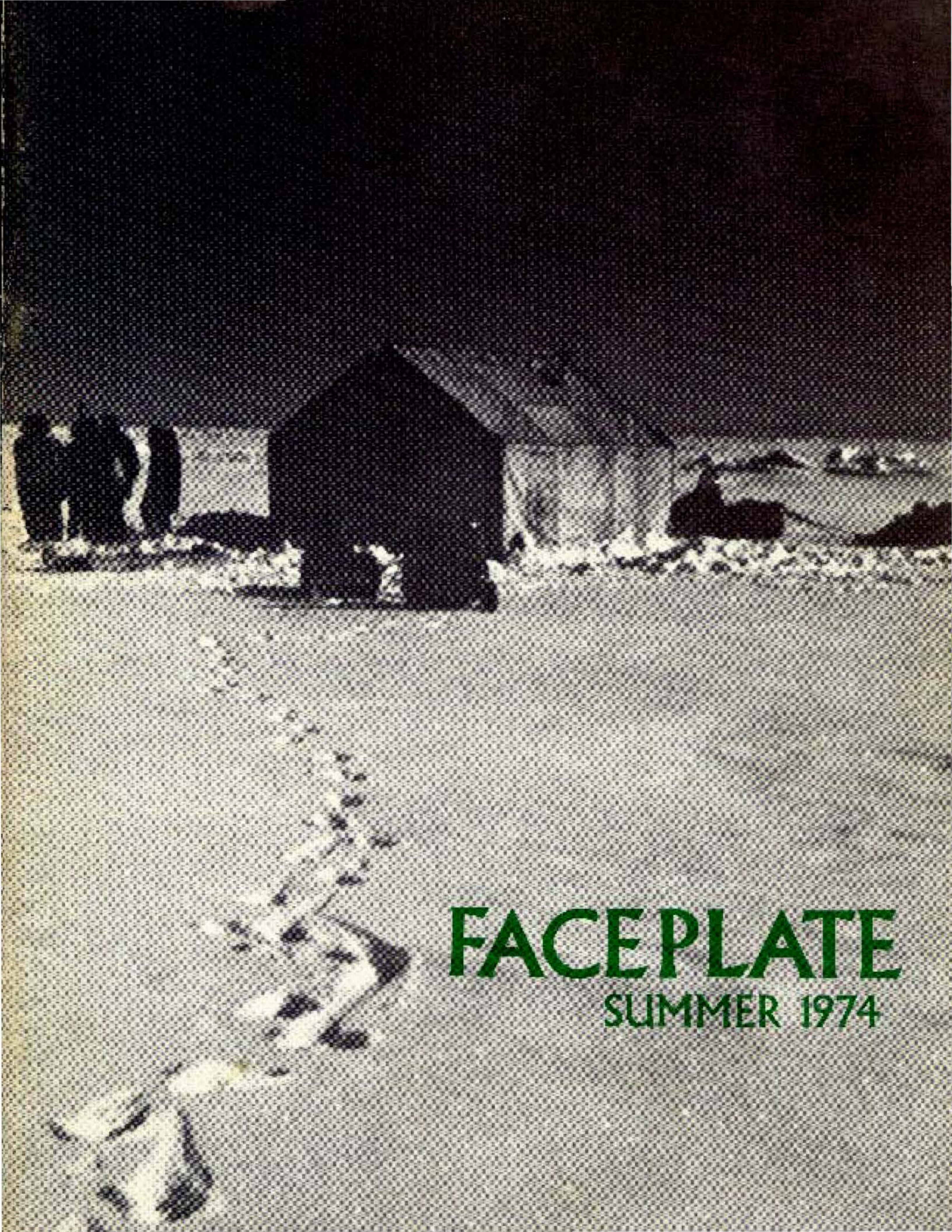
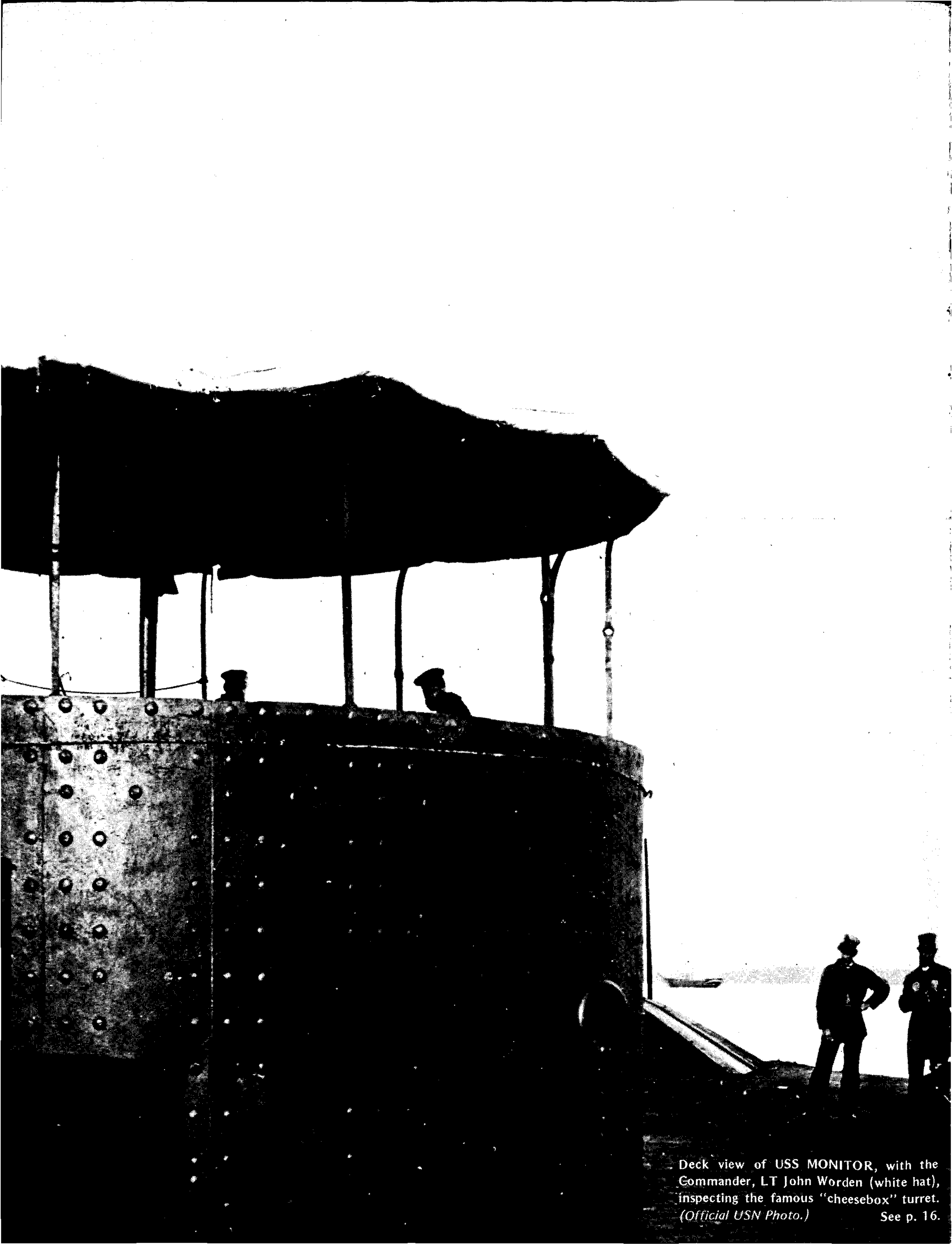


FACEPLATE

SUMMER 1974



Deck view of USS MONITOR, with the Commander, LT John Worden (white hat), inspecting the famous "cheesebox" turret. *(Official USN Photo.)* See p. 16.

FACEPLATE

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

VOLUME 5 NO. 2

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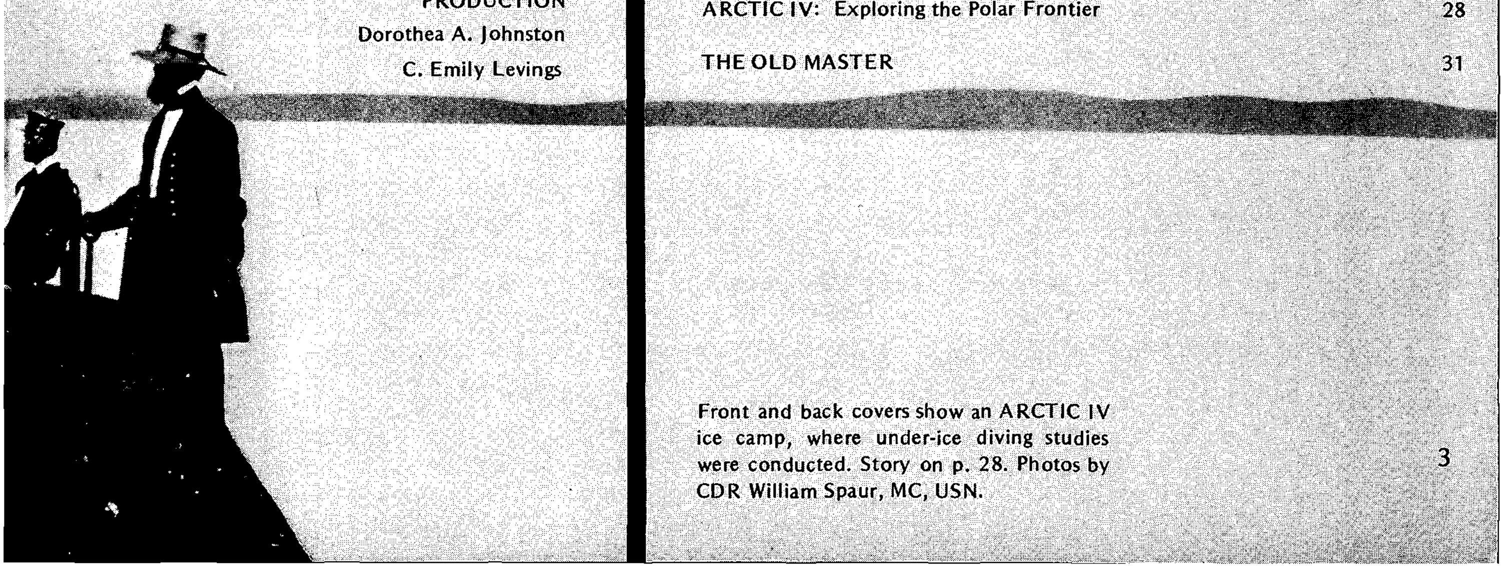


Front and back covers show an ARCTIC IV ice camp, where under-ice diving studies were conducted. Story on p. 28. Photos by CDR William Spaur, MC, USN.

SOUNDINGS

CANADIAN/U.S. NAVY EXCHANGE PROGRAM INITIATED

The Canadian/U.S. Navy Diving Information Exchange Project was officially initiated as the first working meeting of this annual IEP C-21 was conducted at the Navy Experimental Diving Unit on April 15, 1974.

The meeting got under way with a discussion of the Canadian/U.S. Navy Officer Exchange Program. Other items on the agenda included: the availability of USN aid for Canadian submersible salvage operations; exchange program procedures; participation in Canadian cold water and Arctic diving activities; Canadian familiarization with deep diving/saturation techniques at NEDU; and a general discussion on deep diving systems and their operational techniques. Also included in the conference were discussions concerning Canadian interest in divers' hydraulic tools and USN interest in Canadian diving computers.

Several benefits have already resulted from this mutual exchange program. The U.S. Navy has agreed to send lecturers to Toronto, Canada, in June 1974, to speak on NEDU deep diving/saturation techniques. It was also established that the USN submersible salvage capability (SUBMISS/SUBSUNK) would be available to the Canadian Forces should the need arise.

Those attending the meeting included CDR Colin Jones, USN, Officer-in-Charge of NEDU and the IEP C-21 Project Coordinator for the USN; CDR William Spaur, MC, USN, Senior Medical Officer at NEDU; LCDR Edson Whitaker, USN, Assistant Officer-in-Charge, NEDU; and LCDR John Naquin, USN, Head of the Diving, Salvage, and Submersible Systems Branch, OPNAV. Representing the Canadian Forces were: LCDR Roy Busby, CF, of the National Defense Headquarters, Canada, who is the Canadian Project Officer for the exchange program; LCDR Fred Cox, CF, Officer-in-Charge of the Clearance Diving, Trials, and Development Unit in Toronto, Canada; LCDR Barry Ridgewell, CF, Canadian Exchange Officer at NEDU; and LCDR Fergus Finley, CF, of the Canadian Defense Liaison Staff in Washington, D.C..

The next IEP C-21 meeting is tentatively scheduled for April 1975, to be held on the west coast of Canada.

EOD LIAISON OFFICER CHANGE

LCDR Larry Ronan has been relieved by LT Raymond Swanson as the EOD Liaison Officer at the Navy Experimental Diving Unit. Effective February 28, 1974, LCDR Ronan assumed his new position as the Head of the Explosive Ordnance Disposal Section at OPNAV. LT Swanson had served as Assistant Underwater Division Officer at the Naval School, Explosive Ordnance Disposal before arriving at NEDU.

ABSTRACT SERVICES NOW AVAILABLE TO DIVING COMMUNITY

The Supervisor of Diving, the Navy Bureau of Medicine and Surgery, and the Office of Naval Research have provided two abstract alerting services in diving and ocean engineering to Naval, industrial, and university laboratories for several years. These two services, which have been furnished under contracts with the Undersea Medical Society and Battelle Memorial Institute, are now available to the diving community at large on a subscription basis. These services feature individual cards, each containing a full bibliographic citation, an informative abstract, and a selection of key words on published articles, books, symposia proceedings and reports from both government and industrial laboratories.

The Diving Physiology and Medicine Information Service provides a comprehensive survey of biomedical literature related to underwater activities. In addition to the monthly cards that are sent out, the biomedical material gathered is recorded in a Termatrex retrieval system. Searches on specific subject areas and compilation of subject bibliographies are available at an extra charge.

The Diver Equipment Information Center (DEIC) alerting service emphasizes undersea engineering and diving equipment. In addition to current articles on these topics, the DEIC includes new diving-related patents in its monthly card abstracts.The DEIC also has the capability of performing literature searches and furnishing bibliographies on selected subjects. Requests for this special service should be directed to Diver Equipment Information Center, Battelle Columbus Laboratories, Columbus, Ohio 43201.

Subscriptions to both of these monthly alerting services are handled through the Undersea Medical Society. The cards are being made available for $40.00 per set, per year, in the United States, Canada, and Mexico; and $45.00 per set, per year, to subscribers elsewhere. Subscription to both is recommended only when current, in-depth diving information is required, because of duplication of information between these two services.

SENIOR CHIEF REEDY RE-ENLISTS

HMCS(DV) Terrell Reedy (right) was re-enlisted by LT Raymond Swanson, EOD Liaison Officer at NEDU, during a recent 1,000-foot saturation dive conducted at the Navy Experimental Diving Unit. Senior Chief Reedy was the Topside Supervisor during the dive.

CONSHELF XII REGULATOR APPROVED

The conversion of the U.S. Diver's Company Conshelf VI and Conshelf XI open-circuit regulators to the Conshelf XII open-circuit regulator has been completed successfully.

The Conshelf VI had been tested by the Navy Experimental Diving Unit in 1963 but it was superseded in 1971 by the Conshelf XI. However, the Conshelf XI was never submitted for testing, and therefore was never approved for service use. In 1972, the Conshelf XII was tested by the Navy Experimental Diving Unit and approved for use by the fleet. In an effort to rectify the discrepancies in the Conshelf VI, XI, and XII regulators, the U.S. Diver's Company proposed the conversion of these three models to one model, which would be designated as the Conshelf XII.

The NEDU Report 9-73, *Evaluation of U.S. Diver's Co, Modified Conshelf VI and Conshelf XI Conversion to Conshelf XII Open Circuit Regulators,* by Thomas Cetta, discusses the project's testing procedures and approval for service use.

INTERNATIONAL DIVING CONFERENCE SCHEDULED

The second International Diving Conference will be hosted by the Royal Navy on July 30-31, 1974, in HMS VERNON, Portsmouth, England. The format will be similar to the first conference, which was hosted in 1968 by the U.S. Navy in San Diego, California.

The subjects discussed will cover areas of mutual interest to all nations attending, including diving material, life-support systems, diving physiology, underwater ship maintenance, and saturation diving. Representatives from over 20 nations have been invited to exchange information and to discuss common problems faced by the worldwide diving community.

The U.S. Navy will present two papers: A general report on USN diving, and a more specific discussion on the USN 1,600-foot saturation dive conducted in April/May 1973 (see *FP*, Fall 1973). The proceedings of this conference will be discussed in the next issue of *Faceplate*.

FOR YOUR LITTLE BLACK BOOK...

The following telephone numbers are printed here for your information and convenience:

Director of Ocean Engineering/
Supervisor of Salvage:
(202) 692-1400;
Autovon 222-1400

Supervisor of Diving:
(202) 692-1403

Navy Experimental Diving Unit:
O-in-C: (202) 433-3007
Duty Officer:
(202) 433-2790
Medical Office: (202) 433-3528

Diving Detailer at BUPERS:
(general information no.)
(202) 694-1271

Diving Desk at BUMED:
(general information and after-hours no.)
(202) 254-4348

Navy Safety Center:
(804) 444-1321,
Autovon 690-1321

Diver Equipment Information Center (Battelle-Columbus):
(614) 299-3151

CORRECTION ON FSN OF STANDARD ROYLYN GAUGE

The Spring 1974 issue of *Faceplate* (see p. 5), listed the Federal Stock Number for the standard Roylyn gauge as FSN #H6685-009-7470, which is incorrect. The correct designation is FSN #H6605-009-7470. The caisson gauge stands correct, listed as FSN #H6685-431-4895. *Faceplate* regrets the error.

The 18 divers who comprise the Diving Locker team at the Naval Coastal Systems Laboratory (NCSL), Panama City, Florida, are representatives of the Navy's diving forces, and their presence constantly emphasizes that the primary role of NCSL is to support the Fleet. Each man has many years of experience as a diver, either as Master/First Class diver, or as a Sea-Air-Land (SEAL), Underwater Demolition Team, or Explosive Ordnance Disposal (EOD) team member. Currently, the Locker is headed by CWO Jerry W. McDonald, an EOD Officer with 16 years of diving experience.

The Diving Locker team conducts or provides technical assistance for swimming and diving tests, and evaluates related scientific tests and studies. This valuable Fleet input permits face-to-face, day-to-day, exchange of information, avoiding the delays and costs of constant travel to the operating forces for such information. Requirements can be discussed and explained, and task effort monitored as a result of continuous military/civilian scientist interchange. Equipments and operating procedures can be tested and evaluated, not only upon completion, but also throughout the research and development phases of task effort.

The EOD element is constantly on call to support the local community and the nearby states of Georgia, Alabama, Mississippi, and Louisiana, in examining, removing, and rendering safe such items as war souvenirs, bombs, and mines that are occasionally uncovered or washed ashore.

Other divers work with NCSL oceanographers in conducting coastal surveys for sand erosion studies. They maintain scientific equipment at the two offshore research platforms used for test and evaluation of Laboratory-developed gear, render valuable underwater rigging and test assistance to the Large Object Salvage System (LOSS) development; assist nearby Tyndall Air Force Base and Eglin Air Force Base in missile, drone, and equipment recovery; and assist in the operational development of swimmer equipment, such as SCUBA and underwater vehicles.

A major function of the Locker is the operation of the recompression facility. Its two chambers (a third chamber is being readied for use) are used for training and testing and are also available for treating bends and gas gangrene cases as a community service. In 1973, six bends cases and three gas gangrene cases were treated. Bends cases usually involve local or vacationing recreational SCUBA divers.

The NCSL Diving Locker has a Mark VI SCUBA capability and a deep sea locker. Recently, when a barge knocked out the bridge spanning Choctawhatchee Bay in northwest Florida, divers used this gear in support of bridge engineers to survey the bridge damage and expedite repairs. In January 1974, under adverse weather conditions, divers located and salvaged an RF-4C aircraft that had been lost from Eglin Air Force Base in waters off Fort Walton Beach, Florida.

In support of NCSL's research and development effort in underwater physiology, divers assisted in a recent project requiring them to stay in 38° water for 6-hour intervals over a 2-week period. These tests for gas consumption are presently undergoing evaluation.

Divers are also assigned to the Diver Underwater Tool development program. They test and demonstrate to Fleet units such new diver tools as the hot tap, a tool that cuts a hole through the hull of a ship or pipeline so a valve can be inserted in the hole. The compartment or pipeline can then be pumped to remove any contaminants. This tool's potential for stopping oil spills makes it a valuable addition to the Navy's environmental support arsenal.

Whether involved in research and development, removing beaver dams for the Bureau of Fisheries and Wildlife, instructing students in the Scientist-in-the-Sea program, or exploding hazardous ordnance, NCSL's Diving Locker is on the job around the clock in a scientific/university/community support role.

NEDU REPORTS:

Navy Experimental Diving Unit Report 22-72. *Effects of Head-out Immersion at 19.18 Ata on Pulmonary Gas Exchange in Man.* Edward T. Flynn, Herbert A. Saltzman, James K. Summitt

Abstract: Pulmonary gas exchange was studied during the performance of graded exercise in two normal male subjects breathing a mixture of helium and oxygen PIO_2=167-172 mm Hg. while immersed to the chin in water at a simulated depth of 600 ft (19.18 Ata). When compared to control observations at a simulated depth of 5 ft (1.15 Ata), exercise at 19.18 Ata was accompanied by decreases in respiratory rate, Ve and (A-a) DO_2 and by increases in VT, VD, and $PacO_2$. These changes were believed to be due to the interaction of several factors including the increased density of the inspired gas medium, the added external resistance to respiration, the hydrostatic pressure of the environment and the influence of immersion on pulmonary gaseous and blood volumes. In neither subjects, however, were the alterations in ventilatory or gas exchange parameters sufficient to impair the performance of heavy exercise or to produce arterial hypercapnia or hypoxemia.

Navy Experimental Diving Unit Report 25-72. *Environmental Control for Hyperbaric Applications.* LT S. D. Reimers, Mr. O. R. Hansen

Abstract: Careful control of the environment in a hyperbaric facility is necessary to protect the health and well-being of the occupants. In this paper total environmental control in the hyperbaric chamber is broken down into eight categories of control: total pressure, O_2 partial pressure, CO_2 partial pressure, temperature and humidity, trace contaminants, fire detection, bacteria and noise. For each category an assessment is given the difficulty and degree of control required and its importance to the occupants' well-being. For a diver in the water the special problems encountered in O_2 partial pressure control, CO_2 partial pressure control, and temperature control are also discussed briefly, each in its respective category. For each category the state of the art is discussed and the requisites for technological advancement are identified.

Navy Experimental Diving Unit Report 26-72. *Atmospheric Control in the Hyperbaric Environment.* LT Stephen D. Reimers

Abstract: Careful control of the atmosphere in a hyperbaric facility is necessary to protect the health and well-being of the occupants. In this paper total environmental control in the hyperbaric chamber is broken down into eight subareas of control: total pressure, oxygen partial pressure, CO_2 partial pressure, fire prevention, temperature, humidity, trace contaminants, bacteria, and noise. For each subarea an assessment is given of the difficulty and degree of control required and its importance to the divers' well-being. Also discussed for each subarea are the state of the art, and the areas of greatest technological need.

Control of oxygen and CO_2 partial pressure in breathing circuits of diving equipment is described. Methods of heating the diver and his inspired gas are also briefly discussed.

Navy Experimental Diving Unit Report 2-73. *Simulation Testing of Divers Breathing Apparatus.* LT Stephen D. Reimers

Abstract: The development of human simulation and physiologic testing methods is greatly altering the development cycle for military diver life support equipment. The relationships of both testing methods to each other and to the complete development cycle are discussed. The state of development of the NEDU "human simulator" and the measuring techniques needed to support it are discussed in detail. Areas needing further work are identified.

Navy Experimental Diving Unit Report 3-73. *Diver First Class Reading Ability.* Mr. Edward C. Bain, LCDR Thomas E. Berghage

Abstract: The Nelson-Denny Reading Test was administered to thirty Navy first class diver candidates to evaluate the group's vocabulary, reading comprehension, reading rate and overall reading ability. The findings showed the Navy divers to have an overall reading ability equivalent to the college freshman norm. Reading rate and comprehension were at the twelfth grade level, while vocabulary ability was equal to the college freshman norm.

Navy Experimental Diving Unit Report 4-73. *Sound Level Testing of the Standard USN Mk V Air and Helium-Oxygen Diving Helmets.* Stephen D. Reimers, James K. Summitt.

Abstract: Nine standard USN Mark V Air Diving Helmets and two standard USN Mark V Helium-Oxygen Diving Helmets were subjected to sound level testing on two specially built acoustical manikins at the Navy Experimental Diving Unit. The sound levels existing in the helmets were found to be into the hearing damage risk levels under nearly all the conditions tested. Wide variability in the measured sound levels was found to exist from helmet to helmet. The relationship of the test results to other similar work is discussed. Several possible ways of reducing the measured sound levels are presented.

These research reports have been issued by the Navy Experimental Diving Unit, Washington, D.C. Non-DOD facilities desiring copies of reports should address their requests to National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22151. The charge for each report is $2.00. DOD facilities can obtain copies from the Defense Documentation Center (DDC), Attn: DDC-TSR-i, Cameron Station, Alexandria, VA 22314.

[redacted]

In a special award ceremony on March 13, 1974, VADM Eugene P. Wilkinson, USN, Deputy Chief of Naval Operations for Submarine Warfare, presented the Legion of Merit to LCDR John C. Naquin, USN. LCDR Naquin received this distinguished honor for his "exceptionally meritorious conduct in the performance of outstanding service" as the USN Diving Exchange Officer to the Royal Navy. LCDR Naquin served in this capacity from November 1970 through August 1973, stationed at the Admiralty Experimental Diving Unit, HMS VERNON, Portsmouth, England.

LCDR Naquin's contributions during this tour include providing for the first time the training of Royal Navy divers in saturation diving techniques and procedures, enabling the Royal Navy to man a deep dive system and its mother ship. While serving as Officer-in-Charge of the Royal Navy Admiralty Experimental Diving Team, LCDR Naquin was also instrumental in testing and evaluating various diving equipments that were later procured and distributed to Royal Navy operational diving teams.

VADM Wilkinson (right) congratulates LCDR Naquin.

Citing his leadership, competence, and dedication, the award states that LCDR Naquin's contributions during this period of service "reflected great credit upon himself and were in keeping with the highest traditions of the United States Naval Service."

LCDR Naquin is presently serving as Head of the Diving, Salvage, and Submersible Systems Branch in the Office of the Chief of Naval Operations, Washington, D.C.

LCDR YENTES RETIRES

LCDR Yentes (center) completes inspection.RADM Esch (left) and LCDR Esau (right) follow.

After 30 years of service, LCDR Richard D. Yentes retired from the U.S. Navy on March 29, 1974. During the special ceremony held at the Washington Navy Yard, RADM Arthur G. Esch, Commandant, Naval District Washington, awarded the Navy Commendation Medal to LCDR Yentes for meritorious service as Executive Officer of the Naval School of Diving and Salvage. LCDR Yentes had held this post from September 1972 until his retirement.

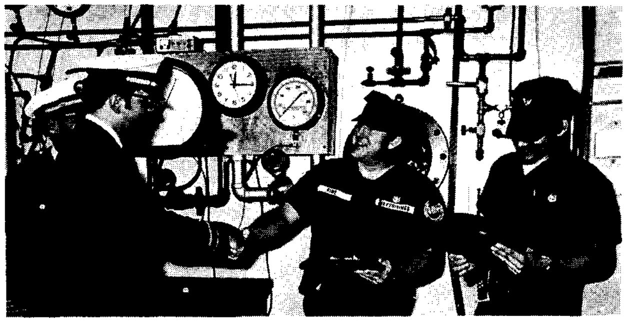
After the presentation of the Commendation Medal, LCDR Anthony Esau, Commanding Officer of the Diving and Salvage School, presented a special award of appreciation to Mrs. Yentes. A final inspection of the formation of the officers and men of the School was then conducted by LCDR Yentes, after which he delivered his farewell speech and requested "permission to go ashore."

LCDR Yentes began his Naval career with his enlistment in 1944, and has served in diving-related duties since qualifying as a USN diver in 1946. He achieved the rate of Master Diver, serving in this capacity until he was selected to the Limited Duty Officer Program in 1964. His career as a commissioned officer has included the duties of Division Officer, Department Head, and Executive Officer, both ashore and afloat.

Top: HT1(DV) Larry Burton (left) and HT2(DV) Jack Welch manage topside surveillance during SHAD II.

New Compressed Air Diving Record Set

Bottom: LCDR George Adams commends HTC(DV) Raymond Fine and TM2(DV) Gary Seibert after completion of SHAD II.



Project SHAD II, the U.S. Navy's second shallow water habitat air dive, ended its record-breaking 29-day saturation dive on April 12, 1974, at the Naval Submarine Medical Research Laboratory, Groton, Connecticut. This experimental dive, which began on March 15, 1974, is the longest recorded compressed air dive at 60 feet in the United States. Several simulated excursions were also conducted in the habitat, ranging from 5 to 250 feet in depth.

The two USN divers participating in SHAD II were selected from a field of experienced volunteer divers during a rigorous pre-dive training and selection program. Hull Technician Chief (DV) Raymond Fine was a member of the diving team in the U.S. Navy's deepest recorded open-water dive of 1,010 feet and has participated in various experimental diving operations for the past 5 years. Torpedoman second class (DV) Gary Seibert was the other selected participant because of his 6 years of operational diving experience and his participation as a chamber operator for SHAD I. Both divers completed the SHAD II experimental dive in good health and spirits.

The SHAD series began in October 1973, with a successful 30-day saturation dive to 50 feet. As in SHAD II, the divers in the SHAD I experiment breathed compressed air rather than the gas mixtures used in most saturation dives. A primary purpose of the SHAD series is to explore the feasibility of using compressed air as a breathing medium for moderate depth saturation diving because of its ready availability and comparative low cost. The uncertainty of the biomedical effects of the high partial pressure of oxygen in compressed air environments has limited the practical use of compressed air in saturation diving in the past. Marine biologists and geologists, oceanographers, and salvage divers presently rely on specialized gas mixtures for underwater saturation operations.

LCDR George M. Adams, MSC, USN, head of the Diving Research Branch of NAVSUBMEDRSCHLAB, is the Principal Investigator and Project Coordinator for the SHAD program. LT Roger A. Williamson, MC, USNR, coordinator of the medical supervisory team, and Chief Engineman James Gordon, (DVM), USN (Ret.), Diving Supervisor, have also been instrumental in the program. Larry Burton, Hull Technician first class (DV), USN, and Jack Welch, Hull Technician second class, (DV), USN, were the two participants of SHAD I in October 1973, and were also members of the surface surveillance crew during SHAD II. The overall scientific effort has been under the direction of CDR Raymond L. Sphar, MC, USN, Officer-in-Charge of the Laboratory, and Dr. Charles F. Gell, Scientific Director.

Fly-Away Diving System Near

Mr. Robert Pfeiffer
Office of the Supervisor of Diving

Two recent incidents involving commercial submersibles, the JOHNSON SEA LINK entrapment in June 1973 and the PISCES III sinking in August 1973, influenced a reexamination of the Navy's rescue assets. The SEA LINK and PISCES III operations were classic cases of "rescue by salvage," in which the only method of rescuing a vehicle's crew is to salvage the craft itself. This is in contrast to rescue from large combatant submersibles, which involves the transfer of personnel from the stricken craft by such methods as buoyant ascent or by using the McCann Chamber. The examination highlighted particularly the need for a greater search and rescue capability in the area of diving support systems. As a result of their own experience in the SEA LINK operation, Commander Submarine Development Group ONE (SUBDEVGRU ONE) proposed the development of an Emergency Fly-Away Mixed Gas Diving System to satisfy this diving support need.

The proposed concept identified specific components capable of being transported by C-141 aircraft that could support diving operations when installed on a suitable support ship. Major components include a diving bell, recompression chamber, air compressor, mixed gas supply, SCUBA, hard hat, and band mask diver life-support equipment. Also included were various supporting tools. NAVSHIPS, in commenting on the SUBDEVGRU ONE proposal, recommended that a meeting be held with the appropriate activities to define detailed scenarios and review ongoing programs involving the development of equipments similar to those selected. The meeting was held at Battelle-Columbus Laboratories, Columbus, Ohio, on March 7, 1974, bringing together a broad cross section of personnel from support activities, experienced divers from both the Atlantic and Pacific fleets, and NAVSHIPS technical personnel.

In establishing the detailed scenario, the requirement for including a mixed gas diving capability was reviewed. Including mixed gas would result in a more restricted number of suitable support craft because of mooring requirements, stowage provisions, and logistic support requirements for the mixed gas. These factors are highly variable according to water depth and duration of a mission and cannot be predetermined. In addition, since the SDS-450 Diving System, assigned to Harbor Clearance Unit One, may provide the Navy with a fly-away mixed gas diving capability to 450 feet, it was proposed to limit the near term capability of the Open Bell Fly-Away System to air only. This decision does not preclude the addition of a mixed gas capability in the future, following further evaluation of the SDS-450 System. The scenario established for the Emergency Fly-Away Diving Support System is to support two divers and one standby diver to a depth of 190 feet on air with a heavy work rate at a 60-minute maximum bottom time. Decompression will be in accordance with Table 1-10, and surface decompression will follow Table 1-26 or 1-27 of the U.S. Navy Diving Manual. Inherent in this system is the capability for doing limited work to a depth of 250 feet on air under exceptional exposure.

The equipment identified as required to support this capability varied from items already approved for service use to items for which no development or procurement program has been initiated. Applicable items presently available include SCUBA, hard hat, and band mask breathing apparatus. Other accessible components include the portable diesel generator set, SCUBA charging compressor, high pressure gas stowage flasks, UDATS underwater television system, hydraulically actuated work tool package, medical kit, and divers' umbilicals and Unisuits. An additional requirement identified was to develop a facemask and communication system for use with air SCUBA. Fleet divers recommended that a capability of direct diver-to-tender and diver-to-diver communication be included in the system as part of the Helle Communicators being procured with the band masks.

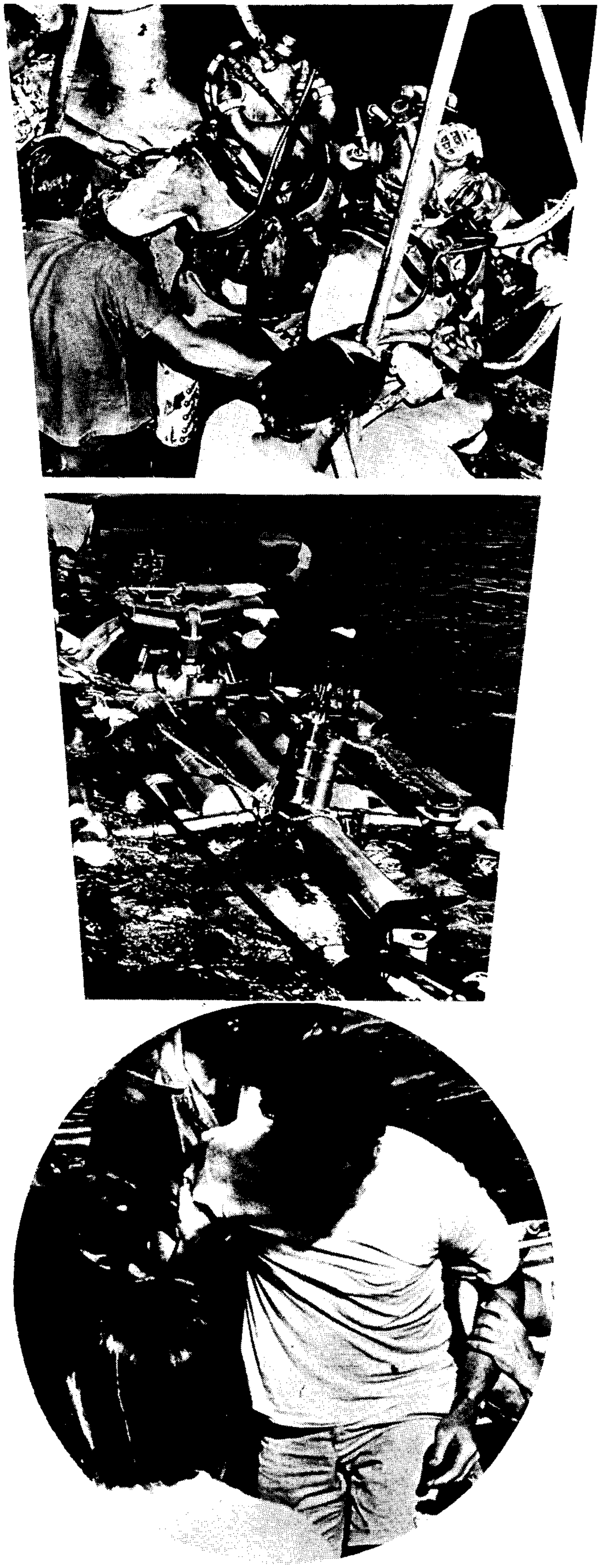
Two items currently under procurement by NAVSHIPS that are applicable to the system are a one-man portable recompression chamber (see *FP*, Spring 1973) and the open diving bell (see *FP*, Spring 1974).

One of the major items required for the system for which no hardware is available is the air compressor system. Battelle Memorial Institute had been tasked initially by NAVSHIPS to identify a modular system for improving the air diving systems on ASR, ARS, and ATF type ships, and was then directed to extend this study to include the requirements of the fly-away system. The system selected is a Quincy W5120 250 psi 96 cfm compressor driven by a Detroit Diesel 3-53 engine. Two compressor units were selected as the most practical means of providing a standby air supply. In order to keep the weight of a single module below 4,000 pounds for helicopter transport, the support equipments (including controls, filters, and receivers) were packaged on a separate module. The two compressor units can be operated with one control module.

One item for which no specific selection was made was the two-lock recompression chamber. Standard Navy two-lock chambers require repacking and are relatively expensive; however, commercial skid-mounted units developed for use by commercial diving companies are being considered for Navy application. The selection of a chamber has been deferred, based on the availability of the portable one-man chamber and the number of existing shipboard and land based chamber facilities.

The concept and equipments identified at the March 7 meeting were recommended to the Chief of Naval Operations as the basis of an Emergency Fly-Away Diving Support System. The implementation of this program involves a detailed packaging and logistic support study. It also includes the acceleration of a program with the Naval Coastal Systems Laboratory, Panama City, Florida, to develop a facemask with voice-actuated communications for use with air SCUBA.

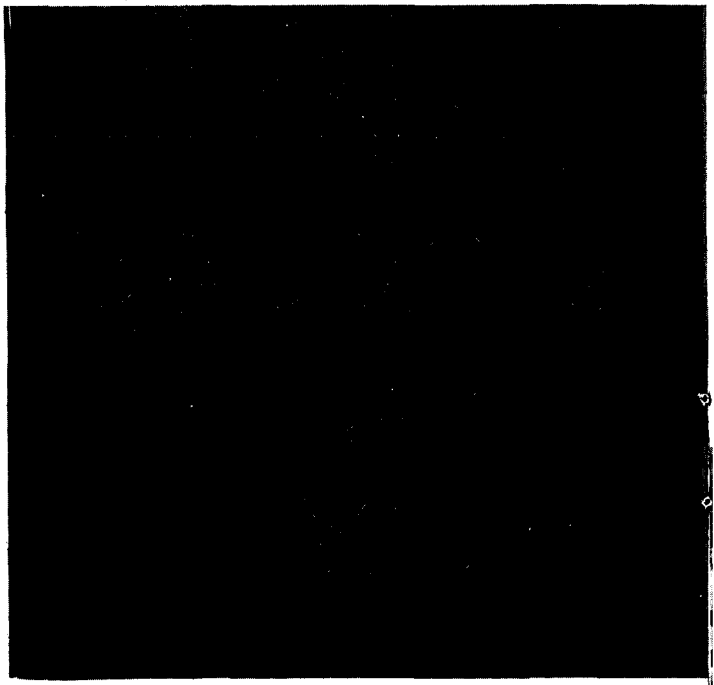
This proposed concept is considered to be the most cost-effective means of providing a fly-away diving response capability. It will provide an expanding response capability determined by the availability of individual components. The first major capability would be achieved with the delivery of the prototype low pressure compressor units as early as January 1975. Procurement of two such systems is planned for concurrent evaluation by both Atlantic and Pacific Fleet Units. The development of the compressor units also has the added potential for providing a much-needed uprating of air diving systems on ASR, ARS, and ATF type ships. Depending on the development of the skid-mounted two-lock recompression chambers, the full system capability could be achieved by September 1975. *Faceplate* will provide news of further developments as they occur.



Top to bottom, the photos at right show hard hat diving, vehicle surfacing, and personnel rescue during SEA LINK recovery.

The Navy Experimental Diving Unit (NEDU), Washington, D.C., has been evaluating the Draeger LAR III pure oxygen SCUBA since October 1973. The LAR III is manufactured in the Federal Republic of Germany by Draegerwerk, Lubeck.

The Draeger LAR III is a closed-circuit oxygen SCUBA that provides breathing gas to the diver via a demand valve or a demand bypass valve. Carbon dioxide (CO_2) is removed from the closed breathing system when it passes through a CO_2 absorbent canister that contains approximately 4.4 pounds of baralyme. Sodalime is used extensively throughout Europe as the CO_2 absorbent, but it is not yet authorized for U.S. Navy SCUBA use. When fully charged with breathing gas and absorbent, the LAR III weighs approximately 21½ pounds. Dimensionally, the Draeger unit is 18 inches long, 15½ inches wide, and 7 inches thick. The SCUBA is secured to the diver's chest by a quick connect/disconnect harness arrangement.

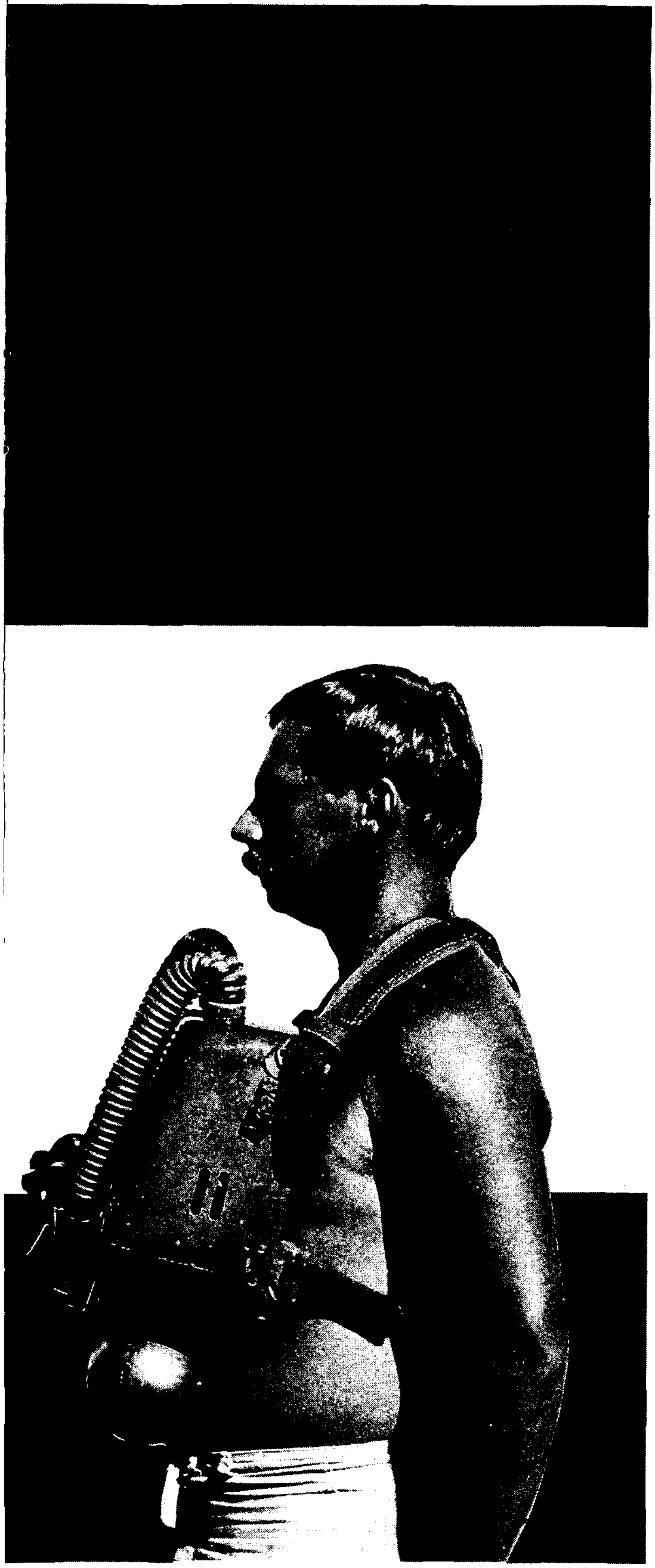


LTJG P.T. Smith, SEAL Team TWO, shows front and side views of LAR III.

Historically, at least during the last decade, the U.S. Navy has had relatively little knowledge of the use or design of Draeger or other foreign-produced SCUBA. There are two primary reasons for this situation. First, as a general rule, there has almost always been domestic equipment capable of meeting the needs of the Navy. Secondly, the "Buy American Act" makes it very difficult to purchase foreign-made equipments, especially when similar (but not necessarily equal) equipment is available. In the past, U.S. Navy experience with Draeger equipment has been limited almost exclusively to the LT LUND 2 closed-circuit oxygen SCUBA, a predecessor of the LAR III. The LUND 2 SCUBA was used in quantity at one time by U.S. Navy Underwater Demolition Teams (UDT) but was superseded by the standard USN EMERSON closed-circuit oxygen SCUBA in 1963.

The recent LAR III evaluation series was conducted as a result of a specific request by the Commanding Officer, SEAL Team TWO. SEAL personnel are continually deployed to Europe and have frequent exposure to and opportunity to train with the Draeger LAR III through various joint training efforts with allied combat swimmer organizations. SEAL Team TWO desired limited allowance quantities of the LAR III as a means of enhancing safer operations through pre-deployment training and allowing a more knowledgeable and professional background for participating SEAL personnel.

Two units of the Draeger LAR III were made available to NEDU at no cost by the manufacturer for the USN evaluation. Testing was accomplished by NEDU



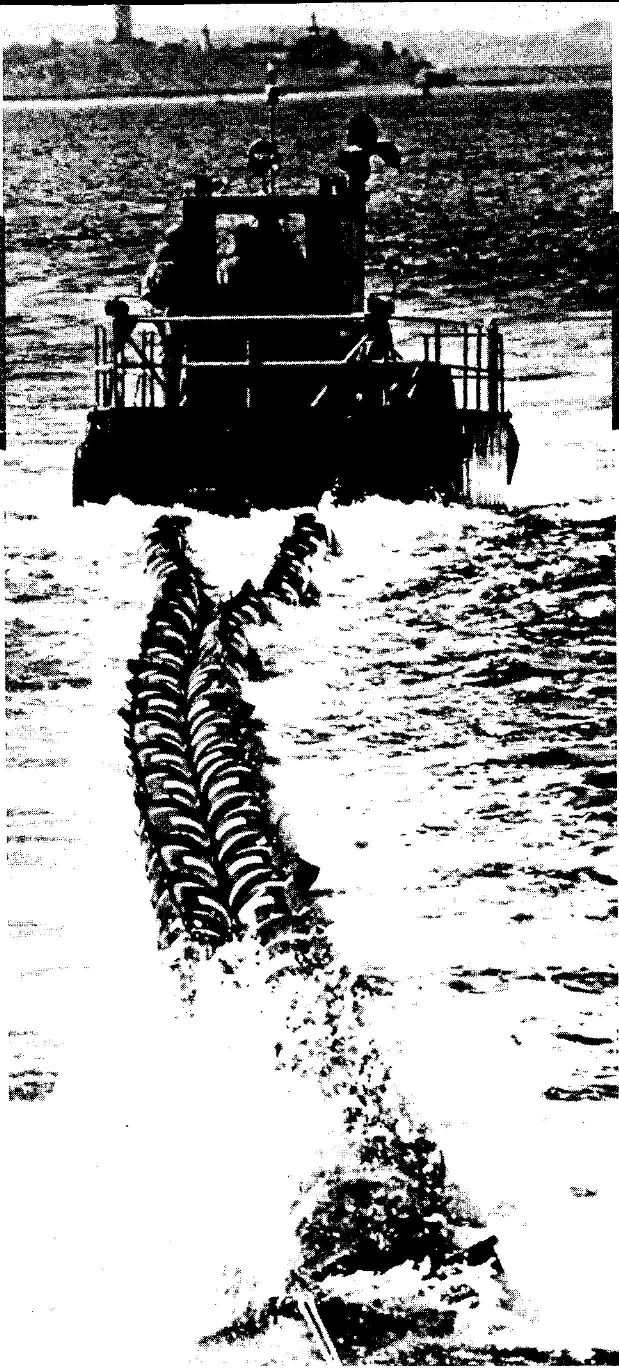
and the Naval Inshore Warfare Command, Atlantic (NAVINSWARLANT). Divers from NEDU, NAVINSWARLANT Operational Testing Department, SEAL Team TWO, and UDT-21 were utilized to complete the required test operations. LT Thomas L. Hawkins, USN, and EMCS(DV) Thomas C. King, USN, were NEDU Project Directors. BMCM(DV) Corney Leyden, USN, was the NAVINSWARLANT Project Officer.

The primary purpose of the test was to determine parameters for safe use of the LAR III by SEAL Team personnel. The LAR III was not tested for service approval nor was the evaluation program so structured since Commander Operational Test and Evaluation Force (COMOPTEVFOR) did not participate. The NEDU tests were both objective and subjective in scope, including wet pot analysis, open-sea test operations, magnetic effects tests, and acoustic influence tests. A primary test objective was to achieve a minimum of 80 hours total bottom time on the two test apparatus; an excess of 90 hours was accomplished in the open-sea.

Completed on March 31, 1974, the NEDU test series determined that the Draeger LAR III is an extremely safe and reliable diving apparatus. During operational comparison it was found to be equal and in some areas had inherent design features that made it superior to the EMERSON SCUBA. This finding does not imply, however, that the EMERSON is not an equally qualified diving apparatus in its own right. Draeger equipment is generally characterized by a close attention to engineering detail, optimum selection of materials, and excellent quality control. It is also basically a simple mechanical design without the multiplicity of backup systems found in many U.S. equipments. This simple mechanical design and care in manufacture result in highly reliable equipment at reasonable prices.

The Draeger LAR III is being recommended for limited use by U.S. Navy Special Warfare Underwater Demolition and SEAL Teams. It was determined that EMERSON-trained Special Warfare divers can acquire the basic skills to operate and maintain the Draeger LAR III with less than 1 hour of instruction. Safety parameters were determined and essentially mirror USN operations with closed-circuit oxygen SCUBA since depth and time limitations are equal. Primary contrasts were encountered with the metric system differences, specifically in tools, fittings, and gauges. This was not considered a serious problem, however. The entire scope and results of the LAR III evaluation are discussed in NEDU Report 11-74.

SUPSALV



Above: High speed transit tow trial through containment boom.
Top of page: Skimmer in operational mode "V" configuration.

Mr. Richard Asher
Office of the Supervisor of Salvage

The Supervisor of Salvage, in further expanding the Navy's response capability to salvage-related and major open sea oil spills, has procured a new prototype oil skimmer. Designated as DIP 3003, this oil recovery device was obtained from the JBF Scientific Corporation, Burlington, Massachusetts, in April 1974. Its capabilities include self-propulsion, recovery of oil in 3- to 5-foot seas, a self-contained pumping system, and a storage capability for 4,000 gallons of recovered oil.

The DIP 3003 operates on a JBF-patented oil recovery principle known as the "dynamic inclined plane," by which a moving plane carries the oil beneath the surface of the water to a collection well where it is gravity-separated. The hull, basically a displacement type, is constructed of aluminum with a length of 38 feet, a beam of 11 feet, a draft of 5 feet, and a displacement of 15 tons.

Propulsion for the skimmer is provided by a Harbormaster Drive Unit with a 360° thrust capability. The unit is diesel-powered with a rating of 66 net horsepower. Pumping capacity, rated at 440 gpm at 120 psi, is provided by a Moyno ID14 progressing cavity screw pump powered by a diesel engine.

A series of operational tests of the skimmer was conducted recently in the Boston, Massachusetts area. Major test objectives included checkouts of skimmer propulsion and pumping. Maneuverability, stability, thrust, and self-propelled speed were also evaluated. The skimmer was towed under two configurations to determine the maximum safe transit speed. Operational towing tests were performed to evaluate the skimmer in a collection mode.

The first week of testing was devoted to determining operational characteristics of the skimmer. During a series of speed trials, conducted on measured courses in both the inner and outer harbors of Boston, the skimmer's maximum speed was measured to be 5.1 knots, with stability and maneuverability maintained at that speed. Pumping capacity was checked using water. An average pumping rate of 550 gpm was maintained when pumping water through 50 feet of 6-inch discharge hose. A Bollard Pull test and an inclining experiment were also performed.

Procures New Oil Skimmer

The oil collection capabilities were evaluated with several simulations. In the first test, sorbent polyurethane foam chips were used to simulate deployed oil in the water. The skimmer made passes through the sorbent successfully, recovering all that was intercepted. With the approval of the Coast Guard and the Environmental Protection Agency, a limited amount of biodegradable oil was deployed to simulate a spill, through which the skimmer made its passes. Because of the small quantity of oil used in these tests, an exact percentage of the oil recovered was not measured; however, visual observations indicated that virtually all of the oil was removed from the water.

The second week of testing involved evaluating the skimmer as one part of a total oil recovery system. Tests were conducted to optimize towing the skimmer in a transit mode, i.e., high speed towing. Operational tows utilizing oil containment boom in a "V" configuration were conducted to determine optimal speeds, tow vessel spacing, and skimmer thrust. Further testing of the skimmer evaluated the capability for discharging cargo from the skimmer to a barge at sea.

The initial high speed towing tests, during which the skimmer was towed at a maximum speed of 10 knots in 2-foot seas, utilized a standard configuration with nylon hawser. Tow line tension averaged 7,000 pounds, which compared favorably with model test data. The skimmer remained stable at the high speeds with a slight lift of the bow and negligible yaw.

A second set of high speed towing tests was performed using oil containment boom in conjunction with the nylon hawser. This particular configuration, which allows the recovery system to be towed to a spill site ready for use, was included in the testing because of the complexity of attaching boom to the skimmer bow at sea. The skimmer again remained stable during this test, attaining a maximum speed of 9 knots with tow line tension reaching 9,500 pounds. The seas were calm over the entire test area during this experiment.

Operational tests of the recovery system were conducted using a "V" configuration for sweeping. Each leg of the "V" consisted of a 200-foot length of Clean Water, Inc., heavy-duty oil containment boom. Two bridles were used to maintain a 30° included angle for the initial 50 feet of boom in front of the skimmer. Trials were conducted with various "mouth" openings, towing speeds, and skimmer thrust settings. During these tests, the seas were running 1 foot with 15-knot winds. The optimal boom spacing or sweep width for these conditions was 175 feet when the system was towed at 1 to 1½ knots. The skimmer applied a reverse thrust of approximately 500 pounds to reduce the boom catenary formation.

A final series of tests was conducted to evaluate the single leg boom sweep method, a procedure in which a single tow boat could be used to recover oil. With 200 feet of boom, the highest spacing (perpendicular distance between skimmer and tow boat) was 75 feet at a speed of 1 knot. Though considerable effort was required to maintain the configuration, the single leg sweep was judged to be a possible mode of operation.

This procurement and testing proved the feasibility of an open sea oil recovery system. In evaluating the prototype skimmer as a subsystem, SUPSALV gained considerable experience in using effective open sea oil recovery techniques. Future plans include additional testing, which will aid proposal evaluation during large-scale procurements, and logistics preparation for the rapid response of this skimmer to an open sea spill incident.

The DIP 3003 skimmer and associated 1,000 feet of Clean Water, Inc., boom will be maintained in a state of readiness at the SUPSALV Pollution Response Center in Bayonne, New Jersey. The skimmer can be either air transported by C-5A or trucked to the scene of an oil spill.

The DIP 3003 system supplements an existing skimmer system stored at the SUPSALV Pollution Response Center in San Francisco, California, providing an immediate response capability for both the east and west coasts of the United States.

MISSING: One federal gunboat; 172 feet long, with a 41-foot beam, 7½-foot draft, and a weight of 776 tons. In addition to very low freeboard, distinguishing characteristics include a small wheelhouse on her bow and a revolving 8-inch-thick armor gunport that is 9 feet high and 20 feet in diameter. Last seen in the vicinity of the Outer Banks off Cape Hatteras, North Carolina, on December 31, 1862.

For over a century the fate of the USS MONITOR has inspired innumerable searches and spawned countless theories. While under tow by the merchant vessel RHODE ISLAND to take part in the Federal blockade of southern ports, the MONITOR sank during a severe storm. She was lost in an area off the North Carolina Coast where the clashing of warm Gulf Stream currents with cold North Atlantic waters has for centuries

...in search of the M

victimized ships, rightfully earning the designation of "the Graveyard of the Atlantic."

The latest reported discovery of the MONITOR came from a 5-month investigation headed by John G. Newton of Duke University, Durham, North Carolina, and Gordon Watts, a North Carolina state marine archaeologist. Their alleged sighting last summer of the Civil War ironclad was supported by photographs that, after months of intensive study, indicated the MONITOR had indeed been found. Their investigation found the ship lying upside down in 220 feet of water, approximately 15 miles south of the Cape Hatteras lighthouse.

The U.S. Navy entered the investigation as part of its project to determine the characteristics, capability, and efficiency of the R/V ALCOA SEAPROBE in operations involving inspection and documentation of shallow-water wrecks. Secondary objectives included inspecting and obtaining photographic documentation of 11 magnetically-located wrecks near Cape Hatteras. Should one of these sightings prove to be the MONITOR, special efforts would then be made to ensure full, high quality photographic coverage suitable for the production of a photo-montage for public display.

Just as the MONITOR in its own time was a radically new and futuristic craft, the ALCOA SEAPROBE today is a unique and technically advanced salvage vessel. Operated by Alcoa Marine Corporation, SUPSALV's primary search and recovery contractor, the all-aluminum research vessel is 243 feet long, with a 50-foot beam, a 14-foot draft, and a weight of 1,700 tons. In addition to other specialized attachments, the SEAPROBE uses its sectioned pipe system to deploy a search, identification, and sensor package called the "search pod." This "pod" contains obstacle avoidance

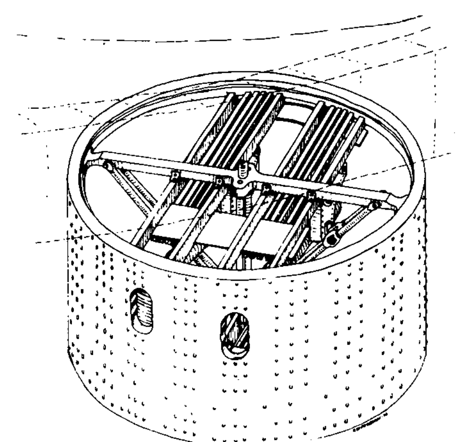
Comparison of photo mosaic from photos taken by SEAPROBE, ilar construction features. Camera angle of mosaic is looking dow val Research Lab, is from an original blueprint of the ship and sh

MONITOR

sonar, side-scan sonar, black and white and color television, still camera, and lighting equipment.

The SEAPROBE departed Moorehead City, North Carolina, on Sunday, March 31, 1974, arriving at the aforementioned Duke sighting later that day. The 13-member research team aboard was under the direction of CDR Colin Jones, Officer-in-Charge of the Navy Experimental Diving Unit, who served as Officer-in-Charge of the expedition. Other team members included representatives from the Naval Research

cameras (left) and a sketch of MONITOR's turret (right) show sim-
n from above the armor belt. Sketch, by Mr. E. Peterkin of the Na-
ows the MONITOR's hulk lying bottom-side up on top of its turret.



Laboratory, U.S. Naval Academy, Chief of Information Office, National Geographic Society, Duke University, the State of North Carolina, and the Massachusetts Institute of Technology.

Using its dynamic positioning and maneuvering capabilities, the SEAPROBE's television and still cameras recorded the wreckage during numerous passes over the hulk. The four TV monitors in the SEAPROBE's darkened control room allowed researchers to compare wreckage on the ocean floor to various charts and drawings of the MONITOR. Several video tapes and more than 1,200 photographs were made before rough seas hampered operations and prevented any attempt to recover artifacts. These photos and tapes, however, enable Navy, Duke, and North Carolina experts to confirm prominent features known to be part of the MONITOR.

According to photographic evidence, the hulk of the vessel is resting bottom-side up on the ocean floor. Approximately one-fourth of the turret is clearly visible and protruding from the armor belt (see photo and drawing). Close study indicates that the turret was apparently dislodged from its original position in the center of the ship when she turned over while sinking. Other features identified include an extended keel unique to the MONITOR, bow and stern shapes, overall size of the hull, direction of the plating, shape of skeg and propeller shaft position, construction and depth of the armor belt, flat bottom, and the spacing of frames and angle iron beside the armor belt.

Particularly interesting was the bow area of the wreck, which was not photographed last summer by the Duke team. SEAPROBE photos clearly picture the circular hatch with a cloverleaf design in its grill cover corresponding precisely with the size, design, and position of the MONITOR's anchor well.

Two additional wreck sites were searched by the SEAPROBE on April 3 and 4, while photographic and video tape evidence of the first site was analyzed. The weather deteriorated, however, preventing identification of the latter wrecks. The SEAPROBE returned to the MONITOR site for the remaining 2 days of the search contract, but turbulent seas prevented lowering the instrument pods for further observation before returning to Moorehead City on April 7.

The 7-day search operation, which proved to be beneficial to both Navy technology and general historical interests, ended Navy involvement in the MONITOR investigation. Whether other organizations or shipwreck enthusiasts continue the pursuit of the Civil War iron-clad remains to be seen.

RA-5C Aircraft Recovered Off Key West

A Navy RA-5C from the Boca Chica Naval Air Station experienced engine failure and a complete loss of hydraulic power and crashed into the Gulf of Mexico approximately 35 miles west of Key West, Florida, on March 5, 1974. Both crew members ejected at an altitude of approximately 10,000 feet, but only the rear-seat RAN survived.

A Navy SAR helicopter was dispatched immediately, arriving at the scene approximately 30 minutes later. Despite the shallow water depth, no wreckage was sighted. A marker buoy was then placed in an oil slick in an area that was believed to be close to the crash site.

The Supervisor of Salvage was notified and was requested on March 5 to provide search and recovery assistance. ALCOA Marine Corporation, and Seaward, Inc., were then instructed by SUPSALV to mobilize for search operations, which commenced on March 7. Mr. William A. Walker, SUPSALV Representative, and Mr. Sid Shaw, Seaward, Inc. Project Manager, arrived in Key West on March 6 and met with CDR A. B. Headley, NAS Key West Base Operations Officer, and LCDR G. Pilcher and LT J. Carter of the Accident Investigation Board to review all known accident data.

Divers from EOD Detachment Key West searched the area around the marker buoy on March 6 without success. On March 7, a side-scan sonar search was conducted in this area, but this also brought negative results. Precision navigation reference stations were set up on Rebecca Shoal Light, 9 miles west of the buoy, and on a boat anchored adjacent to the New Ground Shoal navigation buoy. The search was conducted from a 40-foot AVR belonging to the naval air station, with a high speed turbine-powered LCSR used for the 40-mile-transit to and from Key West. Later in the search, a private-party fishing boat was chartered and anchored near the search area to provide both hotel services and a platform for the precision navigation station, eliminating time-consuming transit.

About 1 week into the search, new information established that the New Ground Shoal navigation buoy was 1.2 miles from its originally charted position. This fact, when combined with information obtained from the crews of several of the shrimp boats who witnessed the crash, resulted in a new revised search area to the northeast of the original one. Search operations shifted to this new location on March 14, and on March 16 the aircraft wreckage was located and positively identified in 24 feet of water.

Almost all of the wreckage was found in one concentrated pile of debris, facilitating its recovery. Salvage operations were conducted from March 18-21 by divers from USS ATAKAPA (ATF-149), which was in the area at the time. LCDR J. M. McGrath, CO of the ATAKAPA, was the on-scene commander for the operation.

After establishing a 2-point moor over the site, wire straps and/or double-braided nylon lines were used to lift the wreckage with the after boom. As it was placed on ATAKAPA's fantail, members of the Naval Safety Center and the Accident Investigation Board inspected it to determine the cause of the crash. Approximately 90 percent of the wreckage was recovered in an opera-

tion that included Army Special Forces divers, as well as the divers from ATAKAPA and EOD DET KEY WEST.

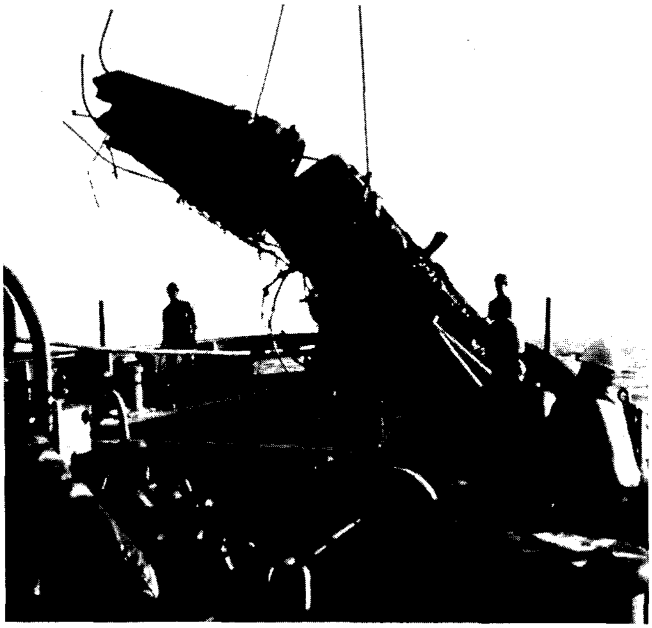
The primary search tool used for this task was a dual side-scanning sonar, which is comprised of two basic units: a towed hydrodynamically streamlined "fish" on which two sonar transducers are mounted, and a shipboard control and recorder unit.

The recorder has a variety of maximum ranges allowing selection to suit water depth and towing speed, and permitting use of an expanded presentation for target classification.

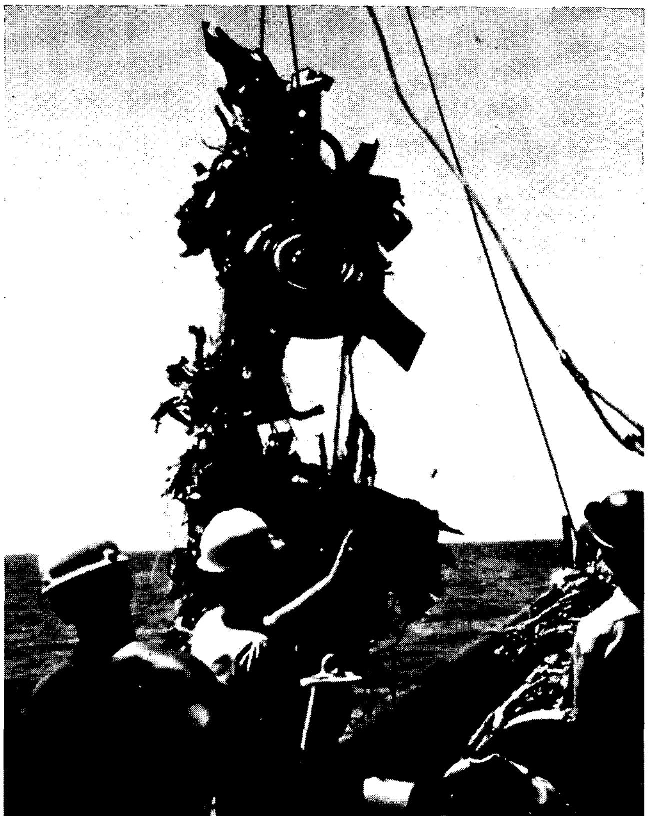
Because of the shallow water in the search area, the fish was towed just below the hull of the search vessel, about 5 feet below the surface. The 100-meter recorder scale was used, but the effective range was limited to about 60 meters per side in the shallow water. The coral patches on the seafloor in the area made detection of the aircraft wreckage quite difficult.

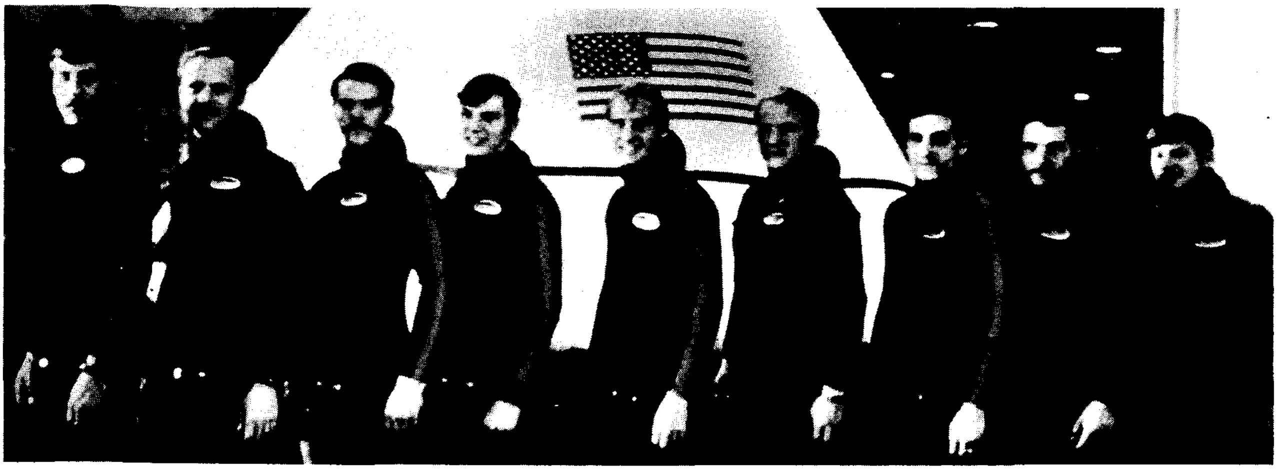
Positioning of the search vessel was accomplished using a Trisponder precision electronic navigation system. This system is a range/range type of system with a useful over-water range of over 15 miles.

Once the sonar target believed to be the missing aircraft was located, repeated passes were made by it on different course headings. This enabled the distribution pattern of the wreckage to be determined. The Trisponder system was then used to position a marker buoy in the debris and to aid in mooring the ship over the debris, facilitating the search and recovery operations.



Left: SUPSALV Representative William Walker swims over tail section of downed RA-5C during search/identification phase. Photos above and below show different stages of lifting wreckage and placing it on ATAKAPA's fantail for inspection.



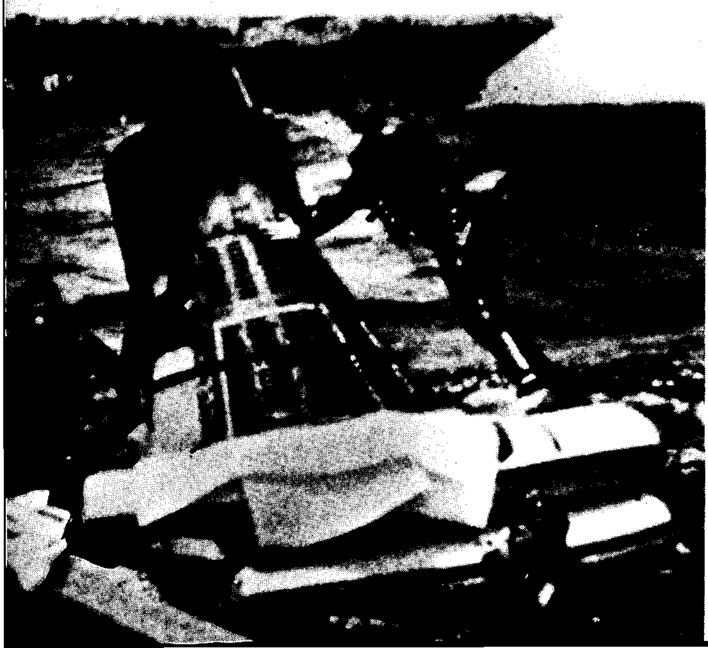


Apollo 14 swim team, left to right: MM2 Michael Bennet, LT Fred Smith, QM3 Joe McFarland, QM3 John Ripple, LTJG Robert Rohrbach, YN2 R. Davis, LTJG Mike Slagle, HM1 Terry Holmes, and GMG3 J. Faller.

APOLLO RECOVERIES: Flashback on a UDT-11 tradition

LCDR C.J. Hatleberg, USN
Underwater Demolition Team ELEVEN

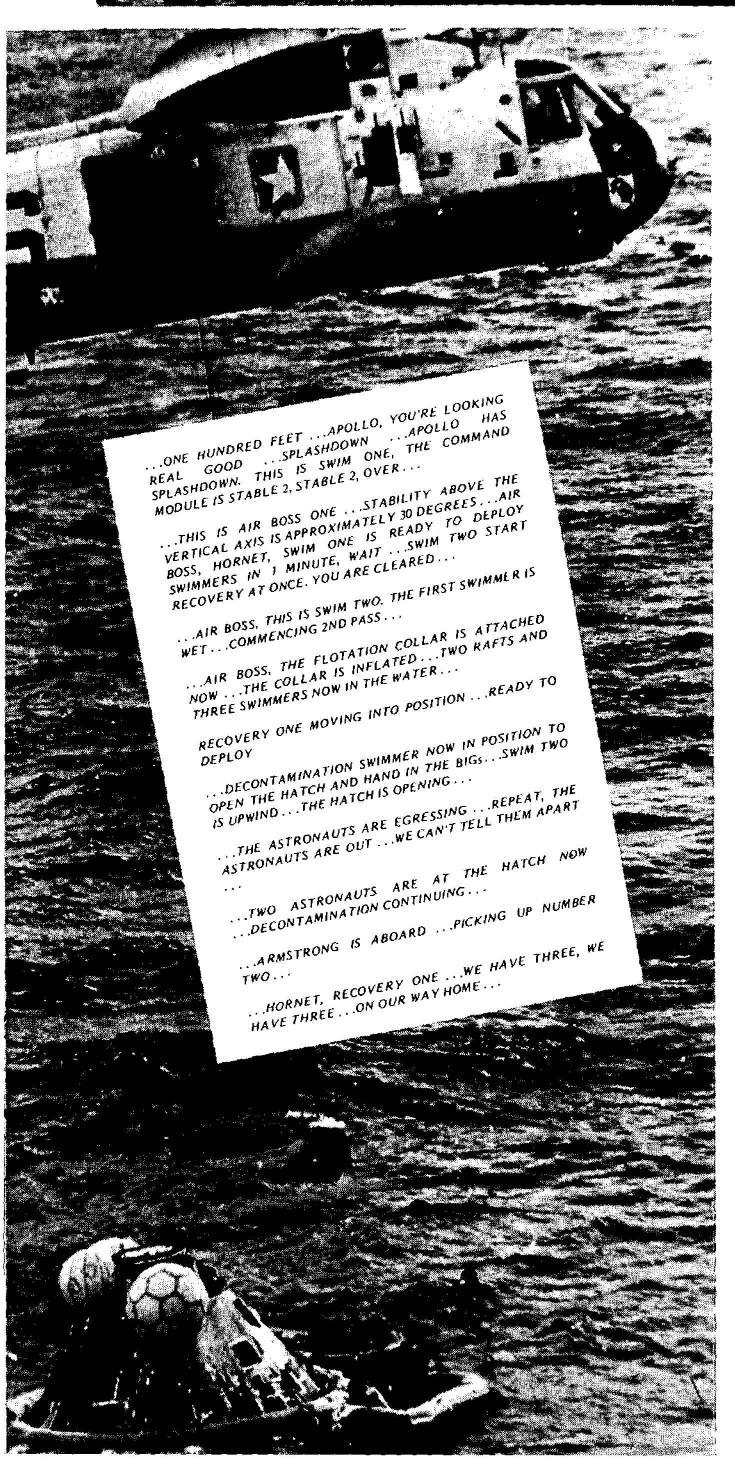
The men of Underwater Demolition Teams Atlantic and Pacific have established a proud tradition with their participation in the Manned Space Craft Program. These U.S. Navy frogmen have assisted in the recovery phase of the Mercury, Gemini, Apollo, and Sky Lab missions.



Underwater Demolition Team ELEVEN (UDT-11), based at the Naval Amphibious Base, Coronado, California, has been a part of this tradition since May 1969, when LTJG Wes Chesser and SNs John Wolfram and Michael Mallory recovered the Apollo 10. BM1 Louis Boisvert, MM2 Mike Bennet, HM1 "Doc" Holmes, and LT Jim Maxwell are other UDT-11 members who have contributed significantly to various recovery operations in the United States space effort.

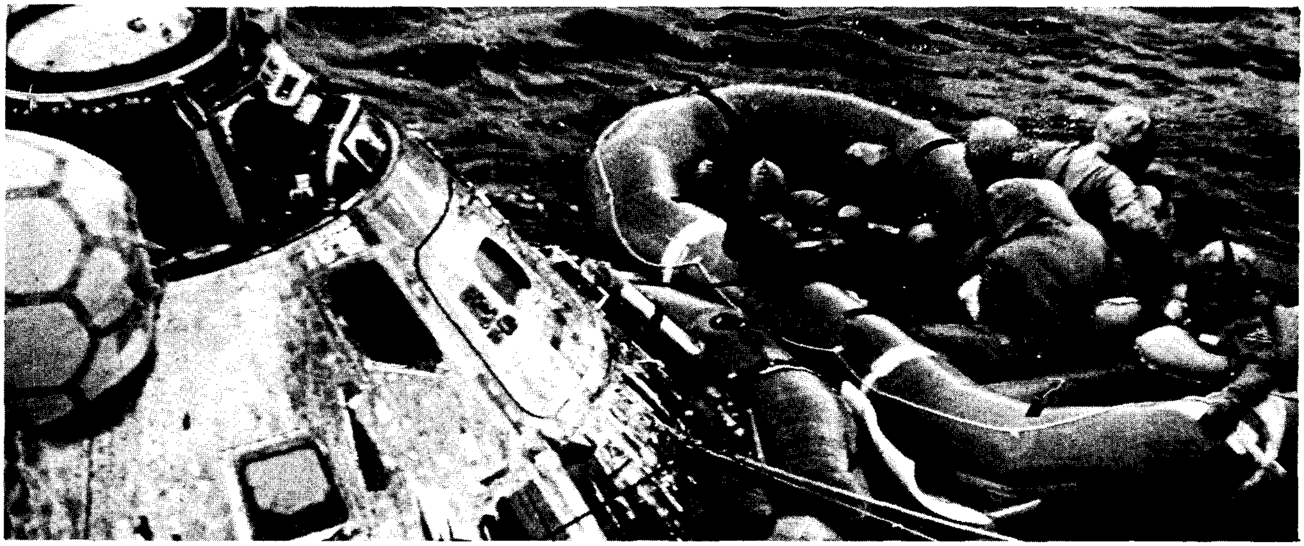
The Apollo missions required a different approach to the standard recovery procedures than had been utilized by the U.S. Navy and the National Aeronautics and Space Administration (NASA) in past space flights. The redesigning of the command module, resulting from the fire prior to the Apollo 1 flight in January 1967, caused it to become too heavy with the astronauts inside for the pick-up by a B & A crane in all possible sea conditions. A sudden jerk on the lines from the crane to the top hatch of the module caused by just medium sea-states could have ripped the structure apart. Thus an alternate method of recovery was devised for the remaining space missions.

Left: Gemini recovery.



Above: Two frogmen exit helicopter with flotation collar for module (at right). Left: COL Aldrin is picked up in rescue net. Excerpts from actual recovery communications of Apollo 11 are inset in photo.

Swimmers were delivered to the command module by helicopter, wearing SCUBA gear to protect them from inhaling fumes from leaking fuels. In later missions, this gear also served as protection against possible lunar contamination. The first swimmer out attached a sea anchor (a parachute 8 feet in diameter with a 50-foot nylon line) to the command module to keep it from "walking," or drifting, down wind. The large parachute sail area almost tripled the effect of the wind velocity on the module's drifting. Once the capsule was stabilized enough to allow swimmers to work around the module, the rest of the recovery team entered with the uninflated 250-pound flotation collar. The collar fits snugly around the command module, providing buoyancy, serving as a work platform, but primarily reducing the heaving caused by most seastates. After the flotation collar was inflated, two rafts were thrown down from the helicopter to the three-man recovery team. The astronauts could now safely exit the module into one of the rafts, which had been lashed securely alongside. Once they transferred to a raft, they were picked up individually by a "Billy Pugh" rescue net lowered from the helicopter and flown to the recovery ship. *(continued next page)*



Astronauts are decontaminated with sodium hyperchlorite. Decontaminant canisters are on the side of the module. Below: Recovery of astronauts is completed; swimmers await transport.

Recovery procedures for Apollo 11 required special precautions because of the possible existence of a Lunar Pathogen, or space germ, that could have been introduced into the Earth's biosphere by the returning astronauts. The concept of the Apollo 11 operation was to biologically isolate the astronauts until sufficient time had passed to ensure that they or their space craft did not contain lunar contaminants; and if these contaminants did exist, that effective measures were found to deal with the situation.

Biological Isolation Garments (BIGs) were fabricated to isolate the astronauts and protect the rescue swimmers during recovery. The BIG suits filtered the exhaled air of the astronauts, who donned them before leaving the command module, and the inhaled air of the decontamination swimmer, also required to wear the suit. The astronauts, wearing their BIG suits, were "washed down" with sodium hyperchlorite, a strong bleach solution. They then washed down the decontamination swimmer in the same manner. After the astronauts had been picked up by the helicopter, the decontamination swimmer sprayed and washed down the entire outer surface of the command module, the flotation collar, and the rafts with Betadyne, a surgical scrub used by doctors. The transport helicopter was also later decontaminated.

The astronauts remained in their BIG suits until they entered a specially designed trailer, called the Mobile Quarantine Facility. The Mobile Quarantine Facility was then air lifted to the permanent isolation facility at Houston, where the astronauts were kept under clinical observation for 45 days. As the possibility of the existence of a lunar contaminant has diminished over the years, each of the elaborate precautions created for biologic isolation and decontamination in the Apollo 11 mission has been discarded. Today, no precautions of this type are taken.

With the last impending joint US/USSR space venture in 1975, it appears that UDT participation in the space program will come to a close. Future space efforts will involve a space shuttle, which has the capability of landing like a plane, thus the splashdown recoveries will no longer be needed.

Reserve HCU's Provide On-Call Salvage Expertise

The Naval Reserve has a new organization of teams available for divers and salvors. This organization has been formed within the newly restructured U.S. Naval Reserve Harbor Clearance Program to provide an on-call capability to diving/salvage emergencies.

These teams, designated as Reserve Harbor Clearance Units (RHCU's), are organized in a 10-unit structure. Determined by geographical placement, five teams report to each USN Harbor Clearance Unit, HCU-1 at Pearl Harbor, Hawaii, and HCU-2 at Little Creek, Norfolk, Virginia. The location of each individual team is based on the response to follow-up questionnaires that had been sent to all divers who answered the 1971 "DIVERS WANTED" advertisement in the Naval Reservist Magazine.

Each team will have a nucleus of qualified divers who are ready and capable of immediate response to a diving/salvage emergency. Each member of each team must be physically qualified to be trainable to USN 2nd Class Diver status; and, in fact, a major effort will be made to achieve 2nd Class Diver status for all RHCU team personnel. Extensive training plans and state-of-the-art diving equipment are two features that will facilitate training and maintaining a "ready" team. Diving pay and requalifying programs for both officers and enlisted men are also included in the RHCU Program.

The need for RHCU's had been recognized in a survey of the Naval Reserve Program conducted by the Reserve Analysis and Study Project (RASP) of BUPERS. In July 1973, RASP advocated the formation of RHCU's as an integral component of the new action-oriented Naval Reserve Program. The Reserve Harbor Clearance concept, sought by the Naval Ship Systems Command for several years, serves two basic functions: offering a program through which divers and salvors can retain and make use of the diving and salvage skills acquired during military service; and providing a qualified, immediate response capability at minimum cost for both civilian and military national emergencies.

Authorization for the RHCU program became official with the OPNAVNOTE 5400 Ser 01/10674, dated May 15, 1974. In addition to providing the guidance for necessary implementing actions, the notice describes harbor clearance team placement and composition. The 10 individual unit titles and locations include: HCU 104, Philadelphia, Pennsylvania; HCU 208, Mayport, Florida; HCU 319, San Diego, California; and HCU 420, San Francisco, California. Each of these four units is composed of five officers and 30 enlisted men. The other six teams, composed of four officers and 17 enlisted men, are located as follows: HCU 1001, Portsmouth, New Hampshire; HCU 1106, Norfolk, Virginia; HCU 1209, New Orleans, Louisiana; HCU 1313, Chicago, Illinois; HCU 1419, Long Beach, California; and HCU 1522, Bremerton, Washington.

A NAVSEA Diving and Salvage Division, headquartered in Washington, D.C., has also been approved for inclusion in the RHCU program. Composed of eight officers and one enlisted man, this group will act as liaison between the individual teams.

The Reserve Harbor Clearance Unit concept is now a reality, providing an on-call salvage expertise for use in mobilization situations by cataloging the necessary talent and making it available without time-consuming search or extensive training. Those who wish to affiliate with the program and have not signed up should contact either CDR Robert Moss, NAVSEA OOC, (202) 692-1400, Autovon 222-1400, or LCDR Joe Whelan, NAVSEA OOV4, (202) 692-1468, Washington, D.C. 20362.

SATURATION EXCURSION TABLE LIMITS EXTENDED

The Navy Experimental Diving Unit (NEDU) has undertaken the task of developing new USN saturation-excursion tables. In a recent series of experiments it has been proven that much longer excursion times than allowed by the present tables are possible from a saturation depth of 300 feet.

The present tables were calculated using the M-value mathematical model, which is based on data derived from dives beginning and ending at the surface. The excursions tested were allowable depth/time relationships established by this mathematical model. During the years 1969 and 1970, 1,126 excursions were performed at NEDU without a single incident of decompression sickness. The complete absence of bends during these excursion dives, in addition to data from other deep dives, indicated that the allowable excursion time limits might be greatly prolonged.

The dive series to develop new tables was started at the intermediate saturation depth of 300 feet. Each of the three saturation dives was manned by five divers and lasted 10 days, during which repeated excursions were made to 400 feet.

During the first 300-foot saturation dive, separate excursions were made to 400 feet for durations of 2, 2½, 3, and 4 hours. In each case, decompression to 300 feet was performed at a rate of 60 feet per minute. Crewmembers of this diving team were: LCDR Douglas R. Knight, MC, USN, MM1(DV) Stephen A. Debolt, PH2(DV) Bill D. Douthit, BM2(DV) Terrance R. Everson, and ST1(DV) Carl G. Cross. The second 300-foot dive consisted of five 100-foot excursions lasting 4, 4½, 5, 6, and 8 hours. LT John Zumrick, MC, USNR, BMC(DV) Richard C. Arlington, EM1(DV) John A. Cantale, BM1(DV) Eugene L. Euteneier, and ENC(DV) Robert G. Watkins were the participants for this series of tests. Following the successful completion of these first two dives, the excursion time at 300 feet had been lengthened from the present tables' 100-minute limit for 100 feet to 8 hours for 100 feet. During the third saturation dive, LT Rudolf Simoncic, BM1(DV) Ronald A. Bunting, BM1(DV) Leland E. Lash, BM1(DV) Michael D. Reynolds, and BM1(DV) Edward W. Thomas not only performed 8-, 12-, and 24-hour excursions to 400 feet without injury, but also conducted four 2-hour and three 4-hour 100-foot excursions successfully.

These three saturation dives proved that the duration of 100-foot excursions from the 300-foot depth was unlimited, a fact which also holds true for all saturation depths deeper than 300 feet. Excursions from depths shallower than 300 feet have not yet been studied, but will be of shorter duration.

The fourth saturation dive in the series, which began on May 14, 1974, investigated excursions from saturation depths of 600 feet and deeper. Divers first saturated at 300 feet, at which depth they conducted a 24-hour excursion to 400 feet. The team then compressed to and saturated at 600 feet, after which they made two 24-hour excursions to 750 feet. Final compression went to 1,000 feet, where they saturated and stayed for 48 hours before decompressing. The participants in this dive were CDR Colin Jones, LT John Zumrick, HMC(DV) Carmon D. Gibson, BM1(DV) Michael Danforth, and MM1(DV) Donald N. Hessler.

Throughout these saturation-excursion dives, studies of the maximum work capability of immersed divers using the Mk 10 Mod 4 closed-circuit underwater breathing apparatus were continued. This includes measurement of the maximum sustained oxygen uptake, mask pressures, breathing bag pressures, inspired oxygen and carbon dioxide partial pressures, and heart rate during hard bicycle ergometer pedalling under water. These studies involved the participating divers in many weeks of physical fitness training in both bicycle riding and running. Serum enzyme and platelet studies were also performed during the dive series. Results of the fourth saturation dive and further test analyses will be published in a future issue of *Faceplate*.

Diver suited in Mk XII is lowered by stage into water.

MKXII TECHEVAL UPDATE

The United States Navy's Prototype Surface Supported Diving System, designated Mk XII, was developed in response to a requirement to improve equipment used by the Navy's hard hat diver. As a result of a survey reported in the Supervisor of Diving Research Report 12-70, it was determined that the existing hard hat equipment (USN Mk V) performed adequately and safely, but that there was considerable need for improvement throughout the system. A prototype Mk XII was then fabricated to incorporate a lightweight helmet, improved recirculator, lower sound levels, emergency bottle, improved weight distribution, and state-of-the-art materials.

The Navy Experimental Diving Unit, as the designated developing agency, prepared three prototype units and assumed the responsibility of testing, evaluating, and modifying the Mk XII. The test program is defined in "The Technical Evaluation Program Outline for the Navy's Prototype Surface Supported Hard Hat System" and "The Detailed NAVXDIVINGU Project Plan for Project T/S 83."

The first phase of the evaluation was concerned with the technical adequacy of the system, including physiologic studies, gas flow, acoustic studies, and representative salvage task studies. The second area of testing dealt with the operational adequacy of the system, considering such factors as reliability, maintainability, compatibility, and supportability.

TECHNICAL PHASES

Salvage task analyses were conducted in a training tank, in the Anacostia River, in one of the NEDU chambers, and in the Patuxent River for the purpose of collecting task time and diver response data. Two hundred twenty-nine Mk XII dives were performed in depths ranging from 10 feet to 90 feet, using both air and He-O_2. Comparisons of dives using the Mk XII and Mk V revealed that the Mk XII provided more comfort (surface and in water), visibility (comparable to SCUBA), buoyancy control, and mobility.

No significant task time differences were noted for tasks accomplished in the Mk V and Mk XII. However, the divers clearly favored the Mk XII system when compared to the Mk V, and particularly preferred the buoyancy control, comfort, and additional mobility of the Mk XII. Acoustic studies indicated that sound levels were greater than the design requirement of 90 dba (decibels on the a-weighted scale). In general, the Mk XII is 5 to 10 dba quieter than the Mk V and, per the established acoustic criteria in NEDU Report 5-71, a diver can be exposed to the sound levels encountered in the Mk XII from 2 to 4 hours.

The gas flow venturi efficiency tests conducted with the gas ejector in the scrubber/recirculator indicated that operation was satisfactory with a 0.025-inch orifice. A venturi efficiency of 10 was established, which is equal to or better than most comparable units.

OPERATIONAL PHASE

The Mk XII operational phase was conducted at sea off Kahe Pt., Oahu, Hawaii. The system was tested in two modes: surface supported, using air in the open cycle mode (50 dives); and surface supported, using He-O_2 in the recirculator mode (89 dives).

Seventeen divers were used, six from NEDU and 11 from HCU-1, Pearl Harbor, Hawaii. Acceptance criteria as defined in the Project Plan and test procedures established by the Project Officer were used with slight modifications to permit maximum utilization of the diving platform for the period allotted. Diving opera-

tions were conducted from July 17 to August 10, 1973.

During the 50 air dives there were five minor failures, all occurring before or after the dive. No aborts or critical or major failures occurred.Of the 89 He-O_2 dives, seven resulted in aborts: five by life-support equipment and two by equipment other than life-support. One of the life-support equipment aborts was deemed a direct result of tender error.

Comments received on post-dive critique questionnaires indicated that technical documentation and training were adequate. Constructive criticism was expressed in areas of troubleshooting and repair, but unanimous favorable responses were made on the degree of comfort and mobility of the Mk XII over the Mk V.

CONCLUSIONS

The basic design requirements of the Mk XII have been met, and the units will be ready for Operational Evaluation upon incorporation of some design changes. The basic Mk XII configuration has been tested and evaluated, with the following items requiring redesign or retesting: (1) helmet: supply valve, exhaust valve, breech ring sealing, piping fittings, and speaker location; (2) CO_2 scrubber: coverplate seal, coverplate securing clamps, piping and fittings, recirculating valve location, scrubber to helmet hose, and venturi noise; and (3) diving dress: garment chafing and leaks, outer garment zippers, and backpack straps.

The redesigned items will be tested to ensure that they will meet the system requirements. Additional technical evaluation results will be published as they become available.

Mk XII (foreground) is shown in comparison tests with Mk V.

Dr. MacInnis, Director of ARCTIC IV.

ARCTIC IV: exploring the polar frontier

A 2-month scientific diving expedition, designated as ARCTIC IV, was recently conducted at Resolute Bay, Cornwallis Island, North West Territories, Canada. The April 25 through June 19 expedition was directed by Dr. Joseph MacInnis, diving physician and founder of the James Allister MacInnis Foundation, Toronto, Canada. Preceded by three similar Arctic expeditions, ARCTIC IV is part of a research and education program of manned diving operations in Canada established by the MacInnis Foundation.

Resolute Bay is almost 600 miles north of the Arctic Circle, lying 75° north latitude and 95° west longitude. To the south is Barrow Strait, the northern corridor of the Northwest Passage. The diving site is only 90 miles from the magnetic north pole. Weather conditions at Resolute are harsh, making working conditions hazardous and fatiguing. During April and May, the temperature ranges from approximately –25°F to +25°F, with winds reaching 25 to 35 miles per hour. The light on the snow and ice is brilliant, and the sun stays well above the horizon. The water temperature is approximately 28.4°F.

In August 1970, a four-man team carried out 22 dives from a shore base on the eastern edge of Resolute Bay. This operation, known as ARCTIC I, was a preliminary survey of marine biology, marine geology, and operational aspects of Arctic summer diving. ARCTIC II was conducted in February 1971, during which time a nine-man team made 41 dives from an ice camp located over the previous dive area. A 15-man team made 205 dives from an ice camp near the western shore of Resolute Bay during the ARCTIC III expedition in November 1972. During ARCTIC III, in which the world's first manned polar diving station, SUBIGLOO, was constructed, programs were conducted on human performance, equipment performance, marine biology, and marine geology. These first three polar diving expeditions were conducted in summer, winter, and fall; the spring ARCTIC IV provides the final seasonal comparison in the continuing study of the operational and logistics problems of Arctic diving.

According to Dr. MacInnis, the general objectives of the ARCTIC IV expedition were to continue the study of human and equipment performance problems of the

Arctic begun in 1970, continue and expand the marine biology and geology surveys already started there, study the operational and logistic problems of placing small teams of divers at Arctic sites, study the technology of ice-adherent structures, and study the human performance problems of working on an Arctic oil field well head at depths to 300 feet.

In pursuing these objectives, Dr. MacInnis's transparent, spherical, SUBIGLOO was constructed on the bottom, and small hemispherical, air-filled SEASHELL refuges were stationed throughout the work area. The inflatable LINK dwelling was also assembled and made ready for saturation diving. Specific diver work-tasks were analyzed for elements of performance decrement, and marine biological and geological surveys were performed. Also studied was the behavior of an oil spill under the ice. Deep helium-oxygen dives to depths approaching 300 feet were scheduled for late May by CANDIVE Ltd. The entire work of the expedition above and below water is being filmed and recorded by the Canadian National Film Board.

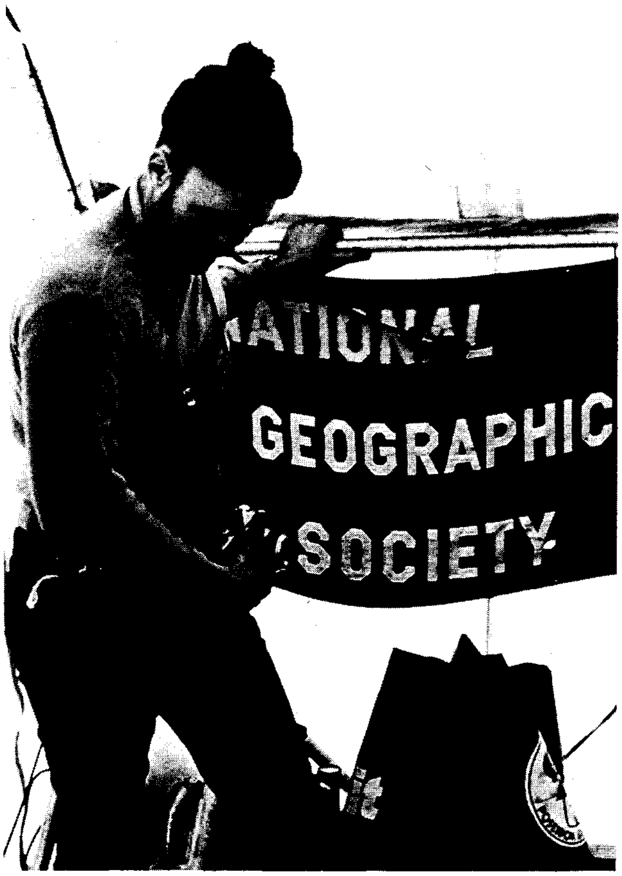
The 24-hour saturation dive was conducted on May 12 and 13 in the LINK inflated rubber dwelling. The habitat was floated up under the 5½-foot-thick ice, providing dry living quarters for two divers. Communications and lighting were installed, and heat was provided by hot water that was pumped through finned copper piping from a Hot Water Unlimited boiler and pump on the surface. The skirted habitat hatch was located at a depth of 14 feet. The two divers performed nine excursions of 40- to 60-minute duration to conduct surveys, collect specimens, and photograph the area.

Several brands and designs of open-circuit SCUBA were used; double-hose U.S. Diver's Company regulators proved dependable, as did the Poseidon regulators with Cressi full facemasks. To prevent any freeze-up, the anti-freeze cap on the Poseidon regulator was filled with quality rum. This regulator proved trouble-free. Several other single-hose regulators designed for Arctic use, however, did develop freezing and free-flow through the first stage on nearly every dive. Unisuits, with two sets of Unisuit Arctic underwear, made hour-long dives in the 29°F water relatively comfortable.

Five U.S. Navy-sponsored investigators participated in the ARCTIC IV expedition. Mr. Walter T. Jenkins, of the Naval Coastal Systems Laboratory in Panama City, Florida, will use information gained during the expedition concerning the evaluation of diving equipment and techniques in a manual that he is presently completing. The manual, entitled *A Summary of Diving Techniques Used in Polar Regions*, is being compiled for the Office of Naval Research. Supported by the U.S. Navy Supervisor of Diving, Mr. Birger G. Anderson, Vice President of Oceanautics, Inc., attended to study the principal factors affecting diver performance. He also assessed the general surface and underwater operations.

(continued next page)

Ice camp at Resolute Bay.



Above: Walter Jenkins, of NCSL, was one of five U.S. Navy-sponsored participants in ARCTIC IV. Below: LCDR David Hall prepares to deflate his Unisuit after a test dive.

LCDR David Hall, MSC, USN, from the Submarine Development Group One, San Diego, California, used an acoustically-transmitted diver monitor to study body core temperature (which is measured from a swallowed radio-pill), skin temperature, and heart rate during the cold dives. These successful studies were conducted during the 24-hour saturation dive with excursions and during two 130-minute endurance dives, which were performed by LCDR Hall and Mr. Jenkins. LCDR Hall was assisted by Mr. Allen Slater, of the Emergency Care Research Institute, Philadelphia, Pennsylvania, who was the designer and builder of the diver monitoring system.

CDR William Spaur, Senior Medical Officer at the Navy Experimental Diving Unit, participated in the expedition from May 8 to 16 to experience first-hand the rigors and problems of Arctic diving. The visit provided an excellent opportunity to work and dive with experienced Arctic divers and expedition members who were accustomed to selecting and conditioning equipment for cold diving, and who had developed safe diving procedures for through-the-ice diving.

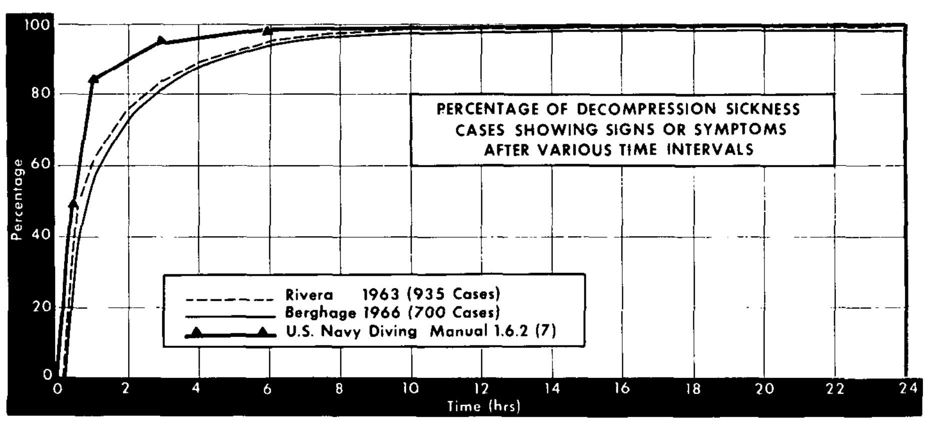
There is still much to be learned about Arctic marine life, underwater ice structures, the extent of pollution, and the existence of new resources in the Arctic regions. By studying the problems of diving in this hazardous environment, the ARCTIC expeditions have contributed greatly to the understanding of the polar frontier.

The Old Master...

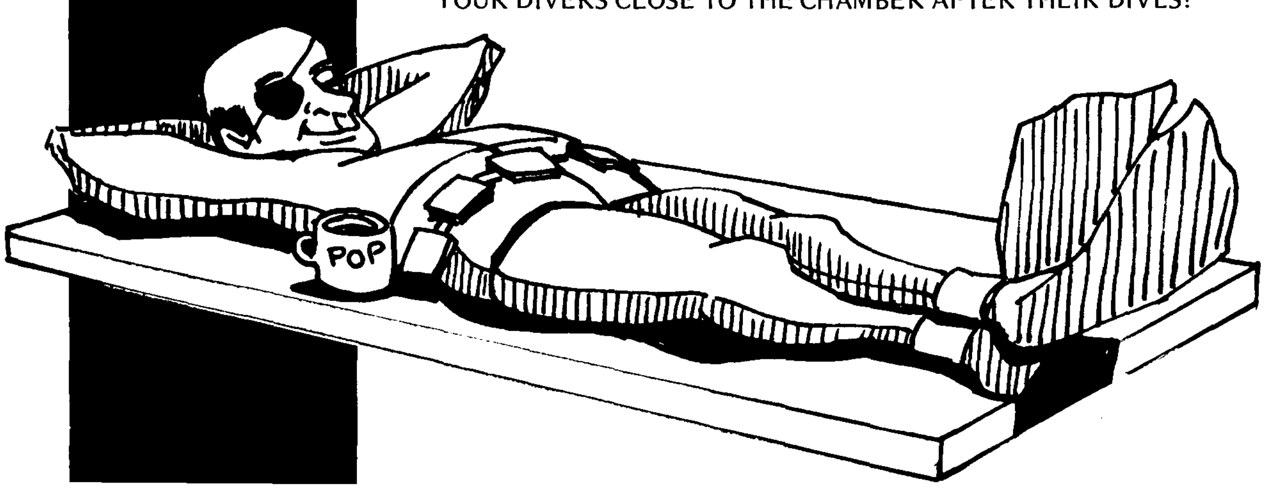
Each year a number of Navy divers are stricken with decompression sickness following an ordinary operational dive or high pressure chamber exposure. The successful treatment of these cases depends upon a number of factors. In a 1963 Experimental Diving Unit report, Dr. Rivera showed that the delay in treating the stricken diver with pressure therapy is directly related to treatment success; the shorter the time interval, the greater the success.

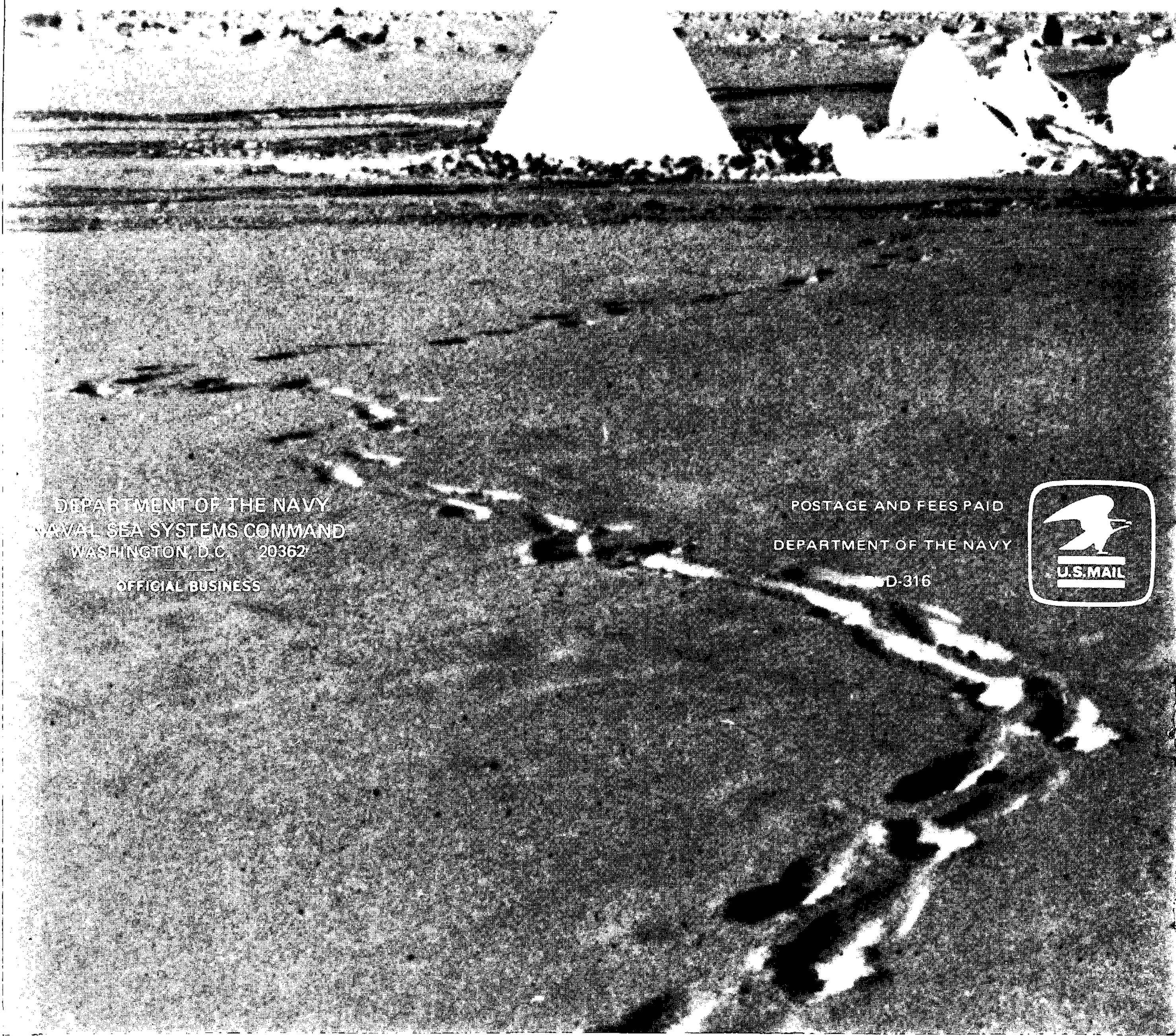
The need for immediate therapeutic action is recognized in the U.S. Navy Diving Manual, Paragraph 1.4.7 (26), which states: "After completing a dive, the diver should remain in the vicinity of the recompression chamber or the facility for underwater recompression for at least 1 hour. This time should be extended to 12 hours for any dive requiring recompression." These rules that concern the time to be spent in the vicinity of a chamber following a dive are based on the incidence of decompression sickness reported after various post-dive periods (Diving Manual, Paragraph 1.6.2(7)).

More recent studies on this question have produced some slightly different results that are worthy of note. The graph below shows a more recent estimate of the time of onset of decompression symptoms based upon the diving accident reports. These results suggest that for dives involving the use of decompression tables, diving supervisors should consider keeping their divers in the vicinity of the chamber for longer than the hour specified in the Diving Manual.



Remember this one fact: *all* of the 16 "bends" cases in Dr. Rivera's report that did not receive relief at 165 feet or less had a delay in treatment of 1 hour or more. KEEP YOUR DIVERS CLOSE TO THE CHAMBER AFTER THEIR DIVES!

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