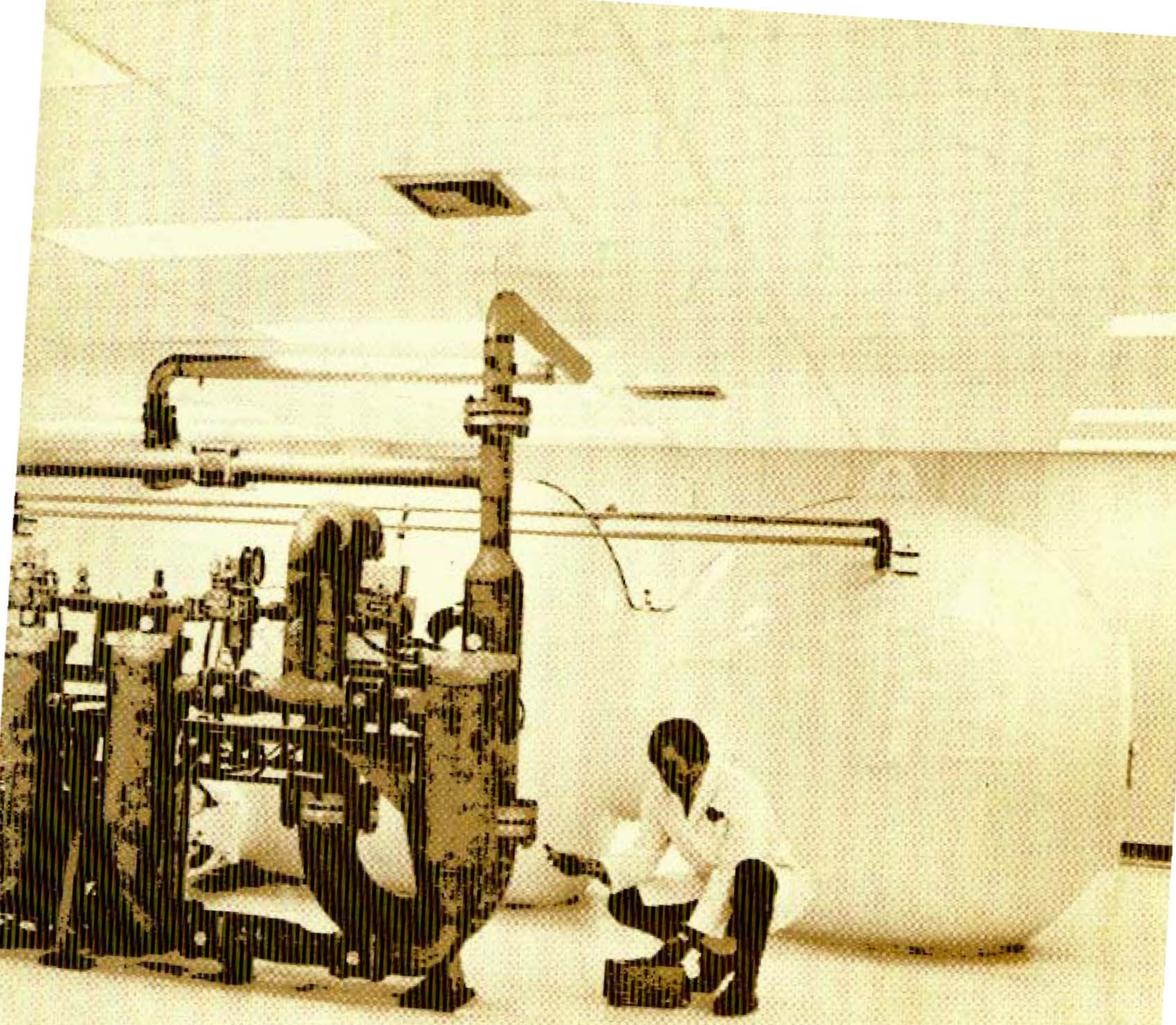
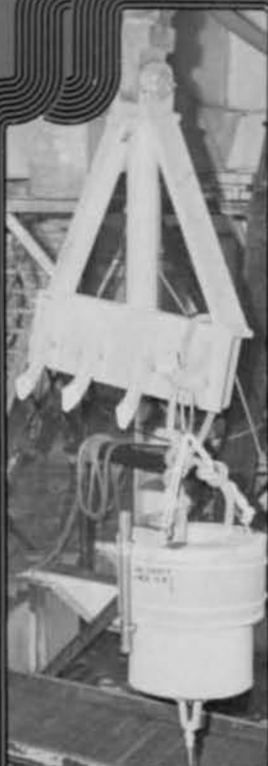


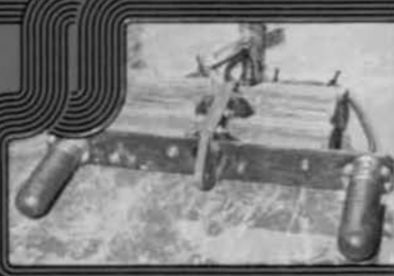
FACEPLATE

FALL 1973

AFAR OPERATIONS '73 . . . *see page 7*

AFAR Operations '73 included tasks which required creativity and imagination to be successful. Pictured clockwise from top: The explosive hook arrangement designed by Project Director, Earl Lawrence, and used to lift NOVEMBER Tower; crew member welding the chain used for connecting NOMAD Buoy to the anchor made of old railroad wheels; Dick Asher of Ocean Search, Inc., calibrates round platform in degrees to indicate the rotation of NOVEMBER Tower; two hydrophones installed under BRAVO Buoy weighted with lead and ready to be lowered; the ALCOA SEAPROBE, which served as the search and operations platform for AFAR Operations '73.





FACEPLATE

VOLUME 4 NO.3

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The cover shows the Hyperbaric Chamber Complex at Taylor Diving and Salvage Co., Belle Chasse, LA, where the Navy's 1600-foot wet chamber dive was conducted.

See page 20.

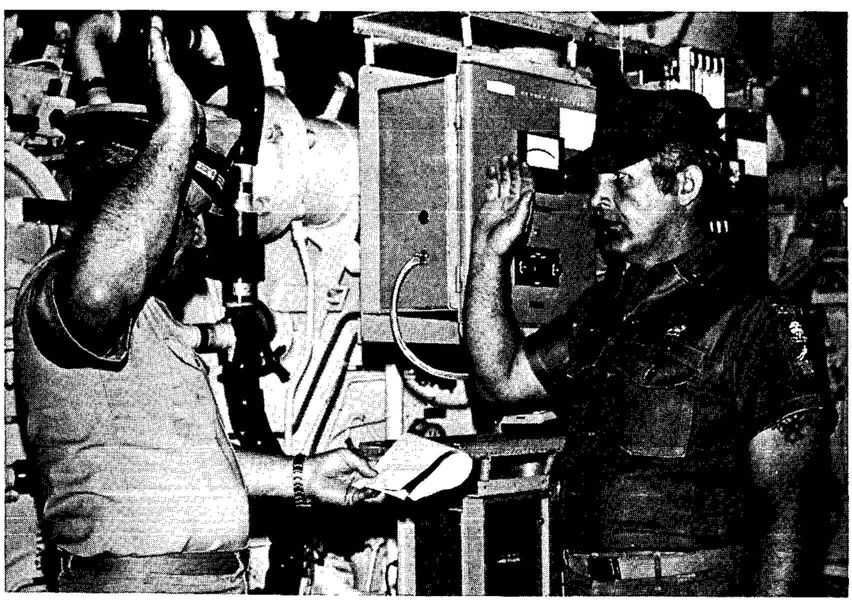
SOUNDINGS

CHIEF BATES SAYS 3 MORE!

Master Diver EMC Joe Junior Bates, USN, of Harbor Clearance Two's Mark One Deep Dive System, (Mk 1 DDS), shipped over for 3 years on May 22 while supervising a dry 300-foot saturation dive at Naval Amphibious Base, Little Creek, Virginia. Below, Chief Bates is sworn in by LCDR John Whitaker, Commanding Officer of Harbor Clearance Unit Two, while Bates was conducting the first operational employment of the Mk 1 DDS since its operational evaluation was concluded in December 1970. Four divers entered the pressure complex on May 21 to begin their 5-day pressure test dive, marking the beginning of a new testing cycle for the Mk 1 DDS.

A Navy Diver since his enlistment in 1955, Chief Bates has served on various ships, completed a 13-month tour in Vietnam in 1966, and, after completing Ist Class Diving School in 1967, served a tour of duty at the Navy's Experimental Diving Unit, Washington, D.C. At the NEDU he participated in various diving table developmental experiments that have been successfully used in SEALAB and other deep dive systems.

In 1968, Chief Bates completed Advanced Diving System Four (ADS 4) training, qualifying as a diving bell operator and supervisor. He completed Master Diver training in April 1969 and went on to supervise 1000-foot saturation dives for NEDU at the Duke University hyperbaric complex. After assignment as the Mk 1 DDS Master Diver in 1969, he became involved in the operational evaluation of the Mk XI diving apparatus, which has been used at depths of 850 feet.



LOSS PROJECT CONTINUES REFINEMENT

The Supervisor of Salvage has a continuing testing program of the components of the Large Object Salvage System, (LOSS), at the Naval Coastal Systems Laboratory. (See *FP*, Fall 1972.) During July and August of 1973, a propulsion system developed by the Naval Ship Research and Development Laboratory, Annapolis, consisting of five thrusters, controllers, and a control console, was used to maneuver the 100-ton rigid pontoon in the water column. The system was designed to enable the pontoon to make 1 knot against a 1-knot current. Conducted at Stages I and II in the Gulf of Mexico off the coast of Panama City, Florida, the testing culminated with the mating of the pontoon to a sunken object.

NEW FSN AND COST ASSIGNMENTS FOR GAUGES

The new chamber gauges and cassion gauges, announced in the Winter 1971 and Summer 1972 issues of *Faceplate*, now have FSN's assigned as follows:

External Gauges—FSN H6605-009-7470, $170.00 each
Cassion Gauges—FSN H6685-431-4895, $390.00 each

EDITOR-IN-CHIEF MOVES WEST

The duties of the Assistant Supervisor of Diving, Naval Ship Systems Command have been carried out by CDR William I. Milwee for the past 3 years. Beginning in June, 1973, however, he has taken on the new assignment as Salvage Officer, Commander Service Force Pacific, Hawaii. CDR Milwee's involvement in diving technology has been fundamental in the significant strides made during his tour as Assistant Supervisor of Diving. These include the construction of the first fully operational saturation diving system (Mk I Mod 0); the development of a deep diving, closed circuit breathing apparatus; and the development of an open circuit face mask complete with communications (Mk I). The implementation of Information Exchange Programs with the Royal Navy, the Federal German Navy, and the Australian Navy was also initiated. *Faceplate* extends best wishes to its former Editor-in-Chief in his new duty tour in the Pacific Fleet Force.

WE NEED YOU

The *Faceplate* editors have been receiving requests from their readers for more articles from the Fleet. We would like to make *Faceplate* even more representative of fleet life and experiences in the fields of diving and salvage. The only way we can do this realistically is to hear from YOU. So please consider putting some of those memorable experiences down on paper and send them to:

FACEPLATE
Supervisor of Diving
Naval Ship Systems Command
Washington, D.C. 20362

NEW RESEARCH POOL FROM BATTELLE

Fish-eye visibility of marine-related studies is possible through hemispherical viewing ports on a new 16-foot-deep, 24-foot-diameter research pool (right) at the Long Beach Research Facility of Battelle Memorial Institute at Columbus, Ohio. According to Battelle's James S. Glasgow, studies to be conducted in the pool will focus on underwater life-support apparatus, underwater electrical and electronic components, floating structures, submerged structures, underwater equipment and tools, diving procedures and techniques, and deep-water mooring systems. The pool is designed to use both sea and fresh water, which can be heated and filtered. Here, research-engineer divers experiment with an "underwater phone booth" which permits divers to remove their mouthpieces and talk to each other in normal voices while under water. The pool also has a 1-1/2-ton crane.

SIDNEY E. SMITH LIVES ON

The collision of SIDNEY E. SMITH and S.S. PARKER EVANS on June 5, 1972, in the St. Clair River at Port Huron, Michigan, (see *FP*, Winter 1972) resulted in the blocking of one of the busiest waterways in the world. The Supervisor of Salvage, the Army Corps of Engineers, and others joined forces in overcoming extremely hazardous conditions to successfully salvage the submerged SMITH.

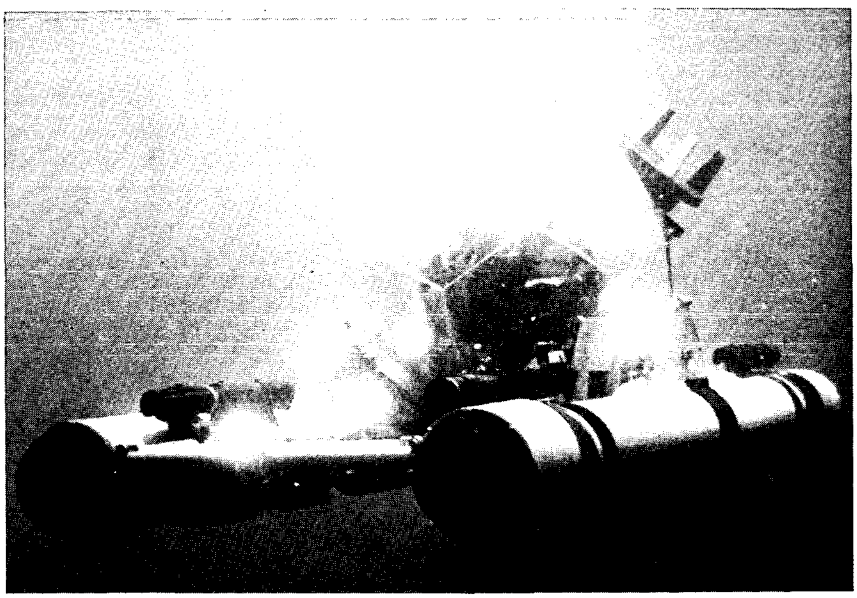
During the salvage operation various types of urethane foam were injected into the hulk of the SMITH to lighten it prior to the pulling, floating, and eventual disposing of the ship. Salvage history was made when the 2400-ton bow section was removed from 85 feet of turbulent water by the use of urethane foam, the first successful full-scale application of this technique at such depths.

The two sections of the hull were sold to a Canadian company, which removed the urethane foam and refilled the hull sections with gravel to form a much needed breakwater in Sarnia, Ontario.

All those involved in the long history of the SMITH will be happy to know that she is still serving mankind as a barrier against the destructive effects of the marine environment.

MAKAKAI—A TECHNOLOGICAL BREAKTHROUGH

Scientists at the Naval Undersea Center, San Diego, have scored a breakthrough in technological development with the certification of the transparent-hulled submersible, untethered, two-man submersible certified for 100-foot depths (see *FP* Spring 1973), while NEMO is an acrylic plastic sphere capable of 600-foot dives.



MAKAKAI. MAKAKAI (Hawaiian for "eye of the sea") has been certified by the Naval Ship Systems Command, Washington, D. C. for 600-foot manned dives.

MAKAKAI is the third of a group of submersible test beds being used by NUC in undersea research. Each of the other two submersibles, DEEPVIEW and NEMO, have special attributes. DEEPVIEW is a glass-nosed, untethered, two-man submersible certified for 100-foot depths (see *FP* Spring 1973), while NEMO is an acrylic plastic sphere capable of 600-foot dives.

The manned, untethered certification dives of MAKAKAI were performed offshore from NUC's Hawaii Laboratory in mid-1972. Since then MAKAKAI has been transferred to San Diego where it is being used by NUC for marine observation and bottom photography.

The submersible looks like an underwater helicopter with its 66-inch diameter acrylic plastic "bubble" mounted on top of two large pontoons. It was developed and built by NUC's Hawaii Laboratory. The innovative and highly useful vehicle utilizes a 2.5-inch-thick transparent acrylic sphere as the pressure hull. This affords the submersible's two operators an unobstructed panoramic view of their aquatic surroundings. To ensure safety for its occupants, the sphere has been prooftested by the Navy to a simulated depth of 4200 feet.

The pressure hull is attached to a frame to which the two pontoons are fastened. The pontoons house the lead-acid batteries used to power the vehicle. Propulsion is by two cycloidal thrusters, which give propulsion control in 4 degrees of freedom. Ballast tanks are placed at the end of each pontoon for controlling buoyancy, trim, and pitch during diving operations.

In MAKAKAI, an operator and one observer-passenger can descend into the ocean without leaving a comfortable, shirtsleeve environment. The normal life support capability is 12 hours with an emergency backup supply of 36 hours. Most of MAKAKAI's control electronics are located outside the pressure hull in oil-filled, pressure-compensated housings. One reason for this approach was to reduce heat within the plastic sphere. Placement of controls outside the sphere also provides more usable room within. Control signals are transmitted through the sphere on a modulated light beam to a receiver outside. The system's chief advantage is that it reduces drastically the number of support system penetrations in the bottom of the sphere.

MAKAKAI is expected to have many uses. In addition to providing a test bed to experiment with and facilitate new technological developments, MAKAKAI is a valuable tool for Navy scientists to utilize further undersea research.

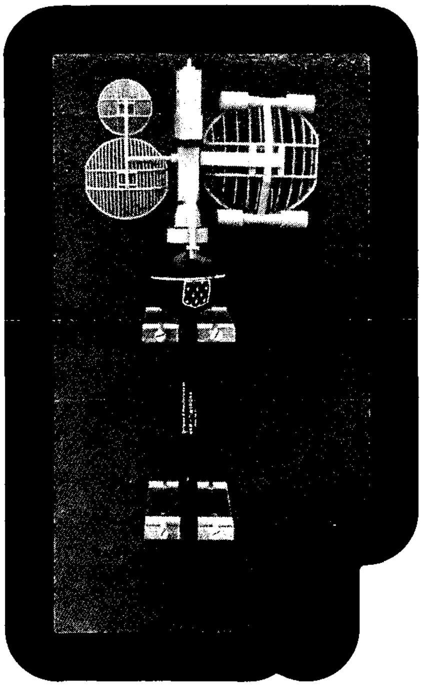
FACEPLATE EDITOR DEPARTS

Since early summer 1972, the publishing of *Faceplate* has been under the leadership of its Managing Editor, Mrs. Sarah Carroll. With this issue, Mrs. Carroll leaves to a new home in Maine and to other endeavors. The magazine's staff and the Office of the Supervisor of Diving extend to Sarah a hearty "well done" for her untiring efforts in *Faceplate*'s behalf and wish her the best for the future.

THE AZORES

AFAR OPERATIONS '73

The Azores Fixed Acoustical Range (AFAR) is a sophisticated deep-water listening system sponsored in varying degrees by eight NATO nations: Canada, France, Germany, Italy, Netherlands, Portugal, United Kingdom, and the United States.



Model of NOVEMBER, ECHO, and SIERRA Tower assemblies.

Implanted in depths of water up to 3,000 feet off Sante Maria Island in the Azores Islands, AFAR consists primarily of three submerged tower and acoustic underwater antenna assemblies designated as NOVEMBER, SIERRA, and ECHO Towers; a submerged buoy for measuring underwater environmental conditions designated as BRAVO Buoy; and a shore station component of the range on Sante Maria Island.

The acoustic antennas, mounted on submerged towers, are the heart of the AFAR range. Designed by the Naval Underwater Systems Center (NUSC), and built in the United States, the individual antennas range in size from 12 to 22 feet in diameter. Three antennas are assembled in pyramid fashion to make one large component spanning 43 feet. In addition to the antennas, each component includes the following: a chemical gas generator to furnish the volume needed to overcome a loss of gas through osmosis from the hollow antennas; a syntactic foam block to provide adequate buoyancy; and a lifting eye at the top of the assembly used for attaching the lowering cable during implantment. These antenna assemblies were shipped to France where they were mounted on French-built towers. Once combined, the total component was 125 feet tall, weighed 74 tons in the air and had a dynamic mass in water equivalent to 120 tons. In the history of ocean engineering, AFAR antennas were the first to be mechanically steerable in both planes.

Another major component of the range is the submerged BRAVO Buoy, which is used for measuring underwater environmental conditions. Referred to as both an oceanographic and an environmental buoy, BRAVO Buoy is 13 feet in diameter and 17 feet tall.

Three major operations have been performed on AFAR. The first operation was its original implantment by NATO forces in 1970. At this time the NOVEMBER and SIERRA Towers were implanted using 2-1/2-inch-diameter double armor submarine cable. In the attempt to implant ECHO Tower, it was dropped in the lowering process. The fall left the tower inoperable on the ocean floor. The BRAVO Buoy was also to have been implanted at this time; however, the mooring legs of the buoy were lost on the bottom of the ocean and the installation was impossible.

SUPSALV was tasked to assist in replenishing the range and succeeded in doing so by completing the following jobs in 1971: ECHO Tower was lifted to the surface, towed 50 miles to shore at Ponte Delgada, refurbished, and then taken back to sea and installed in its proper location in 2100 feet of water; BRAVO Buoy was installed in 2100 feet of water, suspended 200 feet under the surface, and 12 miles of 2-1/2-inch cable were run to shore. The Curv III Submersible was used to lift defective cable from NOVEMBER Tower and after the cable was raised to the surface, new cable was spliced in and returned to the original depth of 3000 feet.

Recently, after experiencing some difficulty with the functioning of the range, the NAVSHIPS Code responsible for AFAR again requested SUPSALV's services in the repair and renewing of the components in the range. SUPSALV appointed Earl Lawrence as Project Director and tasked Ocean Search, Inc., under an existing contract, to assist with the project. The ALCOA SEAPROBE, owned and operated by Ocean Search, was used as the search and operations platform. NUSC provided technical data for the operations.

Counter-clockwise from lower left: Earl Lawrence, Project Director; Bill Sherwood, Ocean Search, Inc.; Tom Cummins, NUSC; Al Ellenthorpe, NUSC.

The NOVEMBER Tower was the first object of concern for the AFAR Operations '73 crew. When installed, the antenna component on the tower was capable of rotating 360 degrees.

Later, the training mechanism jammed, leaving the component immobile with its back to the range. NUSC decided that if the entire tower could be rotated 115 degrees, the range could be returned to its original operational level. It was a job requiring precision work since the rotation had to be ± 5 degrees of the goal in order to achieve the desired effectiveness.

Since NOVEMBER Tower is located in 960 feet of water, the ALCOA SEAPROBE was an ideal vessel for the job. Using a drill-rig concept with a sectioned pipe system, the SEAPROBE deploys a search, identification, and sensor package called "Search Pod," which contains obstacle avoidance sonar, side-scan sonar, black and white and color television, still camera, and lighting equipment to locate the desired object. Once NOVEMBER Tower was located using this equipment, a hook arrangement, developed especially for the AFAR Operations, was installed below the search pod in view of the ship's cameras. This hook arrangement consisted of four hooks constructed with explosive bolts, which could be activated when release of the NOVEMBER Tower was desired.

The completed assembly was then lowered back down to NOVEMBER Tower. One of the four hooks was maneuvered into the tower's lifting eye and secured in place. The tower was then lifted 5 feet off its sea mount, rotated, and placed back on the bottom.

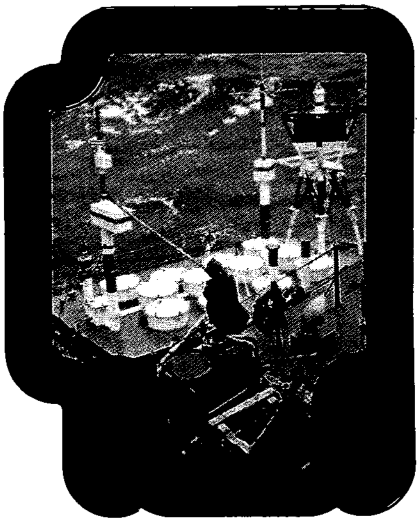
The explosive bolts were fixed and the tower released. After hours of testing and calibrating by the AFAR Operations crew in conjunction with the shore laboratory, it was determined that the tower was 100 percent operational and only 2-1/2-degrees off the desired goal.

The second goal for the AFAR Operations was to return BRAVO Buoy to an operational condition. For sometime BRAVO Buoy had been malfunctioning, and it was believed that the buoy was encrusted in barnacle-type sea life. In order to work on the buoy, it had to be surfaced. The first approach to lifting the buoy was to pick up the third anchor and move it 300 feet toward the center of the moor, which would allow the buoy to surface. In order to do so, the four-prong explosive hook arrangement was used with the intention of lifting the anchor by inserting the hook into the lifting eye of BRAVO's anchor. When the anchor was located, however, it was found that the lifting eye was fouled so the hook couldn't be inserted. At this point an alternative method had to be used to raise the buoy.

The T.V. camera was used to search out the end of the crown wire, which had been used to lower the anchor into its position originally. The hook was then used to scoop up several coils of the 1-1/4-inch wire. As the hook was raised, the wire tightened and formed an almost perfect seaman's knot, and by so doing, allowed the 18,000-pound anchor to be moved the necessary 1300 feet to the center of the moor. As a result of this action, BRAVO Buoy rose and was "watching" on the surface.

Inspection showed that BRAVO Buoy was encrusted with two inches of hard-growth marine life. Testing revealed that the wave-height antennas were inoperative and the cable assembly for two hydrophones that had been installed 250 feet down on leg number three of the buoy had corroded to the point that it was of no value.

BRAVO Buoy was cleaned of all marine life. The wave height antennas were removed and new ones were installed. In order to prevent marine life from attaching to the buoy again, 12 sterilization canisters were installed in the buoy and a nylon screen was placed over its top.



NOMAD Buoy, AFAR's newest component.

BRAVO Buoy was then ready to be returned to its position in the range. The SEAPROBE took hold of the crown wire that had been buoyed to the surface and moved the anchor to its original position, which, in turn, pulled BRAVO Buoy to its proper position 200 feet below the surface.

AFAR Operations '73 provided AFAR with its most recent addition. NOMAD, a new weather-type buoy, was fitted with 500 feet of thermistor cable wound around a strength member, 5000 feet of 6-inch 2 and 1-nylon, 200 feet of 1-1/2-inch wire, and 200 feet of 2-inch chain. NOMAD was anchored with two anchor clumps made of old railroad wheels weighing a total of 9000 pounds. The buoy is anchored in 3000 feet of water and rests on the surface. NOMAD Buoy will be used to measure weather and temperature of water in depths up to 500 feet.

In order to ensure maximum effectiveness of the range, ECHO, NOVEMBER, and SIERRA Towers, as well as BRAVO Buoy, were calibrated. With the addition of NOMAD Buoy, the range can now operate at a 100-percent level of effectiveness.

SUPDIVE sponsors

Diver Equipment Information Center

R. M. Linebaugh
Battelle Columbus Laboratories

The Diver Equipment Information Center, sponsored by SUPDIVE and located at Batelle's Columbus Laboratories provides the diving community with rapid access to literature pertinent to diving equipment. Initiated in February, 1968, as a small information operation providing Battelle staff members working on Navy-sponsored diving projects with needed information, it has since grown into the Diver Equipment Information Center (DEIC) with holdings of more than 12,000 documents including journal articles, books, manuals, patents, conference papers, engineering drawings, specifications, and brochures. In addition to these holdings, the center maintains a small library of pertinent reference books, and subscribes to more than 50 journals. The center also has access to the other Battelle libraries.

The scope of the center includes information on SCUBA and hookah equipment, masks, suits, CO_2 scrubbers, regulators, tanks, gas supplies, power tools, instruments, diver performance, chambers, habitats, submersibles, and communication equipment. This scope is being constantly broadened and refined as the needs of the diving community change. The documents contained in the Center have been abstracted, and the DEIC files can be searched by author or organization.

Over the years the Center's services have increased in both scope and complexity. These services include retrospective searches, preparation of bibliographies,and location of specific documents. The services are available without charge to the Battelle staff, the Office of the Supervisor of Diving, and outside requestors with approval of SUPDIVE. Extensive tasks involving the expenditure of considerable time and effort, or tasks which involve actual technical analysis can be arranged on a contract basis. The center prepares a monthly accession list, and an index to the clue word files is maintained and periodically updated. Rapport is maintained with other sources of information in the diving field so that requestors whose subject area is outside the scope of DEIC can be referred to the proper source of information for their particular need. The Center also provides an interlibrary loan service to requestors.

Requests for information from DEIC may be addressed either to the Supervisor of Diving or to:

DIVER EQUIPMENT INFORMATION CENTER,
BATTELLE COLUMBUS LABORATORIES,
505 KING AVENUE,
COLUMBUS, OHIO 43201

The effects of COLD

A Behavioral Research Program In Long-Duration, Cold Water, Swimmer Delivery Vehicle Operations.
By W.S. Vaughn, Jr. President, Oceanautics, Inc.

Since 1966 the Office of Naval Research has sponsored a program of diver performance research in the context of manned, wet submersible operations. Agencies which have co-sponsored the program are The Bureau of Medicine and Surgery, and Naval Ship Systems Command. The major emphasis of the program has been the effects of long-duration exposure to cold water on both physiological and performance responses of test divers.

Four cold-water test series have been conducted, with the participation of UDT and SEAL team personnel as test divers, the Mk VII Swimmer Delivery Vehicle (SDV), as the submersible, and SDV mission profiles as the basis of the test scenarios. Dates, test sites, and exposure conditions were as follows:

> November-December 1967 at Naval Special Warfare Group, Pacific, Coronado, California: 4- and 6-hour exposures to 16.5°C water (61.7°F).
>
> June-July 1970 at Naval Ship Research and Development Center, Bayview, Idaho: 4- and 6-hour exposures to 10.7°C water (51.3°F).
>
> February-March 1971 at Naval Torpedo Station, Keyport, Washington: 4-, 5- and 6-hour exposures to 6.0°C water (42.8°F).
>
> October-November 1972 at Naval Weapons Center, China Lake, California 4- and 6-hour exposures to 4.5°C water (40°F).

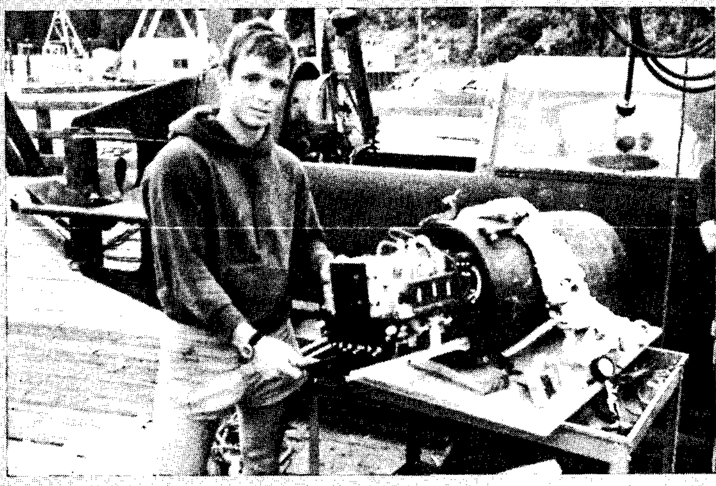
The test series conducted at Naval Weapons Center used a controlled-environment, cold water test facility, and simulated SDV pilot/navigator equipment systems; all others were conducted in open water with operational equipments. All test divers wore tailored wet suits and breathed compressed air with open-circuit SCUBA from bottles carried in the vehicle. The main questions addressed in these test dives were as follows: (1) How does long-duration, cold exposure affect the physiological state of the wet-suited diver; (2) What effect does this physiological state have on his performance; and (3) How do the conditions of exposure affect the rewarming process?

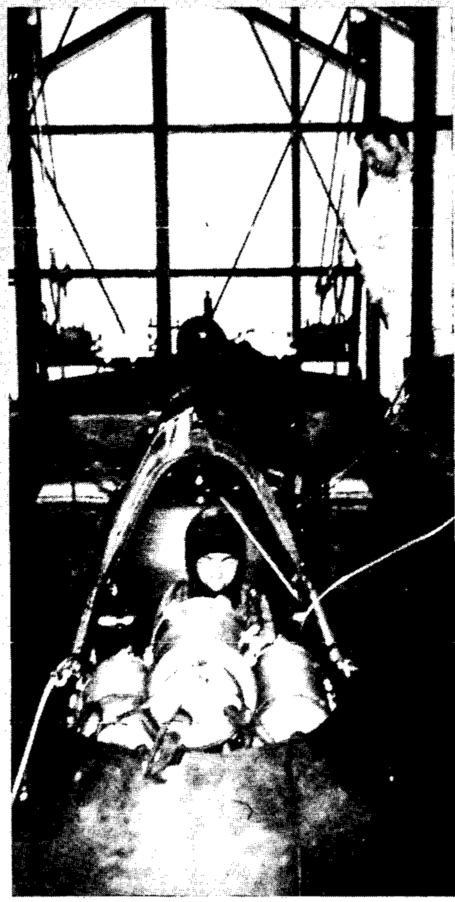
To answer such questions, specialized equipment systems were developed to monitor and record environmental, physiological, and performance variables in the diving situation. Task simulation equipment had also been developed as an initial approximation of an SDV simulator.

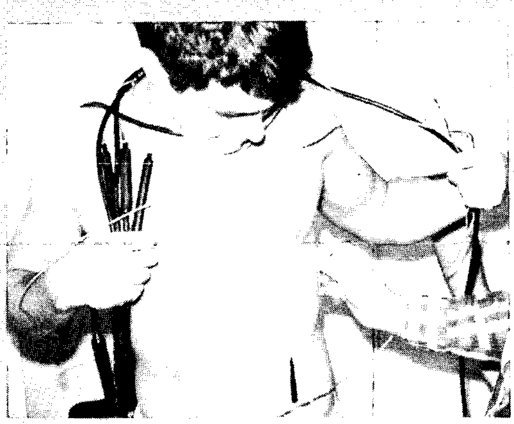
Three separate monitoring and recording systems were developed and given extensive use during the several cold water test series. The first system, the SDV/Swimmer Instrumentation System, is a 13-channel oscillograph recorder and associated signal-processing electronics packaged into a small waterproof container and carried aboard the Mk VII SDV. This system was used to obtain time-correlated records of water temperature, skin and rectal temperature, heart rate, SDV depth, heading, range to a remote transponder, rudder angle, and diving plane angle.

The Acoustic Telemetry System, the second system, is a physiological monitoring device designed to provide continuous, real-time records of SDV crew core temperatures and electrocardiograms. Used principally for safety monitoring, the system included micro-miniature, endoradiosonde "pills" which, when swallowed by a diver, transmit temperature data from within the digestive tract.

For the laboratory test series at Naval Weapons Center, the third system, the Hardware Physiological Monitoring







(Clockwise from top left): Court Taylor (UDT-11) is fitted with electrocardio electrodes for the Hardwire Physiological Monitoring System; the Mark VII SDV Simulator is lowered into 40°F water in the test tank at China Lake, California, for a 6-hour run; Gary Cronin (UDT-13) is shown with the SDV/Swimmer Instrumentation Systems. The participants shown here are all Petty Officers.

System, was developed for continuous monitoring of three skin temperatures, one core temperature, and an electrocardiogram from each of two divers. The temperature values were read directly from four meter consoles, and the electrocardiogram was recorded periodically on an oscillograph.

To move the experiments into a controlled laboratory situation, it was necessary to develop certain task simulation equipment. An initial approximation of an SDV simulator was developed for the controlled environment test series at NWC. A Mk VII Mod 0 SDV hull was transformed into a simulator by the inclusion of three experimental devices. The Depth and Heading Control/Display Simulator has a "joystick" control, and depth and heading displays as in the operational model of the SDV. The displays respond to control stick movements made by the pilot reflecting course and depth changes that are characteristic of an operational Mk VII SDV. The second device included was an Obstacle Avoidance System Display Simulator, a display mounted in the pilot's console that is marked off in azimuth sectors and ranges. Signals of various sizes, shapes, and intensities can be made to appear at selected points on the pilot's display by a remotely operated control console. Once on the pilot's screen, the signal moves down the display face at a rate determined by its range. The signal responds to stick movements so that an avoidance maneuver by the SDV pilot is reflected by the movement of the obstacle signal. To present problem-solving tasks to the SDV navigator, a control console (Doppler Navigation Display Simulator) is used to vary the rate and direction of underwater currents being simulated, and the resultant effects of the "current" on the SDV's track is displayed in real time on the navigator's console. The navigator uses specially prepared underwater plotting boards, writing and measuring materials to construct a vector triangle from the presented information. Measuring aspects of the vector triangle, the navigator can determine current set and drift, SDV speed and course over the ground, and a new heading which compensates for the current.

From these experiments, the Office of Naval Research obtained various results. Over the course of a long-duration, cold water exposure, the SDV crewman's skin surface temperature will fall from 90°F to 70°F, and his deep body temperature will fall from 99°F to

COLD

97°F; his heart rate will be elevated initially, then depressed toward a resting level; and he will lose approximately 4 pounds or 2.4% of his initial body weight.

Deep body temperature will stabilize at a level where the diver's heat production processes (e.g. shivering) balance the loss to the environment; this level is achieved after approximately 2 hours in the water. From the second to the sixth hour, only very small changes in core temperature occur.

Core temperature, however, falls sharply after the diver has been removed from the water and placed in a rewarming situation. The extent of the fall is related to the length of exposure to a given water temperature and to the differences in exposure temperature. For example, following 4-, 5- and 6-hour exposures to water at 43°F, average post-dive falls were 0.2°F, 0.6°F and 0.8°F; the difference between a 6-hour exposure in 60°F vs. 40°F water was 0.4°F vs. 0.9°F. These falls occurred within 10 to 20 minutes of water exit.

The ideal rewarming method is to immerse the diver, wet suit and all, in a hot water bath at approximately 104°F and let him undress gradually. If no hot water tank is available, a good procedure is to quickly remove the diver's cold gear, dry him off, get him into sweat gear and wrap him in a wool blanket. Post-dive fall in core temperature will not be significantly greater in extent, but recovery time will be considerably lengthened relative to the hot bath method.

Through testing and observation several common physiological danger signs were identified. As a diver's core temperature falls below 96°F, signs of impairment may begin to appear in even the most well-conditioned and highly-motivated diver. Symptoms include reports of blurred or double vision, feelings of disassociation with the situation, and intermittent blockages or failures to respond to the task requirements.

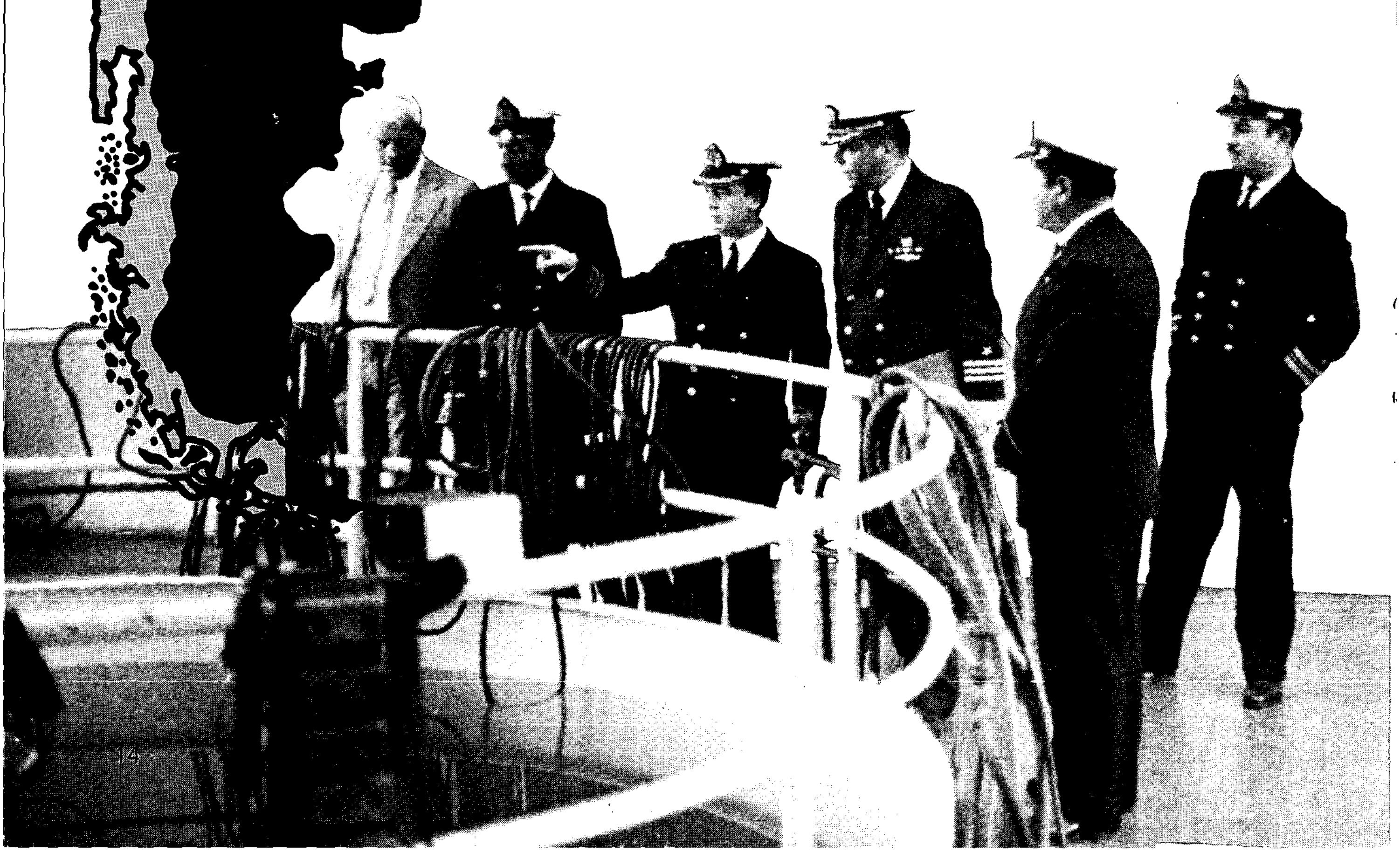
In spite of these physiological stresses, a well-conditioned SDV crew that is highly acclimated to the water, well trained in the tasks to be performed, and highly motivated, will tend to maintain effective levels of performance. There are limits, however, and even the most experienced SDV crewman's performance will be affected by long-term exposure to severe environmental cold stress.

Unless the SDV crewman has been exposed to a cold water pre-conditioning period during his most recent diving experiences, his performance may suffer initially due to the "distraction effect" of a severe cold experience. This distraction effect occurs during the first hour of exposure, after which performance effectiveness does increase somewhat. During the next several hours, however, overall performance gradually deteriorates.

Different kinds of tasks are differentially vulnerable. A perceptual-motor task such as heading and depth control is highly resistant to cold stress; performance during the sixth hour is a close approximation to performance in the first. Vigilance-monitoring tasks are more vulnerable: fewer sonar signals are detected, signal acquisition time lengthens, and more maneuver errors are made in response to detected obstacles. Performance in problem-solving tasks, such as those involved in underwater navigation, also deteriorates with time and severity of exposure.

The combined research findings now provide a representative basis for the establishment of defined performance capability levels. These will give cognizant personnel the means to effectively plan and conduct SDV and other swimmer operations that are more realistic based on the available hydrographic information.

Ship salvage operations are usually created by, and are inherently dangerous because of, the locale or situation in which they occur. In this respect, the South American costal nation of Chile is indeed subject to hazardous salvage tasks. To better deal with this likelihood, the Chilean Navy recently requested the technical assistance and advice of the United States Navy in the planning for a reorganization of the Chilean Navy salvage and rescue services.



In cooperation with Chile's request, the Supervisor of Salvage, Naval Ship Systems Command, appointed a salvage survey team to work in conjunction with a Chilean liaison group in studying the following areas of interest: organization, command and control of salvage and rescue service, and equipment and ship requirements. The U.S. Navy Salvage Survey Team arrived in Santiago, Chile, on June 3, 1973, and, after meeting with VADM J. Merino, Commander-in-Chief, First Naval Zone, CN, met with Chilean Navy salvage representatives, who established the interests and guidelines relative to the proposed survey.

RADM R. Leon, Director of Engineering, CN, described the missions of Chilean salvage service as providing total support to the Chilean Navy in ship salvage during peacetime; direct on-scene support during wartime; salvage service, as available, to civilian shipping interests in Chilean Territorial waters; and providing, as feasible, submarine rescue or escape assistance. RADM Leon emphasized the need for special considerations in the CN Zone III (southernmost Chile) because of the unique strategic and geographic characteristics of that region. The remoteness of this locale from major repair facilities and the many uncharted obstructions suspected to be present in the channels around Punta Arenas and the Straits of Magellan pose a unique and formidable salvage problem. The commercial shipping in the Magellan Strait has increased to about 1000 vessel passages per year. In discussing the general history of Chilean ship salvage experience, CDR Francisco Abrego, Director of Civil Construction, CN, noted that the need for a review of the salvage system was brought to light primarily by a major collision that occured in early 1972 between the CN light cruiser PRAT

and the destroyer COCHRANE, resulting in the near loss of the PRAT. Other inherent problems in Chile's salvage capabilities include the great depths of coastal water, making the possibility of rescue or escape from a bottomed submarine slight. Also, meteorological forecasting is generally poor since Chile's weather originates over the Pacific Ocean and little forecasting is possible. CDR Abrego summarized the Chilean salvage situation as having two distinct facets: a high volume of ocean traffic along a sheer and inaccessible shoreline in the northern region, and intracoastal traffic moving through often narrow channels in shallow water in the southern region. Following these preliminary discussions, the Chilean and United States Survey Team representatives began their comprehensive tour of the CN salvage facilities.

The Chilean Navy salvage system, in coping with the geographical and operational situation, presently includes five salvage stations, located at Valparaiso, Talcahuano, Puerto Montt, Punta Arenas, and Puerto Williams. (Every station but Puerto Montt underwent a Survey Team inspection.) In addition to the ashore salvage stations, there are six CN ships which have some inherent salvage capability, though none has salvage as a primary duty. Construction of a new type of ATF is under way, however, with completion slated for 1974. This new CN ATF is being constructed as a multi-purpose ship with four major missions: towing and salvage, buoy and aids to navigation maintenance, lighthouse replenishment and maintenance, and passenger transport.

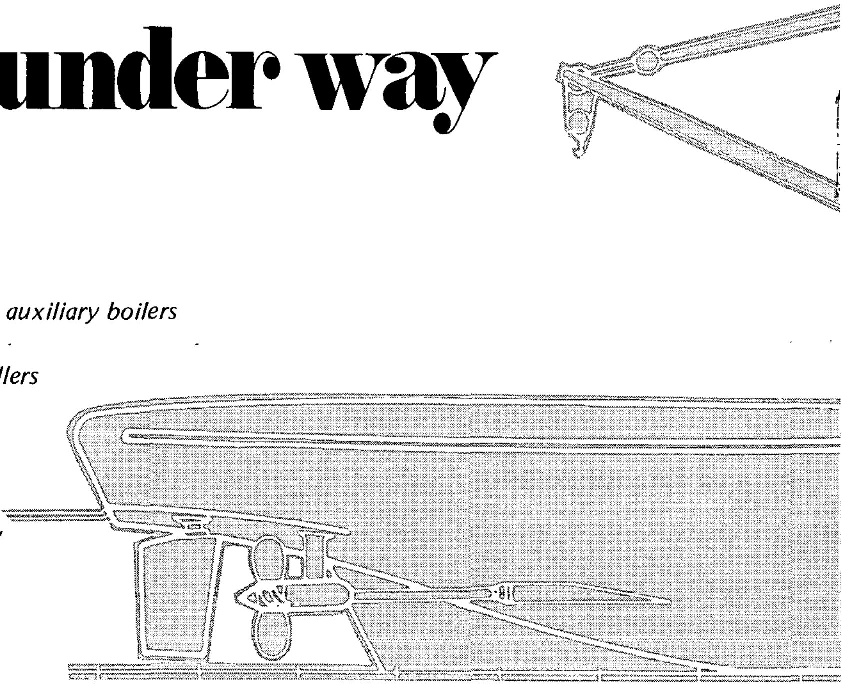
There are three diving/salvage trained officers in the Chilean Navy and approximately 80 qualified deep sea and salvage divers, generally assigned to the ashore salvage stations with three assigned to each salvage ship.

Within the Chilean Navy communications system, which is well equipped and efficiently operated, the "safety of life" network is currently being upgraded and will complete its renovation by the end of 1973. Presently, in the event of a maritime casualty, the Chief of Naval Operations Staff is responsible for directing the appropriate Naval Zone Commander to initiate action with both the ashore and afloat salvage forces in his zone. Engineering and logistics support to these salvage efforts is provided "as requested" from the General Services Department.

CAPT E.B. Mitchell, Supervisor of Salvage, NAVSHIPS, along with RADM Ismael Huerta, Director General of Services, CN, joined the rest of the Salvage Survey Team in meeting with RADM Leon and his staff. A discussion of the U.S. Navy salvage organization was presented by CAPT Mitchell, followed by a joint examination of the Salvage Team findings by the Chilean and U.S. Navy representatives. Recommendations in the areas of organization, personnel, training, and equipment were submitted and discussed, to the mutual benefit of both countries.

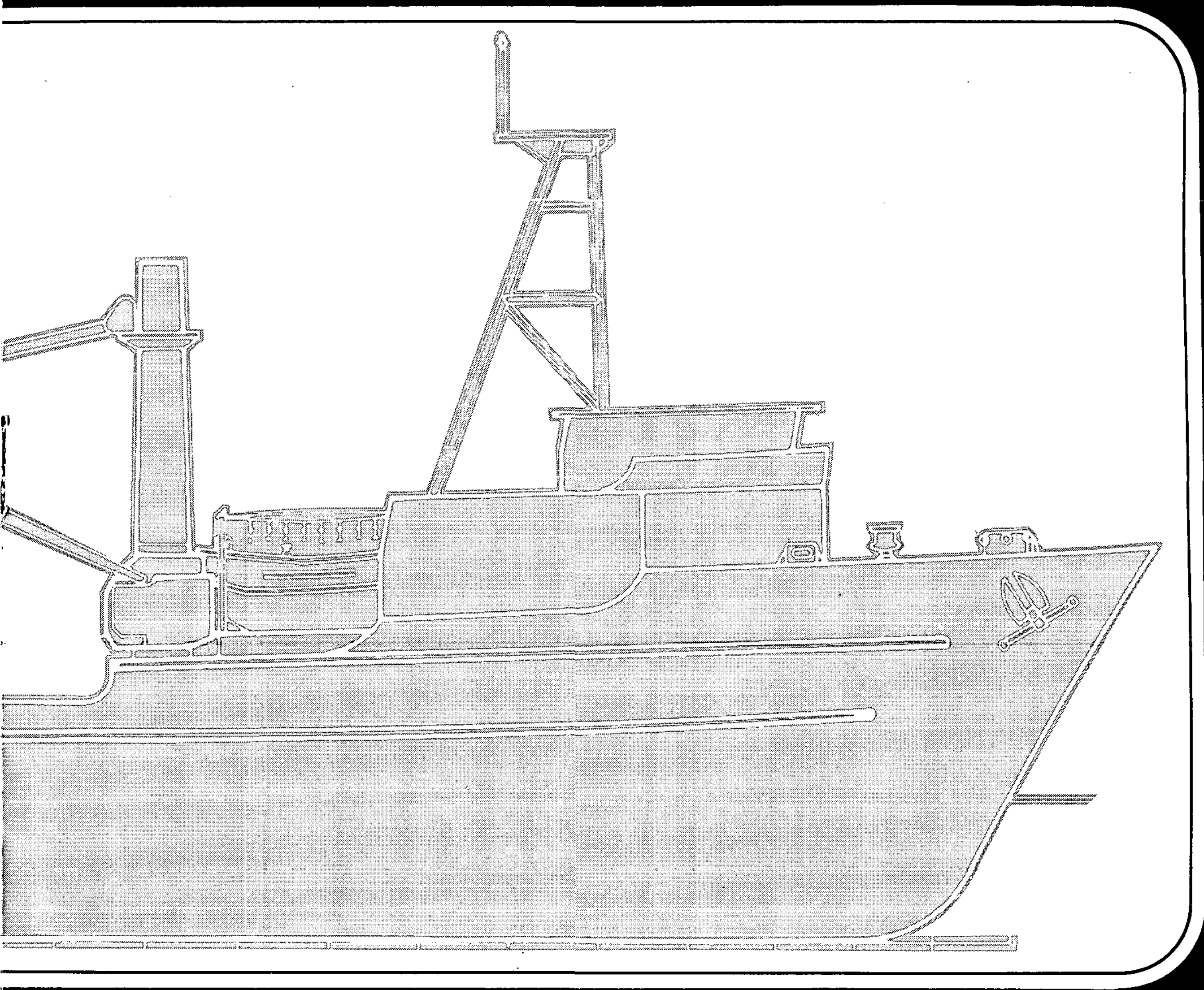
new ATF design under way

4500 horsepower
300 horsepower bow thruster
bridge control for main engines
electric heating system to eliminate auxiliary boilers
twin-screw
controllable, reversible pitch propellers
kort nozzle
firefighting capability
dewatering capability
search lights
living quarters with full habitability
pollution control system including:
- *clean ballast system*
- *sewage holding tank*
- *bilge water holding tank*

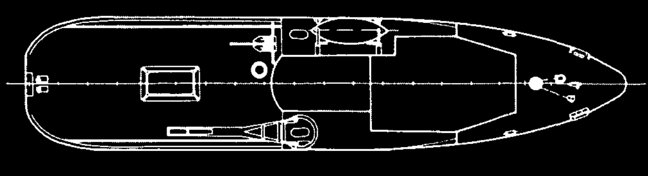


The U.S. Navy Fleet Ocean Tug (ATF) is a familiar sight serving today's Fleet in all parts of the world. Called upon to perform a variety of tasks, the ATFs built at the start of World War II remain virtually unchanged today. Now a new design for these towing and salvage "workhorses" is on the drawing boards at the Naval Ship Engineering Center and is receiving the direct attention of the Chief of Naval Material. The new ATF has progressed to the preliminary design stage only, and the drawings shown here are *conceptual*, not actual. Yet even in these early stages, fundamental improvements are already evident in the design. The duties of the ship require it to be strong and flexible. A logical design model was the offshore supply vessel which has been used extensively in towing, servicing, and handling large anchor gear for offshore oil drilling rigs.

The present-day ATFs are somewhat hampered by crowded deck space, in some cases outmoded equipment, and operating expense. Based on a work platform/towing capability, the ship design itself is streamlined, with salvage, diving, and ocean engineering equipment to be carried on board as necessary. The personnel needed to operate this equipment will also be brought on board as needed and use quarters maintained for that purpose. This cuts down on expense and enhances the flexibility of the vessel. The working, open deck space is greatly increased from the older models and is provided with a lower freeboard and large stern roller for over-the-stern launch and recovery work. The number of permanent crew members is cut approximately in half.



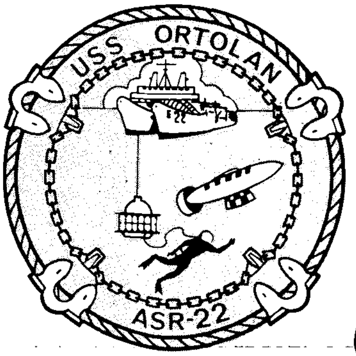
The equipment to be permanently installed on board includes a single-drum wire winch for conventional towing, as well as a traction winch designed for lightweight synthetic lines and capable of handling connectable lines of all sizes. A 9000-pound Stato anchor, developed by the Naval Civil Engineering Laboratory, along with a 2 1/2-inch chain around a high power windlass provides a quick reaction salvage anchor pull. Both are to be standard equipment on the new ATF and will replace two legs of conventional beach gear and the associated equipment. The ship will also have a small SCUBA capability.



The new ATF will be configured to handle the following portable modular systems:

- Deep diving systems with the ship's associated four-point moor
- Hydraulic beach gear pullers with extra sets of beach gear
- Harbor clearance diving and salvage systems
- Oceanographic research systems
- Ocean engineering and deep sea recovery systems

After the contract design stage is completed, construction will begin. The estimated date for introduction of the new ATF to the fleet is Summer, 1977. The final product promises to be a valuable and essential service ship for the Fleet. *Faceplate* will provide news of further developments as they occur.



USS ORTOLAN COMMISSIONED

THE INSIGNE: The four anchors around the border are indicative of the ability of the ship to make a four-point moor in up to 1000 feet of water. The bow-on view of the ship shows the unique catamaran hull while at the same time gives an indication of the size of the ship. The DSRV is shown below the ship to indicate their dual role and compatability. The PTC and diver are shown to depict the capability of the advanced diving system installed.

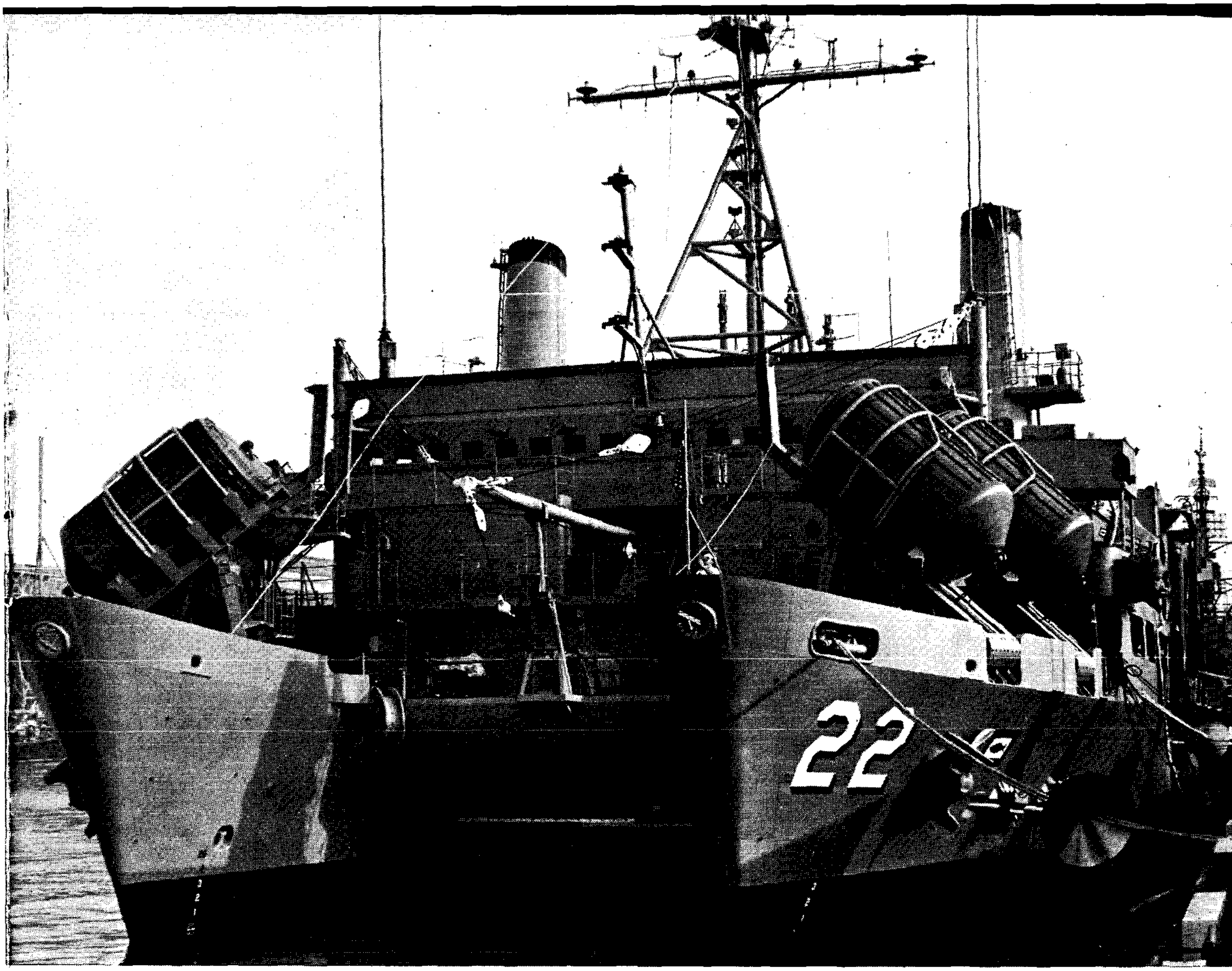
It is said that when Dutch Admiral Van Tromp defeated an English fleet in 1652, he cruised with a broom at his masthead to signify that he had swept his enemies from the sea. When the positions were reversed the following year, the British Admiral hoisted a long streamer from his masthead to represent the lash of a whip indicating that he had whipped his adversary. Thus, the "coach whip" pennant has become the distinctive mark of a ship of war. It is this pennant that USS ORTOLAN (ASR-22), commissioned July 14, 1973, will carry throughout her life. She is the second in a new class of submarine rescue ships designed to rescue personnel from a sunken submarine at greater depths than ever before.

Sponsored by Mrs. Nels C. Johnson, wife of Vice-Admiral Nels C. Johnson, ORTOLAN is the third ship of the fleet to bear the name of a type of European bunting. ORTOLAN commemorates two predecessors: ORTOLAN (ASR-5), veteran of World War II, and ORTOLAN (MHC-34). The first, a minesweeper launched in 1919, was later outfitted as a tug, and then again modified to an ASR. This ship was decommissioned in 1947. The second, an infantry landing craft during World War II, was later extensively modified, commissioned in 1953, and struck from the Navy List in 1960.

ORTOLAN is a catamaran with an overall length of 251 feet, a maximum breadth of 92 feet, and displaces over 4670 tons fully loaded. ORTOLAN has accommodations for a unit commander and his staff, which will permit the ship to function as a flagship.

In addition to the built-in stability of her catamaran configuration and the resultant expansive midship main deck area, ORTOLAN's electro-hydraulic deck handling system is highly sophisticated. This system is used in the launch and recovery of the Deep Submergence Rescue Vehicle (DSRV), the McCann Submarine Rescue Chamber (SRC), and the divers' Personnel Transfer Capsules (PTC).

The Mk 2 Mod 1 Deep Dive System (DDS) will be utilized by ORTOLAN. This DDS consists of two identical deck decompression chambers (DDC's), one per hull, two PTC's and related control 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. The Mk 2 Mod 1 provides ORTOLAN with open sea diving capability to depths in excess of 850 feet for extended durations. Conventional diving capability includes helium/oxygen and air deep sea diving, shallow water diving, and SCUBA.



ORTOLAN's propulsion system is diesel driven through reduction gearing. The propellers are variable pitch units operated through logic circuitry in such a way to provide essentially automatic control. Top speed is in excess of 16 knots.

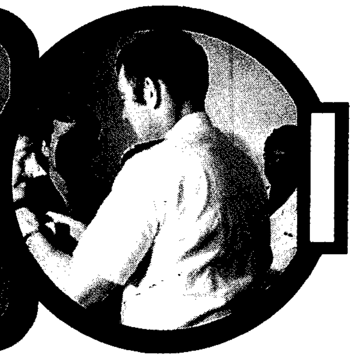
ORTOLAN's prime mission is to locate and rescue personnel entrapped in a distressed submarine on the ocean floor. To aid in this task, ORTOLAN has a sophisticated rescue control center consisting of three-dimensional integrated sonar and computer systems. This center will constantly monitor the exact positions of the DSRV and mother vessel in relation to ORTOLAN and the distressed submarine. It also permits an accurate PTC or SRC deployment to the underwater work sets, maintaining precise station keeping.

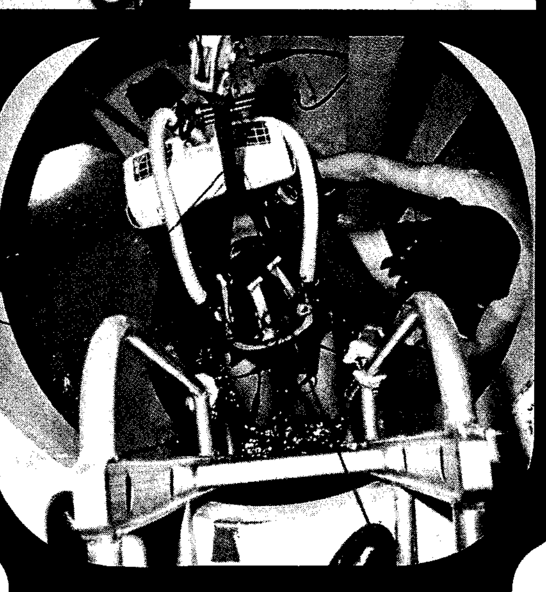
With her deep submergence vessels, ORTOLAN's mission may be expanded to involve deep water inspection, equipment recovery, and salvage operations. Other aspects of her mission may include submarine escort service, open sea diver training, weapon recovery, and limited repair/logistic support to submarines and various surface ships.

LCDR Louis M. Tew is ORTOLAN's new Commanding Officer. LCDR Tew comes to ORTOLAN with a varied background. After entering the Navy, LCDR Tew served in the Armed Guard with service on the SS OLIVER EVANS, SS JUAN N. SEQUIN, SS BENJIMAN HOLT, and SS EDWARD W. BOOK. In 1954, LCDR Tew was assigned to recruit training in Bainbridge, Maryland. As a result of this tour of duty he received the Navy League's John Paul Jones Award for leadership. LCDR Tew served as Commanding Officer, USS PETREL (ASR-14) from 1968 to 1970. After serving as the navigator, first Lieutenant and diving officer for USS HUNLEY (AS-31), LCDR Tew was transferred to Mobile, Alabama, where as prospective Commanding Officer of ORTOLAN, he spent 21 months supervising her construction and fitting out.

1600 ft.

Wet-Chamber Diving Record Set





An outline drawing of the Taylor Diving and Salvage Research Complex houses various scenes of the 1600-foot Project, shown here chronologically, moving clockwise. Pictured lower left in wet pot area is a diver, suited with a Mk 10 Mod 4, descending into the wet chamber for equipment physiological testing. Shown upper left in the dry "igloo" portion is RADM Walter N. Dietzen, U.S. Navy Deep Submergence Program Coordinator, welcoming LT John H. Crothers, MC, USNR, as he exits the entry lock after spending 32 days within the complex. In the annex chamber above, RADM Dietzen congratulates MM1 (DV) Charles D. Wetzel, USN, along with the rest of the participants of the dive; from left to right they are: HMC (DV) Charles P. O'Bryan, MM1 (DV) Charles Wetzel, HM1 (DV) Ronald L. Clinton, CDR Lawrence W. Raymond, MC, RADM Dietzen, LT John Crothers, MC, USNR, and AO1 (DV) Bruce H. Templin. Shown in the entry lock, upper right, is RADM Dietzen awarding the Navy Commendation Medal to Bruce Templin. In presenting the medals to the six participants, RADM Dietzen praised "the exceptional endurance and courage" of the men.

The ability to remain at great depths and work effectively both in a dry chamber atmosphere and in the water using underwater breathing apparatus was established on May 21, 1973, when six U.S. Navy divers surfaced from a successful 32-day chamber dive to the record depth of 1600 feet. Conducted at the Hyperbaric Research Facility, Taylor Diving and Salvage Company, Inc., Belle Chasse, Louisiana, the 1600-foot dive culminated a series of biomedical studies and equipment evaluation dives initiated in October, 1971, by the Director of Ocean Engineering and the Supervisor of Diving, Naval Ship Systems Command, and carried out under the direction of the Navy Experimental Diving Unit, the Naval Medical Research Institute, and the Bureau of Medicine and Surgery.

The six divers in the chamber were CDR Lawrence W. Raymond, MC USN, a diving medical officer from the Naval Medical Research Institute who is also an internist and pulmonary specialist; LT John H. Crothers, MC USNR, a diving research medical officer from the Navy Experimental Diving Unit; HMC (DV) Charles P. O'Bryan, USN, and HM1 (DV) Ronald L. Clinton, USN, two hospital corpsmen specially trained in blood gas analysis and instrumentation; and AO1 (DV) Bruce H. Templin, USN, and MM1 (DV) Charles D. Wetzel, USN, two divers specially trained in the maintenance of underwater breathing apparatus.

Pressurization began on April 20 with an 80 percent helium – 20 percent oxygen mixture to 14 feet gauge with an initial descent rate of 5 feet per minute to the first work/study stop at 400 feet. Compression then proceeded at 40 feet per hour to 1000 feet, 30 feet per hour to 1300 feet, and 20 feet per hour to 1600 feet. Approximately one day was spent at each of the intermediate stops of 400, 1000, and 1300 feet with a total compression time of 6 days. Seven days were spent at the 1600-foot depth.

Throughout the project a team of doctors, medical corpsmen, and electronics specialists maintained a 24-hour watch over the divers. The divers performed rigidly controlled exercises testing Navy equipment inside a specially designed fiberglass tank filled with water, and also conducted various studies of the effects of high pressure on physiological functions. At each intermediate stop and at 1600 feet, testing was performed in the water using a modified Mk 10 Mod 4 UBA. Dry chamber studies of pulmonary mechanics, endocrine hormone levels, serum enzymes, electroencephalography, vestibular function, audiometry, tremor, arterial blood gases, and diver performance were also included in the testing at each depth. In total, approximately 16 different biomedical and equipment evaluation studies were performed during the 32-day dive (see accompanying article).

Decompression commenced on May 3, with an initial ascent at 10 feet per hour for the first 30 feet. The rate of ascent after the first 30 feet was according to depth as follows: 6 feet per hour from 1600 feet to 200 feet, 5 feet per hour from 200 to 100 feet, 4 feet per hour from 100 to 50 feet, and 3 feet per hour from 50 feet to the surface. Extensive biomedical studies continued during decompression. Four of the six divers required treatment for lower limb, pain-only bends during the last 106 feet.

The primary purpose of the 1600-foot dive was not to set a new depth limit; dives to 1640, 1706, and 2001 feet have already been conducted in France with reasonble safety, though these dives did not involve divers entering any water. Instead, the Navy's goal was "to conduct a safe dive to 1600 feet and perform underwater work, provoking no abnormalities of physiologic function and to collect, record, and analyze biomedical and equipment data important to deep operational diving." To achieve maximum safety, the breathing medium, equipment, exercise levels, measurement methods and monitoring devices used were those already tested in the previous dive series. Also, all the participating divers and investigators were veterans of previous saturation dive studies from the surface to 1000 feet. Standard U.S. Navy compression rates and decompression schedules were used except that the rates of compression were slowed at depths deeper than 1000 feet.

A project with the broad scope of the 1600-foot dive obviously demands a great deal of work and cooperation by all involved. Not only the six divers conducting the experiment but also the efforts of those working outside the chamber share in the success of the project. CDR William Spaur, MC USN, Senior Medical Officer for the Navy Experimental Diving Unit, Washington, D.C., was the Project Officer for the experiment. Assisting CDR Spaur as the Assistant Project Officer was LCDR William R. Braithwaite, MC USNR. LCDR Thomas E. Berghage, MSC USNR, LT Donald R. Chandler, MSC USN, and LTJG Michael T. Hadbavny, CEC USNR, all served as Diving Officers for the Operation. The medical investigators were LT Michael M. Knott, MC USNR, and LT Edward D. Thalmann, MC USNR. EMCS (DV) Robert K. Merriman, USN, acted as the Master Diver.

Additional assistance was provided by Project Engineer, Mr. Thomas W. Cetta, Equipment Specialist, Mr. Thomas

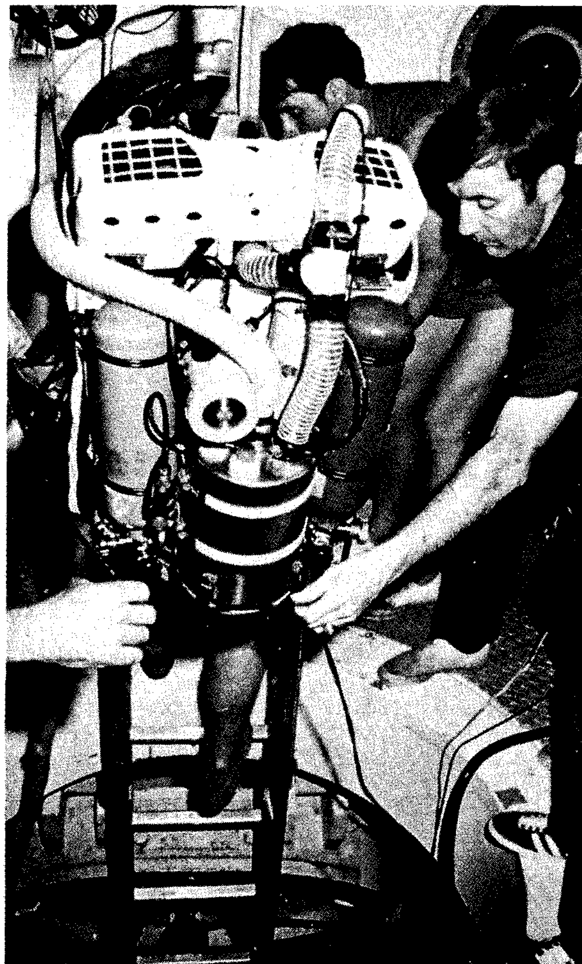
W. James, and Watch Supervisors HMCS (DV) Troy W. Brown, USN, HTC (DV) Joseph E. Langdon, USN, and EMC (DV) Michael D. Travers, USN. Also included in the support personnel from NEDU were QMC (DV) Percy O. McClean, BM1 (DV) Ronald I. Ault, BM1 (DV) Richard Radecki, BM1 Michael D. Reynolds, HM1 (DV) George S. Goehring, PH1 (DV) James R. Huckins, EM2 (DV) Richard A. Yesney, and HM3 Gary Lindgren.

The diving complex at Taylor Diving and Salvage Co. was used because it is the largest operational hyperbaric chamber in the U.S. and was designed to withstand pressures in excess of 2200 feet. Coordinating the use of the facilites at Belle Chasse was Mr. Ken Wallace, Senior Vice President of Taylor, in conjunction with CDR James J. Coleman, Supervisor of Diving and Officer in Charge of the NEDU, and LCDR Edson Whitaker, the Unit's Executive Officer.

Medical Testing Conducted Throughout Dive...

The medical and equipment analyses of the 1600-foot dive at Taylor Diving & Salvage Co. are in the initial stages of being fully analyzed and computed. The 16 different basic biomedical and equipment evaluation studies conducted during the 32-day dive culminate a former series of 1000-foot saturation dives at the NEDU which included studies of the cardio-respiratory system, central nervous system, and equipment physiological testing.

Pulmonary mechanical functions of the divers were studied prior to and throughout the dive, with participants both standing in the dry chamber and immersed in water to the neck. Ventilatory flow rates were found to diminish primarily between the surface and 1000 feet, showing little further change at 1600 feet. Although objective lung function studies did not indicate any significant decline at depths below 1000 feet, the divers subjectively felt short of breath with mild exertion in the chamber from 1300 to 1600 feet. Two subjects had



pressure-volume measurements with esophageal balloons; preliminary analysis of this study indicated no change in the elastic properties of the lungs during the dives.

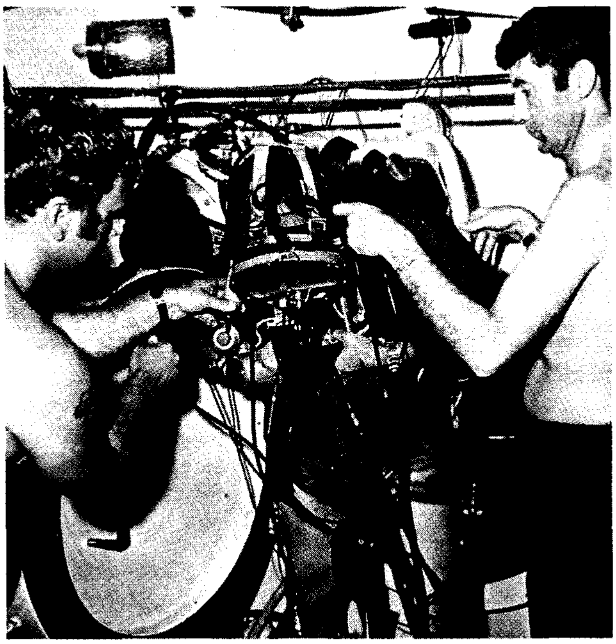
Balance rail studies, testing postural equilibrium, showed that there was a remarkable loss in balancing ability with increasing depth. Tests with eyes open revealed 45 to 50 percent loss at 1600 feet while tests with eyes closed showed over 75 percent loss. However, balance test times did improve significantly during the 7 days at 1600 feet and remained better during decompression that at similar compression depths.

An index finger intention tremor device was one method of evaluating variations in motor function abilities.

Tremor became significantly increased in all divers with compression deeper than 1000 feet, but did diminish somewhat during the stay at 1600 feet and was reduced to normal baseline levels during decompression from 1600 to 1000 feet. To complete the study a computer frequency/power spectrum analysis will be performed to fully assess the significant differences in individual characteristics of tremor.

During most saturation dives in the past, external ear canal infections have caused severe pain and disability if the divers were immersed during the course of the projects. However, because of a rigidly followed preventive program, developed by LT Edward D. Thalman, MC USNR, no external inflammation developed in either dive. The divers filled each ear canal with a solution of *acetic acid 2 percent in aluminum acetate* twice daily for 5 minutes in addition to repeating the procedure immediately following any immersion of the head. All ear tests proved normal.

The testing done on the vestibular system, including positional, tracking, and caloric tests for nystagmus (reflex eye movements) yielded normal results before, during, and after the dive.



Diver performance was measured by the System for the Investigation of Diver Behavior at Depth (SINDBAD), through which sixteen selected tests of human perceptual, motor, and cognitive ability were given. Preliminary analysis of the data gathered from these studies shows that deep saturation exposures may adversely affect human spatial orientation, speed of response, and time sharing ability, though perceptual motor skills such as multi-limb coordination, finger dexterity, and manual dexterity do not appear to have deteriorated noticeably. Cognitive functions such as visualization, logic, problem solving, and short term memory also failed to indicate a significant decline.

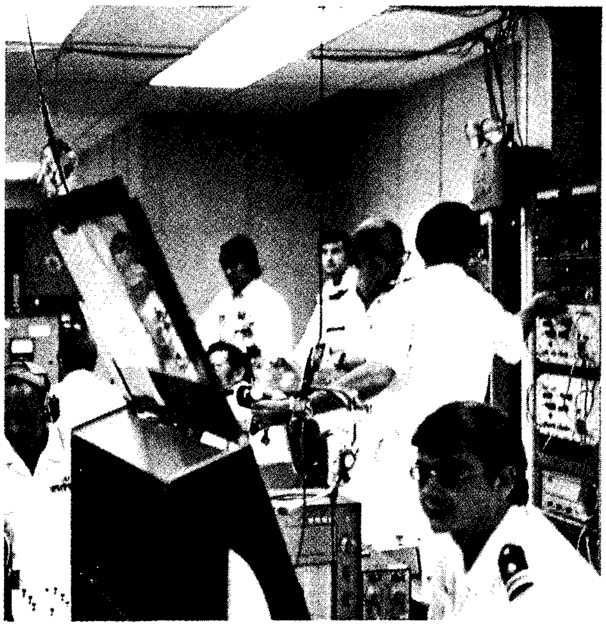
To evaluate psychological well-being, the divers were asked to complete a subjective mood check list daily. The results of this questionaire indicate, as expected, that anxiety and hostility increased during compression and stayed slightly above the surface baseline until approximately the eighth day of decompression. The divers also indicated that their energy level was somewhat lower throughout the dive. Their emotional state of well-being seemed to parallel their degree of success or failure with various experimental projects. The fluctuations of mood seemed to be more marked than on the surface, probably due to the lack of alternative emotional outlets.

The simultaneous measurement of physiological functions and equipment function at depth on immersed working divers was the major purpose of the extensive equipment physiological testing of the Mk 10 Mod 4, self-contained, closed circuit, mixed gas underwater breathing apparatus during the 1600-foot dive. Prepared by percutaneous cannulation (insertion of a small tube) of the radial artery and placement of electrocardiogram leads on the chest, the diver was then dressed in instrumented diving gear and lowered into a specially constructed fiberglass tank filled with water to a depth of 6 feet. Once in the water, the diver mounted a bicycle ergometer and delivered the cannulated wrist through a water-tight sleeve in the forward side wall of the tank, where it was connected to a syringe, stopcock sampling system, and a blood pressure transducer.

Each subject underwent a 54-minute test sequence, consisting of 10 minutes of rest followed by four 6-minute work periods of increasing severity separated by 5-minute rest periods. As the diver pedaled against various resistive loads, continuous measurements were taken of arterial blood pressure, electrocardiogram, inspired oxygen, inspired carbon dioxide, respiratory rate, and breathing apparatus mask pressure. Arterial blood for oxygen partial pressure, carbon dioxide partial pressure, pH, serum pyruvate and serum lactate was also drawn from the radial artery cannula in the exposed wrist; the blood samples were taken during rest and in the last minute of each work period.

Diver performance with light work loads went smoothly at 1600 feet using a modified Mk 10 Mod 4. With increasing work loads, however, respiratory distress was experienced, described as an inability "to breath in enough gas." No significant retention of carbon dioxide was discovered during the initial analyses, a finding that differs from previous studies at 1000 feet and shallower depths where work difficulty was accompanied by CO_2 retention.

Immersed exercise studies were also performed using a modified Navy MK I Bandmask, revealing that divers were able to complete light to moderate work periods at 1600 feet satisfactorily with this equipment, though the gas consumption makes its use impractical.

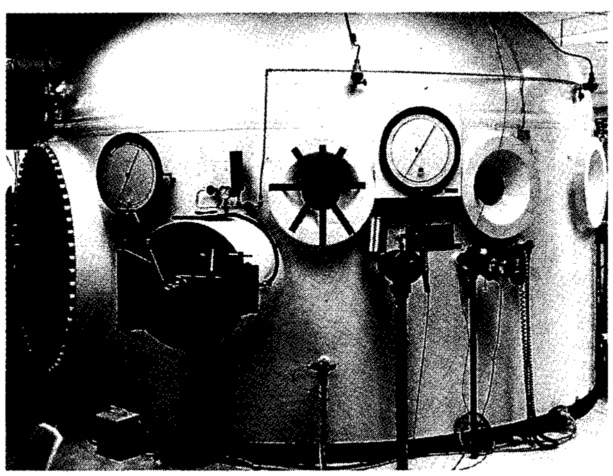


Controlling the atmosphere within the chamber also involved several studies. Continuous gas sampling revealed an even distribution of gases in the chamber complex. The partial pressure of oxygen was maintained at 0.30 to 0.35 atmospheres throughout the dive, with the concentration of carbon dioxide not exceeding 0.005 atmospheres. The chamber temperature ranged from 86°F when shallow to 90°F at 1600 feet, though the divers still occasionally felt chilled because of body-heat loss caused by the 99 percent helium atmosphere. Preliminary calculations and observations indicate that the unclad subjects' apparent comfort and normal skin temperatures were achieved at the expense of an increased oxygen consumption. Wearing sweatsuit-type clothing alleviated the tendency toward decreasing body temperature.

The highly pressurized atmosphere produced various other effects, such as a feeling of density when moving about, shortness of breath when exercising, and compression pains in the shoulders ("dry joints").

Communications with "topside" were clearer and more dependable during the 1600-foot project than in most of the previous dives. Two A. R. L. Helium Speech Converters, type 023, from the United Kingdom were used both in the preceeding 1000-foot dive series and in the 1600-foot project. The deepest that this equipment has been used prior to this dive was in a 1500-foot experiment conducted by the United Kingdom. Constructed to provide two separate communication systems to each of the three portions of the chamber complex, the converters allowed unscrambled speech capability for two research procedures simultaneously. The clarity of the communications from the diver to tender, tender to winch operator, and diver to topside personnel was instrumental in performing the diving procedures safely. The intelligibility obtained with the Speech Converters was similar to that of microphone-headset surface communication; speakers were recognized to the extent that regional accents were identifiable.

Under the leadership of CDR Spaur, the series of dives was a success both from the standpoint of evaluating U.S. Navy diving equipment and in establishing a system of the physiologic monitoring of divers. The system is capable of detecting when a particular diving apparatus fails to meet the physiologic demands of the diver before a hazardous situation develops. Complete analysis of the data obtained from the studies and experiments will significantly advance the knowledge of man's capability to perform work safely from the surface to 1600 feet and at even greater depths.



MK VI MOD I SCUBA APPROVED

Lt Thomas Hawkins
Office of the Supervisor of Diving

Several inquiries have been received at the Experimental Diving Unit and NAVSHIPS OOC concerning the status of the procurement of the Mk VI Mod 1 SCUBA. Basically, the Mk VI Mod 1 is a semi-closed-circuit, recirculating mixed gas underwater breathing system. This type of apparatus employs partial rebreathing and carbon dioxide absorption to improve the efficiency of gas supply utilization. A continuous, steady flow of new gas into the rebreathing system provides a continuous "purge" to prevent excessive deviations of bag gas concentration from the desired level. Inflow of mixed gas into the breathing system, therefore, must always be in sufficient excess of the oxygen demand rate to keep oxygen concentration from falling below the normal level of approximately 21 percent. In comparison to the Mk VI Mod 0 SCUBA, the Mod 1 has the following modifications:

1. *CO_2 Scrubber Assembly.* The inner shell of the scrubber assembly is readily removable to accept a disposable canister. The canister cover has been modified to a three-point securing arrangement. Also, the inhalation/exhalation hoses have been semi-permanently affixed to the breathing bags.

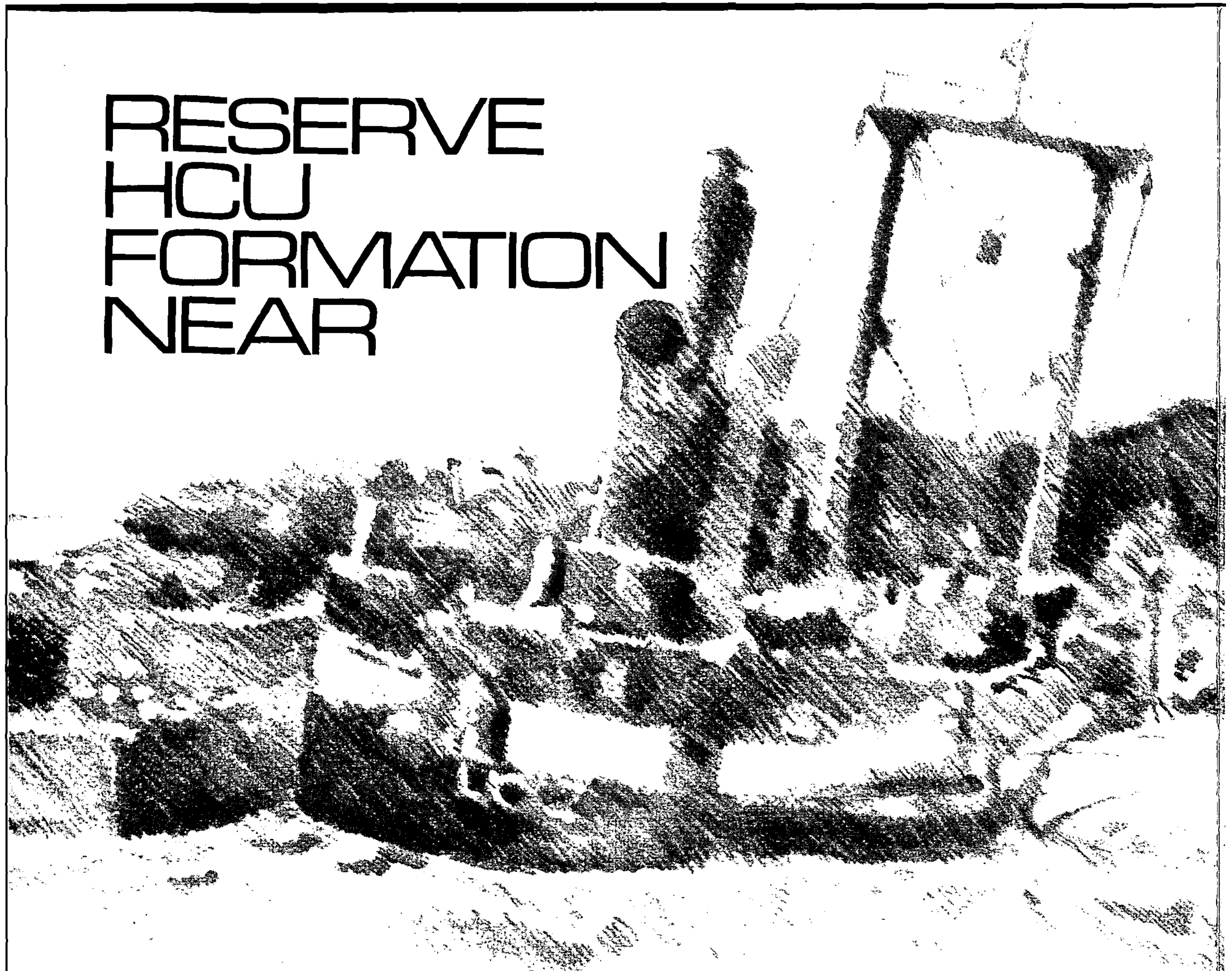
2. *Regulator.* The regulator provides a constant mass flow from surface to a depth of 180 feet by adjusting the regulator pressure, accomplished by means of a hand wheel. The option of installing a 0 to 3000 psi gauge, which indicates cylinder pressure, is provided by a special fitting on the regulator, but normally is not used during diving operations.

3. *Control Block and D.P. (Differential Pressure) Gauge.* The control block and the D.P. gauge are combined into a single assembly mounted on the lower chest of the diver. A by-pass can be activated by pressing a button built into the assembly. The D.P. gauge has an adjustable cover that permits selection of a specific segment of the dial range for each flow.

4. *Breathing Bags.* The vest breathing bags are made of molded neoprene with integral fittings that fit into pockets in the vest. The dimensions of the Mk VI Mod 1 SCUBA are 29-1/2 inches by 16 inches by 6 inches. Its weight in air is 59 pounds, 65.5 pounds when filled with CO_2 absorbent. The apparatus is neutrally buoyant in water, becoming positively buoyant when the bags inflate with gas.

The Mk VI Mod 1 SCUBA was officially service approved by the Chief of Naval Operations on January 23, 1973. Future procurement plans for this SCUBA model will be contingent upon the availability of procurement funding in FY 75.

RESERVE HCU FORMATION NEAR

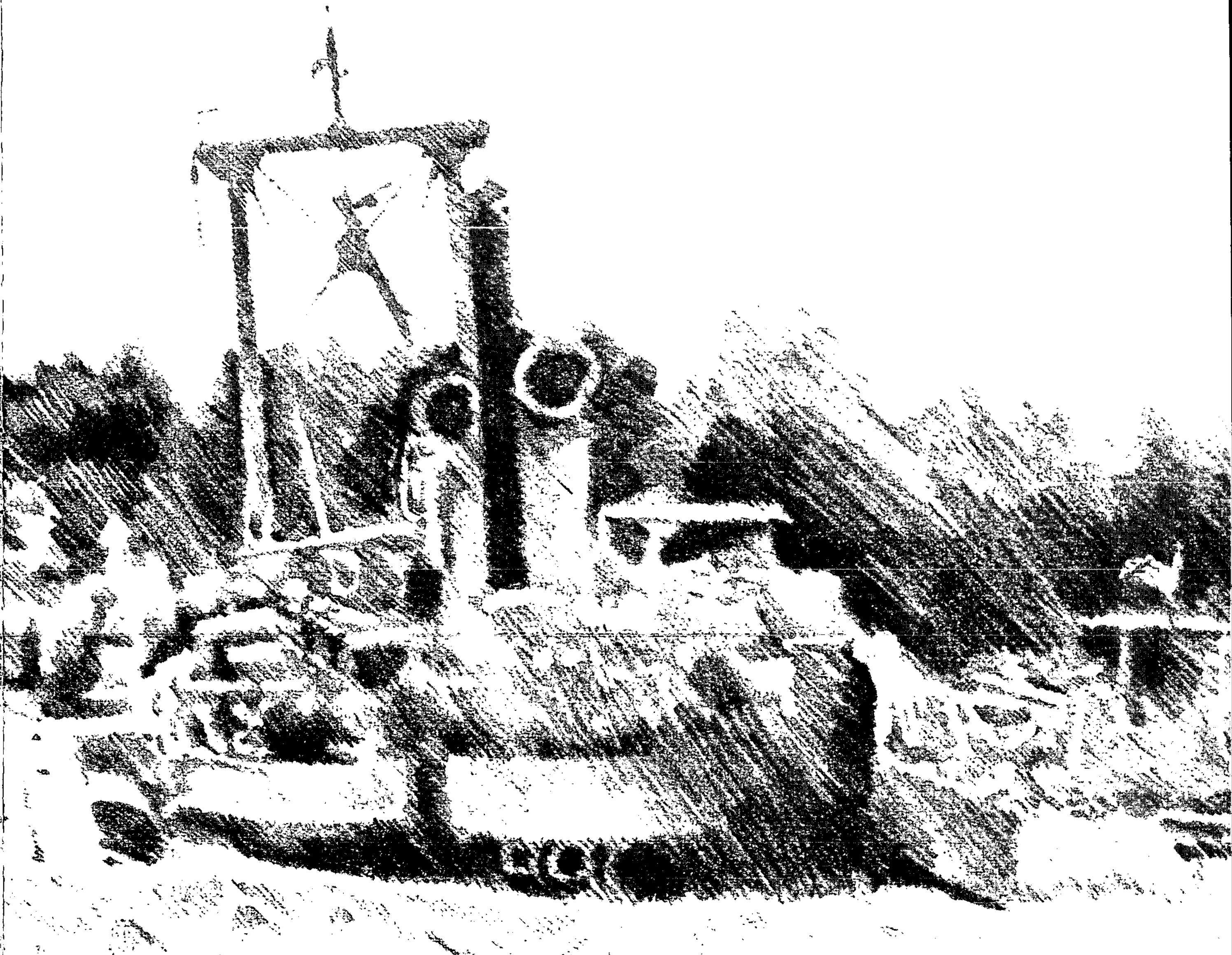


The need for Reserve Harbor Clearance Units (RHCU s) has recently been justified and recommended by two separate studies, resulting in the official approval of both funds and personnel recommendations for FY 74.

In addition to an independent study by a private contractor, the Reserve Analysis and Study Project (RASP) of BUPERS, conducted a survey of the Naval Reserve Program and, as of July 1, 1973, has advocated the formation of RHCU's as an integral component in plans for establishing an action-oriented, meaningful Naval reserve program.

The Reserve Harbor Clearance concept, sought by NAVSHIPS for several years, serves two basic functions: providing a qualified, immediate response capability for both civilian and military national emergencies; and offering a program through which divers and salvors can retain and make use of the diving and salvage skills acquired during military service. The immediate response ability of the RHCU Program implements the DOD "Total Force" Concept, in that while maintaining potential stature at minimum cost, it does not neglect the need for a complete, trained force that is available on a moment's notice. In addition to diving pay and requalifying programs for both officers and enlisted men, RHCU's will offer an action-oriented training plan and state-of-the-art diving equipment, which are expected to attract and retain Navy diving and salvage personnel who have completed their active obligation. The years of education and experience put into military service by a Navy diver is estimated to be 2 years for SCUBA and 2nd Class qualifications, 4 years for a Diving Officer, 5 years for a 1st Class Diver, and 12 years for a Master Diver. The proposed Reserve Harbor Clearance Units will offer a program through which these trained professionals can utilize the skills acquired during this time for national and personal benefit.

The RHCU organization features a "team" type field division with a structure of 10 teams, five reporting to



each parent Harbor Clearance Unit, HCU-1 at Pearl Harbor, Hawaii, and HCU-2 at Little Creek, Virginia. Each team consists of one or two officers and 14 enlisted men, all of whom are qualified divers.

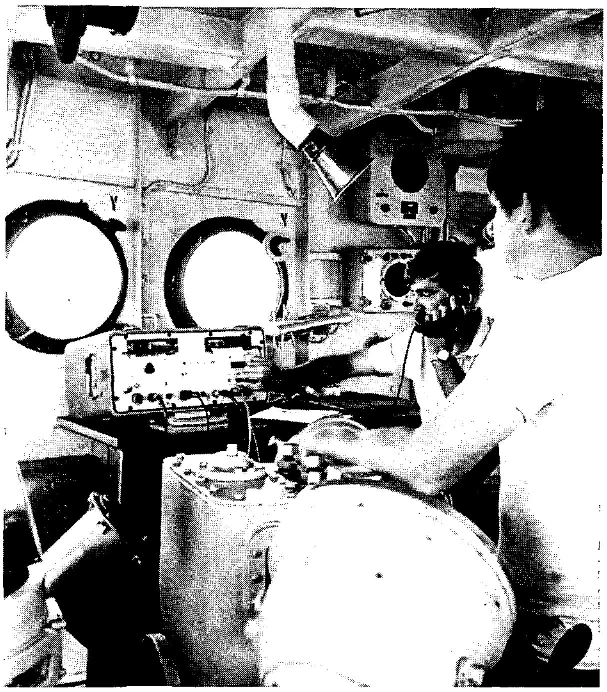
RADM D.H. Jackson, USN, noted the important role diving and salvage has played in his extensive WESTPAC experience and added his support to the proposed Reserve Harbor Clearance Unit Program by stating in part that *as contingency forces, the salvage personnel usually suffer the greatest peacetime military cutbacks. When a wartime situation arises, however, the salvage forces are one of the first recognized needs.* He went on to say that *salvage is a vital profession, both in its harbor clearance capability and the ability of retrieving valuable restorable resources for future wartime or civilian operations. The inherent difficulties of calling and training a salvage force in an emergency could be eased and the response more rapid if the necessary expertise could be retained within an available core of experts.*

The Reserve Harbor Clearance Units are designed to provide this salvage expertise when needed in large mobilization situations, by not only cataloging the necessary talent but also making it available without a time-consuming search or extensive training.

Currently, a follow-up questionnaire is being sent to all divers who responded to the 1971 "DIVERS WANTED" ad in the *Naval Reservist* magazine. This latest survey will allow NAVSHIPS OOC to recommend optimum geographical placement of team locations, implementing the Program's comprehensive instructions being written by BUPERS. Optimistic projections estimate that Naval Reserve Headquarters action will be produced by November, 1973, with the program underway by early 1974.

All *Faceplate* readers who would like to affiliate with such a unit, and who have not already signed up, should contact LCDR Joe Whelan, NAVSHIPS 09M4, Washington, D.C. 20362.

F-4 RECOVERED OFF CAROLINA COAST



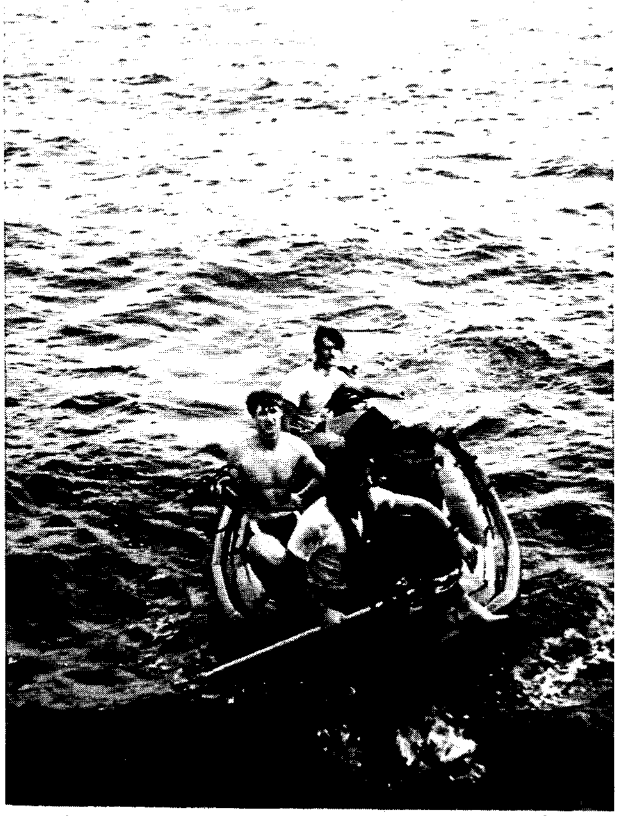
PAIUTE's helmsmen quickly became proficient in steering by the digital range read-outs displayed by the precision navigation receiver.

A USAF RF-4C from Shaw Air Force Base, South Carolina, crashed in 60 feet of water off Myrtle Beach, S.C., on June 7, 1973. While both crew members ejected and were rescued by SAR Helicopter, Air Force safety investigators asked the Supervisor of Salvage to coordinate a Navy effort to locate and salvage the wreckage.

Mr. James W. Walker, SUPSALV Operations Specialist, was designated as the on-scene representative. After advising COMSERVLANT of the potential salvage requirement, he set about the initial task of locating the wreckage. Together with Mr. Gene Daly of Ocean Search Inc., SUPSALV's search and recovery contractor, Mr. Walker proceeded to Shaw AFB to interview cognizant personnel, including the pilot, for information from which to establish a datum point.

A 60-foot charter fishing boat was selected as the best available search platform. Next, key equipment, especially side-scan sonar and precision navigation, were called in and installed in the boat. Final preparations, including the establishment of shore-based navigation stations, were completed and search operations began on June 10.

Fred Anderson, Civilian Sonar Operator, reviews the sonar traces.



(Above) Divers returning to PAIUTE after confirming location of downed F-4; (Below) diver attaches wire strap to wreckage.

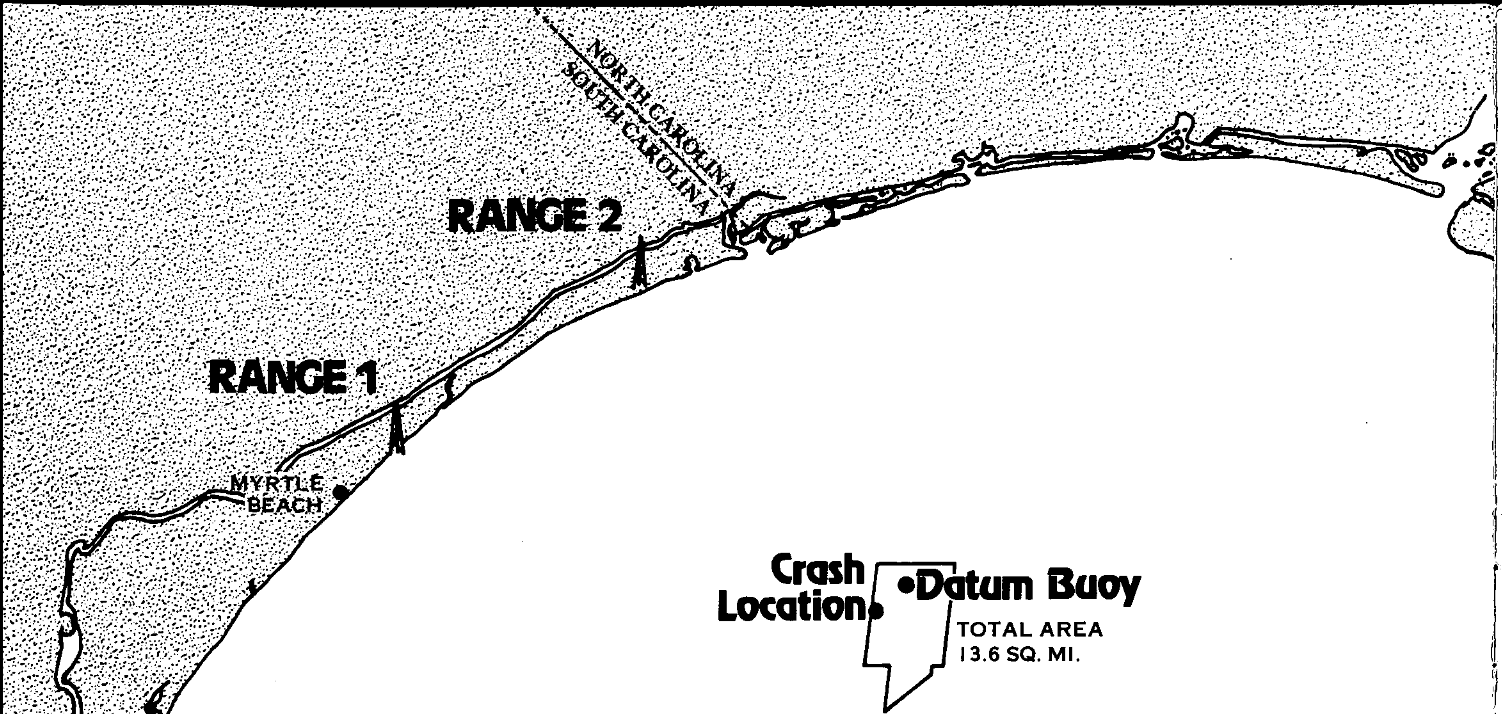
COL Dearborn, USAF, and LCDR Allen, Commanding Officer of PAIUTE, examine F-4 wreckage on deck.

After 4 days of exploration over 7 square miles of search area, the results were negative. Navigation signals proved inconsistent at the outer edges of the search area in higher sea states because of the instability and lack of height of the search platform. These difficulties prompted a request that fleet salvage forces not only undertake the salvage effort but also provide a stable platform for the search effort.

On June 13, LCDR Glenn R. Allen, Commanding Officer, USS PAIUTE (ATF-139), was alerted of this additional requirement. The following morning, PAIUTE departed Jacksonville, Florida, and arrived on station two days later. Search equipment and personnel, including MAJ Pete Haerle, USAF, were transferred to PAIUTE. The officers and men were briefed of the search efforts to date and plans were formulated for expanding the search. By late morning PAIUTE had reinstituted the search for the F-4 wreckage.

The first day of PAIUTE's search provided a bit of excitement for the crew when one significant contact was sighted. The contact was subsequently buoyed and investigated by PAIUTE's divers; but, unfortunately, it turned out to be an unusual outcrop of rock covered by extensive sea life. No evidence of the wreckage was sighted.

No other contacts were sighted during the next several days, despite the fact that 5.5 square miles to the west and southwest of the suspected crash site were searched



The Air Force F-4 crashed 20 miles off Myrtle Beach, South Carolina. Shown here is a chart of the search area. The two range stations on shore provided a digital indication of the range of the shipboard antenna, allowing the search to be conducted along parallel, overlapping search tracks. The top buoy marks the datum point; the bottom buoy shows the actual wreckage location.

extensively. PAIUTE continued her efforts, searching another 3.6 miles to the north, northeast, and northwest. The search became more critical on June 18, when COL James W. Dearborn, USAF, President of the Accident Investigation Board, visited PAIUTE and reemphasized the very high priority that had been placed on the recovery, because of other recent, unexplained losses of USAF F-4 aircraft. COL Dearborn requested the sonar search continue until at least June 22. As a result, PAIUTE initiated a 24-hour, vice 18-hour, operation as the search was expanded to an area due west of that previously covered.

A solid sonar contact appeared on the recorder the same day. Several additional sonar runs were made to confirm the configuration and refine the position. The contact was buoyed and PAIUTE anchored to await dawn and a confirmation dive.

Diving began at daybreak and small pieces of wreckage identified as part of the aircraft were located. With an underwater visibility of 30 feet, divers reported that the wreckage was located in 55 feet of water on a hard sand bottom. Additional dives revealed the wreckage consisted of six major pieces, two wings, the tail and fuselage assemblies, and the two engines.

As the recovery operations began, Air Force experts were on hand to indicate the desired order in which the pieces were to be recovered. The largest pieces were rigged with wire straps by divers dressed in SCUBA gear. Then, the pieces were lifted to the fantail with the after boom. To ensure maximum use of diver bottom-time cargo nets were laid out on the bottom and, after rigging larger wreckage with wire straps, divers loaded smaller pieces into the nets. The tail section, engines, wings, and all landing gear assemblies were retrieved. All parts of the aircraft were recovered except for assorted pieces of "skin," which were not required by the Air Force. The operation was concluded with approximately 95 percent of the wreckage salvaged.

This operation, the first independent aircraft salvage undertaken by an ATF in recent years, is an example of how combined Navy and civilian expertise can be effectively coordinated to bring about an extremely successful search and salvage operation.

The officers and crew of PAIUTE, Mr. Walker, Mr. Daly, Mr. Fred Anderson of Hydrosurveys Inc., and Mr. Buddy Achee of Change & Associates, all contributed their particular talents to the operation, working long hours to ensure its success. *Faceplate* joins Commander, Service Squadron EIGHT, in the following commendation: "The rapid response and professional manner in which the recent salvage of the F-4 aircraft off Myrtle Beach was completed by PAIUTE, coupled with the can-do spirit of all hands, is indicative of a well-trained, highly motivated crew. Congratulations on a job well done."

The Old Master Says...

Reprinted by permission from Spring 1973 issue of *Fathom, Surface Ship and Submarine Safety Review.*
Written by HTCS (DV) C.R. Flynn of the Naval Safety Center.

Two divers hailed the boat to pick them up after they had been down for only 11 minutes. When the boat arrived, however, the divers had resubmerged. Within a few minutes, the diving supervisor became concerned and sent down standby divers.

After a brief search, the divers were located at a depth of approximately 50 feet and brought to the surface. Artificial respiration was given on the diving boat for over an hour, but to no avail. They were both dead.

The two divers had been evaluating swimmer homing equipment. One diver had been wearing an open circuit SCUBA; the other had been breathing recirculated oxygen from a closed circuit SCUBA.

An autopsy disclosed that an alcohol level more than 0.05 percent g/ml was found in each diver's blood indicating that the divers had either been drinking that morning or were still intoxicated from the night before. (In most states, drivers with a blood alcohol level of 0.10 to 0.15 percent g/ml are considered intoxicated.)

Divers under the influence of alcohol are highly susceptible to oxygen toxicity and anoxia, which can cause nausea and vomiting. Should this occur, it can prove fatal. Medical evidence indicated that this was probably what happened to the two divers.

Another incident points out additional hazards of drinking and diving. Six divers, at a depth of 148 feet, were within several seconds of their scheduled maximum 30-minute bottom time when they surfaced.

Shortly after diving operations were secured, one diver developed symptoms of decompression sickness. Treatment had begun when three more divers developed similar symptoms. One diver, reporting no illness, was granted liberty.

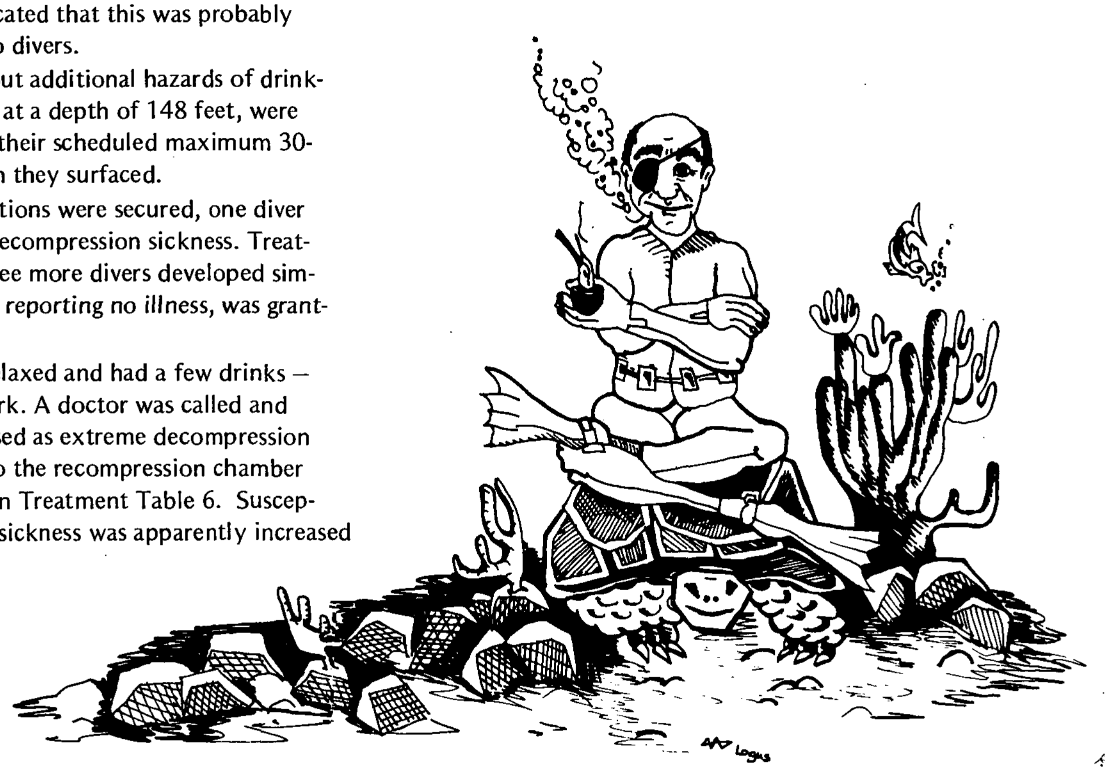
After arriving home, he relaxed and had a few drinks – then suddenly went berserk. A doctor was called and the condition was diagnosed as extreme decompression sickness. He was rushed to the recompression chamber and treated successfully on Treatment Table 6. Susceptibility to decompression sickness was apparently increased by alcohol.

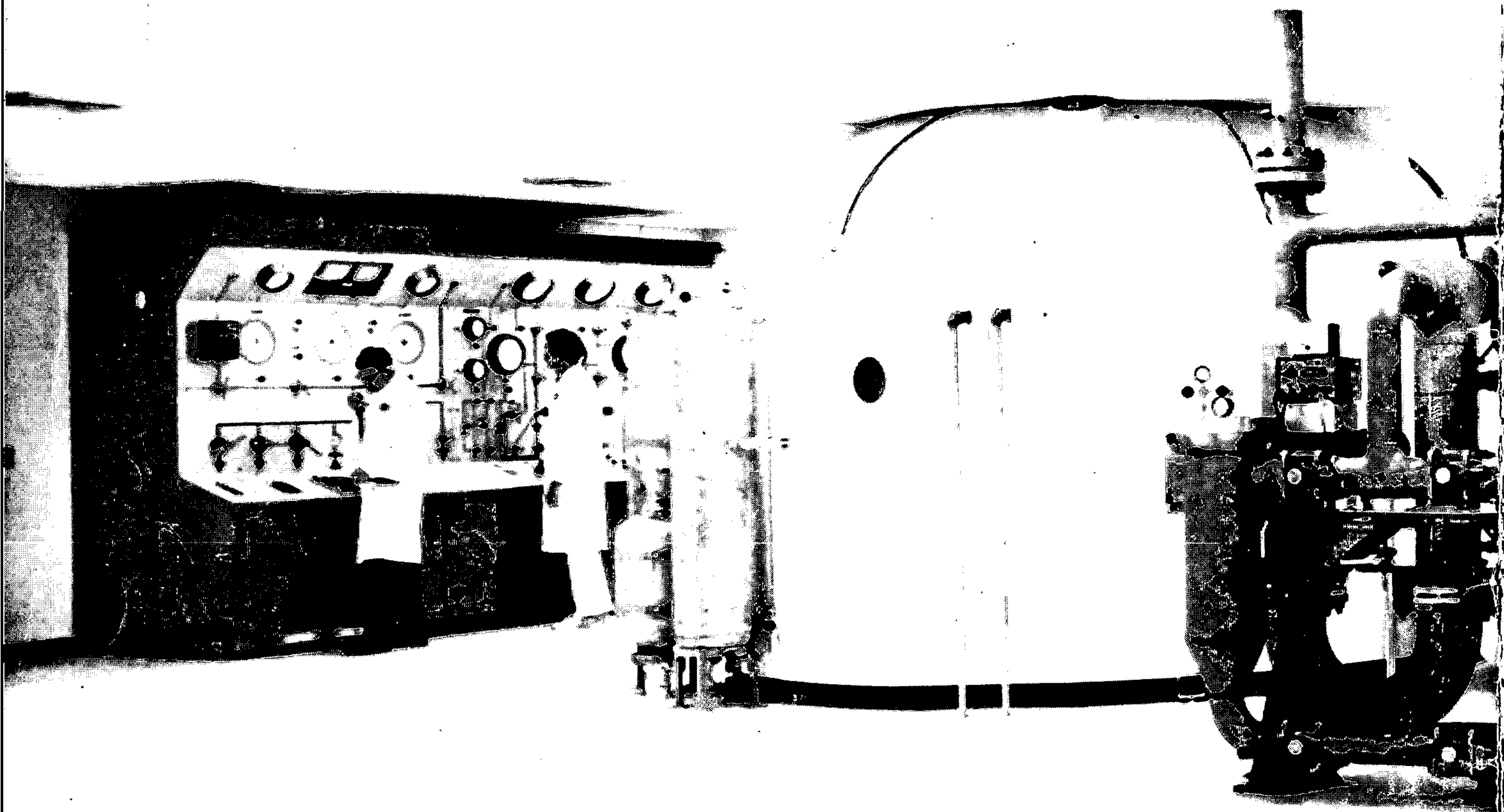
Alcohol is a drug and, as such, can alter both mental and physical homeostasis. Alcohol's effects in combination with pressure, cold, and the physical demands of diving should be well understood by all divers. The obvious include changes in coordination, judgment, balance, orientation, and physical strength. Any one change can create a hazardous situation.

Alcohol causes dilation of skin capillaries which increases circulation to the body's surface. This creates a rise in skin temperature and a decrease in the body's internal temperature. Even though the drinking diver may actually *feel* warmer, he will lose body heat at a much faster rate and will suffer from exposure sooner than the teetotaller.

The *U.S. Navy Diving Manual,* Article 2.6.1 (B), states: "Never dive a man if he has consumed excessive alcohol in the preceding 24 hours." Article 1.4.2 (4 & 4B) states that the diving supervisor with the aid of the medical officer and corpsman must prohibit a diver from diving when he has any degree of alcohol intoxication or any evidence of intoxication's after effects.

Read and heed, divers. *Drinking and diving don't mix!*





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