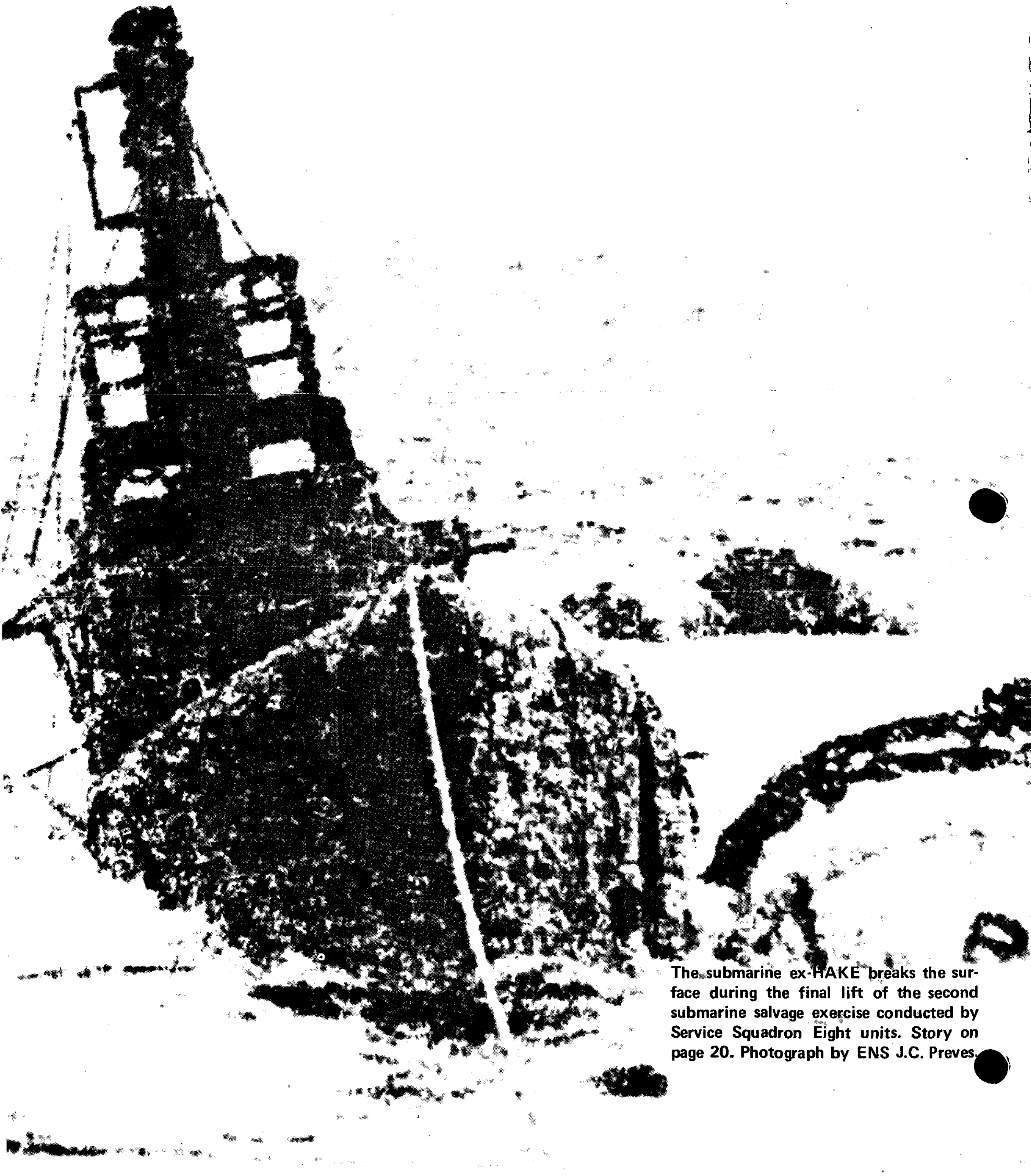
# Faceplate

WINTER 1971



The submarine ex-HAKE breaks the surface during the final lift of the second submarine salvage exercise conducted by Service Squadron Eight units. Story on page 20. Photograph by ENS J.C. Preves.

# Faceplate

Vol. 2 No. 4

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

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

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Photo Credits: Pages 24–26, Alf Jacobsson, HMS BELOS; pages 4–5, U.S. Naval Oceanographic Office.

Cover: It's a chilly job diving under the ice. The two lower photos were taken in Antarctica where scientists of the U.S. Antarctica Research Program from the University of Washington conducted studies of the ocean bottom and marine life. Diving was done in the area of Cape Bird through a hole blasted in the ice. Top picture is divers from the Naval Oceanographic Office; see story on page 4.

In November 1970, a group of oceanographer-divers from the Naval Oceanographic Office made a series of dives into the frigid waters off Point Barrow, Alaska, beneath the floating ice island T-3 (Fletchers Ice Island). These dives were conducted to explore the feasibility of using SCUBA-equipped divers to study the characteristics of the underside ot the Arctic sea ice. As part of the research to improve exposure suits, a representative from the Naval Ship Research and Development Laboratory, Panama City, Florida, also participated in the operation. He was interested in conducting diver suit evaluations under actual field conditions.

The first diving operations began in 15 feet of water off Point Barrow. Air temperature was 10°F and daylight was minimal; only five hours of daylight were useful.

Gasoline-powered ice augers made the job of digging a hole through 12 inches of ice easier. A second hole, to be used as a safety emergency exit, was bored 100 feet away.

The two main problems the divers encountered in the Arctic waters were freezing regulators and the exposure to the cold which severely limited diving time. All dives were made using compressed air, open circuit SCUBA. The tanks were charged by an air compressor at the rate of four cubic feet per minute. By using two filters in the hose between compressor and tank, most of the moisture was eliminated from the air in the tanks, thereby lessening the possibility of regulators freezing.

In addition to safety tether lines, each diver carried two single tanks, each with its own reserve valve and regulator. This allowed the diver to shift to the secondary regulator in case of a freeze-up in the primary regulator. The divers carried 1000 watt cable-powered lights for photography and small battery-operated portable lights for other underwater work. Water temperature was a constant 28.9°F. Currents had a maximum velocity of one-quarter knot which created no additional problems for the divers.

Under the ice the divers found many ice caves and holes caused by erosion of the ice shelf by tidal currents. Cup-shaped features which resembled the sun cups that develop in the snow on glaciers in the summer were found, as well as undersea stalactites. Surprisingly enough, plankton, shrimp, fish and jellyfish were found to live in the cold water.

After a busy and profitable three days of diving at Point Barrow, the divers boarded an Air Force plane and flew to the floating

# Diving Under

From left divers cut entrance hole in ice with power auger; divers prepare to enter arctic waters, note the twin breathing systems; non-compressible wet suit is tested under ice; diver prepares for under water work at the bottom of the 16-foot entrance hole.

ice island T-3, 285 miles from the North Pole, for more extensive diving operations. Here the area was in total darkness.

Ice holes already existed here, bored by a previous generation of scientists who used them for lowering instruments into the water. Heated huts had been erected above the holes to keep them from freezing over. The inside hut temperature varied from 16°F to 55°F (floor to ceiling). Outside the temperature was considerably colder, ranging between −15°F and −39°F.

In this extremely low air temperature, the crucial gasoline-powered compressor failed to operate until a simple solution was found. Covering the compressor with a wooden box which insulated it and retained the heat generated by the engine corrected the problem.

The divers then began the first in a series of dives that continued for seven days. Here the water temperature was 28.9°F. The water depth was 6000 feet, and the ice cover above was 70 to 100 feet thick in some areas. Because of this, the entry hole had been bored through thinner adjoining ice of 16-foot thickness. The hole was approximately four feet in diameter. It was necessary for the divers to descend this shaft before reaching the open water under the ice.

# the Arctic Ice

by
Chester V. Bright

In the days that followed, the divers made measurements, took photographs, and collected marine organisms. After completing a total of ten diving days at Point Barrow and Ice Island T-3, the four divers had cumulative diving time of 39 hours and two minutes to a maximum depth of 130 feet. The dives varied from 37 to 115 minutes in duration.

Nylon-fur underwear was worn under the divers' dry suits. The dry diving suits tested proved comfortable for the divers. At no time did they get cold enough to involuntarily shiver. Except for initial shock to facial areas and numbing cold in the hands, no real problems were encountered during even the longest dives.

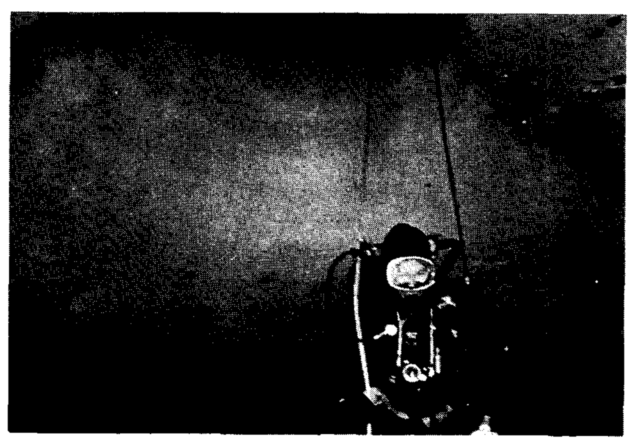
The wet suit was found to be satisfactory only for depths less than 40–50 feet. In actual use, the single-hose regulators proved unsatisfactory in this cold environment (see Soundings, FACEPLATE, Fall 1971). The two-hose, two-stage regulator proved to be excellent and extremely dependable, rarely subject to freezing.

The divers who participated in the operation are the author (433 minutes total bottom time), James E. Turcotte (657 minutes), and Howard D. Huddell (492 minutes), all from NAVOCEANO; and Wallace T. Jenkins from USNSRDL, who had a total of 705 minutes bottom time.

The mission proved that divers can function efficiently and safely in the frigid waters under polar ice, withstanding existing cold temperatures, and performing tasks of considerable difficulty while using available "off the shelf" equipment.

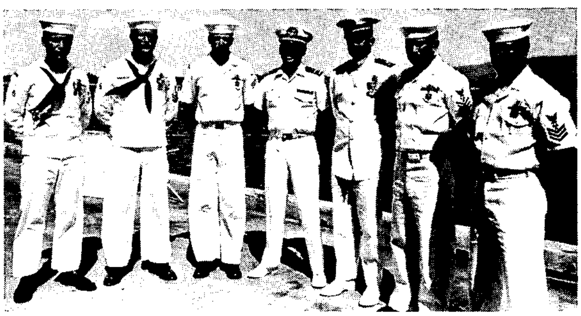
The office of The Oceanographer of the Navy is preparing a filmed progress report of the entire operation. It will be ready for release in a few weeks.

Questions concerning specific details of the dives and equipment should be directed to Diving Office, U.S. Naval Oceanographic Office, Washington, D.C. 20390.




Divers attached to the USS CONSERVER (ARS 39) were recently awarded the Navy Commendation Medal with combat distinguishing device for meritorious achievement while serving with friendly foreign forces in the Republic of Vietnam from 30 November 1970 to 4 January 1971. They participated in the recovery of 60 tons of enemy supplies and munitions from a North Vietnamese trawler sunk by naval gunfire. During the recovery operation, 94 dives were made in water with no visibility, around obstruction with sharp edges of torn metal and through scattered monofilament nets. Under those conditions, CONSERVER divers dove deep into the holds of the trawler and personally recovered tons of enemy munitions and supplies.

Divers, receiving the award, are pictured below in photo A (from left), EN3 (DV) William Paddock, EM1 (DV) Richard Smith, DCFN (DV) Frank Appel, LCDR G. H. Dalton, Commanding Officer, CHBOSN Michael Stott, Diving Salvage Officer, MM1 (DV) Robert Belsha, MM1 (DV) Kurt Hearth. Not pictured is MMC (DV) Leland Carlson, Master Diver (acting).


A


B


D

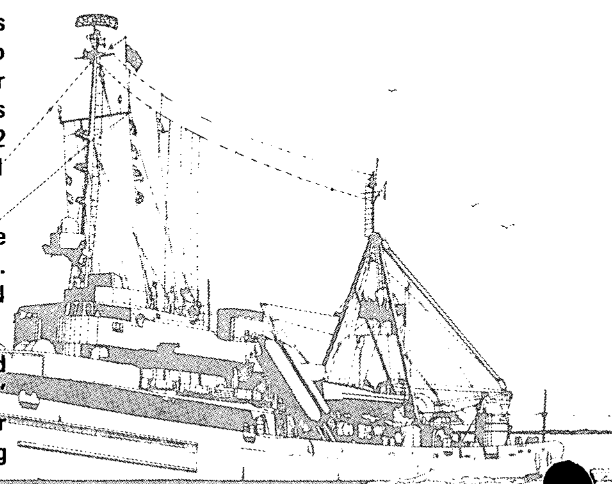

C

THE USS COUCAL (ASR 8), a unit of Submarine Squadron One in Pearl Harbor, was awarded the Navy "E" for fiscal year 1971. Commanded by LCDR R. D. Benites, the ship was cited by the Commander Submarine Force U.S. Pacific Fleet, for "outstanding performance of duty, enthusiasm, and leadership" that were in the highest traditions of the Naval service. The crew was also awarded the Meritorious Unit Commendation.

Several officers and men of the COUCAL were recipients of various additional awards. The Navy Commendation Medal was awarded to LCDR Robert D. Benites, Commanding Officer (photo C), LTJG Peter F. Fawcett, and MLCS (DV) William M. Lucree (photo D). Recipients of the Navy Achievement Medal were EMC Jerome F. Harbinson, EM2 (DV) Curtis O. Murphy (photo B), MR2 Stuart Arthur Huffman, BM1 (DV) Robert E. Batty, and RM2 Richard A. Robinson.

Those receiving a COMSEVENTHFLT letter of Commendation were LCDR Robert D. Benites, YN1 Lowell A. Rosen, ETN2 Larry B. Taylor, SK2 Refugio NMN Neleon, YN3 John C. Ackerman Jr., and TN Juanito A. Hufancia.

WO1 James T. Gee (photo C), having completed all required qualifications, has been designated "qualified HEO2 Diving Officer." Warrent Officer Gee successfully completed this qualification after serving one year subsequent to graduation from diving school, as Diving Officer aboard the COUCAL.



In an effort to assist you in filling out your dream sheets (NAVPERS 1306/34 – E7/E8/E9 Duty History and Preference Card) YNC Chris Moyer, Enlisted Divers Detailer at BUPERS, has provided the list below. Please bear in mind that this list only indicates the location of billets and the types of duty available in the various locations. It is not a list of vacant or open billets! This list should prevent you from wasting choices by indicating areas such as Great Lakes, Illinois of Frankfurt, etc. where there are no billets. Also notice the new NEC 5346 – Master Saturation diver.

# Where to Next?

TYPE DUTY BY NEC

| GEOGRAPHIC LOCATION | 5346 | 5341 | 5342 | 5311 | 5343 |
|---|---|---|---|---|---|
| Philadelphia, Pa | | | 1 | | 1 |
| Newport, R I | | 1 | 1,2,5 | | 2,5 |
| Portsmouth, Va | | | 1 | | 1 |
| Norfolk, Va | | 1,2 | 1,2,5 | | 1,2,5 |
| Panama City, Fla | | 1 | 1 | | 1 |
| Key West, Fla | | 1,2,5 | 1,2,5 | | 1,2,5 |
| Orange, Texas | | | | | 1 |
| San Diego, Calif | 1,5 | 1,4,5 | 1,2,4 | 1,5 | 1,2,4 |
| Long Beach, Calif | | 1 | 1,2 | | 2 |
| Port Hueneme, Calif | | | 1,2 | | 1,2 |
| Point Mugu, Calif | | | | | 1 |
| San Francisco, Calif | | | 1 | | 1 |
| Vallejo, Calif | 2 | | 1 | 2 | 1 |
| Bremerton, Wash | | | 1 | | 1 |
| Keyport, Wash | | | 1 | | 1 |
| Annapolis, Md | | | | | 1 |
| Indian Head, Md | | 1 | 1 | | |
| Washington, D.C. | 1 | 1 | 1 | 1 | |
| Solomons, Md | | 1 | 1 | | 1 |
| Quantico, Va | | | | | 1 |
| Pensacola, Fla | | | 1 | | 1 |
| Davisville, R I | | | 1,2 | | 1,2 |
| Vietnam | | 3 | 3 | | 3 |
| Guantanamo Bay, Cuba | | | 3 | | 3 |
| New London, Conn | | 1,2 | 1,2 | | 1,2 |
| Quonset Point, R I | | | 1 | | |
| Jacksonville, Fla | | | | | 1 |
| North Island, Calif | | 1 | 1 | | |
| Mayport, Fla | | 2 | 2 | | 2 |
| Little Creek, Va | 2 | 2 | 2,5 | 2 | 2,5 |
| Charleston, S C | | 2,5 | 2,5 | | 2,5 |
| Groton, Conn | | 2 | 2 | | 2 |
| Gulfport, Miss | | | 2 | | 2 |
| Pearl Harbor, Hawaii | | 2,6 | 2,6 | | 2,6 |
| Guam, M I | | 4 | 3,4 | | 3,4 |
| Subic Bay, P I | | 3 | 3,4 | | 3,4 |
| Adak, Alaska | | | 3 | | 3 |
| Kodiak, Alaska | | | 3 | | 3 |
| Mare Island, Calif | 1,2 | | | 1,2 | |
| Coronado, Calif | | | 2 | | 2 |
| Naples, Italy | | | 4 | | 4 |
| Holy Loch, Scotland | | 4 | 4 | | 4 |
| Rota, Spain | | 4 | 4 | | 4 |
| Roosevelt Roads, P R | | | 6 | | 6 |
| Portsmouth, Eng | | | | 6 | |
| Yokosuka, Japan | | | 6 | | 6 |
| Bermuda | | | 3 | | |
| Turkey | | | 3 | | |

## EXPLANATION OF DUTY TYPES

Type 1 — Shore duty for rotation purposes. Includes CONUS shore duty, fleet shore duty and certain fleet activities considered as shore duty.

Type 2 — Sea duty for rotation purposes. Includes ships or units which spend considerable periods at sea away from their homeport during local operations and which, when deployed overseas, operate at sea extensively.

Type 3 — Overseas shore duty (sea duty for rotation purposes) is defined as duty performed ashore at activities outside CONUS where the prescribed DOD accompanied tours are less than 36 months.

Type 4 — Nonrotated sea duty (sea duty for rotation purposes) is defined as sea duty performed in nonrotated ships, staffs, or units homeported outside CONUS (except Alaska and Hawaii), or in 12 month unaccompanied tour ships or staffs listed in OPNAVINST 4600.16.

Type 5 — Neutral duty (neutral time for rotation purposes) is defined as duty in ships, squadrons and staffs which normally remain in the assigned home port, or operate locally therefrom only for brief periods.

Type 6 — Preferred Overseas Shore Duty (shore duty for rotation purposes) is defined as duty at shore-based overseas activities where there are available suitable family accommodations and the prescribed Department of Defense accompanied tours are 36 to 48 months in recognition of the desirability of this duty.

## ALUMINUM BOTTLES OK FOR NON EOD

Non-EOD activities having aluminum SCUBA bottles should not dispose of and replace the bottles with steel bottles until the aluminum bottles are no longer serviceable. Aluminum bottles should continue to be used and tested in accordance with NAVSHIPS Instruction 9940.16A as long as they can safely be used. Steel bottles should be procured when aluminum bottles are replaced by non-EOD activities.

## NO DIVING FATALITIES IN FY 71

According to a recent report, diving is safer than driving your family car or crossing the street. There were no fatalities and only 12 accidents while diving during Fiscal Year 1971.
The following is a breakdown of the statistics:

Number of Navy dives by purpose of dive:

| | | Dives |
|---|---|---|
| a. Tender | | 111 |
| b. Experimental | | 98 |
| c. Medical treatment | | 3 |
| d. Sport or recreation | | 79 |
| e. Equipment testing | | 62 |
| f. Requalification | | 1,613 |
| g. Selection | | 56 |
| h. Training | | 8,000 |
| i. Work | | 6,612 |
| j. Other | | 78 |
| | Total dives | 16,712 |

Number of Navy dives and the number of accidents incurred in Navy controlled dive by type of equipment:

| | Dives | Accidents |
|---|---|---|
| a. Deep sea mixed gas | 325 | 0 |
| b. Deep sea air | 2,574 | 0 |
| c. Lightweight mixed gas | 4 | 0 |
| d. Lightweight air | 3,026 | 1 |
| e. Open circuit SCUBA | 8,416 | 1 |
| f. Closed circuit SCUBA | 784 | 0 |
| g. Semi-closed SCUBA | 1,161 | 3 |
| h. Experimental equipment | 88 | 4 |
| i. Other | 334 | 3 |
| Total Dives | 16,712 Total Accidents | 12 |

## INFORMATION EXCHANGE PROGRAM

The annual information exchange program (IEP) meeting was held between divers of the U. S. Navy and the Royal Navy at HMS Vernon, England during October, 1971. This program, which has been in effect for several years, provides for the exchange of information on all aspects of diving medicine, equipment, and techniques. USN/RN cooperation under this program has led to the establishment of two Exchange Officer billets and one Exchange Chief Petty Officer billet in each country. Information exchanged has prevented duplication of effort and allowed each navy to benefit from the new developments and operational experience of the other. Specific information exchanges through the IEP will be made available to Navy diving activities.

## NAVY STANDARDIZES CHAMBER GAGES

Recompression chamber gages, both internal and external, are being standardized throughout the Navy.

The Director of Ocean Engineering/Supervisor of Diving has purchased a quantity of the new standard gages which are calibrated at feet of seawater instead of psi, and has provided two each for all Navy facilities possessing recompression chambers. External gages have been sent to all facilities; internal gages are still under construction and will be sent when completed.

A federal stock number has not yet been assigned. FACEPLATE will publish this information when it becomes available.

## SUPDIVE ADVISES RECHECK OF EQUIPMENT

Many U.S. Navy diving activities are using the U.S. Divers Aquamaster Double Hose Demand Air SCUBA Regulator. The Supervisor of Diving has been advised that, when the instructions contained in the technical manual (NAVSHIPS 394-0065; AQUALUNG Model DA "Aqua Master" Demand Type Diving Apparatus), detailing adjustment of the first stage regulator pressure are strictly adhered to, consistent but spurious readings of the first stage regulator pressure may be obtained. The spurious readings appear to be due to a reflected pressure wave effect. Adjustment of the first stage regulator using these readings results in a pressure setting significantly lower than that desired. Established instructions promulgated by the manufacturer in commercial maintenance instruction books and taught in the manufacturer's maintenance instruction course do not produce the same unreliable pressure readings.

Diving activities using U.S. Divers Aquamaster Double Hose Divers Demand Air SCUBA Regulators are advised to set the outlet pressure of the first or high pressure stage of the regulator as follows:

1. Follow procedures outlined in NAVSHIPS 394-0065 to the point where the high pressure block, with gage installed, is connected to the cylinder manifold.

2. Close the bleed valve on the gage; back off the pressure adjustment completely and turn on the manifold valve.

3. Adjust the pressure setting to 110 psi. Crack and close the bleed valve several times. Adjust pressure setting as necessary to hold the pressure to 110 psi ±5 psi.

4. Close manifold valve. Open bleed valve.

5. Close bleed valve. Slowly open manifold valve.

6. Crack and close bleed valve and then check pressure reading. Readjust the pressure setting if the ±5 psi tolerance is exceeded.

7. Repeat steps 4, 5, and 6 as necessary until the pressure observed in step 6 is 110 psi ±5 psi.

## SYMPOSIUM IN FEBRUARY

The Supervisor of Diving, Battelle Memorial Institute and the Marine Technology Society are sponsoring a symposium, "The Working Diver 1972" at Battelle's laboratories in Columbus, Ohio, in February 1972. Nineteen papers in four sessions are planned. Session subjects are:

Diving System Design
Operations and Extreme Environment Diving
Diving Equipment
Breathing Gas Technology

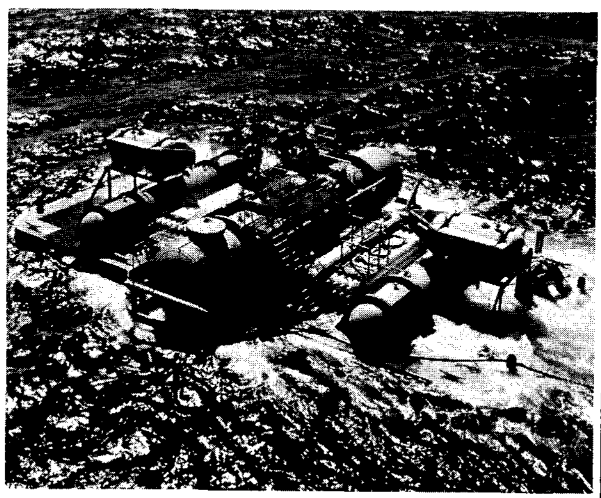
Inquiries about the symposium should be directed to the Supervisor of Diving, Naval Ship Systems Command, Washington, D.C. 20460.

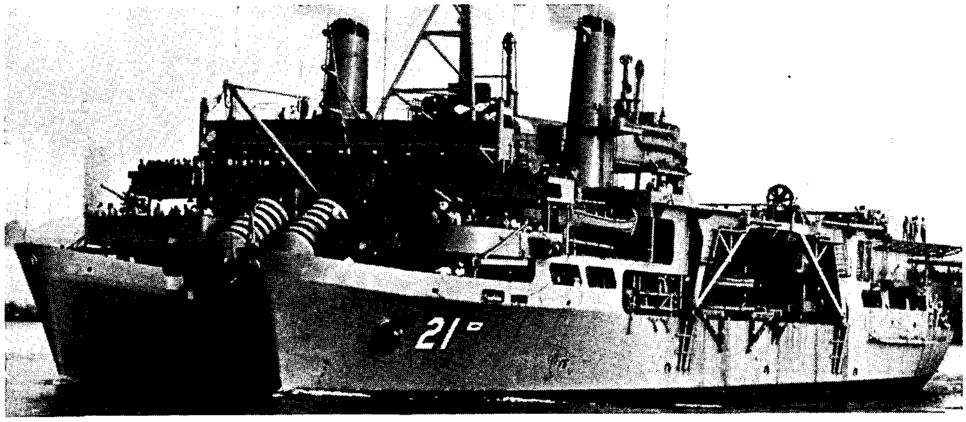
## Pacific Site for Deep Dive

The Supervisor of Diving in conjunction with the Office of Naval Research is conducting a series of dives using the Makai Range mobile ocean floor diving station "AEGIR." The purposes of the dives are to evaluate the AEGIR concept as a means of conducting deep diving and salvage operations, to evaluate underwater power sources and hydraulic tools for use in salvage tasks, and to evaluate the Mk 10 Mod 4 closed circuit underwater breathing apparatus. In December shallow training dives and a four-day saturation dive to 200 feet were conducted.

CAPT J. D. Johnson, COMSERVRON FIVE is the OTC, LCDR J. D. Mustard of SUBDEVGRU ONE is the On-Scene Supervisor of Diving. The diving team is led by LCDR James L. A. Majendie, RN, and is composed of three divers from the Navy Experimental Diving Unit, LT D. E. Chandler, PH1 J. R. Huckins, and AO1 B. H. Templin, plus Ken Conda from NMRI and Mike Spirka from Makai Range.

SERVRON 5 ships and HCU-One are providing Fleet support. Additional support is coming from the Navy Experimental Diving Unit, Office of Naval Research, Naval Special Warfare Group, Pacific, NMRI, and numerous other groups. Project Manager for the dive series is Denzil Pauli from ONR. It is planned that the dive series will culminate in a ten-day 520 foot dive early in 1972.





# New PIGEON Joins ASRs

PIGEON (ASR 21) is the first ship of a new generation of submarine rescue vessels. She is designed to provide the Navy with the most advanced and comprehensive facilities for submarine rescue, mixed gas saturation diving, and deep ocean salvage. In addition to the conventional McCann Submarine Rescue Chamber (SRC) she will be capable of supporting the Navy's new Deep Submergence Rescue Vehicle (DSRV). PIGEON will be the Fleet's foremost saturation diving platform, incorporating the Mark 2 Mod 1 Deep Dive System (DDS) and the latest Diver Equipment Systems.

She will also possess a full suite of conventional deep sea and shallow water air and mixed gas diving apparatus including open-circuit SCUBA. PIGEON has the capability to perform precise (within ±2 feet) three dimensional tracking of up to five submerged contacts, in addition to the traditional ASR tasks is submarine escort, torpedo retrieval/stowage, and towing services.

The Mark 2 Mod 1 DDS is presently under construction at the DIXIE Manufacturing Company, Baltimore, Maryland. The system will be installed aboard PIGEON during her Post Delivery Availability.

PIGEON is presently nearing completion at the Alabama Dry Dock and Shipbuilding Company in Mobile, Alabama, where her keel was laid 17 July 1968. She was launched on August 13, 1969. Her sponsor was Mrs. Allen M. Shinn, wife of Vice Admiral Shinn who was at that time, Commander Naval Air Force, U.S. Pacific Fleet. PIGEON is scheduled to be commissioned midsummer 1972.

ASR 21 is a catamaran, the first contracted for the Navy since Robert Fulton's twin-hulled steam warship DEMOLOGUS, constructed at the close of the War of 1812. She is the third ship of the fleet to bear the name PIGEON, and the second to be named in commemoration of the much decorated submarine rescue ship PIGEON (ASR-6) which, originally designated a minesweeper, served the Fleet from 1919 to 1942. The second PIGEON, also a minesweeper (AM-374), was active from 1945 to 1955. The eight ASR's now in service with the U.S. Fleet were built during World War II.

PIGEON has, in addition to the built-in stability of her configuration and the resultant expansive midship main deck diving and rescue area, a highly sophisticated electro-hydraulic deck handling system. This system is utilized for the deployment and recovery of the DSRV, the McCann Rescue Chamber and the Personnel Transfer Capsules (PTC's) in seas up to and including state 3. Launching/retreiving is conducted either via a tv camera equipped lift platform, through a large well between the hulls, for the DSRV and PTC's or over-the-side for the SRC and the PTC's. The prime mover in these operations is a 70-foot span crane with a maximum short lift capacity of 155 tons and normal work capacity of 82.5 tons. The highly versatile crane travels athwartships above the diving and rescue work area upon dual tracks mounted at the 0-2 levels of the fore and aft deck houses. Four hinged track extension outriggers allow the crane to move 29 feet outboard of either side of the ship. This enables over-the-side operations at sea for launching the SRC/PTC or 30-foot work boats and pierside loading of the DSRV prior to a rescue mission. The crane structure supports two trollies, each equipped with a main and auxiliary wire rope hoist. The trollies are capable of fore and aft movement, and are operable either individually or in unison while mated together. Mated operation provides the means for lowering and raising the lift platform through the centerwell and for loading the DSRV aboard when pierside. In the primary mode, the DSRV is launched and recovered from the lift platform while positioned 125 feet below the ocean surface. In calm seas or in an emergency, a secondary surface recovery mode is provided. The submersible approaches from astern between the hulls, and by a system of towing and tending winches is guided onto the lowered lift platform and raised aboard.

To handle the PTC's and SRC, the aft crane trolley auxiliary hoist is utilized in conjunction with a specially designed stabilizing system mounted beneath the trolley. Further stability is attained from either of two PTC "trucks" that travel on deck mounted gear racks. The "trucks", through a system of boom-mounted sheaves also fairlead the PTC Strength, Power, Communication (SPC) cable or the SRC back haul cable to the desired launch position.

All diving/rescue handling operations are controlled from the Deck Operation Control Station (DOCS). DOCS is located in the after section of the forward deck house on the 0-1 level which overlooks the entire handling area.

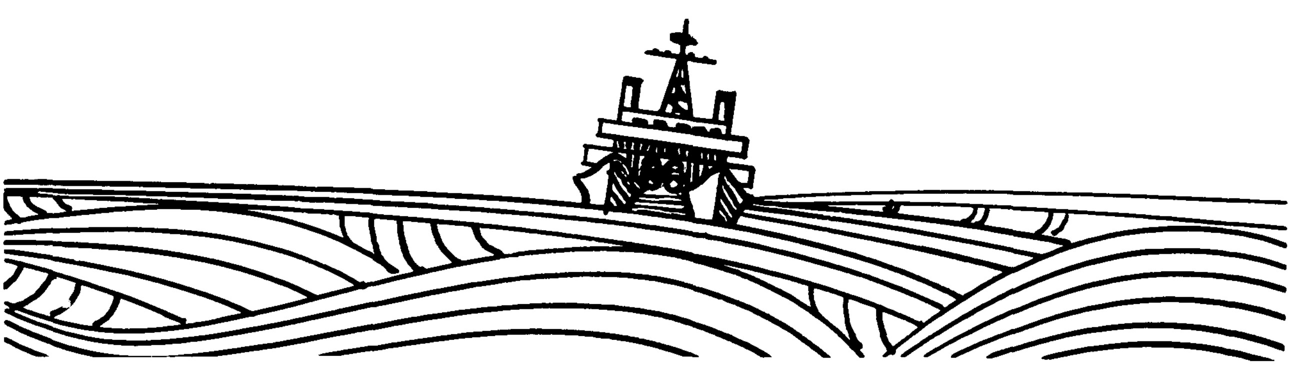
To provide the on-scene rescue mission commander with the necessary tactical data to properly coordinate and execute a successful submarine rescue, PIGEON is equipped with a Rescue Control Center (RCC). With the installed RCC 3-Dimensional Sonar Tracking Computer System, acoustical, oceanographic and geographical raw input data can be processed to determine the relative positions of the ASR, DSRV, Deep Ocean Transponders (DOT's) network, and distressed submarine with a display of pertinent output data. The DOT is an expendable, nonrecoverable underwater device which responds with an acoustic pulse to an acoustic interrogation. Its information is used as a computer input for determining ship position.

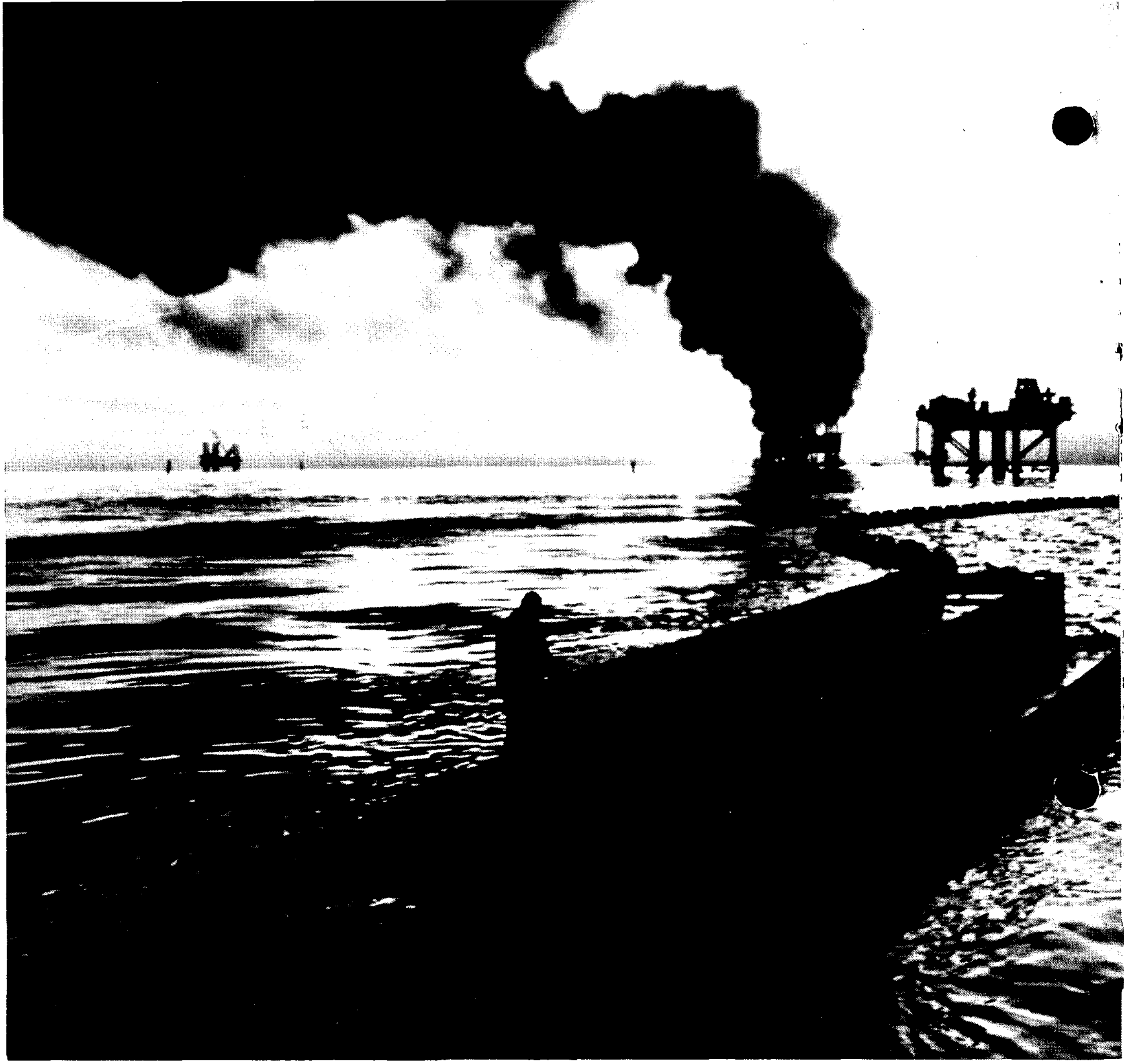
The DDS, Mk 2 Mod 1 consists of two identical Deck Decompression Chambers (DDC's), one per hull, two PTC's and related control and life support subsystems. This is the most advanced dive system of its type, designed to utilize the principle of saturation diving to produce the greatest amount of effective diver work hours in the shortest time span. With PIGEON's large gas storage facility, helium reclamation unit, and two $HeO_2$ gas mixers, the DDS will be able to maintain two teams of four divers each to 850 feet in a saturated condition for extended periods. To permit accurate PTC and SRC deployment, to an underwater work or rescue site, ASR 21 is capable of setting a four-point moor in waters up to 1200 feet deep. Unprecedented on previous ASR's is PIGEON's helicopter landing facility. Her spacious landing platform is complete with day/night visual landing aids and JP-5 fueling and helo startup systems. It will accommodate a helicopter of up to 14,000 pounds gross weight. Propulsion is by four Alco diesel engines, two per hull, of 1530 BHP each. Each pair of engines drives a controllable-pitch propeller through reduction gear boxes of 130 RPM. The two engine rooms are complete propulsion plants capable of independent operation. However, a pneumatic/electric automated system for single lever master control of engine speed, shaft RPM and pitch of each propeller, can be exercised through propulsion control consoles in the pilot house, port and starboard bridge wings, and the DOCS.

PIGEON's principal characteristics include an overall length of 251 feet and a molded beam of 86 feet. She will have a full load displacement of approximately 4530 tons at a mean draft of 22 feet, 8 inches. Top sustained speed will be 14.5 knots. Ship delivery at Mare Island is expected this winter followed by a Post Delivery/ Fitting-out Availability to install the DDS, Mk 2 Mod 1. Subsequently, PIGEON will undergo an extensive shakedown, training and operational evaluation period. She will then proceed to her homeport at Ballast Point, San Diego, there to be a unit of Submarine Development Group ONE and begin her service to the Pacific Fleet.

The Prospective Commanding Officer of PIGEON is Lieutenant Commander James J. McDermott, U.S. Navy. After 22 years of combined Enlisted and Officer service in Submarines and ASR's, LCDR McDermott was assigned as Executive Officer of USS PENGUIN (ASR-12) from 1964 to 1966.

Following this tour, he took command of USS TRINGA (ASR-16), which he held until the fall of 1969. In February of 1970, LCDR McDermott was designated CTU 56.1.7 and OTC for the operational evaluation of the Navy's first open-sea saturation diving system, the Mk 1, Deep Dive System (DDS). For his leadership displayed during this operation, in which a new world's record of 870 feet was set for open-sea diving, LCDR McDermott received the Legion of Merit.





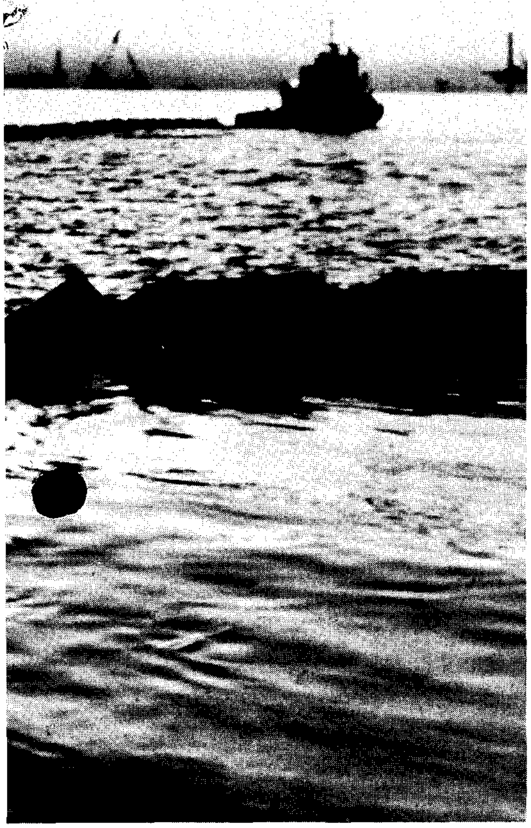
# A "Do Something" Program for Oil

Oil pollution abatement is no stranger to Navy salvors. Such noted salvage operations as the OCEAN EAGLE, GENERAL COLOCOTRONIS and ARROW are a few cases where salvage forces encountered and dealt effectively with the oil pollution problems associated with the ship salvage effort.

The Supervisor of Salvage provided assistance in dealing with recent major Navy-originated spills unrelated to ship salvage, such as the USNS TOWLE spill in New York Harbor and the USS MANATEE spill off San Clemente Island. The experience derived from these and other cases contributed to the promulgation of NAVMATINST 6240.1A. The instruction assigns the following responsibilities to the Director of Diving, Salvage and Ocean Engineering through the Commander, Naval Ship Systems Command:

"(1) Procure, test, evaluate and maintain specialized equipment and related technical expertise, by contract or otherwise deal with oil (and other hazardous materials) pollution problems which occur incident to Navy salvage evolutions.

"(2) Provide technical expertise and resources for



# Spill Control

combatting major (greater than 10,000 gallons) oil spills from Naval sources ashore and afloat.

"(3) Provide guidelines for operations procedures and development and use of materials and equipment for corrective action to minimize adverse impact on the environment when fuel oil is spilled during shipfilling and transfer operations."

In many respects, pollution abatement is similar to ship salvage – response must be both immediate and effective. An effective response capability requires the combination of two key elements, functional resources and trained personnel. In the Navy equal importance is placed on the development of both programs.

The initial means is the use of 6,000 feet of heavy-duty, open sea containment boom which is strategically located on the east, west, and southern coasts of the United States. (The article following describes this boom in full.) The development and original use of this containment system was on the Santa Barbara oil spill as reported in the July 1970 issue of *Ocean Industry.* The second generation system, which incorporated lessons learned on the two most recent offshore platform spills in the Gulf, is one of the most effective state-of-the-art containment booms available for rugged, at-sea operations. Future issues of *FACEPLATE* will provide information on further equipment and material acquisitions by the Supervisor of Salvage and will further delineate contingency planning developments.

A one-week course in the control of major oil spills is being planned by SUPSALV. The curriculum is shown in Figure 1 on page 22. This course is scheduled for mid-January and will be held on the west coast. Requests for attendees will be mailed in the near future.

Those same elements which in the past have contributed to tremendous successes in ship salvage will not be applied to oil pollution abatement operations.

Emergency Ship Salvage Material (ESSM) Bases (see *FACEPLATE*, Fall '71) overseas will be supplied with pollution abatement assists for use by the On-Scene Coordinator or his designated representative for major Navy incidents, or for any spill which threatens to cause substantial loss to human life or property.

This program will provide salvage personnel at the scene of any major pollution incident almost immediately. With the proper training and resources, future Navy-originated spills of oil and hazardous material will be effectively alleviated by Navy salvage forces with minimum damage to the environment.

# BOOM IS EFFECTIV
# CONT

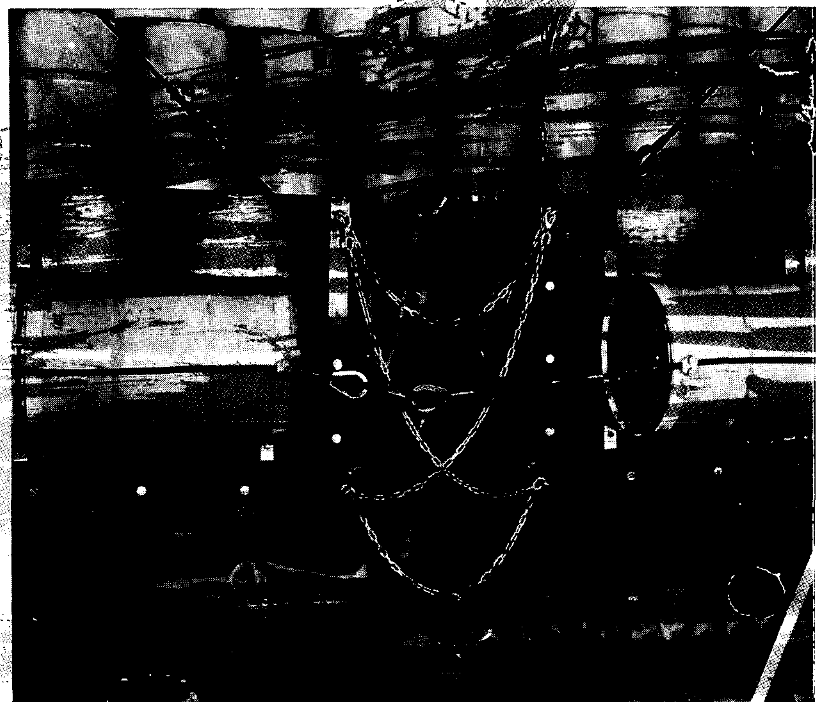


*Figure 1*

One of the primary weapons of the oil spill response team is an effective containment system to confine the spill to a restricted area and facilitate collection. Oil Pollution Abatement Pools, now being established by the Supervisor of Salvage, CAPT E. B. Mitchell, will contain several varieties of oil boom suitable both in heavy duty at-sea work and for protected harbor major pollution incidents.

The "OOC" heavy duty offshore boom, a section of which is shown *in figures 1 and 2, has an interesting* history. Early versions of the boom were used on the OCEAN EAGLE salvage operation in March 1968 and as protection for the Long Beach Harbor during the Santa Barbara oil well blowout in January 1969. The boom was used extensively and successfully at the Chevron oil fire in the Gulf in March of 1970 and more recently at the Shell oil fire off New Orleans. Three thousand feet of the boom were used for towing the large oil skimmers used in that incident in seas up to four feet and winds of 30 knots.

As shown on pages 13 and 14, the horseshoe configuration was utilized with the three skimmers to channel the oil into collection systems where it was pumped to waiting barges. The present version, known as the "OOC" boom, represents the optimum design for this type of containment system. It is *designed and constructed for final fabrication at the* site. The ten-foot lengths of 3/4-inch wire cable on each side uses a weighted hook on one end and an eye on the other, and zips the 23-ounce Facilon skirt together with a specially designed and constructed

# E
# AINMENT SYSTEM

*Research and development efforts by both the Navy and Coast Guard will eventually result in a more effective, easier deployed and maneuvered containment system, but since major pollution incidents will not wait, neither will the requirement for effective pollution abatement resources. The "OOC" boom represents the most effective state-of-the-art containment system available.*

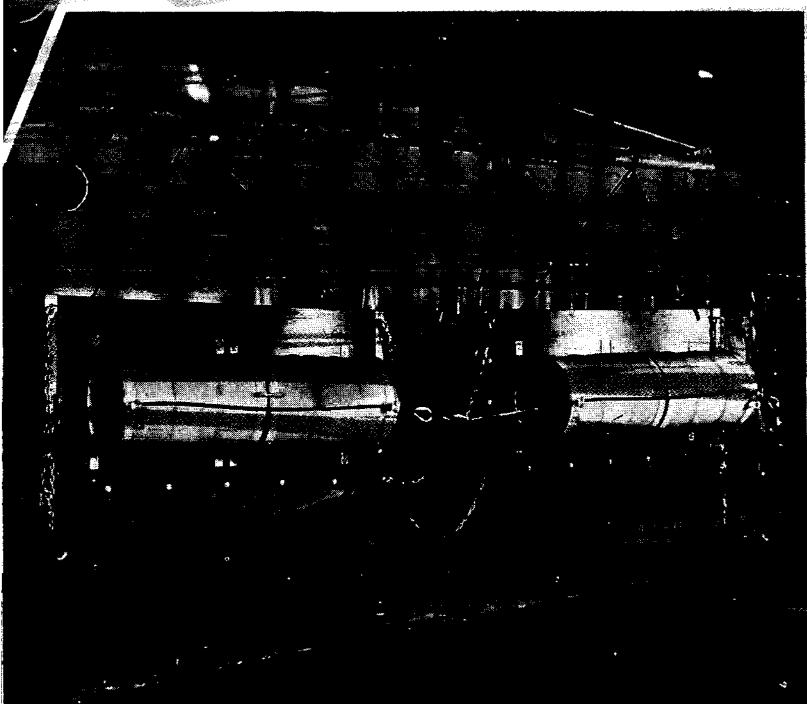


*Figure 2*

**zipper. The drums are 16 gauge heavy duty oil drums, and are filled with polyurethane foam to render them unsinkable if ruptured. Marine plywood painted with epoxy paint is used throughout.**

**The versatility of this design is readily apparent, since a specific length can be fabricated from the ten-foot sections and since the boom can be unzipped at any point to readily accept mating with a skimmer or skimmers at areas of high oil concentration.**

**Booms will eventually be stored in the Supervisor of Salvage's Oil Pollution Abatement Pools. Two thousand feet each will be on the east, west, and southern coasts of the United States. It represents a major step in the fight against large oil spills.**

# Joint Effort Raises Tug in Qui Nhon

Early on a summer morning of 1971 an ARVN LCM-8 broached in the surf in the outer harbor at Qui Nhon, Republic of Vietnam. ARVN tug 2134 proceeded to the scene to assist the LCM-8 out of the surf and back into deep water. However, in the heavy seas ARVN tug 2134 capsized and immediately sank in twenty feet of water.

The Senior Advisor of Military Assistance Command, Vietnam Advisory Team 8, stationed in Qui Nhon requested the aid of the river salvage craft, USS COHOES (ANL-78) to assist in the salvage of the sunken harbor tug.

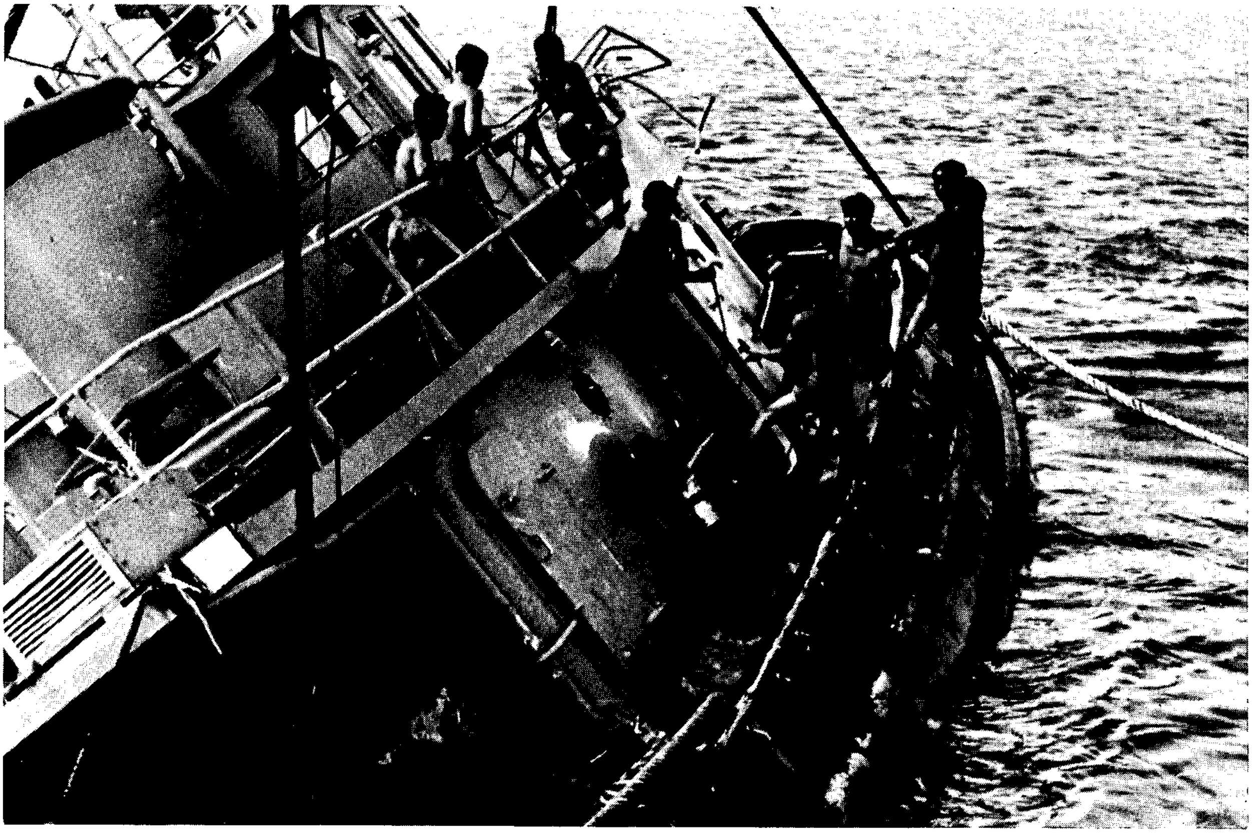
Later that afternoon, COHOES sent a team of divers to the salvage site. An initial survey of the tug revealed the 70 foot long, 120 ton craft to be resting on her port side with only slight damage to her superstructure with her hull intact. The salvage plan decided upon was simple: A lifting bridle would be rigged to the tug, and then, utilizing 60 ton and 100 ton floating cranes available in Qui Nhon, a combined lift would be made to raise the tug to the surface.

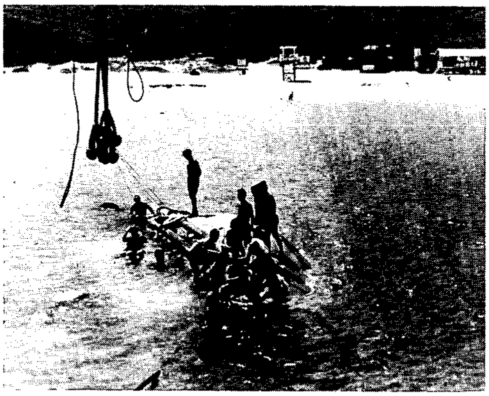
Before sunrise the next day, an ARVN LCM-8 carried COHOES' divers to the salvage site to begin rigging the bridle on the tug. Meanwhile a U.S. Army tug brought the 100 ton floating crane to the salvage site. Because of choppy seas in the outer harbor in early morning the idea of a joint lift using both the 60 ton and 100 ton floating cranes was abandoned.

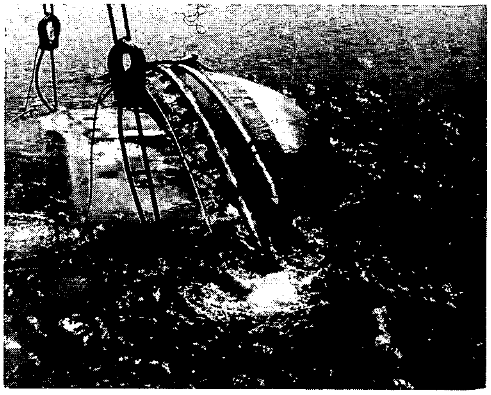
By early afternoon the bridle was rigged and the crane was in place, with lifting wire attached. Within a half hour after commencing its lift the crane had raised the tug's decks clear of the surface. Dewatering with salvage pumps commenced immediately and shortly after sundown ARVN tug 2134 was afloat. After dry-docking and reconditioning the tug will be returned to service.

It is particularly interesting to note that the salvage operation was a joint effort of Korean, American, and Vietnamese forces. The salvage team from USS COHOES was headed by her Commanding Officer, LT R. J. Gebeaux, who also headed the salvage operation. The Vietnamese crew was headed by Major Tru, ARVN, who supplied three LCM-8s to assist in the operation. One U.S. Army LCM-8, one U.S. Army tug, and the 100 ton crane were manned by Korean forces. Also present on the scene for the salvage operation was CW03 Warner, USA, representing the Senior Advisor, Military Assistance Command, Vietnam Advisory Team 8. CW02 E. L. Coward, USA, harbormaster of the Qui Nhon Army Terminal Transportation Unit, provided coordination between the salvage teams and the Korean crane and tug operators.

As for the LCM-8 which broached on the beach in the first place, it was successfully recovered at high tide on the same day it was stranded using a bulldozer on the beach and another LCM-8.







*After an initial survey dive, COHOES' divers readied the lifting bridle using an ARVN LCM-8 as a diving platform.*

*The lifting straps were lowered into position next to the ARVN tug for attachment to the lifting bridle. One by one the legs of the lifting bridle were attached to the capsized boat. After the bridle was secured the lift began.*

*Within one half hour after beginning the lift, the tug was on the surface and began to right herself in the water. Dewatering operations which commenced immediately after the tug was brought to the surface, continued for six hours until the tug was completely dewatered.*

*After this final phase of the recovery, ARVN tug 2134 was towed into Qui Nhon where she awaited dry-docking and reconditioning before returning to service.*

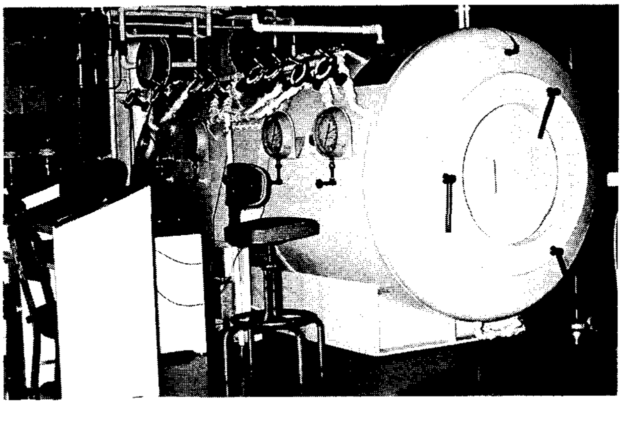
# HIGH FLYING HYPERBARIC THERAPY

Major Bassett (BA, San Jose State College, Calif.; MA, University of Calif.) is an aerospace physiologist assigned to the Aeromedical Indoctrination Branch of the USAF School of Aerospace Medicine. While assigned to Williams AFB, Ariz., as a Physiological Training Officer from 1959–1961, he developed the first student instructor guides in Aviation Physiology for Air Training Command's Undergraduate Pilot Training program. He is presently the Compression Training Project Officer at the USAF School of Aerospace Medicine, and serves as course supervisor for the Physiological Training Supervisor's course.

*BRUCE E. BASSETT, Major, USAF, BSC*

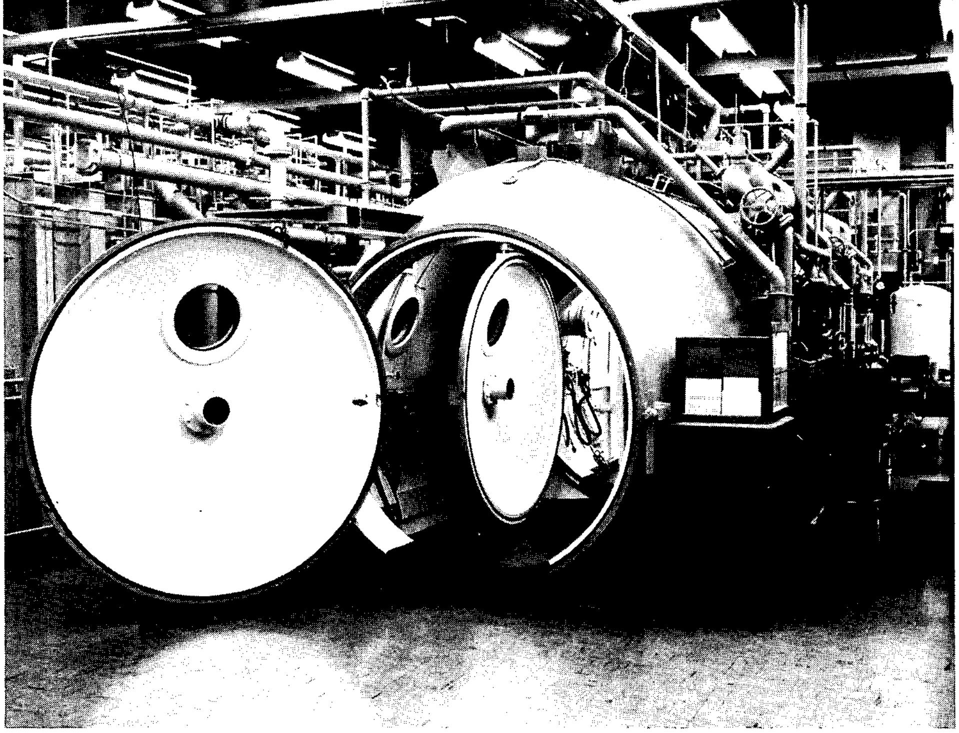
Fliers and divers share a common bond in that they both face the environmental hazards associated with changes in atmospheric pressure. The sea level-dwelling pilot who flies to high altitudes is equivalent to the saturated diver who decompresses to sea level, with the magnitude of pressure change and the absolute volume of dissolved inert gas representing the only difference. In terms of pressure ratios, however, the pilot who is exposed to altitudes of 18,000 feet (1/2 ATA), 34,000 feet (1/4 ATA), or 43,000 feet (1/6 ATA) has undergone equivalent decompression as a diver surfacing from depths of 33, 99, or 165 feet of sea water, respectively. Therefore the pilot exposed to altitudes greater than 18,000 feet faces the threat of decompression sickness.

One method of preventing decompression sickness in pilots (or passengers) of aircraft flying above the "bends threshold" of 18,000 feet is to pressurize the crew and passenger compartments so that the pressure altitude within is kept below this threshold regardless of actual flight altitude. Almost all present-day aircraft, both military and commercial, provide this protection. However, pressurized aircraft pose another threat to the occupants identical to one faced by divers. Rapid or explosive decompression of pressurized aircraft, as with the loss of a door or window, is equivalent to divers' "blow-up," or free ascent as in submarine escape, again the only difference being the absolute pressure change. In today's pressurized aircraft this pressure change, which can occur in fractions of seconds under the worst conditions, ranges from 5 to 9 psi. The potential for lung overinflation accidents (air embolism, pneumothorax, etc.) in such decompressions therefore represents the second common bond between fliers and divers.



Finally, divers and fliers who do encounter either decompression sickness or air embolism must receive the same therapy, namely, recompression. In the flier stricken at altitude, the initial recompression occurs with his return to ground level, which in most cases is sufficient therapy for decompression sickness. In a small percentage of the cases of altitude decompression sickness either the flier's symptoms persist in spite of recompression to ground level or he may suffer his symptoms only after returning to ground level. Such cases must therefore receive hyperbaric therapy.

Prior to 1959 it was not generally recognized in the U.S. Air Force that fliers with delayed, recurrent or persistent symptoms of decompression sickness would benefit from hyperbaric therapy. In 1959, an Air Force pilot suffering from severe altitude decompression sickness as a result of exposure to 43,000 feet during altitude chamber training, was successfully treated in the U.S. Navy's Little Creek, Virginia, recompression chamber. This case brought into focus the need for hyperbaric chambers at selected U.S. Air Force bases. Eight small aluminum chambers of the U.S. Navy portable design were procured and installed at various Physiological Training Units beginning in 1965. These chambers are presently located at Fairchild AFB, Washington; Castle



Above, large hypo-hyperbaric research chamber at the USAF School of Aerospace Medicine. Double doors allow this two-compartment chamber to be used for simulation of altitudes up to 1,000,000 feet above sea level or depths equivalent to 225 feet of sea water. In addition to research, this chamber is used for conducting oxygen tolerance and pressure tests and has been used in the majority of treatments performed at the School.

Below left, this chamber, with the exception of the fire suppression system, is identical to seven other chambers located at various U. S. Air Force bases. This chamber is used primarily for training crews assigned to the Physiological Training Units equipped with such chambers.

AFB, California; Edwards AFB, California; Ellsworth AFB, North Dakota; Wright-Patterson AFB, Ohio; Brooks AFB, Texas; Weisbaden AFB, Germany; and the eighth chamber is being installed at Kadena, Okinawa. In addition, the USAF School of Aerospace Medicine at Brooks AFB in San Antonio, Texas, possesses a large hypo-hyperbaric research chamber that was made available for therapy in 1964. Each of these facilities maintains teams of trained physicians, physiologists and technicians on call 24 hours a day for emergency treatment.

Since the U.S. Air Force hyperbaric therapy program began in 1965 the incidence of in-flight episodes of decompression sickness requiring hyperbaric therapy has been very low. This is due to the excellent protection provided by the cabin pressurization systems of today's USAF aircraft. Likewise, the incidence of altitude chamber cases has been very low owing to the routine use of preventive procedures such as denitrogenation (breathing 100% oxygen prior to decompression). However, in the time period from 1965 to the present these USAF facilities have been increasingly used for the treatment of diving accidents and other medical emergencies such as gas gangrene, carbon monoxide poisoning and air embolism not related to pressure change. From 1 January 1965 through 1 October 1971 there have been a total of 81 patients treated at seven USAF hyperbaric facilities, 46 of which were treated at the USAF School of Aerospace Medicine. Thirty-eight patients were treated for decompression sickness or air embolism, 35 for gas gangrene and eight for other disorders. Of the 38 patients treated for decompression sickness or air embolism, 20 cases resulted from altitude exposure in altitude chambers, two were in-flight cases, three were in hyperbaric chamber personnel, nine were SCUBA divers, two were "hard-hat" divers, and two suffered air embolism not related to pressure change.

The diving casualties treated included two sports divers who, following adequate

*continued on page 22*

Above, ex-HAKE is towed to salvage site; OCE, CDR Don Minnich, COMSERVRON EIGHT Operations Officer and LCDR Don Kraft, Commanding Officer, USS OPPORTUNE (ARS-41) watch the day's activities.
At right, pontoon is lowered into position on ex-HAKE; sub breaks the surface after successful salvage attempt. Boarding party and salvage master board ex-HAKE to prepare for pumping internal compartments.

# SUBSALVEX 71 Successful Despite Interruptions

The submarine ex-HAKE slipped quickly below the surface and descended to a depth of 100 feet. This time the ex-HAKE was not commencing a war patrol to search for the enemy as she often did during World War II. It was 9 August 1971 and ex-HAKE settled on the bottom, unmanned and with no power to return to the surface. SUBSALVEX-71 had commenced in the lower Chesapeake Bay, 2.5 miles off Cape Charles City on the Eastern Shore Peninsula.

The submarine salvage exercise was completed in four phases. On August 10, the USS SUNBIRD (ASR-15) completed the first phase, a simulated rescue of trapped crewmen using the McCann Rescue Chamber.

It was in this stage the Salvage Master, LCDR Kurt Gustafson, had an indication of possible future problems. During the internal inspection of the submarine in the second phase, flooding was found in the after battery compartment. It was expected, however, that flooding would be confined to one compartment and by deballasting ballast tanks, the added weight could be compensated for.

The second phase was an intermediate lift to tow the submarine into shallow water. Crewmen and divers on the salvage ships USS PRESERVER (ARS-8) and USS OPPORTUNE (ARS-41), assisted by a team from Harbor Clearance Unit TWO aboard LCU 1490, made the necessary preparations for this and the following phases of the salvage operations. For the second phase, two pontoons were rigged athwartships on either end. The lift pontoons were on the deck of the submarine and the control pontoons were set 35 feet from the surface to provide a lift of approximately 37 feet. In the third and fourth phases, the submarine salvage pontoons were rigged alongside with axes fore and aft. As a result of the progressive flooding that occured in the submarine, six additional inflatable pontoons were added to the stern and, during the lift, ballast tanks on the submarine were deballasted.

During the third phase, the submarine was raised to the surface and towed into shallow water. The final phase brought the dewatering of internal compartments and towing the submarine back to the Little Creek Naval Amphibious Base, Norfolk, Virginia. The task was completed on 14 September.

Task Group Commander of the exercise was CAPT Carvel Blair, COMSERVRON EIGHT. On 31 August 1971, Commodore Blair was relieved by CAPT J. L. Koons. Officer-in-Charge of the exercise was CDR D. E. Minnich and the Salvage Master was LCDR K. A. Gustafson. The direction of the personnel assigned to them by the following persons was instrumental in realizing a successful salvage of the ex-HAKE:

LCDR Don C. Craft, Commanding Officer, USS OPPORTUNE (ARS-41)

LCDR Tom McGuire, Commanding Officer, USS PRESERVER (ARS-8)

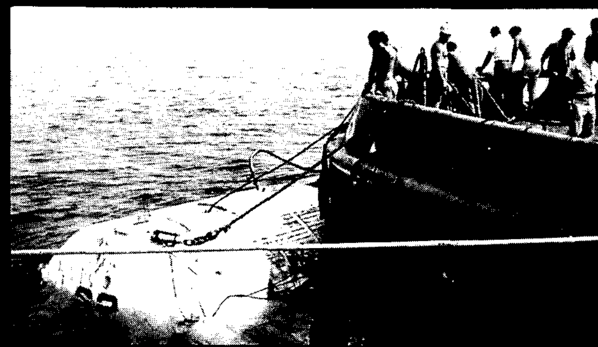
LCDR Cecil Sherer, Commanding Officer, USS MOSOPELEA (ATF-158)

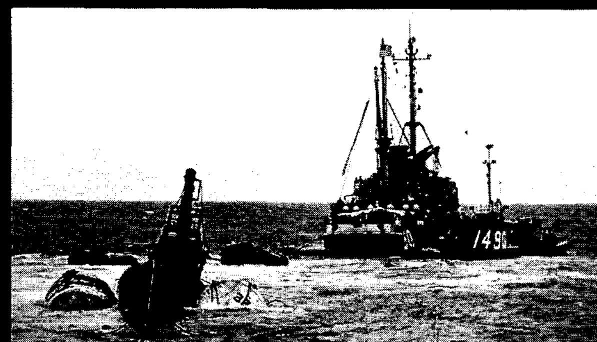
DCCM Strobe, Team Leader, Harbor Clearance Team 1, HCU TWO

SUBSALVEX-71 was the second training exercise of this type conducted for salvaging submarines. In completing this exercise, the participating units of Service Squadron EIGHT have increased their readiness for an actual submarine salvage. The proficiency of the personnel improved rapidly during the course of the exercise and more progress in submarine salvage procedures will evolve from the exercise.

The exercise was hampered by the unscheduled flooding of the internal compartments of the submarine. Flooding commenced through a ruptured line from a fuel oil ballast tank and resulted in flooding of all compartments except forward torpedo room, forward battery, and the conning tower. An unscheduled visit of Hurricane Doria the evening of 27 August resulted in a temporary delay. The final lift was threatened by Hurricane Heidi, but without result.

Although several factors increased the difficulty of the training exercise, the units of Service Squadron EIGHT accepted the challenge and a successful and safe exercise was conducted.





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decompression, flew in a commercial aircraft at a maximum cabin altitude of 5,000 feet within a few hours after their last dive. These divers had the onset of symptoms of decompression sickness 16 to 20 hours following diving. Another diver who suffered spinal cord involvement had made a single dive to 110 feet for 9-1/2 minutes in a lake at an elevation of 6,000 feet above sea level. The onset of symptoms in this case was rapid but there was a 25-hour delay between onset and treatment. In spite of this, the diver obtained complete relief of symptoms during hyperbaric therapy.

The U. S. Air Force training program in hyperbaric therapy began in October 1965 with a group of six instructors at the USAF School of Aerospace Medicine. The original group consisted of one flight surgeon, one aerospace physiologist and four altitude chamber technicians. The flight surgeon and physiologist received their training at the U. S. Navy's Diving School, Washington, D. C. and at the postgraduate courses in Hyperbaric Medicine conducted by the State University of New York at Buffalo. The success of the USAF Hyperbaric Training and Therapy Program is due in large part to the excellent instruction received at these facilities from those masters among Diving Medical Officers, Doctors Workman, Goodman, Bornmann, Lanphier and Alvis.

Since October 1965 a total of 576 individuals have completed the special two-week hyperbaric therapy course at the USAF School of Aerospace Medicine. Two hundred twenty-eight of these have been altitude chamber technicians, 201 were USAF Flight Surgeons, 14 were Flight Nurses, 28 were Army Flight Surgeons, 63 were USAF Physiologists and 42 others including NASA and FAA personnel also received this training. The course encompasses basic diving physics and physiology, hazards of hyperbaric exposures, decompression tables, treatment tables, chamber operations, case discussions and simulated treatment dives. Each student participates in five to seven hyperbaric chamber dives to depths to 165 feet of sea water during the course of instruction.

Continued from page 13

CONTROL OF MAJOR OIL SPILLS

| DAY | TIME | COURSE |
|---|---|---|
| Monday | 9:00–10:00 | Introduction; Registration; Welcome |
| | 10:00–11:00 | National Contingency Plan |
| | 11:00–12:00 | Regional Poll, Contingency Plans |
| | 12:00–1:00 | Lunch |
| | 1:00–2:00 | Environmental Protection Agency |
| | 2:00–3:00 | State and Local Authorities |
| | 3:00–4:00 | Navy Responsibilities |
| Tuesday | 9:00–10:00 | Oil Containment and Recovery; Introduction |
| | 10:00–11:00 | Containment |
| | 11:00–12:00 | Collection (Skimmers, Absorbents, etc.) |
| | 12:00–1:00 | Lunch |
| | 1:00–2:00 | Collection (Skimmers, Absorbents, etc.) |
| | 2:00–3:00 | Dispersants |
| | 3:00–4:00 | Control of Hazardous Mat. |
| Wednesday | 9:00–12:00 | The Command Post and Deployed Field Activities (includes movement of oil, surveillance and monitoring) |
| | 12:00–1:00 | Lunch |
| | 1:00–2:00 | Communications |
| | 2:00–4:00 | Public Relations |
| Thursday | 9:00–12:00 | Laboratory Demonstration Lecture on oil, its characteristics and types. Class participation in exercise using dispersants, absorbents, piston film, etc. |
| | 12:00–1:00 | Lunch |
| | 1:00–2:00 | Beach Clean-Up, Restoration & Disposal |
| | 2:00–3:00 | Bird Cleaning Stations & Ecosystem Protection |
| | 3:00–4:00 | Logistics |
| Friday | | "0730–1100" Field Demonstration Exercise (using bio-degradable oil) |
| | 12:00–1:00 | Lunch |
| | 1:00–2:00 | Final Exam |
| | 2:00–4:00 | DISCUSSION |

14–70, (Partially Originals) *Initial Evaluation of Revised Helium–Oxygen Decompression Tables.* J. M. Alexander, E. T. Flynn, J. K. Summitt, 23 October 1970, 100 pages. AD 719 388

15–70, *Report of Experimental Dives for Sealab III Surface Support Decompression Schedules.* J. K. Summitt, 1 December 1970, 119 pages. AD 723 177

16–70, *Visual Function in Divers At 15 to 26 Atmospheres Pressure.* J. S. Kelley, P. G. Burch, M.E. Bradley, D.E. Campbell, 1 October 1970, 7 pages. AD 714 044

17–70, *Bidding Preferences and Personality Characteristics of Many Divers U.S. EDU–Research Report No. 17–70 (MWE) AD 716 313.*

1–71, *Effect of Immersion on the Exchange of Oxygen in the Lung.* E.T. Flynn, 31 January 1971, 12 pages. AD 719 389

3–71, *Computer Generated Depth – Pressure Conversion Tables.* Thomas E. Berghage, Hugh T. Beatty, 1 April 1971, 69 pages.

4–71, *Revised Tables of Appropriate Oxygen Percentages for Selected Partial Pressures at Various Depths.* Thomas E. Berghage, Gilbert C. Tolhurst, 1 April 1971, 89 pages.

5–71, *Noise: A Hazard to Divers and Hyperbaric Chamber Personnel.* J. K. Summitt, S. D. Reimers, 15 May 1971, 31 pages.

6–71, *Indexed Retrieval System for Navy Experimental Diving Unit Research and Evaluation Reports.* H.T. Beatty, T. E. Berghage, D. R. Chandler, 1 June 1971, 78 pages.

7–71, *Preliminary Survey of Diver Anthropometrics.* Hugh T. Beatty, Thomas E. Berghage, Donald R. Chandler, 1 June 1971, 28 pages.

8–71, *Navy–Duke 600 Foot Saturation Dive.* E. T. Flynn, J. K. Summitt, 25 May 1971, 85 pages.

9–71, *Report of Nine Four Hour Exposures to 100% Oxygen at 11–13 feet of Seawater.* J. M. Alexander, E. T. Flynn, Jr., 9 August 1971, 13 pages. AD 728 760

10–71, *Swimmer Support System Diving Procedures and Tables.* W. H. Spaur, E. T. Flynn, 17 August 1971, 10 pages. AD 728 759

1–70, *Tables for Converting Oxygen Percents to Partial Pressures.* Robert Jenner and Robert Biersner, April 1970, 56 pages. AD 706 039

2–70, *Repetitive Excursion Dives From Saturated Depths On Helium–Oxygen Mixtures Phase I: Saturation Depth 350 feet.* J. K. Summitt, J. M. Herron, E. T. Flynn, 15 March 1970, 51 pages. AD 703 610

4–70, *Experimental Dives for ADS–IV Decompression Schedules.* M. N. Kahn, J. K. Summitt, 26 August 1970, 113 pages. AD 711 842

5–70, *Conversion Tables for Beckman CO2 Analyzers (Models IR 215 IR 315A).* Robert Biersner, Gregory Zingsheim, June 1970, 167 pages. AD 711 320

6–70, *Repetitive Excursion Dives from Saturated Depths on Helium–Oxygen Mixtures. Phase II: Saturation Depth 200 feet, Saturation Depth 150 feet.* J. K. Summitt, J. M. Alexander, E. T. Flynn, J. M. Herron, 23 September 1970, 51 pages.

7–70, *Repetitive Excursion Dives from Saturated Depths on Helium–Oxygen Mixtures. Phase III: Saturation Depth 300 feet.* J. K. Summitt, J. M. Alexander, E. T. Flynn, 23 September 1970, 43 pages.

8–70, *Repetitive Excursion Dives from Saturated Depths on Helium–Oxygen Mixtures. Phase IV: Saturation Depth 500 feet. Saturation Depth 600 feet.* J. K. Summitt, J. M. Alexander. E. T. Flynn, 23 September 1970, 43 pages.

9–70, *Saturation Dives, with Excursions, for the Development of a Decompression Schedule for use during Sealab III.* J. K. Summitt, 23 September 1970, 67 pages.

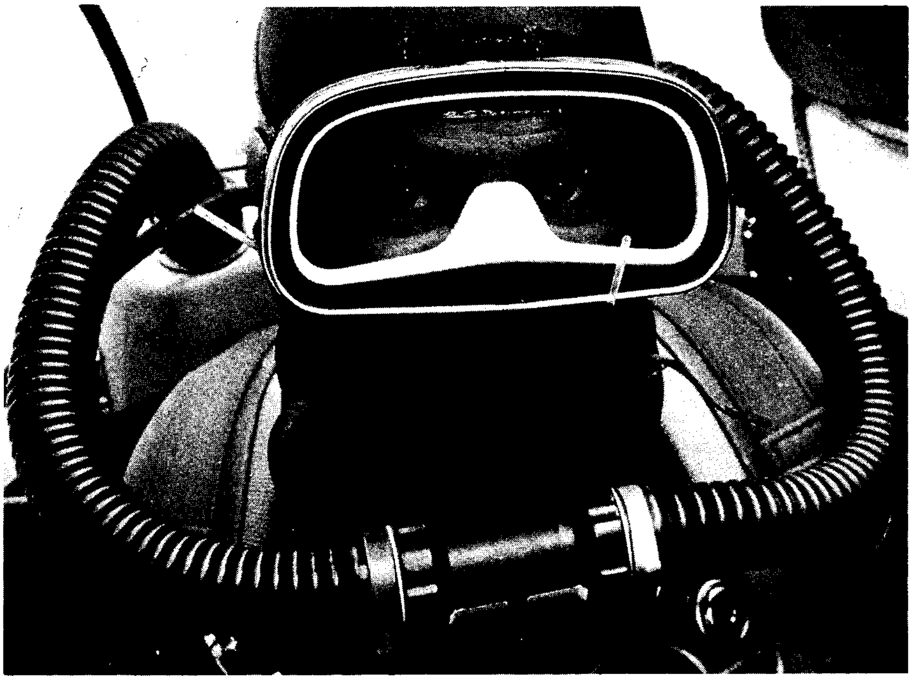
10–70, *Cognitive Performance During a 1000–foot Helium Dive.* R. J. Biersner and B. J. Cameron, 1 August 1970, 7 pages. AD 714 343

11–70, *Review of Diving Accident Reports 1968.* J. K. Summitt, T. E. Berghage, 1 December 1970, 78 pages. AD 723 175

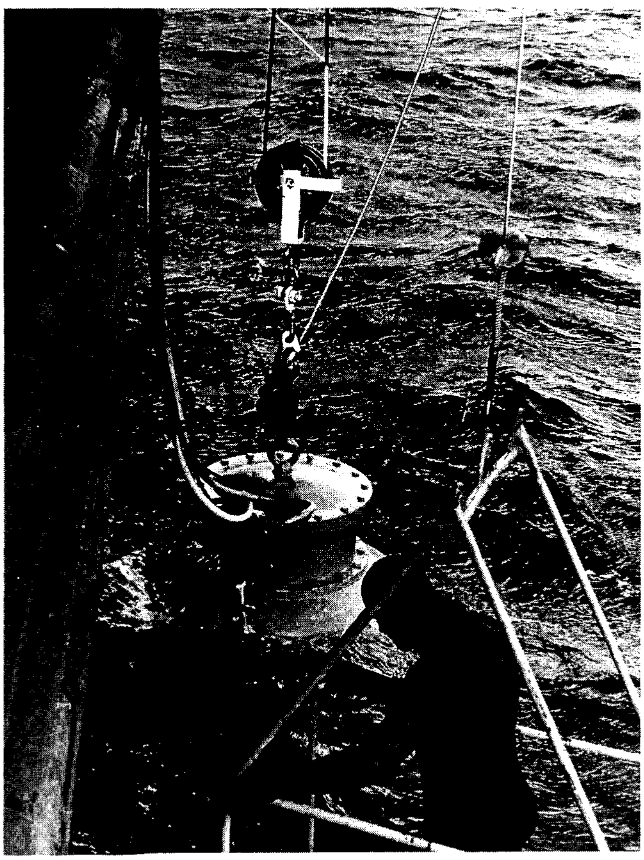
12–70, *Review of Diving Accident Reports 1969.* J. K. Summitt, T. E. Berghage, 1 December 1970, 94 pages. AD 723 176

13–70, *Memory Impairment During a Deep Helium Dive.* R. J. Biersner, B. J. Cameron, 15 September 1970, 7 pages. AD 715 344

*The Medical Department at the Experimental Diving Unit, Washington, D.C. propagates a great many worthwhile publications which, due to administrative difficulties, never reach many of those who may find them of interest. The list of publications shown here from the EDU Medical Department was published during the past two years and is available for the asking. Requests should be addressed to the Defense Documentation Center (DDC), ATTN: DDC–TSR–1, Cameron Station, Alexandria, Va. 22314. If the desired publication has an AD number, this should accompany the request to insure faster handling. FACEPLATE will continue to list current publications offered by EDU along with an abstract describing the publication.*



At left, Swedish diver uses Heliox for a dive off the HMS BELOS, the Swedish Navy's primary diving ship. Below, Personnel Transfer Capsule is lowered into water from BELOS.



# Diving in

Diving in Sweden in not a new activity. One of the most famous diving events of that country involved von Treileben in the 1660's when he successfully salvaged hundreds of old guns from shipwrecks along the Swedish coast. During the 1930's and 1940's when diving all over the world began to gain significance, Sweden was well ahead. During that period the Swedes developed tables for surface-decompression which were used with very good results. The young technologist Arne Zetterstrom will be remembered for his very sophisticated system of diving with a hydrogen oxygen gas mixture. Unfortunately, however, the accident that caused his death also stopped the development of diving in Sweden.

The renewal of Swedish diving began at the end of the 1950's. Today there exists an intensive military diving program and small civilian diving groups. Cooperation has increased between military, professional, and sports-diving groups during the last few years. The military has the only organized facilities for diver training, and underwater work exercises. The professional divers are tied to a very old guild system (systeme de corporation) restricting a diver's work to topside for many years with an old diver, before he is permitted into the water. The only exceptions to this rule are a few hundred civilian clearance divers employed by the government who received training in the Navy. The sports-diver gets his training in the club he belongs to, but the club is dependent on the advice and special instructor training that they get from the Navy. Safety precautions for diving are universally observed.

### Types of Divers

Classified by the equipment they use, there are five types of Swedish Navy divers, mine-clearance divers with requirements for non-magnetic and acoustic parameters in their diving equipment, underwater demolition divers who primarily use oxygen equipment requiring ruggedness and combat reliability, ships-divers who work inside and around ship's hulls using normal SCUBA gear, hardhat divers who are capable of diving on air down to 230 feet with conventional hardhat equipments, and deep-divers with highly developed systems requiring helium.

# Sweden

*by Peter Wide, Manager of Diving and Salvage, Sweden*

### Mine-clearance diving

Today Swedish mine clearance diving units are using wet-suits and AGA ME 1800 SCUBA gear. The equipment is rugged and functions well under severe conditions. However, magnetic and acoustic performance is poor and thermal protection is unreliable.

Project work is progressing on a new nitrogen-oxygen (NITROX) system. The equipment is to be designed with the inexperienced conscript in mind. The Swedish Navy believes diving gear should be built for the diver and not vice versa. Plans call for production to commence in 1973-74. Much consideration must be given to physiological parameters. Special emphasis will be placed on breathing resistance, thermal control and $PO_2$- limits, and little emphasis placed on electronics in diving gear. Two-man decompression chambers are being purchased for clearance diving teams.

### *Underwater demolition*

Underwater demolition teams (UDT) are using dry-suits of Swedish Trelleborgs Gummifabriks design. Diving gear is Drager oxygen diving apparatus type Norge II which has proven to be very reliable and is regarded as the best set to be found today. For practical reasons equipment for UDT must be modernized to give longer diving distances, better navigational accuracy, and more comfort under arctic conditions.

A new diving system for UDT is planned for a year later than the nitrox-system for mine-clearance divers. We hope to be able to use the same system with minor modifications.

### Ships-divers

Swedish ships-divers are using uncomplicated equipment with normal SCUBA gear. The apparatus used in the AGA 324 for both working in contaminated atmospheres and water diving. The 324 is very handy and operates at 300 (4500 psi) atmospheres working pressure with two bottles of four liters each. The Swedish Government has accepted 300 atmospheres as standard working pressure. All new compressors are 300 atmospheres.

## THE FUTURE OF DIVING IN SWEDEN

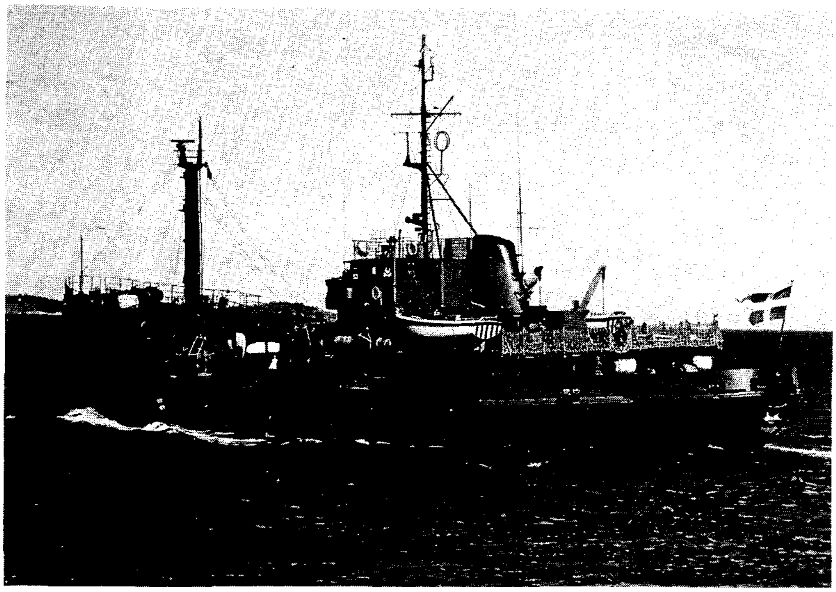
The importance of diving is increasing in both the military and the civilian sectors all the time. Not only will more sophisticated new systems be needed for diving, but the conventional methods will also need to be made more effective. Thus, both the old and new systems are receiving attention, the latter serving to complement the former.

### 1. Submarine rescue

The possibility of saving lives in submarine disaster is unusually good in waters that are most common for submarine exercises in Sweden. Because the waters are rather shallow, less than 650 feet, there is a good chance to find the crew alive in a lost submarine. But the methods and material resources for this purpose are too old. It must be possible to use divers at the actual depth even if one uses a collective method. For example, if the submarine is not equipped for attaching or sealing the normal way, the system must allow the diver to assist on the spot. The goal of 490 feet with one hour bottom time that we hope to reach during the next year, will be increased to a depth of 980 feet, or more later. Free ascent will remain the emergency method, but it must be developed for use to the same depth.

### 2. Underwater work

Conventional methods will continue to be used, but the working schedules and the tools used must be more effective. There are



At left, HMS BELOS; Swedish diving centers around this Submarine Rescue Vessel. Below, mine clearance divers use AGA Me 1800 SCUBA gear.

Continued from page 25

some good reasons to be optimistic concerning these areas; namely, the possibilities of developing material in this country.

Concurrent development in methods for underwater work and submarine rescue appears to be a progressive step. There is the possibility of a system to cover both these interests, but there are multiple problems to be solved.

3. Scientific research

The requirements for man-in-the-sea research will be well satisfied by the methods and systems already described.

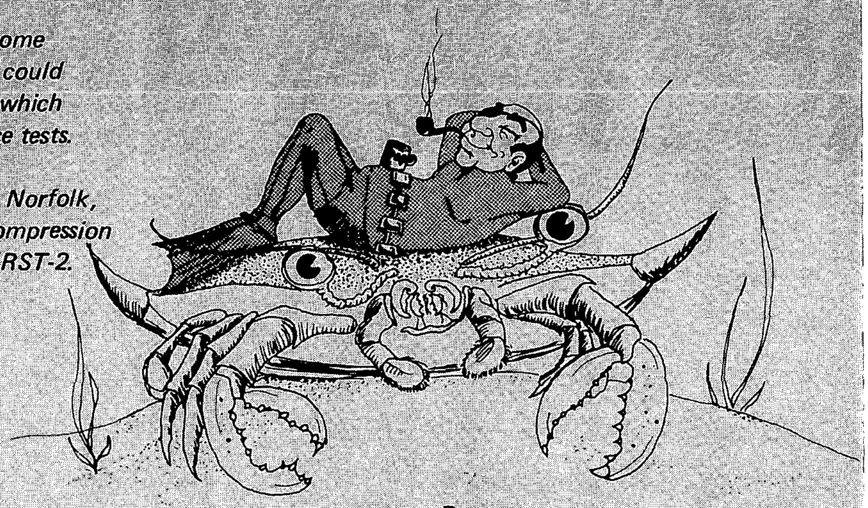
The special diving research service, both from technical and medical points of view, needs more attention. Experience has shown that it is not possible to acquire all the required information, tables, etc., without regarding the medical aspects. Experts in personnel selection, medical treatment, and training must be given rein.

4. Resources

To begin the research-work, trials, and training, resources are needed that aren't available today. Among them, a new chamber system stands out as a priority. The increasing complicity concerning modern diving systems will force us, for security reasons, to deal with more and more of these activities in simulated millieu. Today we have just this old unit (Diving Tank at Galarvarvet) which has a very limited work capacity. Because of this it has taken us almost ten years to develop the helium system that now is about ready for standard use to 328 feet.

*HM 1 (DV) Calkins has come up with a good idea which could be adapted to all activities which do pressure and $O_2$ tolerance tests.*

*HM 1 Calkins, from HCU-2 in Norfolk, describes how they run the recompression chamber tests aboard the YRST-2.*



Date:

From: HCU-2, YRST-2, USNAVPHIBASE, Little Creek, Norfolk, Va. 23520

To:

Name Rank/Rate SSAN

Subj: Recompression Chamber Test, indoctrination of

1. *Information.* Welcome aboard YRST-2 for your recompression chamber test. First check your health record in with the Medical Department to see if your physical is complete and in order.

Answer the Following:

Have you had:
- a. a good night's sleep (8 hours)
- b. any heavy drinking (past 12 hours)
- c. a recent cold
- d. hospitalization (past year)

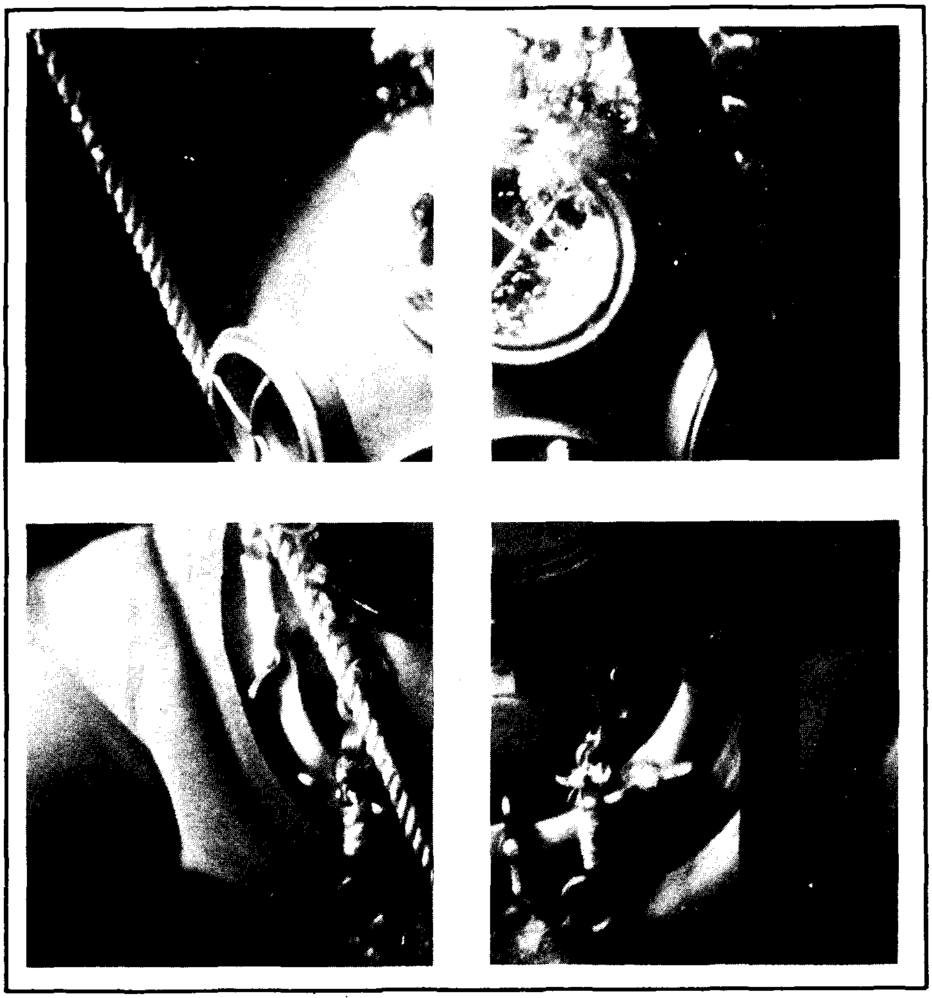
You may find coffee on the mess decks in the forward part of the barge; after which time you should remain in the classroom (by the chamber, below deck) so as to be available when your name is called for your test.

Prior to entering the chamber, it is mandatory that you remove your shoes, any cigarettes, lighters, matches, or paper as a safety precaution. It is also advisable to leave any ballpoints, felt-tips, and watches outside the chamber.

When entering the chamber, please be seated so as not to be in a cramped position. There will be a qualified diver (inside tender) operating the chamber and controlling the chamber going down. When the air is turned on by the inside tender, it will be extremely noisy and the pressure can be felt. This is the time to start equalizing either by yawning, swallowing or holding your nose and trying to force air out. (Should you have trouble trying to equalize or have pain in your ears, raise your hand and the tender will stop the chamber and in most cases give you a chance to clear prior to continuing.) After reaching the bottom, 112 feet (50 psi) breath normally, returning to 60 feet for oxygen tolerance candidates and to surface for pressure test only.

2. *Oxygen Tolerance Test.* When told by the tender, you will put on your oxygen mask and breath 100 percent oxygen. During this time if you should experience any trouble such as muscular twitching, nausea, dizziness, abnormal vision or hearing, difficulty in breathing, anxiety or confusion, fatigue, or poor coordination, please notify your tender. It should also be noted that while you are breathing oxygen the chamber will be vented at periodic intervals to lessen chances of an explosive atmosphere. (Depth is maintained at 60 feet.)

3. *Conclusion.* After completion of test you are to remain on the YRST-2 for one (1) hour and in the immediate area for the next twelve (12) hours. If you should feel anything unusual such as pain in joints, or break out in a rash, get in touch with HCU-2 by telephoning 464-7433. Please pick up your health record at Medical Department prior to departing and make sure the results of your test have been entered on your records. Thank you; and the best of luck on submarines or in the field of diving.



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