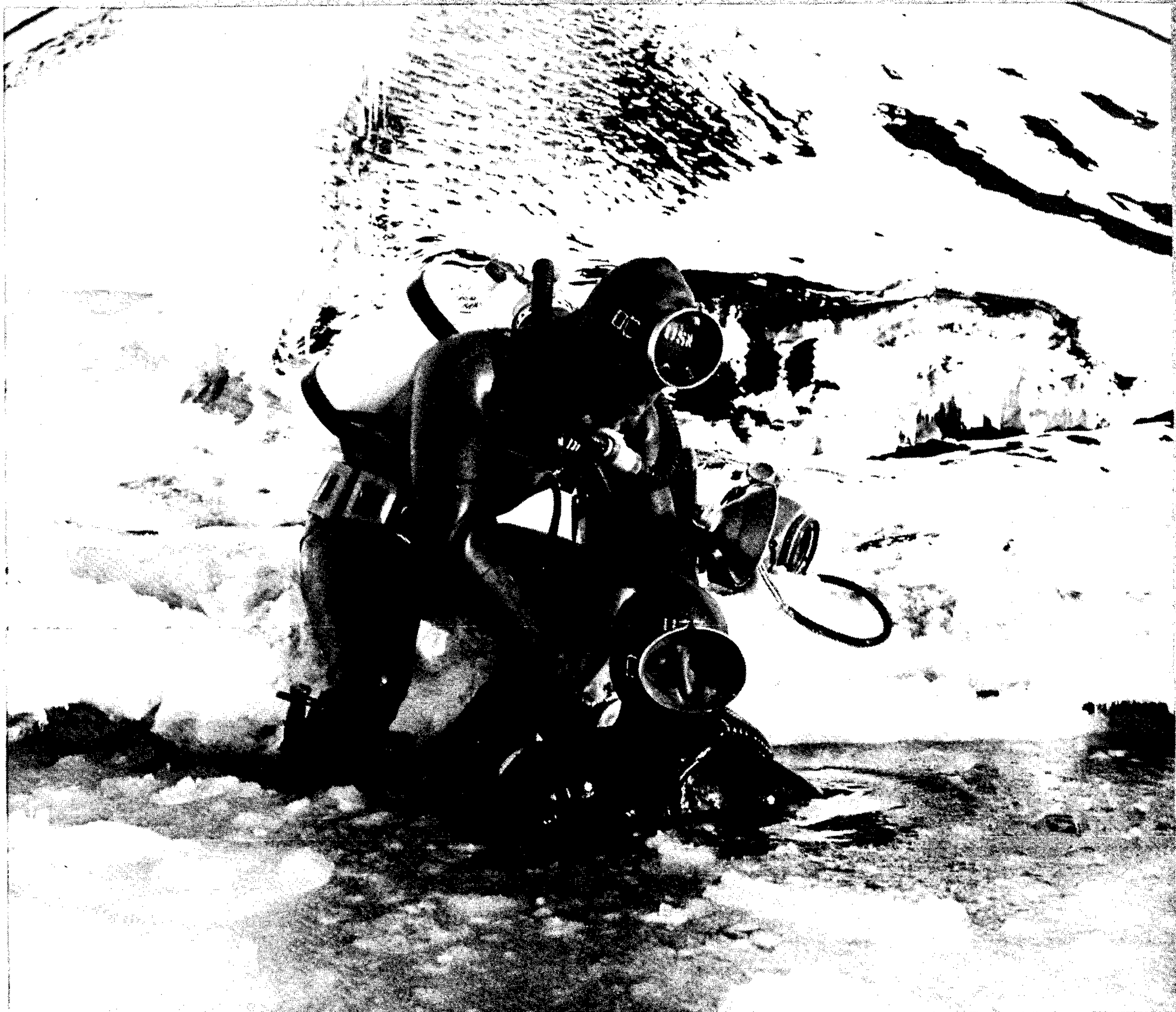
The MK 4 consists of an inflatable inner bladder, which is constructed of polyurethane, and a neoprene nylon outer bag which defines the shape of the preserver.

Task leader for the development and testing of the MK 4 is Frank Wattenbarger, NCSC, Panama City, Florida. The technical agent for the program is LCDR Bill Bacon, NAVSEA Code OOC. Mr. John Freund, NAVSEA 0353, is the program manager.



Above: Rigorous evaluations of MK 4 in test pool. Right: BMC Bloechel wears new Life Preserver MK 4 with MK 15 UBA.

The Diver's Life Preserver MK 4 is now undergoing the process of approval for service use, and is scheduled for distribution to the Fleet within the next two years as part of a Life Preserver Support Package, which will consist of eight MK 4 preservers, eight repair kits and two spare parts test kits.



Keeping the Diver Warm

Adequate thermal protection is essential whether one is diving in frigid or warm water. While wet suits, as shown here, are still used in cold water operations, they lose much of their thermal protection value when compressed at depth. The thermal protection system being developed by NCSC is designed around the dry suit concept, with specialized accessories and a layered undergarment that is compression-resistant.

Cold is the source of more suffering to all animal nature than hunger, thirst, sickness, and all other pains of life and of death itself put together.

THOMAS JEFFERSON

Inadequate thermal protection is the single most limiting factor for the Navy diver. Moreover, much of the Navy's diving is conducted in cold water, and in situations which preclude surface support and restrict use of fully protective equipment.

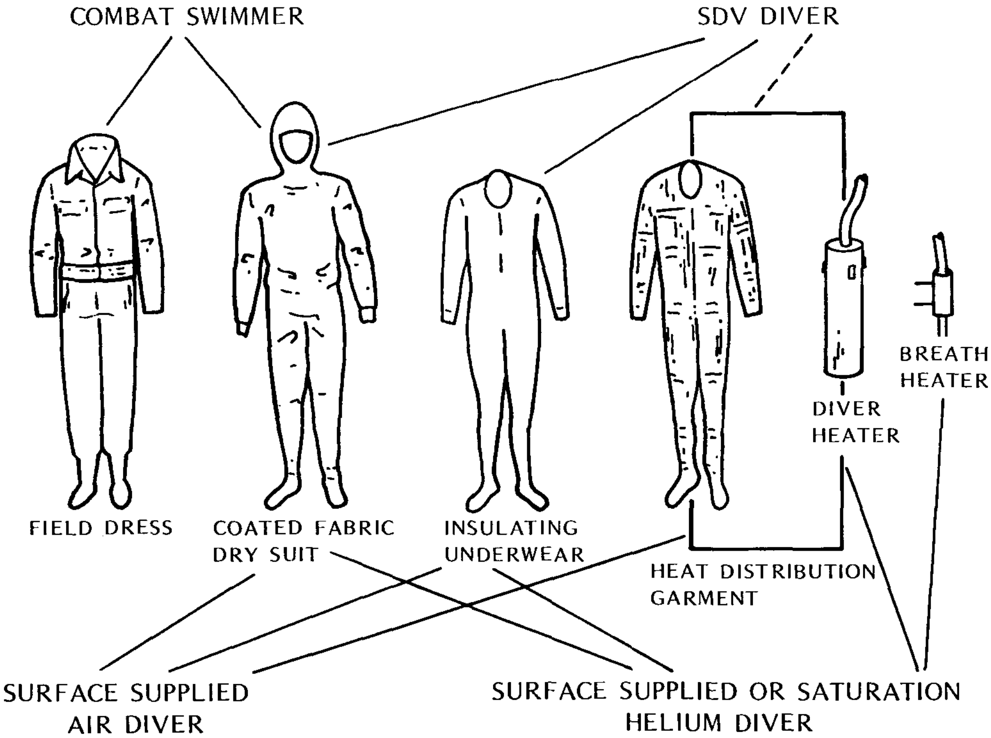
The U. S. Navy Diving Manual is clear on the subject of cold:

> As the diver's body temperature is reduced, he will first feel uncomfortable and then. . . he will begin to shiver. If cooling continues, his ability to perform useful work may become seriously impaired. The hands lose dexterity and the sense of touch is dulled. As shivering intensifies, it brings on a general lack of coordination . . . it becomes increasingly difficult to concentrate, and the ability to think clearly is soon lost. At extremely low temperatures, or with prolonged immersion, body heat loss will reach a point at which death will occur.

But the manual goes on to say that "appropriate dress can greatly reduce the effects of heat loss, and a diver with proper dress can work in very cold water for reasonable periods of time."

Which is what the Diver Thermal Protection (DTP) program at the Naval Coastal Systems Center (NCSC) is all about— development and testing of "appropriate dress" to provide the diver with the best thermal insulation possible, and extend the length of time he can perform useful work in cold water.

DIVER THERMAL PROTECTION SYSTEM ELEMENTS



NOTE: System will include appropriate accessories such as gloves, valves, weight distribution system, abrasion protection, and urine collection system for each end use.

Genesis of the Program

To do this, the DTP researchers first defined the operational requirements of Navy diving. These included diving modes and depths, mission characteristics, work requirements, dive duration and expected temperature ranges. Meanwhile, a panel of experts on thermal problems convened by BUMED developed a matrix of temperature limits for allowable thermal stress– for example, mean skin temperature must not drop below 77° F.

Using these criteria, NCSC launched a test program designed to evaluate commercial diving suit systems. The basic segments of this program are:

- Evaluation of suit design and construction by textile engineers at the Navy Clothing and Textile Research Facility.
- Anthropometric measurements by the Dept. of Kinesiology at UCLA to determine the range of motion afforded by seven suits.
- Testing of insulative effectiveness of dry suits at the Army Research Institute for Environmental Medicine using the copper manikin technique.
- Testing of insulative properties of various suit and undergarment combinations under wet, hyperbaric conditions using the copper manikin (see article on page 14).
- Thermal studies on divers over a range of hyperbaric conditions in selected garment systems, in cooperation with NEDU.
- Manned tests under simulated mission conditions.
- Evaluation of gloves and other component equipment, including a joint NCSC/NEDU program to measure hand and finger dexterity in cold water.

Toward a Basic DTP System

But the prime objective of the DTP program is the development of a basic thermal protection system. To this end, work is currently focused on dry diving suits, with special attention toward:

- Improving seals and closures.
- Selection of a good material for the outer garment.
- Provisions for the containment of urine.
- Provisions for the absorption of perspiration.
- Development of an effective undergarment.

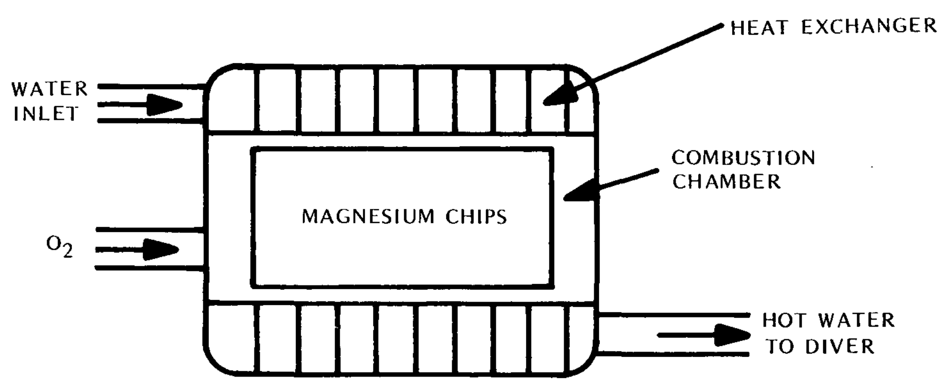
The system now being developed incorporates the above items. It is composed of an elastomer-coated fabric which has improved neck seals, wrist seals and entry closure. The undergarment (see accompanying article) is multilayered and will withstand hydrostatic compression in the diver's feet and leg regions. A diver urine collection system is being modified from a NASA-developed unit. The new suit system also includes inflation and deflation valves, integrated weight distribution, and dry gloves.

Diver Heater Approaches

NCSC is also developing diver heating systems for use in situations where the practical limit of passive thermal insulation systems has been reached. These active heating systems furnish heated water to the diver. Current approaches include:

- A propane catalytic heater for the surface-supported diver.
- A magnesium-oxygen system which burns magnesium wool in oxygen, for the free-swimming diver.
- A hydraulically-powered system which circulates heated seawater to a PTC and diver at depth. It may also provide improvements over the existing hot water system in efficiency, and a reduction in hose losses and deck space requirements.

A more detailed account of the Diver Thermal Protection program at NCSC can be found in the 1978 Working Diver proceedings available from Battelle Memorial Institute, Columbus, Ohio. The article is titled, "Development and Test of Thermal Protection Systems for the Navy Diver," by Maxwell W. Lippitt.



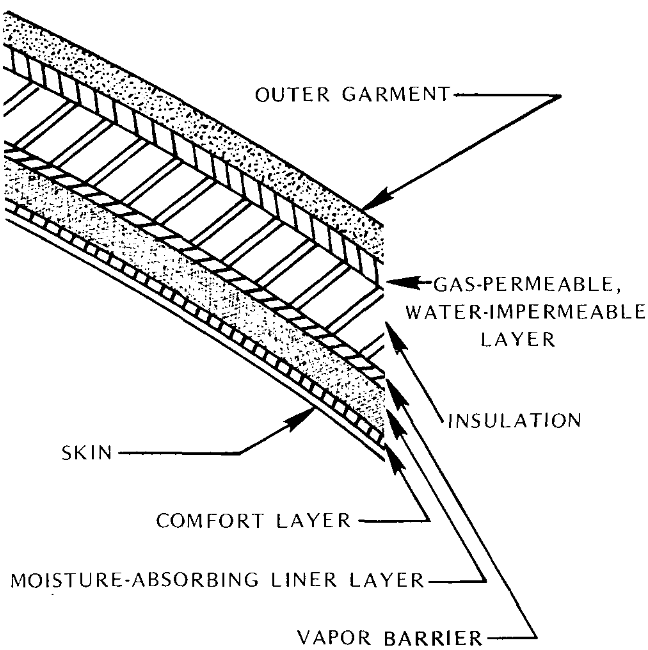
Magnesium-oxygen diver heater concept.

Anatomy of an Undergarment

NCSC has Developed a Layered Undergarment that is Comfortable, Moisture-Absorbant, Compression-Resistant at Depth, and Provides the Dry-Suited Diver with Excellent Thermal Insulation.

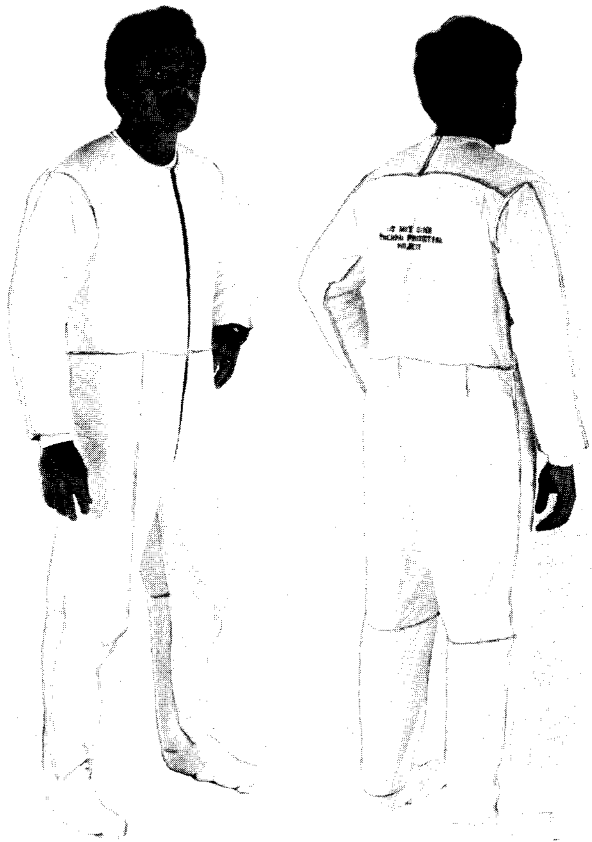
The basic thermal protection of NCSC's new dry suit system will be provided by an undergarment capable of withstanding the compression produced by hydrostatic forces from the chest area to the feet. The undergarment, which is being developed jointly by NCSC and the Naval Clothing and Textile Research Facility, is a composite with a comfort liner next to the diver's skin. A moisture-absorbing layer to contain any sweat produced at higher metabolic rates is applied next.

This layer is followed by a vapor barrier to prevent water vapor from passing through the insulation and condensing on the cold inner surface of the outer garment. This effect, similar to that used in a heat pipe, could transfer a substantial amount of heat, if allowed, and would basically short-circuit the insulation. A compression-resistant insulation (open-cell foam plastic or a fibrous batting) is located next to the vapor barrier.



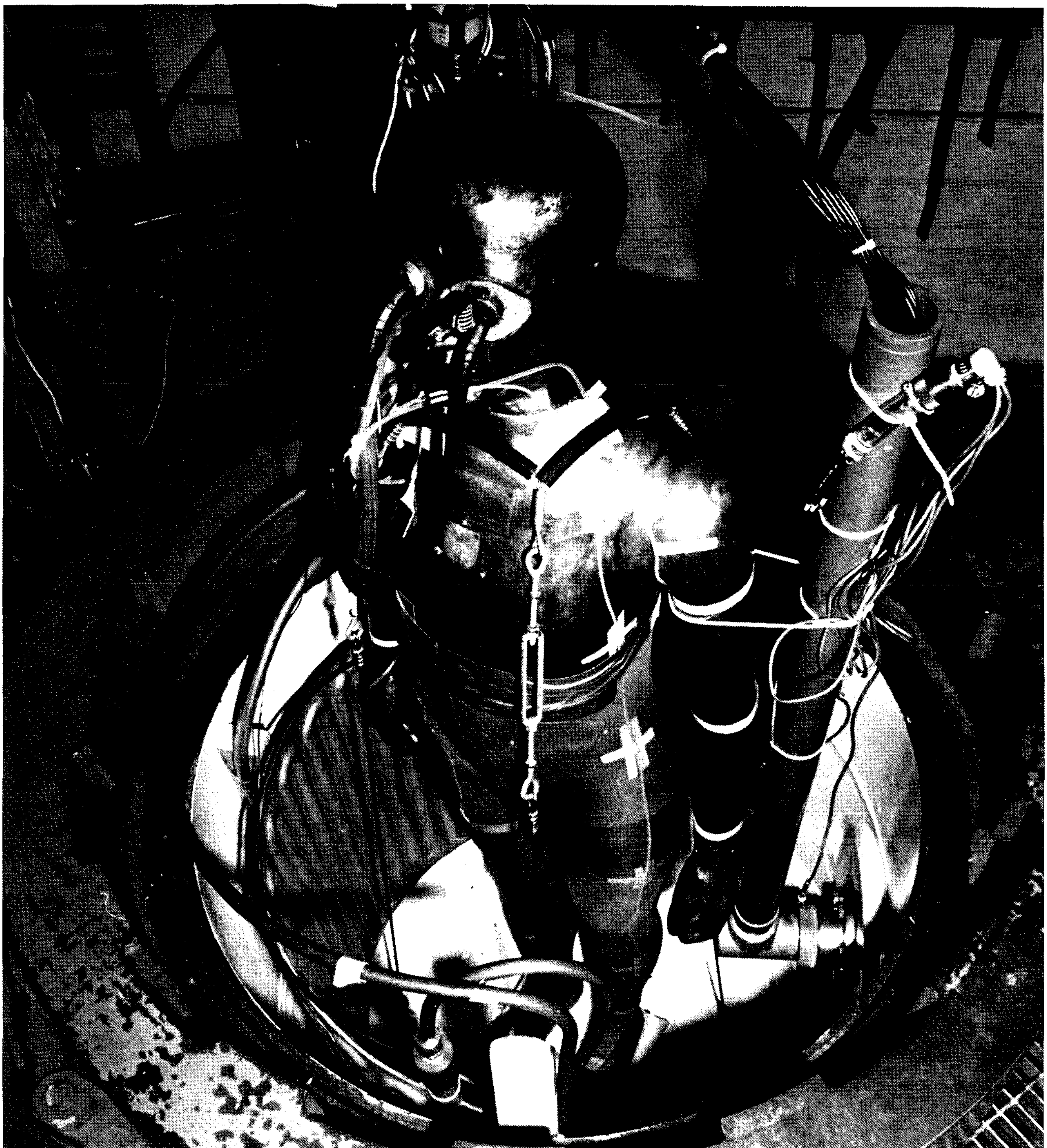
The selection of these two materials resulted from an extensive program to identify or develop insulation materials best suited for dry suit undergarments. These materials are being used in patches located over major muscle areas (which are the primary heat loss sites) and as continuous garments designed to improve mobility and to prevent gross movements of trapped gas due to diver movements.

The material used in the leg and foot areas needs to be more compression-resistant than that used in the torso and arm areas, where more flexibility is required. For this reason, consideration is being given to using different materials above and below the waist.



In a dry suit system, a major thermal failure would be sustained should a significant amount of water enter the suit through seal leakage or punctures. This water would be absorbed by the open-cell insulation used in conventional dry suit undergarments, and greatly increase diver heat loss. To prevent this, a material is being investigated which allows the passage of gas to permit pressure equilibration and prevent crushing as depth changes, but which is impermeable to water. Several such materials have recently become available and are being tested.

Meet "The Copper Man"



Above: ARIEM's copper manikin in hyperbaric test chamber. Right: Manikin is dressed in dry suit for NCSC diver thermal protection tests.

HE BEARS A CLOSE RESEMBLANCE TO C3PO IN "STAR WARS". BUT HE'S REALLY A STAR IN HIS OWN RIGHT – IN WHAT COULD BE CALLED "COLD WARS".

Researchers at the Naval Coastal Systems Center in Panama City have an almost ideal subject for their diver thermal protection studies – one who doesn't mind standing for hours in a hyperbaric chamber, immersed up to his neck in very cold water.

He's the Copper Man, a life-size copper manikin covered with circuits and sensors that allow him to "feel" the effects of cold under various test conditions.

For a recent series of tests, conducted by NCSC's Diver Thermal Protection Project personnel, the Copper Man was used to determine the insulation properties of several commercial dry suits and undergarments under various hyperbaric conditions. The suits were sized to fit the manikin, and included head and foot protection, plus some specially-designed mittens. Because dry suits derive much of their insulation from gas trapped between the diver and suit, each suit was tested with nitrogen and helium as the suit gas.

Through those sensors that simulate skin temperature, the Copper Man revealed the following:

- Neoprene-foam dry suits provide better insulation at shallow depths than rubber-coated elastomer dry suits, but are less effective at greater depths, especially after exposure to high-pressure helium.
- The composition of the gas layer noticeably affects insulation; nitrogen provides the best insulation, followed by helium.
- The insulative value of rubber-coated suit fabric could be increased by improving the undergarment.
- Compression-resistant undergarment materials should be worn, especially in the lower extremities, to offset the effects of pressure at depth.

Although live subjects ultimately remain the best and truest determinants of the value of a given thermal suit, the Copper Man is relieving experimental divers of a great deal of grueling, cold-water testing. In the battle against the debilitating effects of cold, the diving Navy is fortunate to have the support of the Army Research Institute for Environmental Medicine and their Copper Man.

Flyaway Diving System

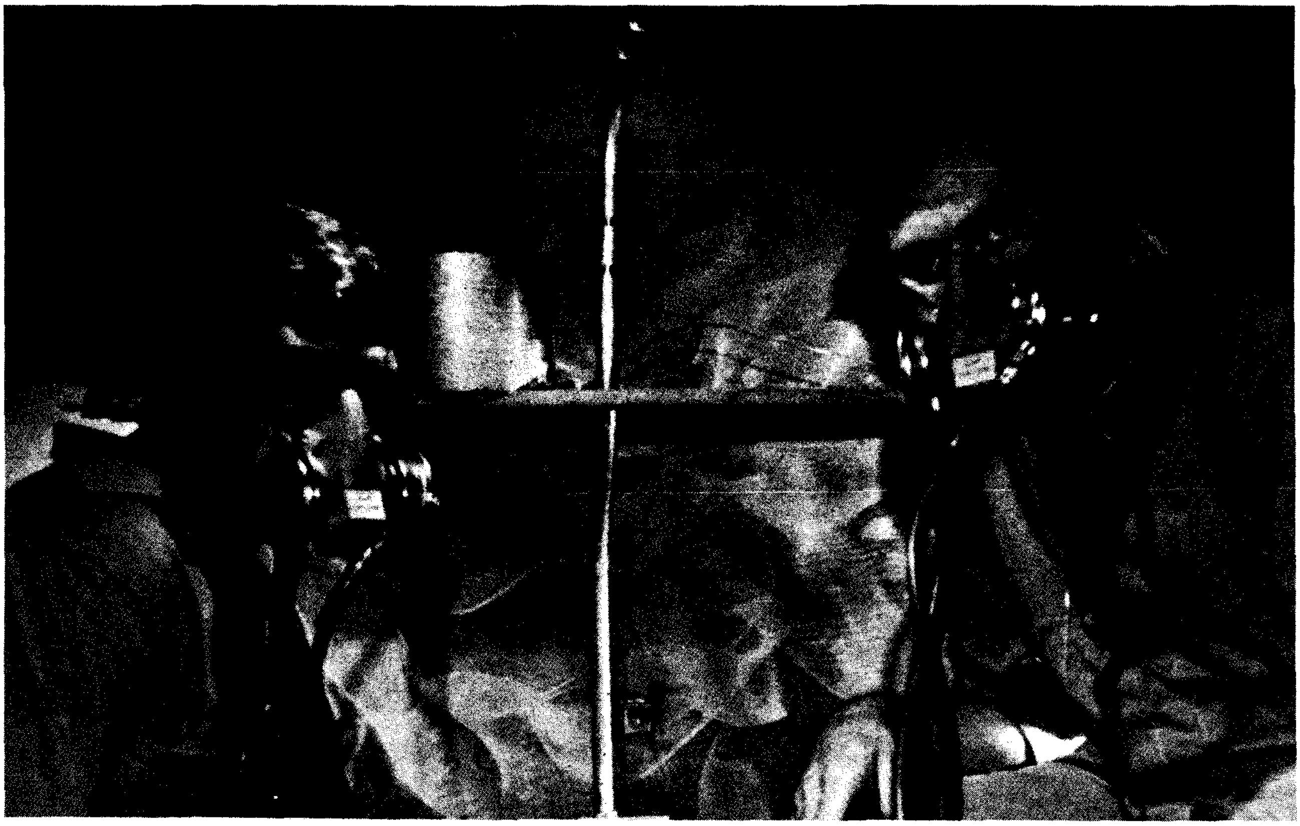
A MORE HABITABLE DOUBLE-LOCK RECOMPRESSION CHAMBER WITH VASTLY REDUCED AIR SUPPORT REQUIREMENTS

A major advancement in recompression chamber technology was realized in June with the successful completion of manned tests on the Navy Experimental Diving Unit's flyaway recompression chamber in Panama City, Florida.

The test series was the culmination of a seven-month effort by NEDU to modify a standard, 1940s-design double-lock recompression chamber by hyperbaric engineer Jim McCarthy, fabricator Ray Dunn, electrician Jerry Pelton, and facilities engineer LT Tony Parisi. Project management for the flyaway system was performed by LCDR Bob Demchik. NEDU Executive Officer LCDR Bruce Banks hailed the chamber's improved habitability features, safety, ease of operation, and air conservation.

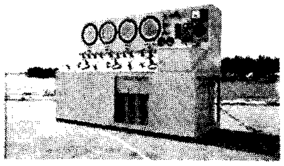
NEDU obtained the surplus aluminum chamber late last year and began refurbishment to meet the Unit's flyaway diving capability mission. After stripping the chamber to the bare shell, the NEDU team removed all original threaded hull penetrations and internal piping and controls. They then installed ASME flange penetrations, external mounted pipe lights, CO_2 scrubber and temperature controller, atmospheric monitoring, new external piping and controls, overboard O_2 dump,

(continued on page 19)



BT1 Siemiet and HTC Hammill wearing built-in oxygen breathing system in new chamber. Above, l-r: NEDU's McCarthy, Dunn and Pelton.

Technology "Takes Off" at NEDU



FLYAWAY DIVING SYSTEM CONSOLE – HOW HUMAN ENGINEERING MADE IT BETTER

The design of dive consoles has traditionally been dictated by the arrangement of the "plumbing" – i.e., piping, valves, gauges, etc. Now, for the first time, a dive console has been built that puts the operator before the plumbing.

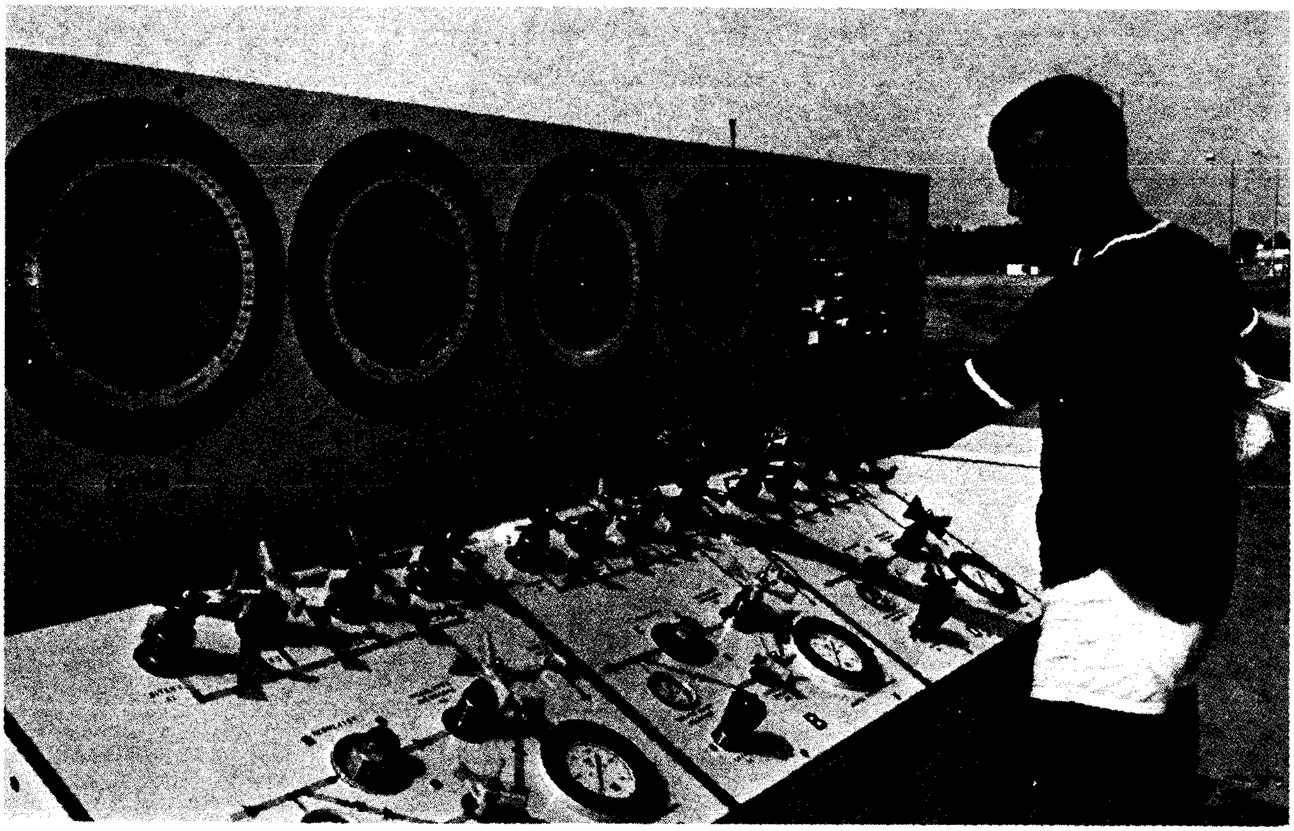
This is called human engineering. And the console designed for the NEDU Flyaway Diving System by experimental psychologist LT John Brady is perhaps the diving Navy's best example of it.

In designing the console, LT Brady focused on the layout of the operator's panel, emphasizing simplicity, efficiency, and functional clarity. Although it sounds easy, it had never been done before. Indeed, many people (including console operators) doubted that it needed to be done, despite the intimidating layout of existing console panels.

The task of rebuilding the system around the new console panel fell to the same NEDU team that reconfigured the Flyaway recompression chamber: LT Tony Parisi, Jim McCarthy, Ray Dunn and Jerry Pelton.

When the job was completed, skeptics became believers. The new console is, by any standard, simple, safe, efficient, and easily operated. Moreover, it in-

(continued on page 20)



NEDU's flyaway diving system console with experimental psychologist LT John Brady.

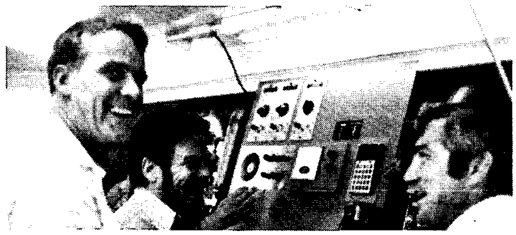
NEDU's modifications to the 1940s surplus recompression chamber are outlined below. The Supervisor of Diving warns that commands shall not attempt to make such modifications on their own equipment until proper authorization is received. Not all changes have been fully approved or certified. Upon completion of final evaluation and certification, appropriate alteration instructions will be issued.

Twenty Improvements to a Forties Design

1. *Removed* all internal valves, gauges, redundant supply and exhaust lines, and redundant fixtures and fittings.
2. Added an *environmental control unit* to maintain acceptable humidity and temperature levels, thus reducing venting requirements and noise levels in the chamber.
3. Added an *O_2 built-in breathing system (BIBS)* with overboard dump system to eliminate O_2 buildup in the chamber, and to reduce venting and noise.
4. Added an *O_2 monitor and readout* to allow supervisor to accurately assess when to ventilate for low or high O_2 content. (High O_2 content may be caused by imperfect fit of BIBS mask to diver.)
5. Added a *CO_2 scrubber* to maintain CO_2 content at acceptable levels and to eliminate the need for venting for CO_2 removal.
6. Added three *pipe-lights* which, by means of acrylic rods, penetrate the chamber hull. This system replaces the two internal lights and eliminates both the 115 VAC power and the heat source generated by the bulbs.
7. Reduced the number and size of *penetrations* and situated them on the console side of the chamber wherever possible.
8. Used *flange fittings* on all ½-inch or larger gas penetrations. Used *O-ring fittings* on all penetrations smaller than ½-inch. This improves maintainability and makes stronger and safer penetrations.
9. Located *supply and exhaust lines* for maximum circulation of air with minimum interference to occupants.
10. Fitted all supply and exhaust lines with *mufflers and handguards* for safety.
11. Fitted a *single depth gauge* to each lock, cross-connected for use should one gauge fail during operations. This eliminates unnecessary duplication of gauges and improves maintainability, while not compromising safety.
12. Fitted all external fittings with *protective covers and waterproofing.* Covers combine to make a shelter over operator console area.

13. Used *acrylic viewports*, with an internal retainer flange so that internal pressure will provide seating.
14. *Viewports* situated on console side of the chamber, two for the inner lock, one for the outer lock.

15. Installed an updated *communications* system, with sound-powered phones retained. All systems hard-wired and low-powered.
16. All internal *wiring protected* by rigid aluminum conduit equipped with correct fittings as per NFPA. Wiring insulated to latest standards for pressure vessels.
17. *Electrical penetrators* given the capability to handle all internal electrical equipment plus a 50-percent margin for expansion. Pin-type through-hull penetrators used. *Connectors* both externally and internally are such that incorrect or accidental electrical connections cannot be made.
18. *Door retaining clips* used for both doors, fitted to prevent damage to the doors and hull and to allow doors to be secured shut to prevent internal contamination of the chambers when not pressurized. Normal door dogs removed.
19. All *plumbing* high-pressure-welded to enable HP air to be used.
20. *Drains* located in each lock at outer ends to allow condensate to be drained during prolonged dives.



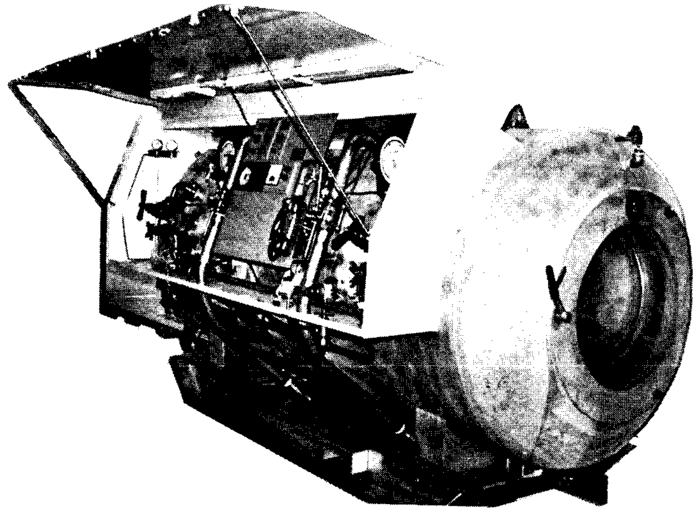
NEDU also proposed the following improvements but was unable to implement them due mainly to constraints on converting the old chamber shell:

1. CO_2 monitoring, if and when a reliable portable unit becomes available.
2. Internal temperature and humidity readouts.
3. Fit a service lock, with quick-acting closure fittings, to the inner lock. This will reduce the need to use the outer lock for passing small items into the lock, thus reducing air requirements and simplifying operation of the chamber over prolonged periods.
4. Relief valves fitted to supply lines and not the chamber hull. To be sited with isolation stop valves, thus cutting down on chamber penetrations and placing the isolation stop valves on the console within easy reach of the chamber operator.
5. Chamber hull and system to be manufactured to the ASME Code on Pressure Vessels for Human Occupancy.

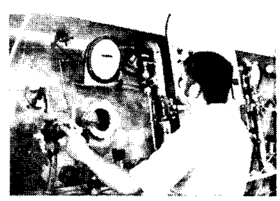
Chamber (continued)

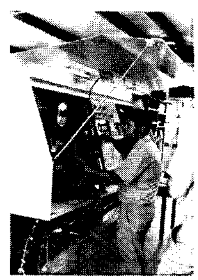
external centralized control station, sound-powered phones, and a protective cover for shipping.

The new chamber will be a central component of NEDU's Flyaway Diving System and has become a prototype model for the design of future recompression chambers. It provides increased diver safety (especially in light of emphasis on O_2 treatment tables), improved portability, less operational complexity, and, of paramount importance, vastly reduced air support requirements.



The chamber has been well received by divers and supervisors alike. Divers being treated will find noise levels greatly lowered as a result of the reduction in ventilation requirements. Temperature and humidity inside will be at much more comfortable levels due to the addition of an environmental conditioning system and removal of the heat-generating lights. Dive supervisors will find all controls and readouts on a redesigned and human-engineered control console outside the chamber for simplicity and ease of operation. Finally,





Controls were repositioned for ease of operation. HTC Gibson operates chamber during manned test.

salvage ships and other platforms will be able to operate and ventilate the new chamber using only a fraction of the amount of air required by other chambers.

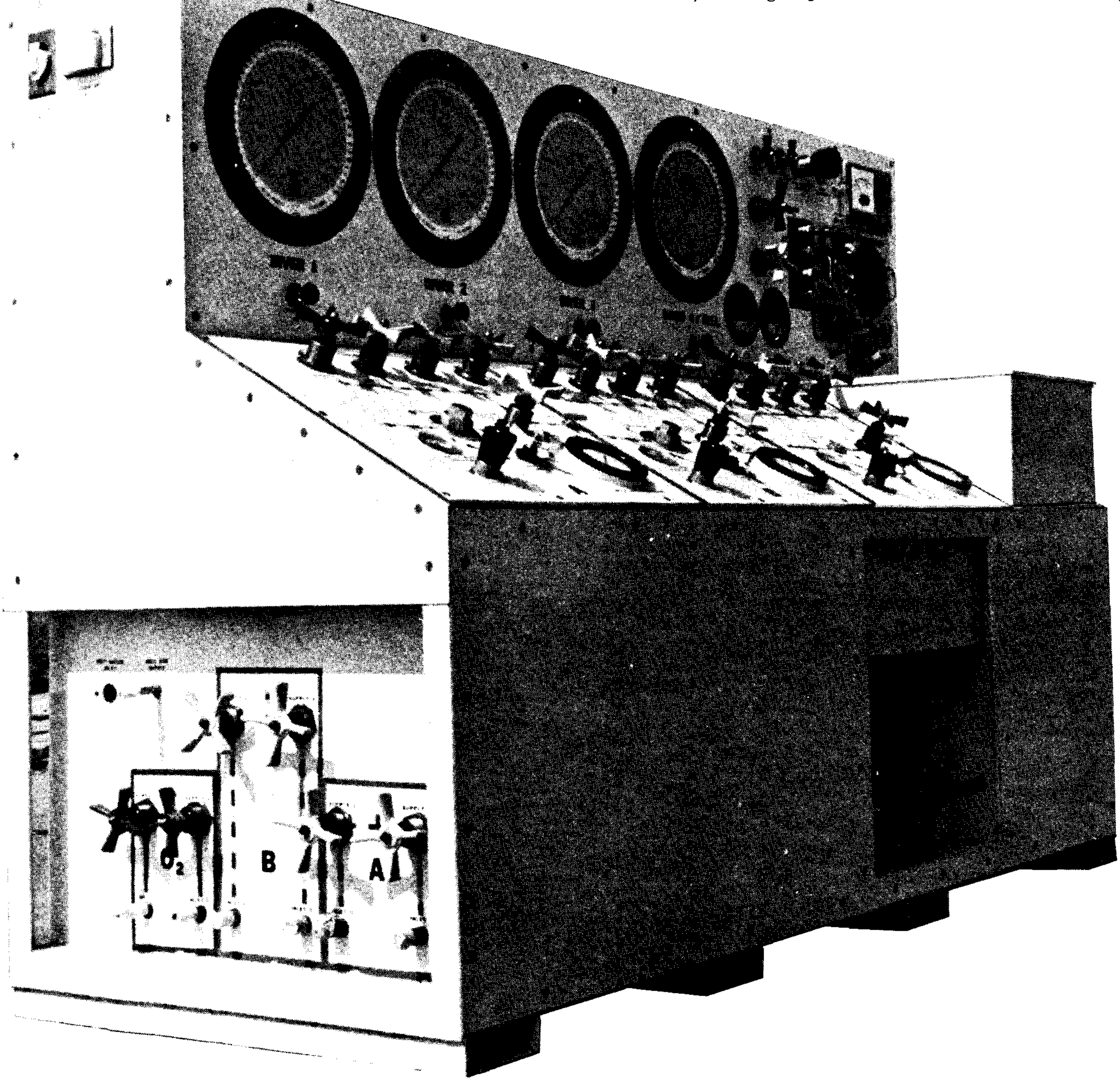
Console (continued)

corporates both air and mixed-gas capabilities, including diving bell, and, for the first time, a MK 12 SSDS capability.

Other notable features and improvements include:

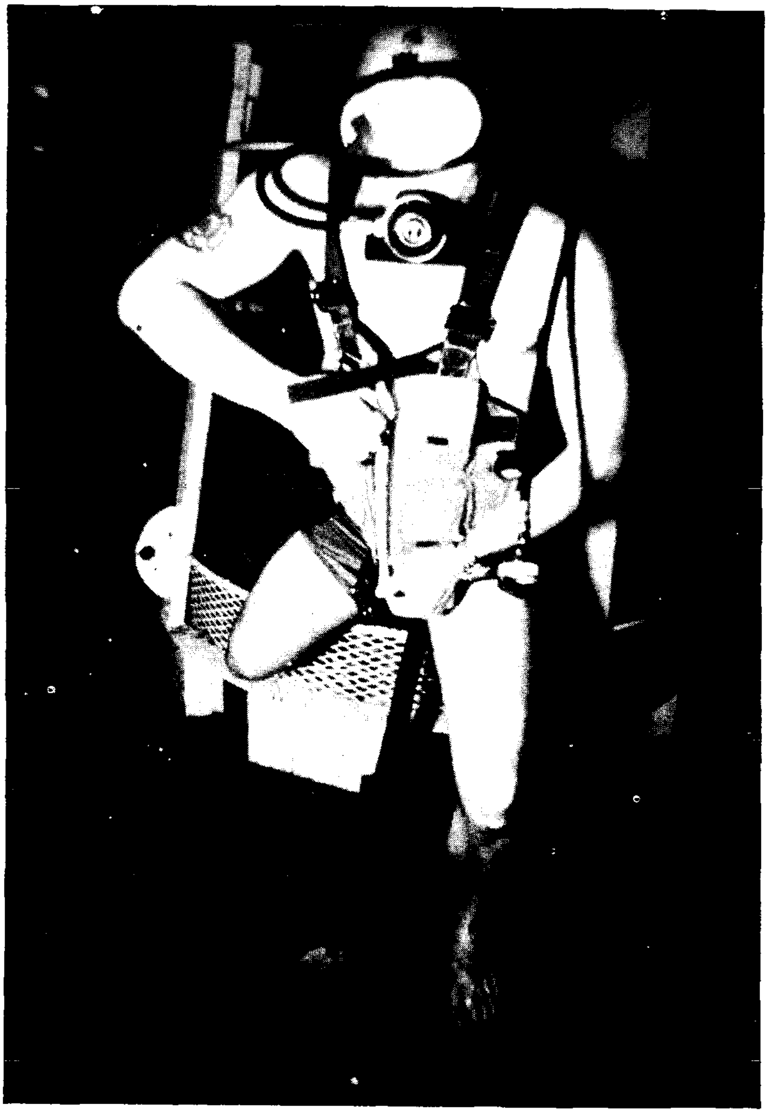
- All controls and gauges color-coded for clarity and safety.
- All controls and gauges positioned in order and direction of flow for clarity.
- All controls and gauges positioned for easy reach and readability.
- Separate controls, gauges, air supply, and hot water flow for each diver.
- In-line breathing gas oxygen concentration display.
- All gas and hot water hose inlets positioned at left side of console and all outputs at right side. All connections color-coded.
- Protective hood for all-weather operation, plus lighting for night operations.
- Communications capability built-in, with color-coded connections.

The console also features an all-aluminum structure with stainless steel and Monel piping. It contains ample storage space and a built-in writing surface. The console was completed in June and is currently undergoing test and evaluation at NEDU.



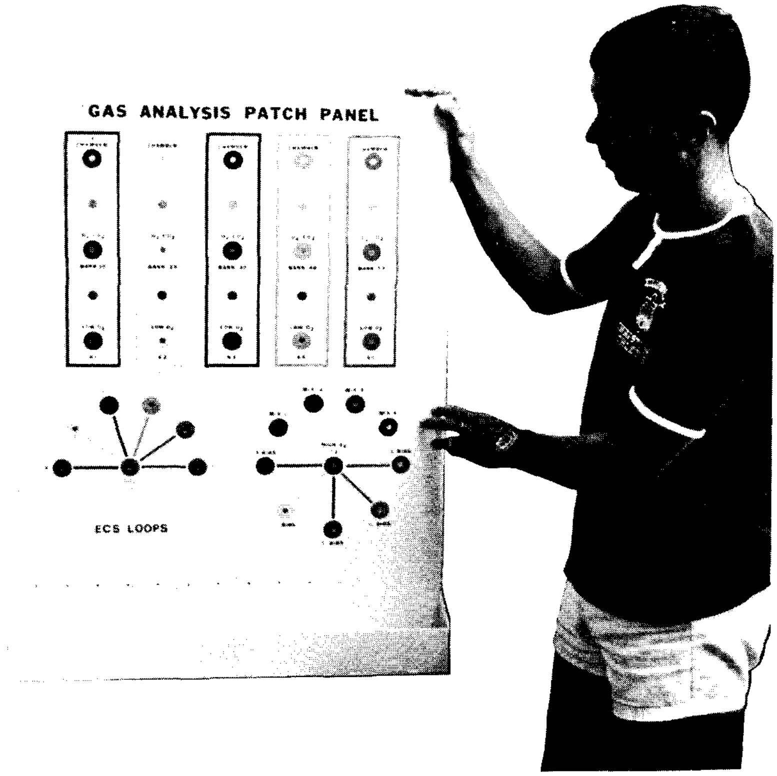
Human Engineering

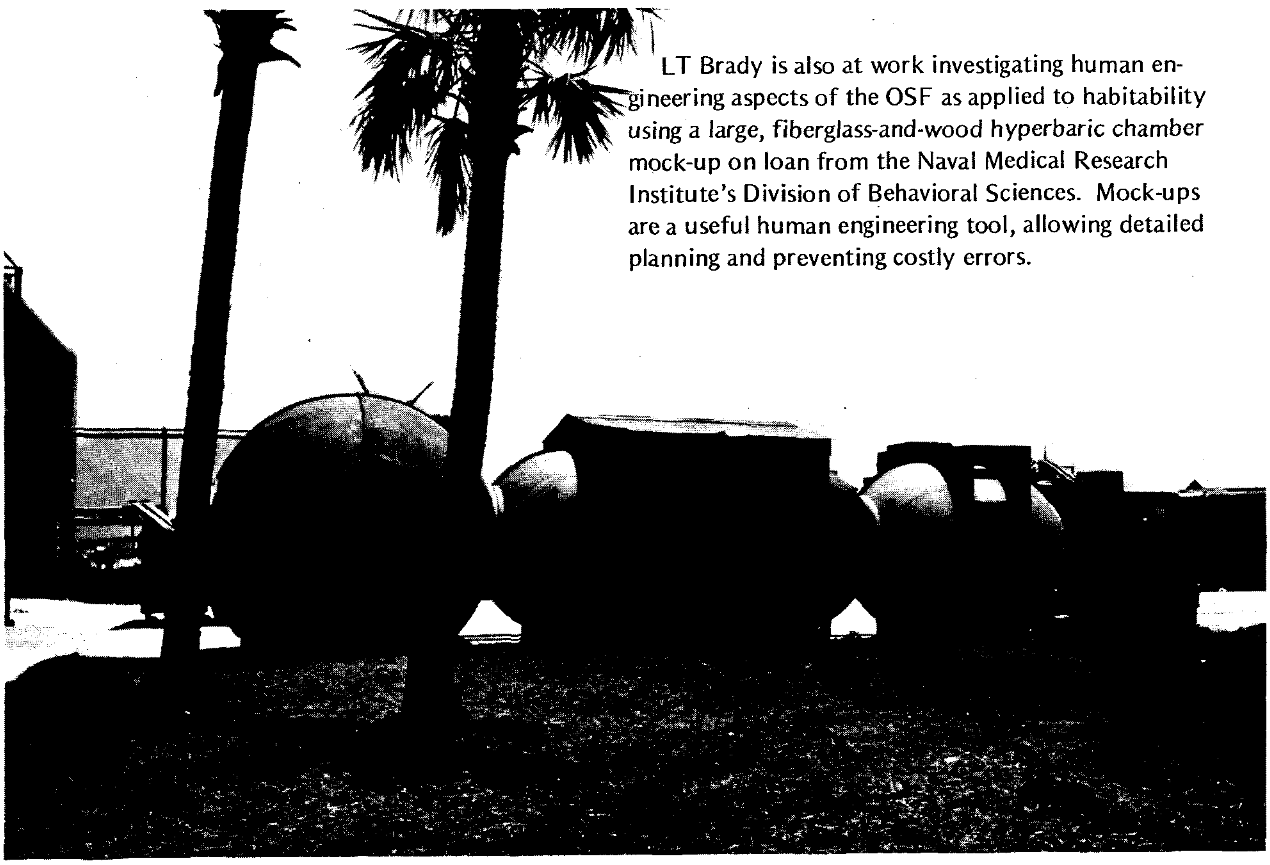
A Closer Look



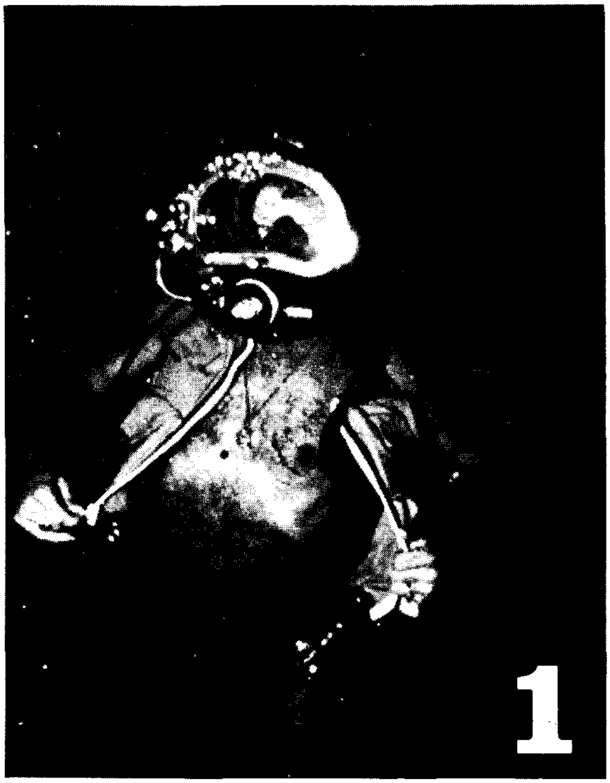
Judging by the acceptance of the dive console designed for NEDU's Flyaway Diving System, human engineering appears to have a bright future in Navy diving. LT John Brady, the NEDU Experimental Psychologist who designed the console (see accompanying article), notes that the philosophy of human engineering as applied to diving is to strive for (1) simplicity, thereby enhancing safety by eliminating operator errors, and (2) clarity, thereby promoting an understanding of the equipment by the operator or trainee.

Grouping controls by function and color coding are two ways to achieve these two goals. These techniques were used in the design of the Flyaway console and in a prototype Gas Analysis Patch Panel intended for installation during the upcoming refit of the Ocean Simulation Facility (OSF) at NEDU.





LT Brady is also at work investigating human engineering aspects of the OSF as applied to habitability using a large, fiberglass-and-wood hyperbaric chamber mock-up on loan from the Naval Medical Research Institute's Division of Behavioral Sciences. Mock-ups are a useful human engineering tool, allowing detailed planning and preventing costly errors.



Improving the operation of diving equipment also comes under the umbrella of human engineering. LT Brady has just completed an investigation into safety procedures and compatibility of various diving suits with the new MK 1 Mod O/Scuba (Tethered) diving configuration, and is now at work evaluating possible solutions to a flow rate problem in a non-return-valve hot water suit.

The EX-17

A Very Deep Subject

The Navy Experimental Diving Unit (NEDU) has successfully assembled and tested an underwater breathing apparatus intended for diving operations to 1,000 feet. Designated the EX-17, the new UBA is a modified version of the self-contained, closed-circuit, mixed-gas MK 15 UBA (see article, next page). To meet the requirements of deep diving, the EX-17 UBA is configured with a dry helmet and an umbilical gas supply.

The EX-17 also constitutes an engineering tool for future research in deep saturation diving. Such a UBA will be best suited for saturation diving missions in conjunction with a personnel transfer capsule (PTC).

The manned tests on the EX-17 UBA were performed during the NEDU Deep Dive 77 series at the Ocean Simulation Facility in Panama City, Florida, last December (see FP Winter 1977).

The EX-17 UBA will be able to meet much broader mission requirements at greater depths than the MK 15 UBA, which was designed for special warfare and counterinsurgency teams to depths of 200 feet.

The EX-17 UBA offers all the advantages of its MK 15 counterpart - increased diver mobility and safety, extended mission time, no gas bubbles, compactness, reduced helium costs, and minimized equipment maintenance. Low breathing resistance and neutral buoyancy enhance diver efficiency. The EX-17 can support a diver doing hard work with the added comfort of a dry helmet.

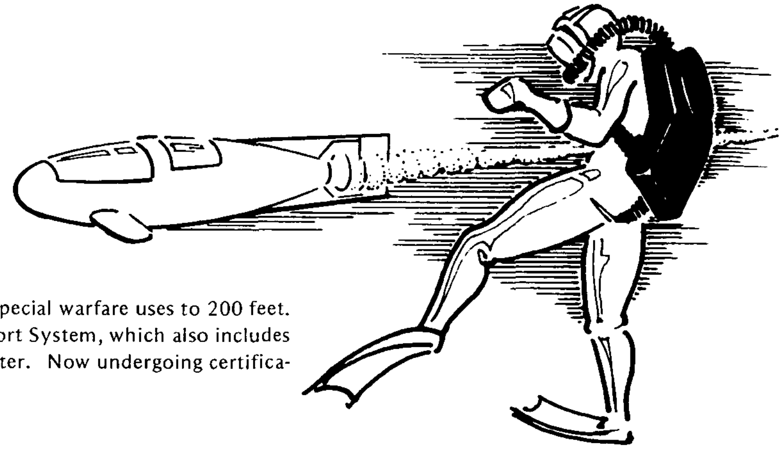
The EX-17 may be operated in a closed-circuit or open-circuit mode. Under normal operating conditions, the EX-17 is in the closed-circuit mode with umbilical-supplied gas. The O_2 sensors and O_2 bottle supply maintain the preset pO_2 level. A diluent bottle provides an emergency gas supply for closed-circuit operation.

The EX-17 operates in the open-circuit mode only in an emergency. Gas supply is solely from the umbilical. When open-circuit is initiated by opening the helmet gas supply valve, the diver must return to the surface or PTC.

The Deep Dive 77 test series in December was the culmination of a 3-phase testing program that began in July 1977. Ten manned dives with the EX-17 were performed in the OSF at simulated depths from 1,054 to 732 fsw in 40°F water. NEDU is performing further investigations to insure EX-17 UBA life support capability and mission reliability at depths in excess of 1,000 fsw.

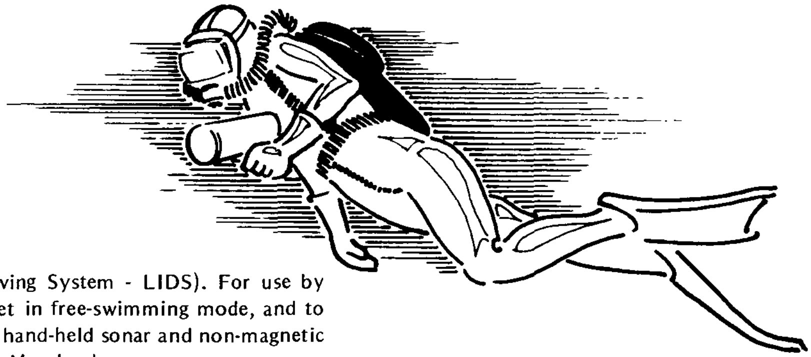
SNEAK PREVIEW
The New UBA'S

The Navy's new family of advanced underwater breathing apparatus – the MK 15, EX-16, and EX-17 – will permit the execution of specialized diving missions to depths of 1,000 feet. Each system is an adaption of the Biomarine Industries' CCR-1000 closed-circuit, mixed-gas, self-contained UBA.



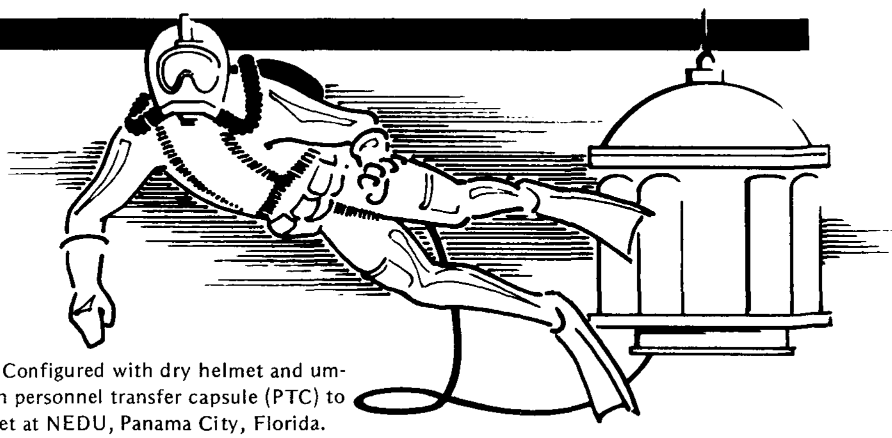
MK 15

MK 15 UBA (formerly called the SLSS MK 1 UBA). Special warfare uses to 200 feet. This is the main component of the Swimmer Life Support System, which also includes a full face mask and underwater decompression computer. Now undergoing certification at NEDU, Panama City, Florida.



EX-16

EX-16 UBA (formerly called the Low Influence Diving System - LIDS). For use by explosive ordnance disposal (EOD) divers to 200 feet in free-swimming mode, and to 300+ feet in tethered mode. Used with full face mask, hand-held sonar and non-magnetic wetsuit. Under development by EODFAC, Indianhead, Maryland.



EX-17

EX-17 UBA (formerly called the Deep 15 UBA). Configured with dry helmet and umbilical gas supply. Intended primarily for use with personnel transfer capsule (PTC) to 1,000 feet. Developed and tested to over 1,000 feet at NEDU, Panama City, Florida.

MK 12 SSDS: Mixed-Gas Testing Quickens

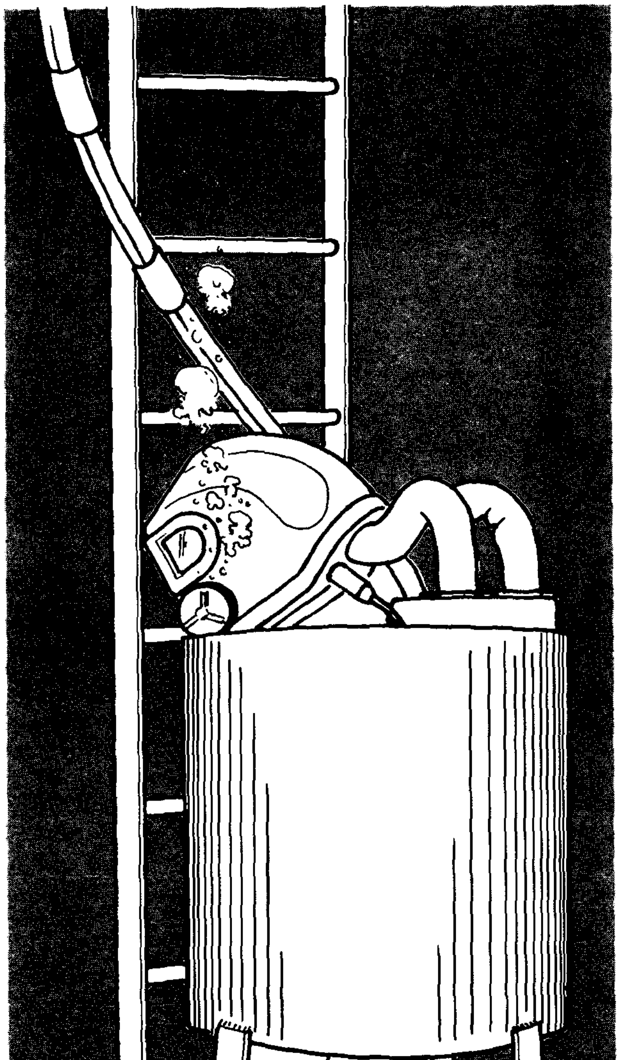
The MK 12 Surface Supported Diving System successfully completed technical and operational evaluations in the air mode in 1976. The system is now in the final stages of development, with test and evaluation focusing on preproduction mixed-gas components, which are designed to interface with the air portion of the system.

Shallow-water, manned prototype testing at the Navy Experimental Diving Unit during January and February 1978 demonstrated that the required mixed-gas characteristics of the MK 12 system can be successfully achieved in the present hardware design.

A recirculator hot water heating technique was evaluated, yielding canister durations which exceeded SOR requirements. An artificial heating technique is required in mixed-gas diving to most efficiently use CO_2 absorbent and to provide the diver with thermal protection.

The MK 12 diver thermal protection concept, i.e., having free-flowing hot water between the diver's dry suit and outer garment, was further refined, enabling divers to meet SOR duration requirements in cold water. Extreme temperature testing demonstrated the MK 12 recirculator can effectively operate in 29°F water.

The team of Navy divers performing the exhaustive test dives included LT (CF) Rank, NEDU MK 12 Project Officer; MMCS (MDV) Yarley, NEDU; BM1 (DV) Rash, NCSC; AOC (DV) Rusek, EOD Det; BMCS (DV) Stone, EOD Det; HTCS (DV) Smith, NCSC; EN1 (DV) Harkins, NEDU; ENC (DV) Tardy, NEDU; BMC (DV) Whites, NEDU; and HM2 (DV) Walker, NEDU. After receiving indoctrination dives in MK 12 SSDS air operations, a number of visiting Special Warfare EOD Mobile Unit divers acted as standbys.



Representation of hatch mock-up test.

During this developmental test series, ancillary testing verified that the MK 12 SSDS design allows divers to pass through a 24-inch diameter opening 30 inches deep (representative of a submarine hatch or watertight hatch scuttle). Human factors evaluations comprised location, size, and accessibility of the two diver-manipulated valves; anthropometric factors; reach envelopes; and comfort. Test results showed that the current MK 12 SSDS design with recirculator adequately meets system size and human factor engineering requirements.

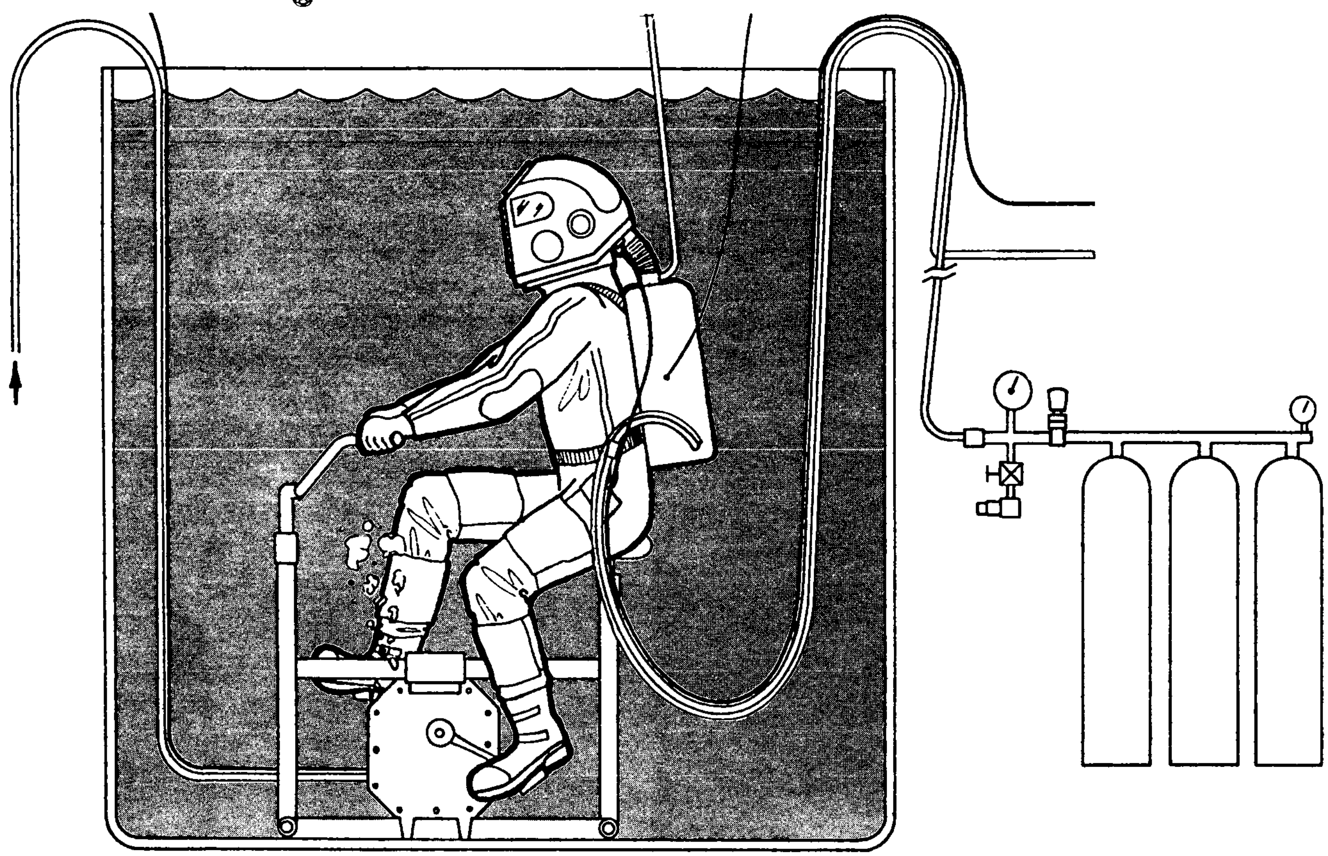
Testing Continues

Further testing was conducted at NEDU in a fourteen-day saturation dive during July in the Ocean Simulation Facility to:

- Verify system performance in cold water (40°F)
- Determine canister duration
- Evaluate the MK 12 thermal protection dress prototype
- Evaluate the performance of the mixed-gas emergency mode
- Perform an initial evaluation of the MK 12 communications set with the MK 12 unscrambler and the TDCS unscrambler

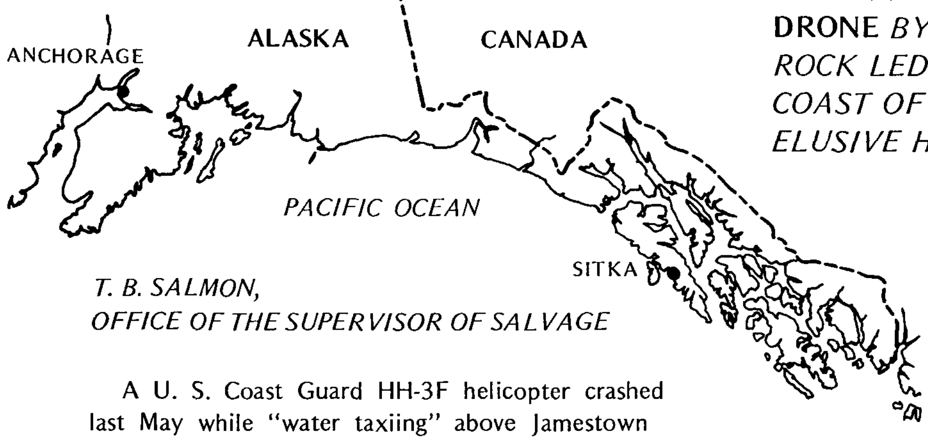
FACEPLATE will report on the results of the July tests in the Fall issue.

Anthropometric tests measured diver mobility and suit comfort.



Pedal ergometer permits measurable diver work rates.

DEEP DRONE Aids Coast Guard in Alaska



OPERATORS MANEUVER THE DEEP DRONE *BY REMOTE CONTROL THROUGH ROCK LEDGES AND CANYONS OFF THE COAST OF ALASKA IN SEARCH OF AN ELUSIVE HELICOPTER ROTOR BLADE.*

T. B. SALMON,
OFFICE OF THE SUPERVISOR OF SALVAGE

A U. S. Coast Guard HH-3F helicopter crashed last May while "water taxiing" above Jamestown Bay near Sitka, Alaska. The crew escaped without serious injury and the Coast Guard quickly recovered the helicopter.

During the crash, one of the helicopter's rotor blades was lost in an estimated 150 feet of water. Recovery and analysis of the blade was considered essential in order to help determine the cause of the mishap and to assess the impact of the crash on other HH-3F helicopters, which are also widely used by the Navy, Air Force and private industry.

The Coast Guard had already made two attempts at locating the blade. Initially, local divers surveyed the bottom, but were restricted to a short bottom time at the 150-foot depth. The next attempt involved a towed TV system. On May 23, after approximately 6 days of search with no success, the Coast Guard contacted the U. S. Navy Office of the Supervisor of Salvage (SUPSALV) to discuss the feasibility of locating the rotor blade.

In discussing the potential operation, all facts were considered and it became apparent that the SUPSALV DEEP DRONE would offer the best probability for locating and, if necessary, recovering the lost blade. Among its sensors, DEEP DRONE offers two TV Systems, a search sonar, and a bottom navigation system, all three essential for this type of operation.

On May 30, DEEP DRONE was placed aboard a CG C-130 and flown to the USCG Air Station in Sitka. Upon its arrival the system was offloaded and placed on the pier next to the USCG Cutter CLOVER, a 180-foot Buoy Tender homeported in Sitka.

SUPSALV representatives Tom Salmon and Joel Teague worked closely with LCDR Frank Long and LT Jim Rao, the designated Coast Guard salvage officers, in developing a search and recovery plan. All of the details were reviewed and while the plan was being made final, DEEP DRONE was loaded aboard CLOVER.

At 1900 on May 31 installation of the DEEP DRONE was complete, and the system was "wet" checked alongside the pier. All systems checked out, and plans were made to get underway at 0700 the following morning.

Arriving on scene at approximately 0800 on June 1, CLOVER moored to the datum marker and the search commenced. While DEEP DRONE was conducting her first dive, a precise surface navigation system was set up, thereby assuring 100% coverage of the area.

On the second day of the search LT Rao and Mr. Salmon re-interviewed the eye-witnesses and discovered that some confusion existed in one of the accounts. After spending most of the day reevaluating and plotting the data, a new datum was selected. That evening CLOVER moved the marker buoy approximately 400 yards to the southwest.

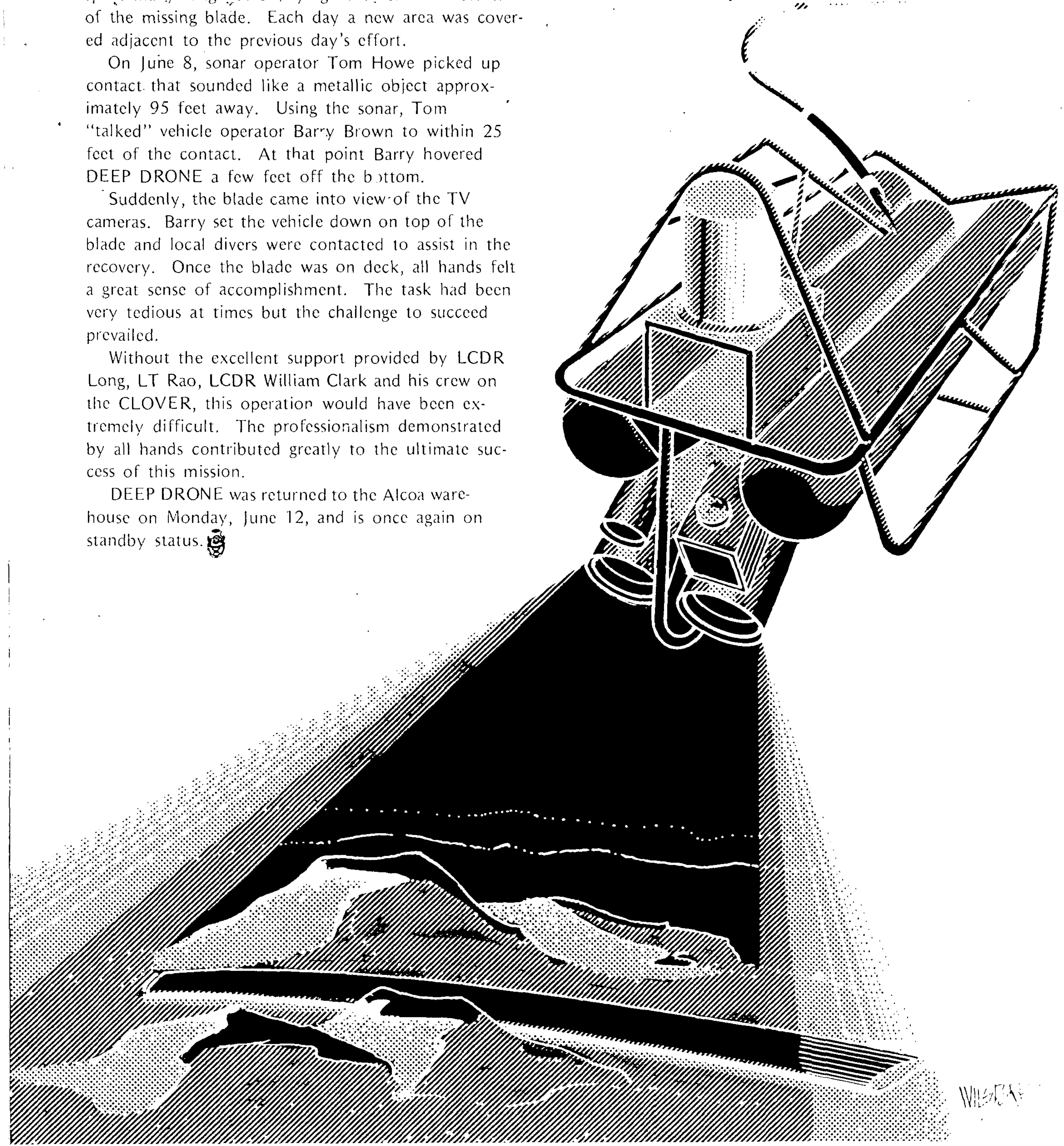
Continuing the search on June 3, DEEP DRONE found the bottom characteristics much more difficult Rather than a smooth, silty bottom the new area consisted of a mix of silt and large rock ledges and canyons. The DEEP DRONE crew, consisting of Bob Hamilton, Ralph Reed, Tom Howe, Barry Brown, and Rob McCauley, all of Alcoa Marine Corporation, spent many long hours "flying" the vehicle in search of the missing blade. Each day a new area was covered adjacent to the previous day's effort.

On June 8, sonar operator Tom Howe picked up contact that sounded like a metallic object approximately 95 feet away. Using the sonar, Tom "talked" vehicle operator Barry Brown to within 25 feet of the contact. At that point Barry hovered DEEP DRONE a few feet off the bottom.

Suddenly, the blade came into view of the TV cameras. Barry set the vehicle down on top of the blade and local divers were contacted to assist in the recovery. Once the blade was on deck, all hands felt a great sense of accomplishment. The task had been very tedious at times but the challenge to succeed prevailed.

Without the excellent support provided by LCDR Long, LT Rao, LCDR William Clark and his crew on the CLOVER, this operation would have been extremely difficult. The professionalism demonstrated by all hands contributed greatly to the ultimate success of this mission.

DEEP DRONE was returned to the Alcoa warehouse on Monday, June 12, and is once again on standby status.



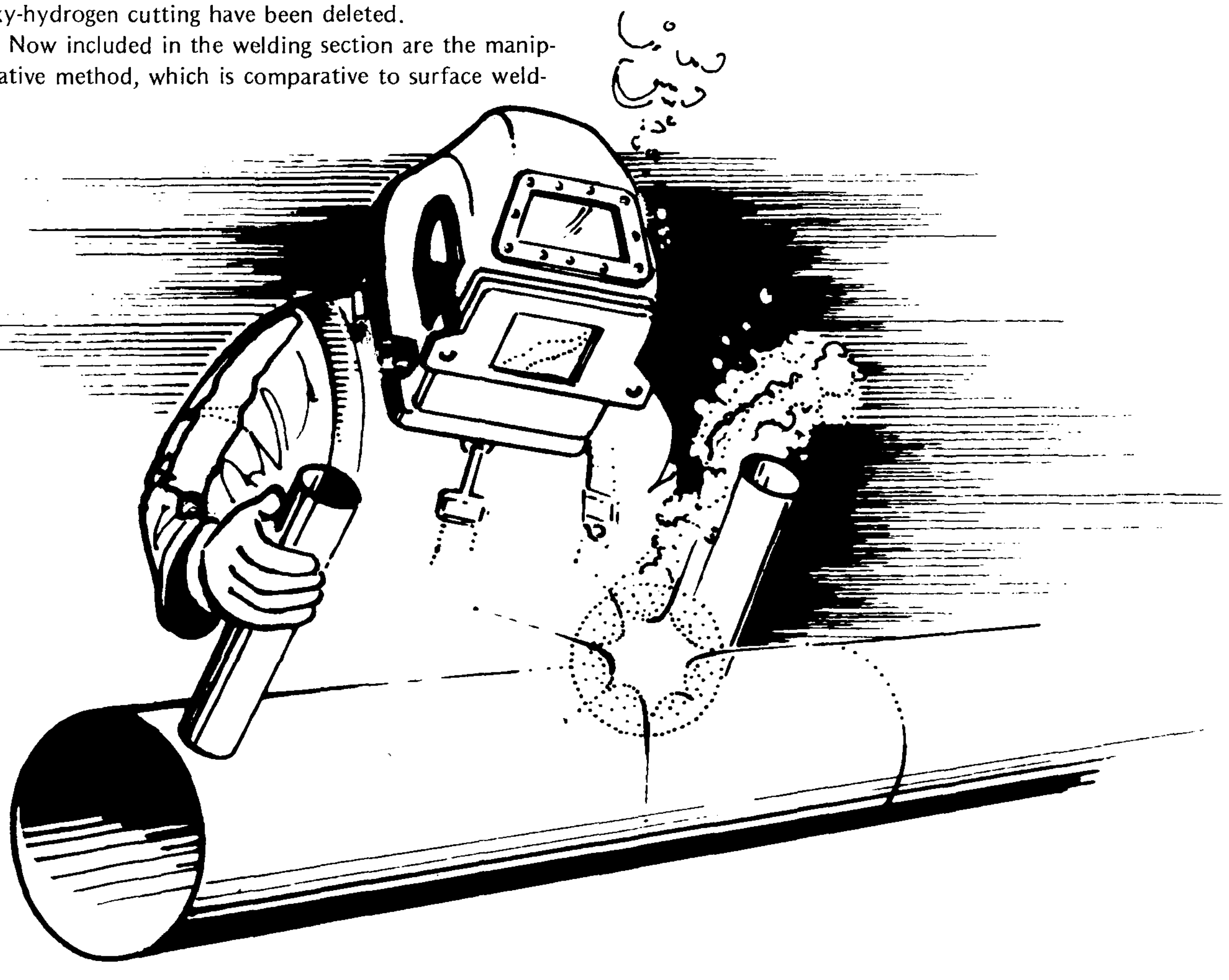
New Underwater Cutting and Welding Manual

A completely updated Underwater Cutting and Welding Manual is being prepared by the Office of the Supervisor of Salvage. The new volume, which was written by Donald "Blackie" Keane, represents the first major revision of the manual in 25 years, and will contain state-of-the art naval and commercial techniques and procedures.

The new manual is the product of a six-month effort which brought together the inputs and ideas of numerous experts in government and industry. Among the new cutting techniques included are MAPP gas and ultra-thermic (Broco-rod) cutting. Ceramic rod and oxy-hydrogen cutting have been deleted.

Now included in the welding section are the manipulative method, which is comparative to surface welding, and the austenetic (stainless steel) rod method which allows the welding of both mild and high tensile steel underwater.

The new manual recently underwent an intensive pre-publication review in New Orleans by representatives from NAVSEA, NEDU, HCU-1, HCU-2, NSDS, FTC San Diego, USS AJAX, and USS FULTON. It is currently being prepared for printing and should be available this fall. The manual may be ordered from the U.S. Navy Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.



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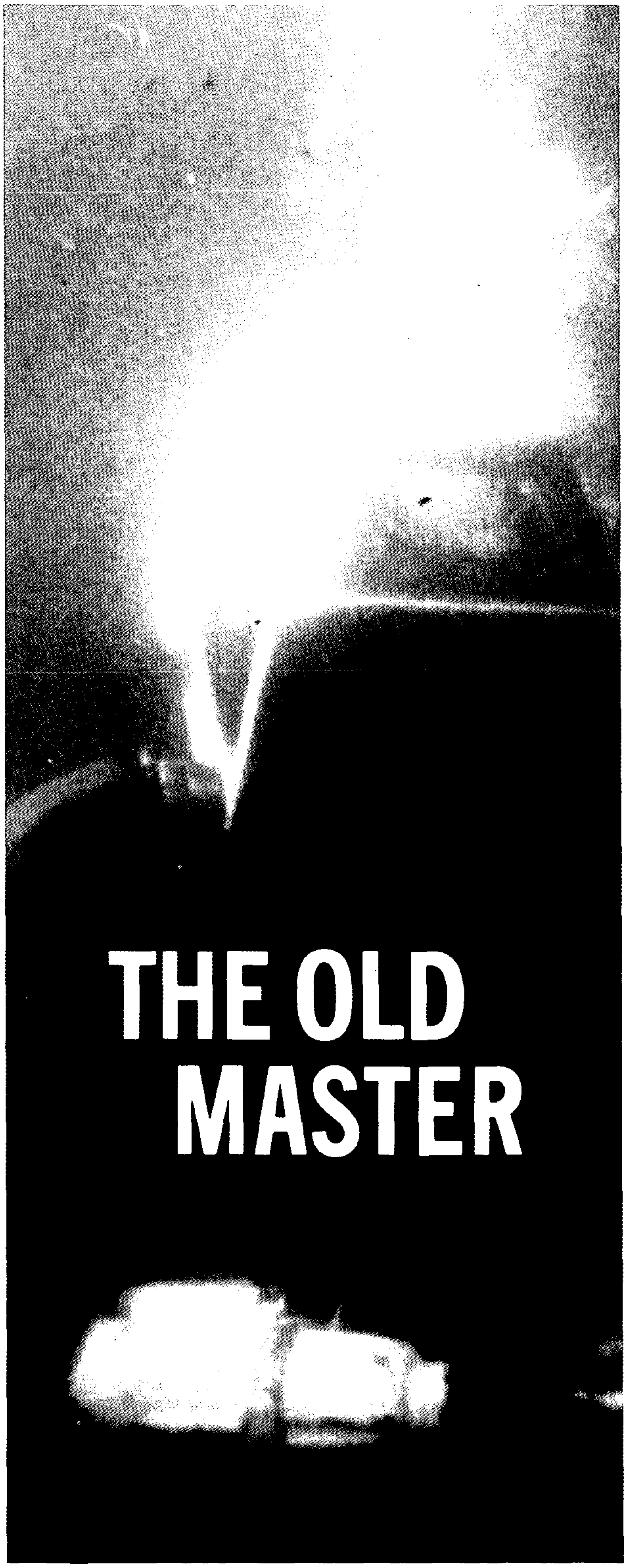
THE OLD MASTER



As a representative of the Supervisor of Diving, I recently visited several diving commands on both the East and West Coast. The purpose of the visits was to update the commands on Navy diving programs today and what the future might be. Also, to get an input from the Fleet as to problems they may be having or improvements that might be made. It was a very successful trip as both the Supervisor of Diving and the commands benefited from the talks.

Since I made the trip, the recirculator for the MK 12 Surface Supported Diving System has been successfully tested to a depth of 380 feet in 40°F water. Technical Evaluation of the MK 12 gas mode is scheduled for Fall 1978 and Operational Evaluation for early 1979. Just when the Fleet will get the mixed-gas units is not firmed up yet, but we hope it will be by 1982.

I received a lot of questions during my trip. Some I could answer and some I couldn't. Of those that I could not answer, I will try to answer a couple now.

Question: Is there an instruction that says when and how often a diver should get a physical?

Answer: The manual of the Medical Department, Article 15-30, clearly defines the physical requirements for all divers. Scuba divers, second class divers, first class divers, and master divers under the age of 40 must within 3 months of their 18th, 21st, 24th, 27th, 30th, 32nd, 34th, 36th, 38th, and 40th birthday have a physical. Those over 40 must have a physical within one month of their birthday yearly. Saturation divers and divers doing experimental dives must within one month of their birthday have a physical. The instruction further states what the physical will entail. Now, the doctor at the command may elect to give a physical more often than is required by the manual. The instruction also states that the Medical Department will insure that the diver is physically fit to dive prior to each dive.

Question: How do you get on the mailing list for correspondence pertaining to diving?

Answer: If your command is not on the distribution list, it should initiate a letter to its parent command, i.e., SUBPAC, SUBLANT, NAVSURFPAC, NAVSERFLANT, etc., requesting to be placed on the distribution list.

There was some discussion on the quality of divers that are coming out of the diving schools. I talked to the diving school commands and their attrition rate is very high. The schools are graduating only those students who measure up to rigid standards. But, let me say this, when you get a new diver from the school, he is not a diver *per se*. There is still a lot of training to be done. It is up to you as a diving supervisor to motivate this man and train him as a Fleet diver. Think back to when you reported to your first diving command after you completed diving school. You were green and had a lot to learn. Be patient.

Until the next issue, Safe Diving.

BMCM James L. Tolley
Senior Master Diver, USN
Navy Experimental Diving Unit

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