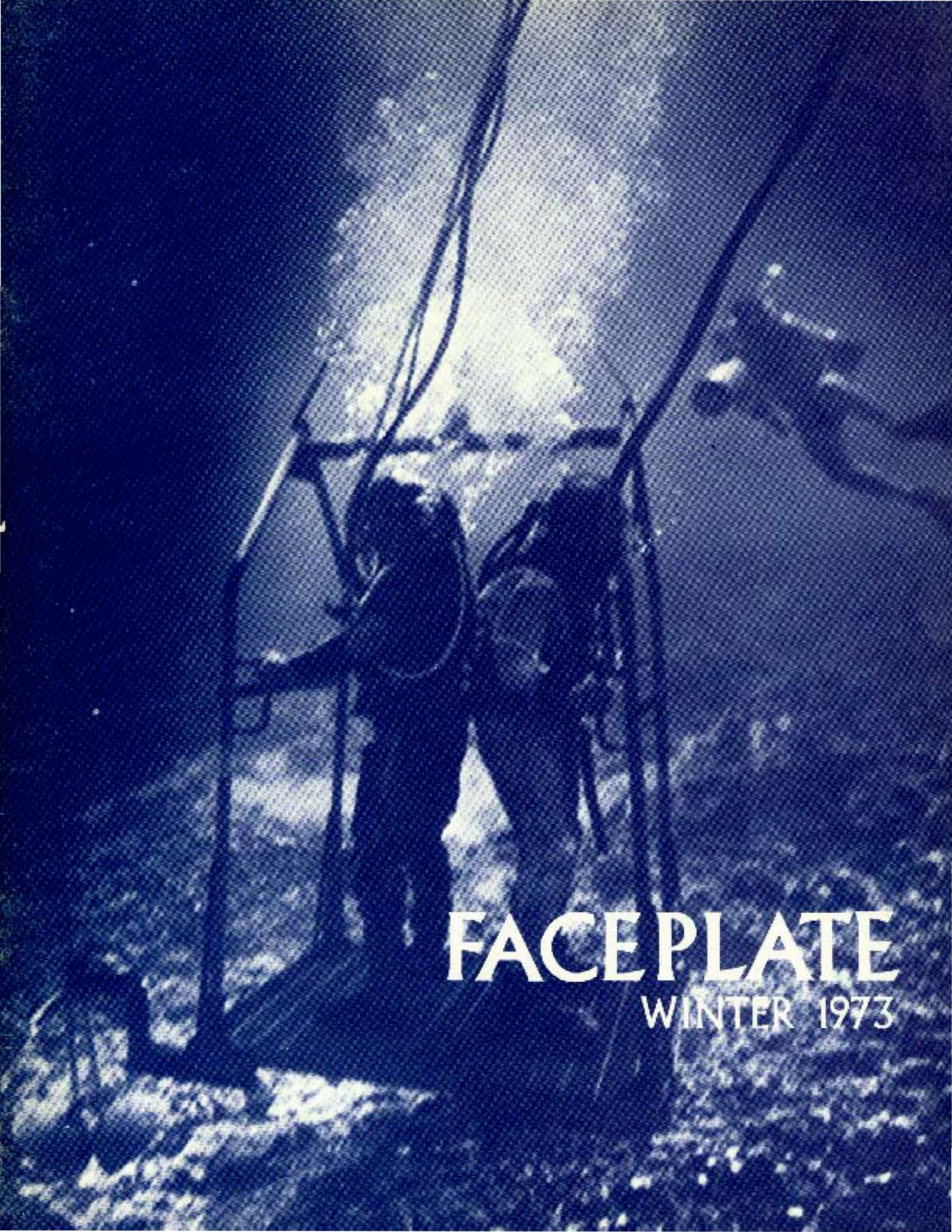
FACEPLATE
WINTER 1973

Diving operations during search and recovery mission in southeast Asia. See page 19.

FACEPLATE

VOLUME 4 NO. 4

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The cover shows the Mk 12 (left) and the Mk 5 hardhat systems during evaluational testing. See page 16.

Photo credits: Bow lift(pages 8-9, back cover) and NEDU change of command(page 24), PH1(DV) J. R. Huckins, NEDU.

SOUNDINGS

RELOCATION OF ESSM ASSETS

The transfer of materials and equipment has been completed or initiated at several Emergency Ship Salvage Material (ESSM) Bases/Pools. This is a result of the DOD Shore Establishment Realignment (SER) action, which has closed several Naval Shipyard facilities. Emergency salvage assets have been relocated from the ESSM Pool at Bayonne, New Jersey, to Cheatham Annex, Norfolk, Virginia. Transfer of ESSM Base equipment has also been completed from NAVSHIPYD Hunters Point, California, to NAVSHIPYD Mare Island, California. ESSM Base materials at NAVSHIPYD Boston are currently being moved to Rosyth, Scotland, with approximately 75 percent of the equipment relocation completed to date. The submarine salvage assets at Boston have been partially shipped to NAVSHIPYD Charleston, South Carolina, with the remaining items to be shipped shortly.

EXCHANGE OFFICER RETURNS TO U.S. DUTY

LCDR John Naquin, USN, assumed duties at OPNAV as Head of the Diving, Salvage, and Submersible Systems Branch on October 15, 1973. LCDR Naquin relieved LCDR James McDole, who has retired. Prior to coming to OPNAV, LCDR Naquin served in the USN/RN Exchange Officer Project as Assistant Supervisor of Diving and Officer in Charge of the Saturation Diving Team, Admiralty Experimental Diving Unit, HMS VERNON, Portsmouth, England. LCDR Naquin was relieved there by LCDR Carl Seeler. Previous duties include Assistant Officer in Charge, NEDU; Officer in Charge, Harbor Clearance Unit ONE; and with Ship Repair Facility, Guam. *Faceplate* welcomes LCDR Naquin back to the United States and to his new post.

A CHANGE OF "BRIT" AT NEDU

LCDR Bryan N. Barrett, RN, has relieved LCDR Patrick Dowland as the Royal Navy Exchange Officer at the Navy Experimental Diving Unit, Washington, D.C. As were his two predecessors, LCDR Dowland and LCDR James L.A. Majendie, LCDR Barrett is a Mine Countermeasures and Clearance Diving Specialist. His duty stations in the RN have included working in research and development of underwater weapons at the Admiralty Underwater Weapons Establishment, Portland, England; and serving as the MCD Officer on the staff at the Naval Academy, Dartmouth, England. Prior to becoming Project Officer, NEDU, in July, 1973, LCDR Barrett was stationed at the Admiralty Experimental Diving Unit, Portsmouth, England. Before ending his tour at NEDU, he hopes to qualify as an Anglo/American interpreter.

Faceplate extends to LCDR Barrett a hearty welcome to his new post and to the United States and hopes his tour at NEDU is an enjoyable one.

THE WORKING DIVER – 1974

The Working Diver Symposium will again be held at Battelle Memorial Institute, Columbus Laboratories, Columbus, Ohio, on March 5–6, 1974. As in the past, the emphasis of the symposium will be on the practical application of recent advances in diving technology. If you are involved in work that you feel is of interest to the diving community and wish to present a paper, send an abstract immediately to the Program Committee. Further information regarding the Symposium may also be obtained by contacting the Program Committee, c/o Cliff Marr, Program Coordinator, Battelle, Columbus Laboratories, 505 King Avenue, Columbus, Ohio, 43201.

DIVERS' GAS PURITY SYMPOSIUM – 1973

The second symposium dealing with Divers' Gas Purity, sponsored by the Supervisor of Diving, U.S.N., was held at the Battelle Memorial Institute, Columbus, Ohio, on November 27-28, 1973. The Symposium covered such topics as diving gases, sampling, monitoring, and the cleaning of breathing-gas systems. Also presented were divers' air-filter testing and an experimental investigation of recompression chamber ventilation. Additional information regarding this Symposium may be obtained by contacting the Program Committe, c/o Peter S. Riegel, Battelle Memorial Institute, 505 King Avenue, Columbus, Ohio, 43201. Copies of individual reports and papers presented can be obtained by writing the Defense Documentation Center (DDC), Cameron Station, Alexandria, Virginia, 22314.

NEDU REPORTS:

Experimental Diving Unit Report 14-72. *Pulmonary Mechanical Functions in Man Breathing Dense Gas Mixtures at Great Depths.* **W. Brandon Wright, R. Peterson, C. J. Lambertsen**

Abstract: The high density of breathing gas at great depths may impair a diver's performance by mechanical overload of his respiratory system. In order to describe this phenomenon and to search for a respiratory limit to deep diving we measured pulmonary mechanical functions at 19 different breathing gas densities ranging from 0.4 to 25 gms/L. (equivalent to helium at sea level to helium at 150 Ata). The results of these studies showed that function at rest is not severely affected by the great density increase. Respiratory limits to forced or exercising ventilation do appear, but useful function persists even to the maximum density studied and can be predicted to persist to even much greater densities.

Experimental Diving Unit Report 17-72. *KMB-8 Bandmask Evaluation, Final Report.* **LT Stephen D. Reimers, LTjg Bernard S. Lebenson**

Abstract: The Kirby-Morgan KMB-8 Bandmask was tested and evaluated for comfort and its ability to supply a diver's respiratory demand. Tests were run at various work rates and depths from 10 fsw to 650 fsw. The mask was found to meet the respiratory pressure requirements of MIL-R-24169A. It was found to be satisfactory for fleet use provided certain recommended minor changes in the mask design and bail-out bottle configuration are carried out. Recommended depth limits for air and HeO_2 diving are also established.

Experimental Diving Unit Report 18-72. *Report on the 100-Foot Saturation Dive Series for Complex System Check and Personnel Training on #5 Chamber Complex.* **R. D. Brewer, MM1 (DV)**

Abstract: On 5, 9 and 13 June, a series of saturation dives was made to depths of 100 feet. Their purpose was for the training of personnel and equipment checkout prior to commencing a deep dive program reaching depths to 1000 feet.

With the exception of the equipment not installed, and the refrigerator system, the complex and its associated equipment performed satisfactorily meeting design specifications. The experience gained through the training of the personnel involved was such that the deep dive program can commence according to schedule.

Experimental Diving Unit Report 19-72. *1000-Foot Unmanned Certification Dive in #5 Chamber Complex.* **R. D. Brewer, MM1 (DV)**

Abstract: An unmanned dive was made in #5 Chamber Complex at the Navy Experimental Diving Unit on 29 June 1972. The dive's purpose was to demonstrate the operation for the purpose of certification before commencing a manned deep dive program reaching depths of up to 1000 feet sea water.

With the exception of the leaking exhaust fitting, and the hot water shower fitting, the complex met all performance requirements satisfactorily. Based on this test, the complex demonstrated that it is capable of supporting life at 1000 feet seawater after correcting the leaks.

Experimental Diving Unit Report 20-72. *The Use of Standard Navy Classification Test Scores for the Selection of Diver First Class Candidates.* **LCDR Thomas E. Berghage**

Abstract: Training records at the Naval School of Diving and Salvage for the years 1965–1970 were surveyed. Four hundred and sixty-four complete records for diver first class students were found. These records were used to evaluate existing, readily available aptitude tests as predictors of success in diver training. Scores on the four subtests (GCT-General Classification test, MECH-Mechanical test, ARI-Arithmetic test, and CLER-Clerical test) of the standard navy enlisted classification battery along with age were evaluated statistically. Results suggest that the present ARI-MECH combination selection score of 105 is not the best predictor for success in the diver first class training program. Results also indicate that even the best combination of scores on the Navy's standard classification test will only account for about 15 percent of the variance in trainee performance.

Experimental Diving Unit Report 21-72. *1000-Foot Unmanned Certification Dive in #6 Chamber Complex.* **R. D. Brewer, MM1 (DV)**

Abstract: An unmanned dive was made in #6 chamber complex at the Navy Experimental Diving Unit on 7 August 1972. The dive's purpose was to demonstrate the operation for the purpose of certification before commencing a manned deep dive program reaching depths to 1000 feet seawater.

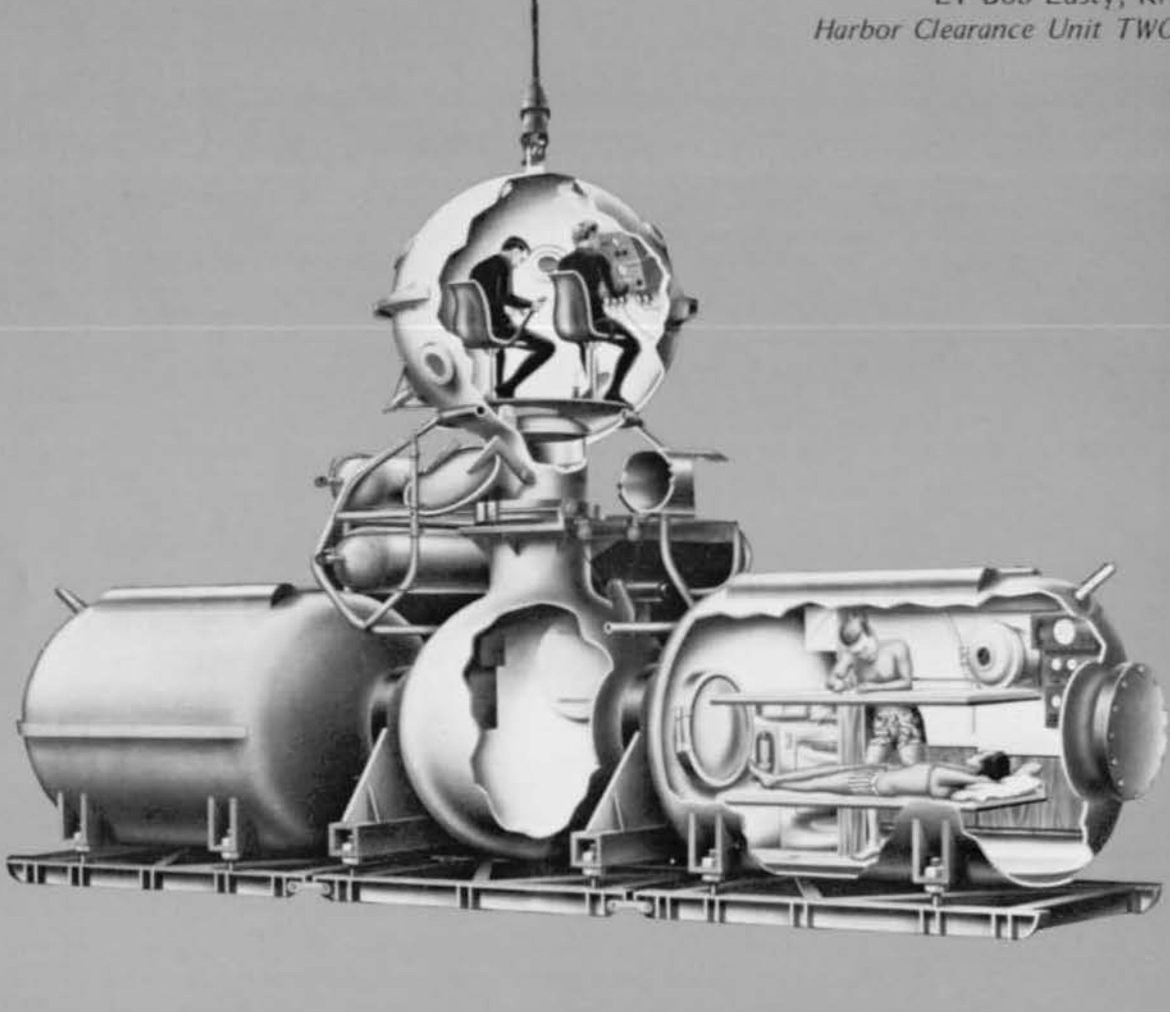
With the exception of the problem of foulage in the drain valves, and the two false alarms in the fire suppression system, the complex met all performance requirements satisfactorily. Based on this test, the complex demonstrated that it is capable of supporting life at 1000 feet seawater, after removal of foulage in the drain valves.

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

ON YOUR MARK ...

MK 1 DDS/YDT-16 PREPARES FOR ACTION

LT Bob Lusty, RN
Harbor Clearance Unit TWO



The Mk 1 Deep Dive System (DDS) is on the move again.

Currently aboard the YDT-16 at Little Creek, Virginia, the Mk 1 DDS has been experiencing a fairly inactive period because of problems with the handling equipment for the Personnel Transfer Capsule (PTC). After investigating numerous alternatives, a Norfolk Naval Shipyard design for a split topping lift system, employing such components as tugger booms and winches, was decided upon and is presently being installed. July 9, 1973, marked the beginning of a restricted availability (RAV) period, with a scheduled completion date of November 1, 1973. The primary component being replaced is the articulated Jerad crane, formerly used in handling the bell through the center well of the parent craft. The new system features a boom-type arm attached to a dual post structure (see top right photo). The advantage in this handling rig is that it will swing the PTC over the side of the YDT-16 instead of through a well in the center of the barge deck. Using the well, there was the danger of jarring the communication/gas supply cables against the well walls whenever the barge moved. In addition to the main arm, there are also two side booms near the deck edge, which

prevent the transfer capsule from swinging during launch and recovery.

The Mk 1 DDS is a sophisticated combination of modular units functioning to enable divers to perform useful work safely at depths to 850 feet. The basic components include two deck decompression chambers (DDC), each capable of providing all life-support requirements. These two chambers, housed beneath the barge deck, are separated by an interconnecting entrance lock (EL). The PTC is mated onto this entrance lock following the completion of a dive (see artist conception).

Declared operational in 1969, the Mk 1 DDS was the first manned deep dive system designed and built specifically for the United States Navy. The first duty assigned to the Mk 1 was aboard the USNS GEAR, operating out of Port Hueneme, California, where it underwent an extensive evaluation and testing period. The YFNB 43 (now the YDT-16) was the next home for the Mk 1. Located at that time in New Orleans, Louisiana, the YFNB 43 was specially configured to handle the Mk 1 System, resulting in one of the most sophisticated diving system/platform combinations existing. This unique combination then went to Harbor Clearance Unit TWO (HCU-2), Norfolk, Virginia, where it now serves as a vital component of SERVLANT forces.

How does the Mk 1 DDS/YDT-16 fit into the command and control operations of the Fleet?

The Officer-in-Charge of the Mk 1 DDS/YDT-16 is directly responsible to the Commanding Officer, HCU-2, for the daily management of the craft, team, and diving system. Operational command and control is exercised by COMSERVLANT through Service Squadron EIGHT. Valuable support in the area of resources and "know-how" is provided by the Supervisor of Diving, NAVSHIPS. Within this command structure, the Mk I DDS, with its parent craft, can be employed for three broad tasks: deep operational salvage and recovery, open sea equipment Operation Evaluation and experiments, and personnel training.

The present goal for the Mk 1 System is to extend its capabilities from a safe working depth of 850 feet to 1000 feet. Through far-sighted planning in the early design stages of this Mod, the costs involved will be comparatively low. An extensive program established to achieve the 1000-foot capability is currently scheduled for completion during spring/summer, 1974.

The Mk 1 personnel have worked diligently on the System's maintenance and preparation for expanded depth capabilities, and are confidently waiting for completion of the refurbishment to get the Mk 1 DDS/YDT-16 back into full swing.

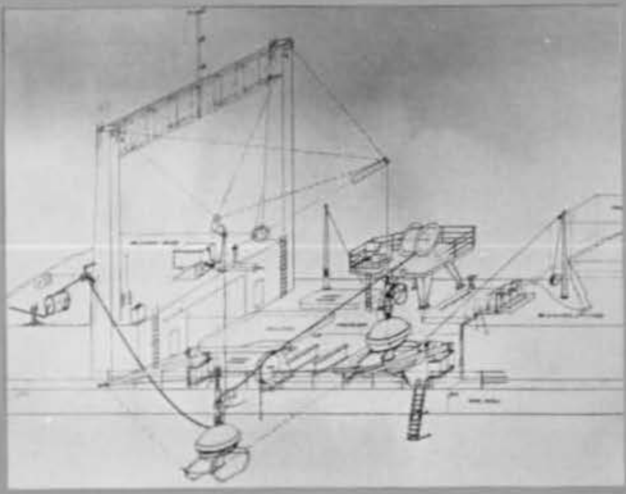


Diagram illustrates new PTC handling system. Located at left is the dual-post structure, from which the main boom arm can swing over side of deck. Two auxiliary booms are shown assisting the PTC overboard. Located on center of deck, the main support cable, which includes gas and communication lines, locks into capsule. Hot water cable for chamber heating is shown extending from left of diagram.

OPPORTUNE Executes Bow Lift

Mr. William A. Walker
Potomac Research, Inc.

The Norfolk-based fleet salvage ship USS OPPORTUNE (ARS-41) returned recently from a rather unusual but highly successful mission in the New York City area. OPPORTUNE removed a sunken 42-ton harbor tug from the Coney Island Channel, employing the effective but seldom used single-ship bow-lift technique. Prior to initiating the clearance operations, the ARS-41 traveled up the Hudson River to Yonkers, New York, to participate as a representative of the U.S. Navy salvage forces in local Veterans Day festivities. In carrying out her New York assignment, OPPORTUNE performed a valuable interservice support mission by clearing a navigable channel for the Army Corps of Engineers. Perhaps more importantly, though, the typically enthusiastic and highly motivated Navy salvors projected to the civilian public a healthy Navy image, displaying several practical benefits of an active peacetime Navy.

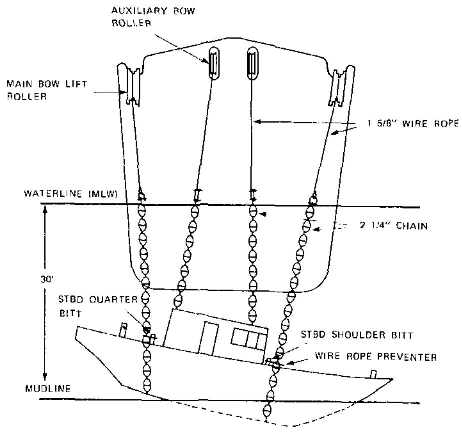
In Yonkers, OPPORTUNE salvors joined Navy recruiters in the Veterans Day Parade and accompanying ceremonies. OPPORTUNE divers later demonstrated diving equipment and techniques on the ship's fantail to an enthusiastic audience on the pier.(See photo at right.) The standard ship's tours were also well received.

Early October 23, following the successful port visit, OPPORTUNE got under way from Yonkers for the salvage site off Coney Island. Navy assistance had been requested by the New York District Office of the Army Corps of Engineers to survey and remove the small commercial tug H.W. LONG from the edge of the Coney Island Channel. The Corps of Engineers was conducting dredging operations in the Channel. Service Squadron EIGHT Headquarters in Norfolk responded by dispatching a diving team from Harbor Clearance Unit TWO (HCU-2) to perform the survey and by scheduling USS OPPORTUNE to carry out the removal effort.

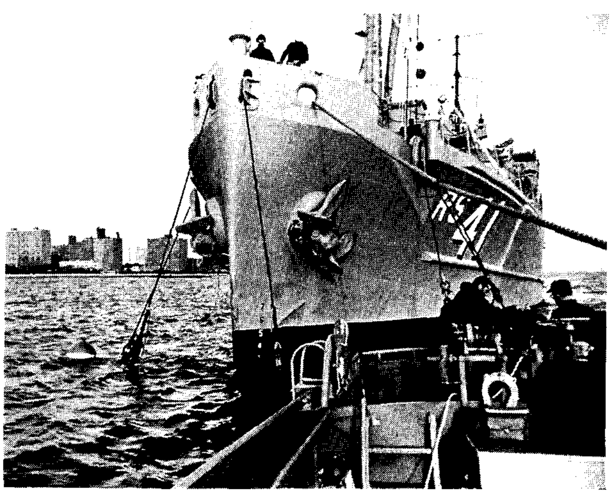
The HCU-2 divers discovered the 54-foot tug resting on a firm mud and shell bottom in 30 feet of water. The tug was in an upright position, slightly down by the bow in the mud. Though heavily encrusted with marine

growth, the tug appeared structurally sound. An internal survey was not performed.

OPPORTUNE's tentative removal plan called for raising the tug clear of the bottom by utilizing the ship's bow-lift capability. A pair of heavy chain lifting slings were to be passed under the wreck by means of "messengers" lanced through the mud under her hull. Wire preventers would secure the slings to the tug's shoulder bitts forward and to the quarter bitts aft to prevent the slings from slipping forward or aft on the hull. Rigging details are shown in the accompanying drawing. When fully rigged, the beach gear/bow-lift purchase system would be used to tighten the slings, lifting the tug clear of the channel bottom.OPPORTUNE would then proceed with the tug to a designated deep water disposal site, where the slings would be tripped open, allowing the tug to drop to the ocean floor.



BOW LIFT RIGGING DETAIL



OPPORTUNE arrived at the salvage site at 10:30 a.m., October 23, positioned herself in a 4-point moor, and commenced the removal effort. The "tentative removal plan" was successfully implemented despite a number of problems that emerged during the 9-day operation. The most significant problems encountered were foul weather, which forced OPPORTUNE to slip her moor and depart the area on two separate occasions; deceptively hard-packed bottom sediments, which hampered efforts to pass messengers under the wreck; and limited depth of water at the salvage site. The water was too shallow to permit lifting the wreck clear of the bottom without rolling it up against the bow of the ship. While this procedure was acceptable under the existing circumstances, it did increase the potential for chafing and placed an increased load on the lift wires and slings.

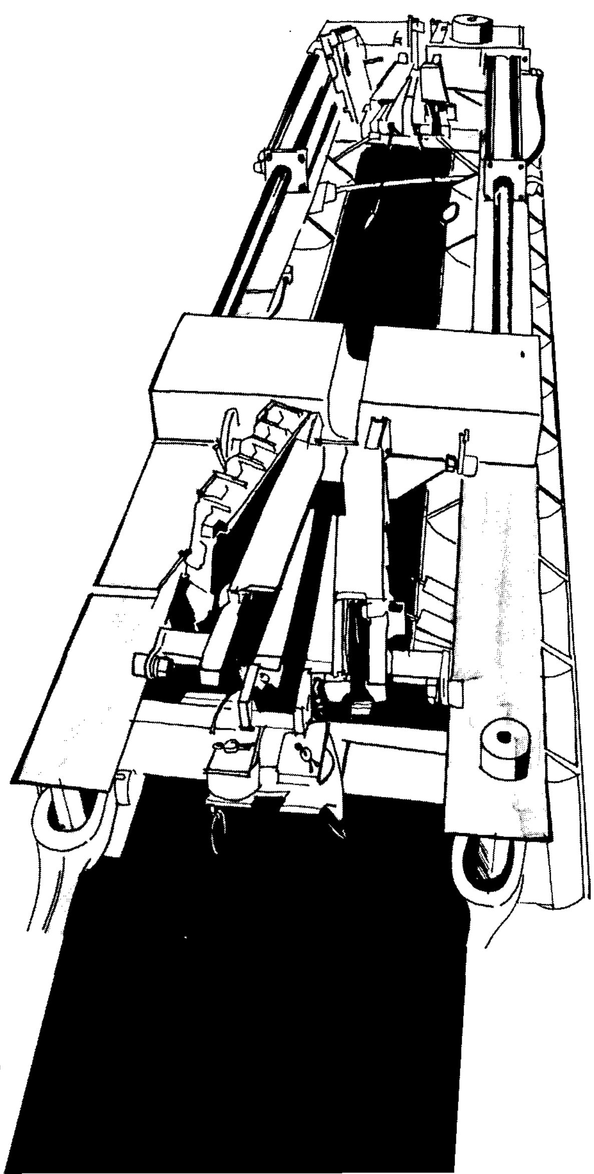
The problem of hard-packed bottom sediments resulted in the inability to pass a specially fabricated lance under the wreck. (The lance consisted of a curved length of small diameter steel pipe secured to the end of a high-pressure fire hose.) During subsequent efforts to pass the messengers, divers tunneled under the wreck with varying degrees of success using a falcon nozzle; a peri-jet eductor, with and without a suicide nozzle secured to the suction hose; and a 6-inch air lift. The air lift, powered by a 600-cfm air compressor, finally proved to be the most effective tool for this problem. This particular piece of equipment provided the tunnel, through which a messenger was passed, under the deeper and more difficult bow area of the wreck.

When properly positioned, the two messengers were used to pull the 1-5/8-inch lift wires and the 2-1/4-inch chain slings into position under the wreck. The air lift was again utilized to lighten the wreck by removing mud, sand, and debris from the internal compartments. OPPORTUNE was then repositioned in her moor and the final rigging completed in preparation for the lift. With the high tide on October 31, the beach gear/bow-lift purchase system heaved around on the port and starboard lift wires, hauling the wires in over the main bow-lift rollers. The wreck was then rolled up off the bottom and against the bow of OPPORTUNE.

With the wreck riding in the lifting slings, OPPORTUNE slipped her moor and transited the Coney Island and Ambrose Channels outbound to open water. At this point, the wind and swells increased considerably, causing chafing of the wreck and the lifting gear. Early November 1, while proceding to the disposal site, the 1-5/8-inch lift wire over the port auxiliary bow roller flattened against the roller and parted. The H.W. LONG slipped from the starboard lift sling and plunged bow-first to the bottom. There were no personnel or material casualties. Although the wreck was not delivered to the designated disposal site, it was dropped in deep water and will no longer constitute a hazard to navigation.

Beach Gear Goes Hydraulic

by Jerry Totten
Office of the Supervisor of Salvage



Rescuing stranded ships requires extensive personnel and equipment, all of which are subject to rigorous, hazardous conditions. For some time, the Supervisor of Salvage has been investigating hydraulic pulling equipment to find methods of reducing the back-breaking manpower needed in ship salvage operations.

As a result of this investigation, the beach gear tackle that has been a vital component of salvage inventory will undergo a much-needed change. The deck force will no longer have to rig 1200 feet of 5/8-inch wire and manhandle 150-pound carpenter stoppers. Instead of having to refleet the line after each pull, the hydraulic beach gear system provides continual action. It also eliminates the need to constantly rerig. Other advantages of the new beach gear include requiring less deck space and fewer handling personnel. Two or three men are required to rig the hydraulic puller; one man operates it after rigging; and two men are needed to coil the wire once it comes through the pullers.

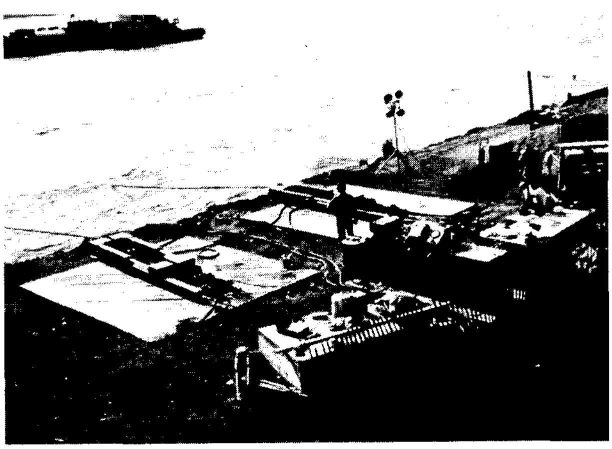
Not until the salvage operations of the SIDNEY E. SMITH at Port Huron, Michigan, (See *FP*, Winter 1972) were hydraulics shown to be a valuable asset to the salvor. Limited beach area on the St. Clair River almost prohibited use of the present beach gear system and offered an opportunity to procure and operationally test the hydraulic pullers (Photo 1). Six hydraulic pullers and two large winches were used to create 700 tons of pulling force at one stage of the SMITH salvage operations. These hydraulics proved to be extremely successful even under the restrictive environmental conditions of from 100° temperatures and dust in the summer to 20° temperatures and snow in the final phase of the operation.

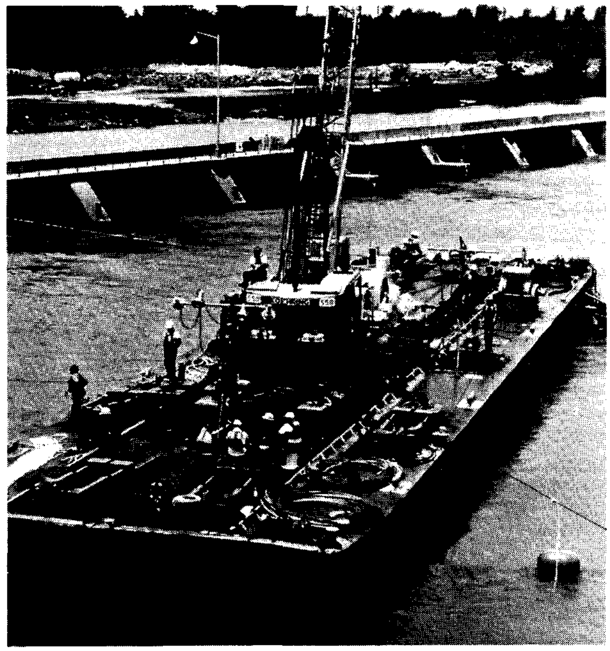
Since the SMITH salvage operations the hydraulics have been used successfully on two other salvage tasks. In

May, 1973, a barge sank and blocked a gate dam on the Arkansas River near Pine Bluff, Arkansas. Because there was no shore area for placing beach gear, it was necessary to mount four hydraulic pulling systems on a barge (Photo 2), a task that could not have been done with the standard beach gear tackle.

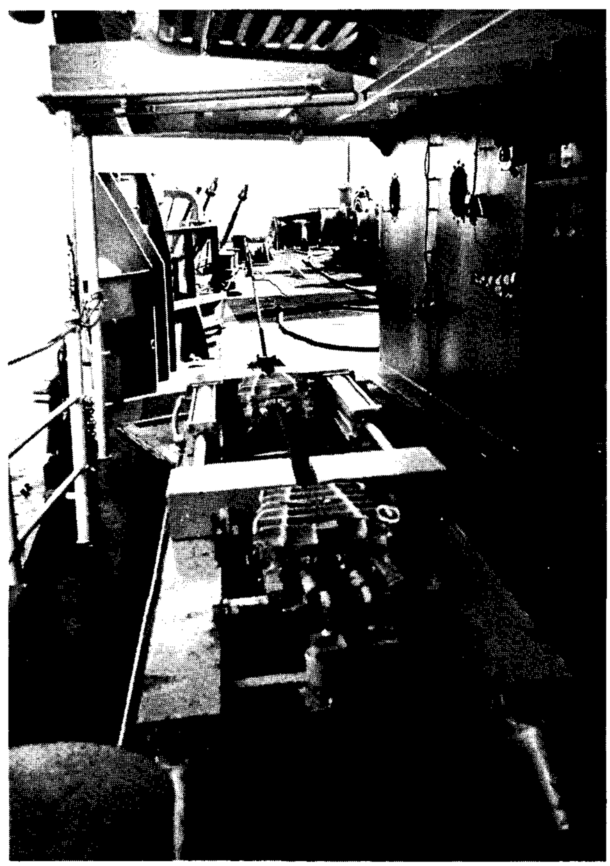
In June, 1973, the Supervisor of Salvage conducted a test operation using the beached BUTTERNUT, the salvage training ship at Pearl Harbor, Hawaii. For this operation, the USS GRAPPLE (ARS 7) was rigged with hydraulic pullers (Photo 3) instead of the deck tackle previously required in the beach gear system. The success of this test procedure further proved the ability of the hydraulic system to adapt to different surroundings.

Plans for the hydraulic system include tasking Battelle Memorial Institute to correct deficiencies found during past operations and write specifications for procurement and inclusion into the Emergency Ship Salvage Material (ESSM) System. It is anticipated that these hydraulic pullers will also be included in the FY 75 ATF Program, replacing the present beach gear tackle.





Hydraulic beach gear is shown as follows: Lower left (photo 1), on St. Clair River bank; above (photo 2), onboard barge; and below (photo 3), rigged onboard USS GRAPPLE (ARS 7).



SPECIAL WARFARE TRAINING-GERMAN STYLE

The Federal German Republic and the United States have been sharing in an annual data exchange program on diving techniques since October, 1971. Hosted in September, 1973, by the German BWB (NAVSHIPS equivalent), this third annual conference focused on combat swimmers (UDT/SEAL), Explosive Ordnance Disposal (EOD), and general shallow water diving equipment and procedures. LCDR Charles LeMoyne, (NAVSHIPS), LCDR Mike Ronan (NEDU), ENCS Tom King (NEDU), and Mr. Rolf Mossbacher (NCSL), spent 5 days visiting various German diving installations as the United States' delegates.

September 17: ECKERNFORDE

The first official stop for the U.S. diving representatives was Eckernforde, a city located in the northern segment of the Federal German Republic. Eckernforde houses several German Navy installations, including the Underwater Weapons School, the Underwater Weapons Test Station, and a base for submarines and patrol craft. Of principal interest to the U.S. delegates was that basic diver training and combat swimmer (Kampfschwimmer) training is conducted here. United States representatives viewed a pool demonstration of basic Kampfschwimmer training, which stressed underwater breath-holding (required for 2 minutes), underwater swimming without fins (required for a distance of 50 meters), and the ability to meet in-water stress situations with a relaxed, deliberate response. The swimmers used the LAR III SCUBA, a closed circuit, pure oxygen apparatus designed primarily for prolonged shallow-water diving. The LAR III is worn on the chest, leaving the swimmer's back free for a specially configured backpack, consisting of a waterproof equipment bag or a general purpose demolition charge. LCDR LeMoyne (below right) and LT Hawkins (below left) swam the LAR III and found it "simple to operate, compact, and comfortable to swim."

The use of a buoyancy compensator life jacket was also illustrated. This apparatus permits a swimmer to weight himself heavily with the life jacket partially inflated and still swim easily on the surface. If a tactical situation demands it, the life jacket can be deflated almost instantly for a splashless dive. Generally, the individual items of equipment used by Kampfschwimmers complement one another quite well, providing an integrated set of equipment that is superior in design and compatibility.

September 19: BREMEN

From Ekernforde, the U.S. representatives traveled to Bremen, where they were hosted by the Krupp-Atlas Electronic Company (KAE). Presentations were given on the KAE Doppler Navigation system, which is very similar to USN doppler navigation systems.

September 20: KOBLENZ

Koblenz, where the BWB is located, was the next stop on the trip. Discussions featured various EOD equipment used in clearing underwater ordnance. Also presented was a swimmer-carried depth and bottom profile recording device, equipped with a phosphorescent plexiglass slate for low-visibility writing.

September 21: MUNICH

The final phase of the trip was spent visiting the German Army's Engineer Divers School, located at Starnberg Lake, outside Munich. The German Army trains its own divers and distinguishes between hard-hat and shallow-water divers. Hard-hat divers work to depths of 40 meters (approximately 133 feet) and generally perform Army-related underwater salvage and construction tasks. The shallow-water divers utilize open circuit SCUBA and normally operate no deeper than 10 meters (approximately 33 feet). These divers provide direct support to front-line units of the German Army. They conduct tasks that include hydrographic reconnaissance in rivers and lakes, demolition of underwater obstacles, and light salvage and construction work. A highly professional demonstration of the various techniques used by both types of divers was given by instructors at the school.

The final function of the conference was writing the official minutes of this 1973 meeting and laying the foundation for next year's program.

As an immediate result of the conference, two LAR III systems, including test kits, spare parts, operating instructions, and carrying cases, were sent to the Navy Experimental Diving Unit (NEDU). This SCUBA will be evaluated for safety in hopes of obtaining approval for limited UDT/SEAL use, enhancing the ability of these units to train and operate with other NATO countries that use the LAR III. Information on the training of the Kampfschwimmer will be sent to NEDU for study and evaluation.

The 5 days were well spent, providing the U.S. representatives with an opportunity to learn new techniques as well as enjoy the warm German hospitality. The United States Navy will have an opportunity to reciprocate next fall, when they host the fourth annual exchange program with the Federal German Republic.

CONCRETE AND HULL REPAIR:
USNS CORPUS CHRISTI BAY

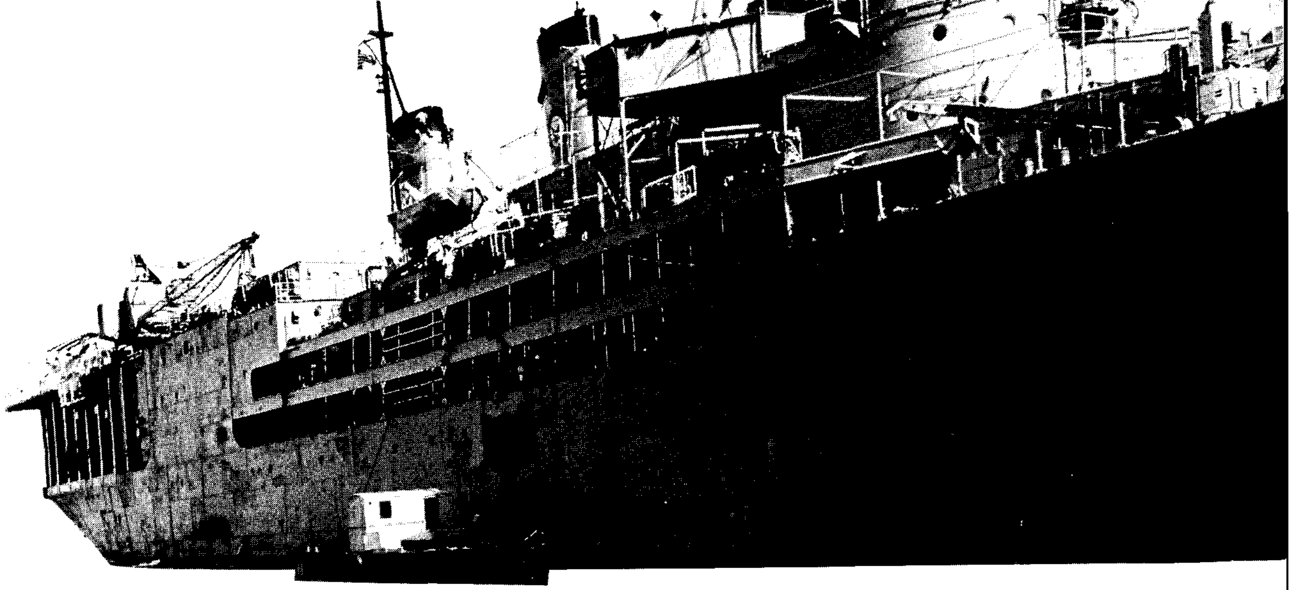
During operations in the South Pacific, the crew members of the USNS CORPUS CHRISTI BAY (ARVH-1), a Military Sealift Command Ship, discovered that deterioration in a wing void had caused cracking in the shell. Conditions indicated that a long ocean voyage might cause progressive damage, endangering the ship and her crew. Accordingly, the vessel put into port at Papeete, Tahiti, for emergency repairs in late August, 1973.

CDR William I. Milwee, the Pacific Fleet Salvage Officer, and Mr. W. C. Johnson, Director, Design Division, Naval Facilities Engineering Command, were dispatched to meet CORPUS CHRISTI BAY on her arrival at Papeete. They found one of the void spaces flooded with a mixture of fuel oil and water. It was determined that the void had flooded within an hour's time, indicating that plugging or patching would be necessary prior to pumping out the void and conducting permanent repairs to the hull.

Inspection of the flooded compartment was not immediately feasible and assistance was requested from the French Naval Dockyard Authorities on the island. Monsieur Vergness, the Hull Section's Chief Engineer, assigned a diver from the French Naval Ship Repair Facility to help with the investigation. CDR Milwee and the diver accomplished a subsurface inspection of the hull to determine the nature of the damage and to develop a prepumping course of action. The search revealed six major cracks, extending horizontally, vertically, and diagonally along the hull and varying in length from 20 to 80 inches. The cracking was considered typical of failure resulting from unrestrained flexure of steel plate.

Additional inspection at this time revealed that five compartments were flooded, three with an oil/water mixture and two with water. Dewatering of the water-filled voids was undertaken to allow access for further structural inspection. After finding that these particular areas were structurally sound, it was concluded that the flooding had been caused by a leaking bilge suction pipe.

After cleaning the hull subsurface cracked areas, the divers filled the cracks with a plastic steel mastic compound. This compound consisted of two moldable sticks – a resin and a hardener – and was worked together under water before insertion into the cracks. When pumping commenced on one of the tanks, the mastic that had not yet hardened was sucked through the wider portions of the cracks, indicating the existence of free communication between two of the voids. Rags soaked in epoxy were used to cover the reopened gaps. This method proved more difficult, because the epoxy had to be mixed on the surface, carried down in a plastic bag, and applied under water before it set. A sludge barge was procured from the French Navy, and pumping of the spaces filled with the oil/water mixture was initiated. Progress was briefly impaired when a minor oil spill occurred, but it was quickly corrected by the use of chemical dispersion.



Once dewatering of all compartments was completed, a more extensive inspection of the hull structure was possible. In the major damaged compartment, the area above the waterline remained sound and provided support for the shell. However, the bulkhead between this void and the forward compartment had buckled and the transverse structural parts (slosh plates) between the inner and outer hulls were rusted out below the waterline, providing no support for the shell. Further investigation disclosed leakage from the inboard fuel tank into this compartment. The danger of explosive vapors from this leakage precluded the use of cutting/welding equipment within the damaged area.

The placement of concrete in the effected area had seemed an attractive method of repair even before inspections had actually begun. Although this procedure is a fairly common USN salvage repair technique, objections were voiced by the French Repair Facility Officials, who felt it would result in too much concentrated load on the hull. The U.S. salvage representatives, however, believed the hydrostatic loads imposed on the outside of the hull would offset the loads imposed by the concrete. French officials agreed to this plan after being advised that full responsibility would be borne by the U.S. Salvage Team.

Assistance from the Travaux Public de Polynesie Highway section enabled the salvage team to find a local contractor with the capability of placing the estimated 36 to 40 cubic meters of concrete in the ship within the required time frame. Because the water depth alongside the berth prevented turning the ship to allow work from the pier, it was necessary to use a small pontoon barge as a work platform. To enable the mixer to reach the only available access hole, it was placed on a structure of drums, pallets, and timbers, where it teetered precariously each time the skip was loaded. Concrete batching/placing operations began September 6, continuing on a round-the-clock basis until completion early September 8.

Despite extensive deterioration below the waterline, the remaining structure was still effective as reinforcing material in concrete, particularly if a homogeneous placement with no "cold joints" was obtained. In light of these conditions, the placement of the cement was terminated at the waterline rather than filling the void completely. Placement of the concrete presented a special problem since just one access hole existed in the forward area of the compartment. A 23.6-square-inch hole was cut and a chute was rigged above the manhole to facilitate the operation. Shovels and vibrators were used to move the concrete forward and to achieve an even depth distribution throughout the compartment.

The concrete used was a cement-rich mixture of eight 110-pound bags per cubic meter, ensuring high early strength and quick setting. Tests conducted by the Laboratories des Travaux Public de Polynesie showed a strength exceeding 2900 psi 12 hours after batching and 3000 psi 24 hours after batching. A total of 63 tons of concrete was placed within the damaged area.

No abnormalities were found on the final subsurface inspection of the ship's hull. The access port was then welded closed and repairs were considered completed on September 9. The USNS CORPUS CHRISTI BAY was subsequently cleared for travel and departed Papeete Harbor the following day.

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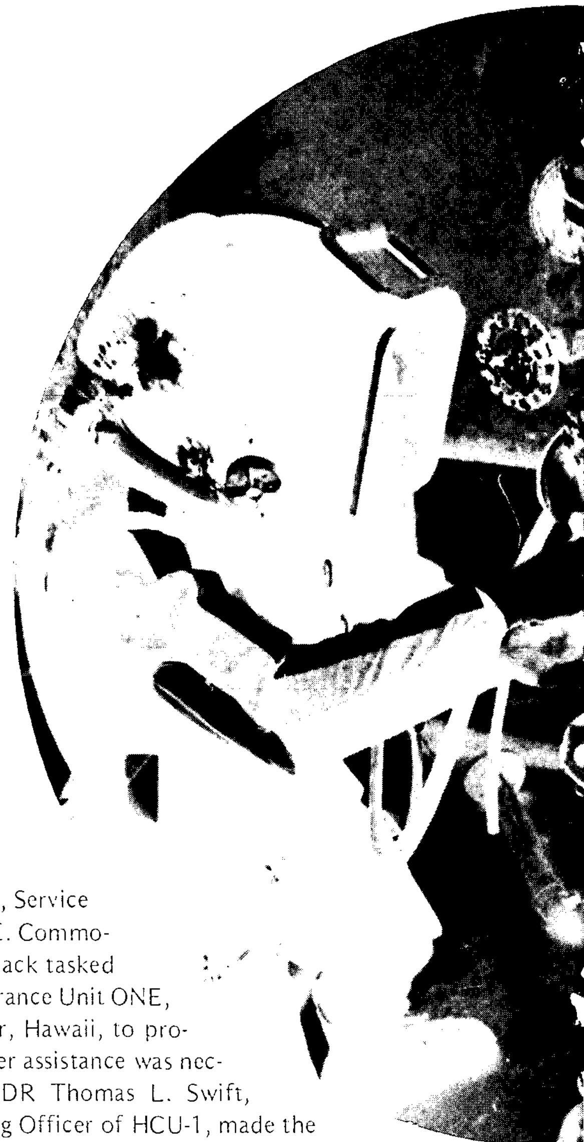
Navy Experime



The Navy Experimental Diving Unit accepted delivery of three prototype surface-supported Mk 12 hardhat diving systems in June of 1972. A technical evaluation was launched immediately calling for a long series of in-house technical tests, studies, and dives. The evaluation was to culminate with a series of at-sea dives designed to duplicate actual operational diving conditions. Consequently, after a number of minor modifications resulting from in-house testing, the system was ready to go to sea for its ultimate test in June, 1973. Approval was granted by Chief of Naval Operations and the project was designated T/S-83.

Support services for T/S-83 were provided by Commodore O. J. Bilderback, Captain, USN, Commander, Service Group FIVE. Commodore Bilderback tasked Harbor Clearance Unit ONE, Pearl Harbor, Hawaii, to provide whatever assistance was necessary. LCDR Thomas L. Swift, Commanding Officer of HCU-1, made the YRST-1 available as a diving platform and assigned CWO M. Stott as diving officer with a support group consisting of one master diver, 11 first class divers, and the always essential logistic support. In addition to the various supportive elements present in any at-sea operation, 41 individuals representing several activities and institutions were directly associated with T/S-83.

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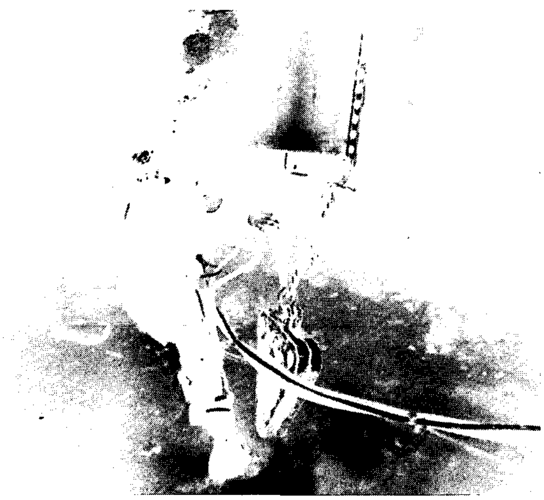


Represented were the Navy Experimental Diving Unit, Naval School of Diving and Salvage, Navy Medical Research Institute, Naval Civil Engineering Laboratory, Combat Camera Group Atlantic, Harbor Clearance Unit ONE, USS CONSERVER (ARS-39), General Electric Company, Northrop Services, the University of California at Los Angeles, and the University of Hawaii.

Diving operations began on June 18, after the YRST-1 was towed into a four-point moor site off the southwest coast of Oahu, Hawaii. By August 10, when operations terminated, 363 dives had been conducted from the YRST-1. Of these dives, over 200 were made using the Mk 12 system, bringing the total number of Mk 12 dives to over 550 since the TECHEVAL began. Preliminary indications from this testing are that the Mk 12 (center and upper right photos) is in many cases superior to the repsent Mk 5 hardhat system (upper left photo) and will be well accepted by Fleet divers.

Future plans include completing the Mk 12 TECHEVAL at the Navy Experimental Diving Unit's Washington Facility. The result of this evaluation will appear in a future issue of *Faceplate*, after the final analysis of all accumulated data has been completed.

RN/USN BENEFIT FROM EXCHANGE PROGRAM

The Information Exchange Project B-12 was initiated between the United States and Royal Navies as a result of a mutual desire to share in the research and development of diving equipment. Also included within this project is the exchange of data from studies of the medical and physiological aspects of diving. The IEP B-12 met aboard HMS TAMAR, Hong Kong, on October 9 and 10, 1973, to pursue these objectives further.

This 1973 conference also hosted representatives of both the Canadian and Australian Navies. Since IEP 1972, the US Navy has executed an agreement with Canada similar to that with the Royal Navy. A pact with the Australian Navy is in the planning stages for the near future.

The IEP B-12 is not just an annual conference, but an active and ongoing project with open communication between the USN and RN during the intervening months. Between the 1972 conference in Honolulu, Hawaii, and this year's meeting, the USN and RN maintained a highly viable diving information exchange policy. For example, the Royal Navy's loan of Marconi speech unscramblers to the Navy Experimental Diving Unit (NEDU) provided excellent communications between divers and "topside" personnel during the USN 1600-foot dive in May, 1973. (See *FP*, Fall, 1973.) More recently, the USN has requested the loan of two "Gemini" boats for support craft for the Mk 1 Mod 0 Deep Diving System (DDS) in Norfolk, Virginia. Also, the 1972 IEP proposal that ship salvage be included in the RN/USN program was acted upon this past summer with a modification to include this subject in the Project. Plans were made at the 1973 conference to identify those areas of salvage that would be beneficial to the IEP B-12.

The IEP B-12 also includes the regular exchange of RN and USN officers. LCDR Bryan N. Barrett, RN, has recently arrived at NEDU, Washington, D.C., where he is serving as Project Officer. (See Soundings, p. 4.) LT Bob Lusty, RN, is presently at Harbor Clearance Unit TWO, Norfolk. His duties there include working with the Mk 1 Mod 0 DDS team in bringing the System to a fully operational status on completion of current refurbishment. (See p. 6.) The recently appointed USN Exchange Officers are LCDR Carl Seeler and LT Robert Wells, both of whom will be operating out of the Admiralty Experimental Diving Unit, HMS VERNON, Portsmouth, England.

A wide variety of topics were discussed at the 1973 IEP B-12 conference. Listed below, the reports that were presented are available for those interested in obtaining copies. Inquiries should be addressed to LCDR Bryan Barrett, Project Officer, Navy Experimental Diving Unit, Washington Navy Yard, Washington, D.C. 20374.

Breathing Equipment:

- Mk 10 UBA, Mods 4 and 5 (USN)
- Equipment heating
- Compressor/Depressor systems
- WINDAK UBA (RN)

Diver Heating:

- RN heated suits
- USN heated suits
- Diver-carried heating sources
- Respiratory heat loss: engineering solutions

Monitoring:

- Hyperbaric chamber monitoring
  - RN and USN statements
- Operational diver monitoring
  - RN and USN statements

Underwater Communications:

- RN and USN statements

Decompression Schedules:

- RN and USN statements

Deep Dive Systems:

- RN and USN statements

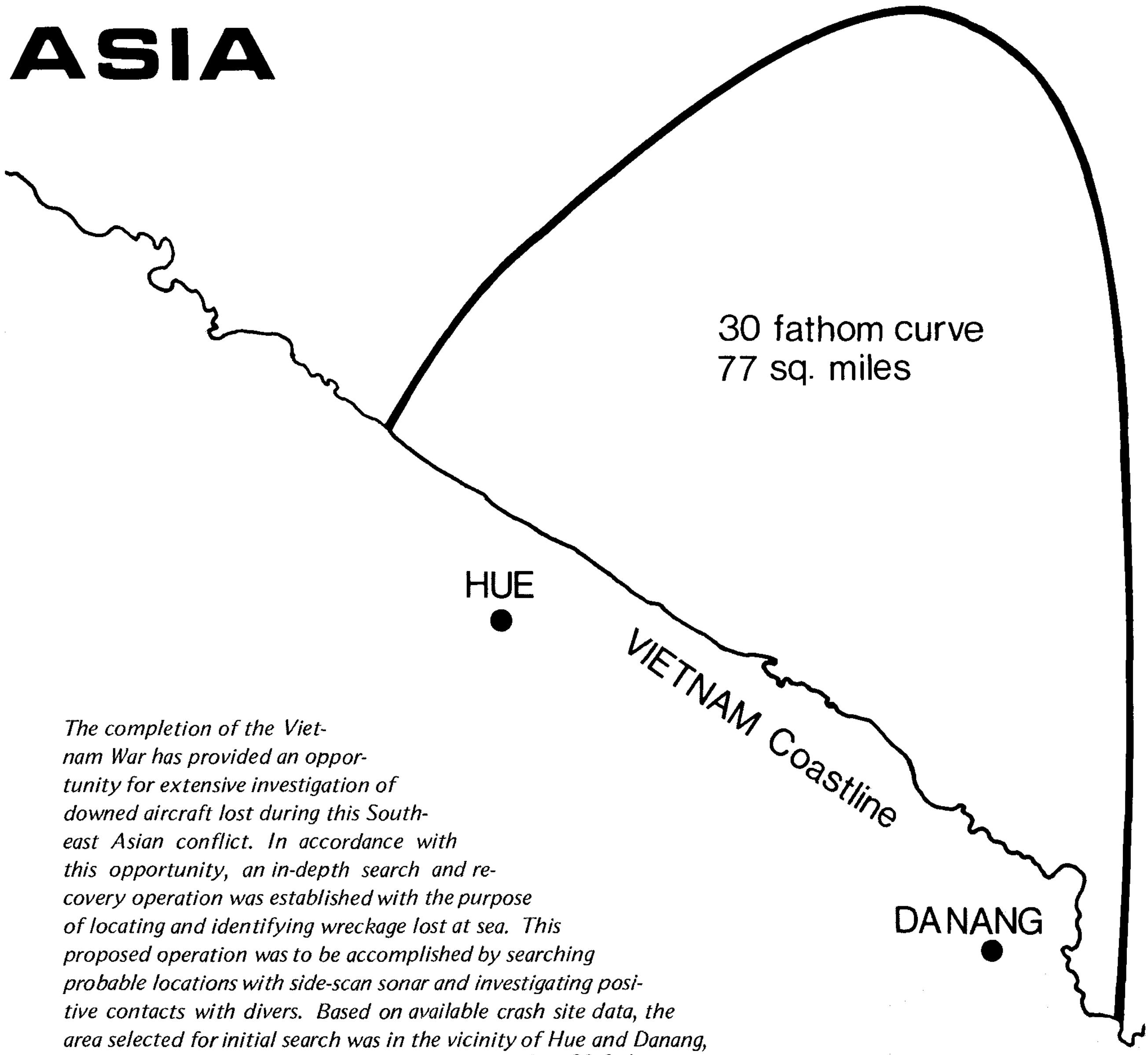
Tethered Diving:

- USN statement on Hard Hat replacement

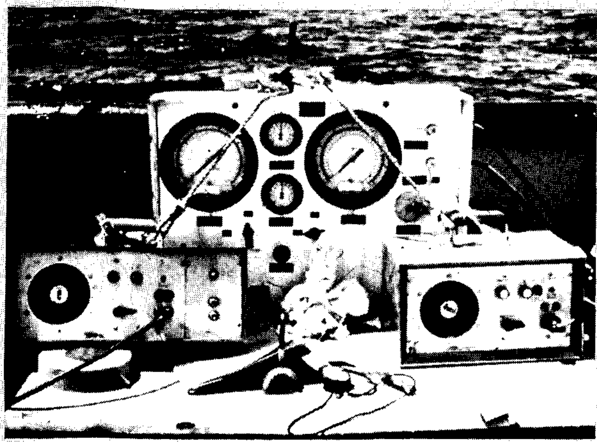
Breathing Gases Storage; Recovery Compression and Standardization:

- RN and USN statements

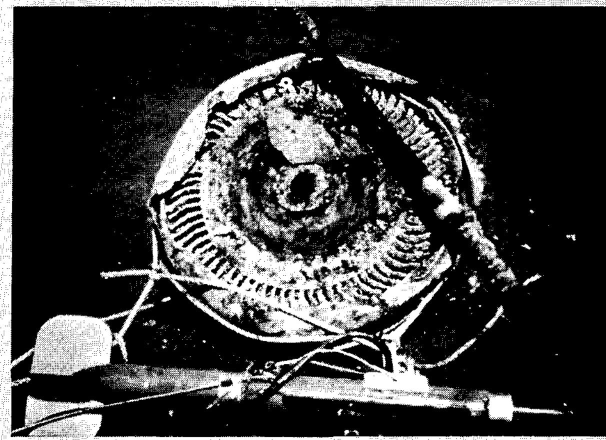
SEARCH AND RECOVERY IN SOUTHEAST ASIA



The completion of the Vietnam War has provided an opportunity for extensive investigation of downed aircraft lost during this Southeast Asian conflict. In accordance with this opportunity, an in-depth search and recovery operation was established with the purpose of locating and identifying wreckage lost at sea. This proposed operation was to be accomplished by searching probable locations with side-scan sonar and investigating positive contacts with divers. Based on available crash site data, the area selected for initial search was in the vicinity of Hue and Danang, South Vietnam, between the shore and the 30-fathom curve.



Deck diving stand, with radio and cassion gauges.



Sonar "fish" used to locate gun barrel and engine compressor.

Upon learning of the problems involved in the actual location of off-shore crash sites, the U.S. Navy Supervisor of Salvage (SUPSALV) offered their search and recovery expertise. SUPSALV's offer was accepted, and representatives were sent through the office of Commander Task Force 73 (CTF 73). LT Craig Mullen served as the initial SUPSALV representative and was later relieved by LCDR J. Mike Martinez. Support was also provided by Mr. Jim Bladh, Operations Specialist for SUPSALV.

The operations were conducted using civilian personnel and equipment under contract to SUPSALV. Contractor assets were used to provide the precision navigation system; the support ship, M/V SEA TENDER; the towed side-scanning sonar and sonar interpretation; and the diving services. Basic on-scene logistic support was also the responsibility of the contractors, with additional support provided by U.S. and Vietnamese government agencies. Overall operational control was exercised by Commander SEVENTH Fleet through CTF 73.

The actual "at sea" operations commenced on July 10, 1973, running continuously through September 29. The support ship, M/V SEA TENDER, is a 150-foot offshore supply boat. An American flagship, M/V SEA TENDER is usually homeported in Singapore and carries a 10-man operating crew. The navigation equipment used was a cubic DM-40 autotape precision navigation system. Two shore antenna stations utilized an auto-tape interrogator onboard the M/V SEA TENDER. This system is capable of extremely accurate ranges (plus or minus 5 feet at 10 miles). The accuracy it provided enabled the ship to return at will to any sonar contact for further examination or classification. The auto-tape system performed very well during the operations, with a percentage of "down times" for the entire mission of only 4 percent. As the search area expanded, shore sites were relocated, usually in a leap-frog manner along the coast.

Basically, search techniques began with the mapping of a search square, normally 16 square miles, around a given geographical grid reference position. Navigational sites were then selected on shore to provide full area coverage. Search lines were run at precisely spaced intervals to provide continuous overlap, using a towed dual side-scanning sonar that recorded findings on paper readout.

Once a contact was picked up by sonar, it was examined and/or verified by several additional sonar passes. If the contact did not prove to be fish (that is, an object of disappearing or changing shape), its position was precisely defined by further passes. A mooring diagram was drawn and the ship moored over top of the site. A three-point moor, two bow and one stern anchor, was usually used to achieve as much stability as possible. Surface-supplied divers were normally used to take advantage of two-way radio communication. SCUBA was used in shallow water investigations. On the average, diver investigations lasted from 3 to 5 hours each.

To provide an adequate description of the contact, divers searched the surrounding area thoroughly. When an aircraft was found buried (most were 90 percent buried), a surface-supplied air-lift was utilized to uncover the airframe. A high velocity jet nozzle was also used in some instances. Wreckage was lifted to the surface by means of a lift wire, slings, and the ship's winch. Small debris was recovered by hand and put into an underwater recovery basket, which was later hauled to the surface for inspection.

Six prime areas established on available information were searched by side-scan sonar between July 10 and August 17. Secondary areas were searched between August 18 and September 30. A total of 77 square miles was searched, but the total reached 110 square miles including the areas that were searched more than once.

Of the problems encountered during the search operations, the most significant was the uncertainty of crash site locations. The poorly defined locations required large areas to be searched and yielded numerous contacts that proved to be of no interest after diver investigation. The original crash site position given was usually not consistent, in that latitude/longitude position and UTM grid position often differed by several miles.

Another problem encountered in the "at sea" operations was that within the 30-fathom curve searched, all located aircraft were more than 90 percent buried. This situation is due to the heavy silting that the shallow coastal waters in Vietnam are continually subject to. The presence of numerous fish traps in search areas was hazardous during night operations to both the towed sonar and to the ship. Sonar cable was severely damaged on several occasions and once the sonar was completely torn away. These fish traps, measuring as much as 15-20 feet across, are only occasionally marked with surface markers. These traps and the presence of numerous small unlighted boats severely limited night search procedures and resulted in operations being restricted mainly to daylight hours with diving on contacts until 10 or 11 p.m. Weather and sea conditions also posed some problems, causing delays in mooring over contacts, as did the light weight of the stern anchor when used in a silt ocean bottom.

Shore operations also encountered various problems. The remote location of shore navigation sites required the full-time presence of technicians. The shore team consisted of three men working alternately, with two men out (one at each antenna site) and one man at the shore house in Danang. A second obstacle was that a 12-volt power supply (storage batteries) for shore-based navigation equipment was not readily available and had to be air-lifted from an Air Force base in Thailand. Recharging batteries proved to be a continuous problem due to the limited hours power was available at various equipment sites. Commercial electric power in Danang was shut down almost daily for short periods of time, which required using a secondary line of communications with M/V SEA TENDER.

Diver climbs aboard M/V SEA TENDER after completing an underwater investigation of a sonar contact.

The operation would have been extremely difficult to conduct without support from the Army of the Republic of Vietnam (ARVN). Commander Military Region ONE was responsible for the installation of telephone and primary radio communications at base operations as well as furnishing ARVN jeeps and drivers to shore stations. The support provided by the Commander, First Coastal Zone, was also outstanding throughout the operation. The aid of both of these offices enabled the establishment and maintenance of the shore navigation station in relative safety.

This operation demonstrated both the ability of the contractor to locate and identify wreckage under the most adverse conditions and the increased expertise of the Supervisor of Salvage to get successful recovery results in remote areas. Using lightweight, air-transportable equipment, SUPSALV, with search and recovery contractors, is capable of going to any area of the world on short notice to search for and recover objects lost at sea.

NOT EXACTLY CANDID CAMERA

Television is usually considered an entertainment facility. However, the personnel at the Naval Ordnance Laboratory Field Branch (NOLFB), in Fort Lauderdale, Florida, have an entirely different conception of its use – deep ocean recovery of damaged and/or lost objects.

Designed by Hugh Bowen, electronics technician at NOLFB, the underwater TV recovery system was developed primarily for the retrieval of experimental naval weapons. Basically, the system consists of a tripod framework with a TV camera attached to the underside of its roof. This controlled camera can swivel 180 degrees horizontally and vertically. Other features include two propellers, a compass, light source, sonar pinger/receiver, and a grappling hook. With this equipment, the NOL team has recovered objects from depths of 1200 feet, working in currents of up to 4 knots. Location and visual inspection have been achieved at depths to 2000 feet.

Prior to the development of underwater TV in 1958, ordnance recovery was achieved by using Navy divers, usually SCUBA, and by incorporating flotation systems or automatic buoys into naval weapons. Navy divers were limited in operating depths and time in the water, however, and the flotation systems were not 100 percent dependable. Because of these limitations, a commercial underwater camera was attached to a "homemade" rig and used in several underwater trials. However, problems with locating and retrieving objects still existed and it became apparent that having just a TV camera on site was not enough.

To make this system more versatile and effective, several modifications have been made over the past 15 years. The tripod framework of welded, lead-filled steel pipe is roughly the same. An early addition was a compass, which is placed at bottom center of the rig and read directly by the TV crew to aid in underwater orientation. A large metal vane was added to keep the rig lined up and stabilized in underwater currents. To increase maneuverability, two electrically-driven, reversible propellers now enable the operator to move the camera against swift currents. A sonar pinger/receiver was added recently to detect bottom anomalies beyond the light range. This modification also is used to find sonar reflectors that are occasionally attached to semipermanent test assemblies. The light source has changed several times. It is presently a quartz iodide material that illuminates an area approximately 50 feet in diameter.

The underwater TV system usually operates from the A.B. WOOD II, a commercial oceanographic vessel under exclusive contract to NOLFB, Fort Lauderdale.

In an actual recovery operation, the A.B. WOOD II travels to the suspected site, scans the area with sonar to establish an exact location, and anchors above the sunken object. The TV sled is suspended by wire cable from a deck crane and raised or lowered by a winch. As the TV descends, it is stopped every 25 feet while a cable clamp is quickly installed and the instrumentation line connected to it. For maneuvering more than 50 feet, the ship itself is moved by winching-up or lengthening its anchor cable.

Meanwhile, aboard the A.B. WOOD II, a technician/operator watches the video screen. As the camera approaches bottom, the operator begins scanning horizontally, checking the attached compass to obtain a bearing on the sunken object. Watching the video screen closely, the technician directs the winch operator in raising or lowering the camera rig. Starting the propellers provides sufficient force to move the sled against the current, allowing it to sweep over the target to get the most appropriate approach angle. After sufficient maneuvering, the grappling hook on the underside of the rig catches onto the sunken object, enabling the ship to bring it to the surface.

The A.B. WOOD II/underwater TV sled combination has proven itself an invaluable asset in deep ocean search and recovery. The most important element, though, is the teamwork behind the operation. As Mr. Wallace Taylor, Jr., NOLFB Senior Technical Representative at Fort Lauderdale, has stated: "Without the trained personnel to accompany the gear, successful recovery would be doubtful. Our results are based more on the teamwork among the ship's Captain, crane operator, TV technician, and deck force than on any sophisticated equipment." Fortunately, both the teamwork and the equipment are available—and able to achieve successful results.

New Officer in Charge at NEDU

CDR Colin Jones assumed the duties of Officer in Charge of the Navy Experimental Diving Unit (NEDU), Washington, D.C., in a ceremony held on October 1, 1973. CDR Jones succeeds CDR James J. Coleman, who will continue in his duties as Supervisor of Diving, Naval Ship Systems Command.

Prior to coming to NEDU, CDR Jones served an interim assignment in the Plans and Policies Maintenance Division of COMSERVPAC/CINCPACFLT Staff. He was stationed at this post November, 1972, through June, 1973. However, from March to mid June of this tour, CDR Jones attended the Saturation Diving School at Sumarine Development Group ONE, San Diego, California. He also worked with the Mk 2 Deep Dive System Team while attending the school at SUBDEVGRU-1.

CDR Jones' career to date includes serving on the Naval Advisory Group, Commander Naval Forces Staff, Vietnam, from May, 1971, through October, 1972. He has also served as Production Engineer, Docking Officer, and District Diving and Salvage Officer at Pearl Harbor Naval Shipyard, Hawaii. Earlier duties include tours as Executive Officer, Naval Shore Electronics Engineering Activity, Pacific (NAVSEEAPAC); Fleet Electronics Engineering Officer, Commander Service Force, Altantic Fleet Staff (COMSERVLANT); and Chief Engineer, USS SAMPSON (DDG-10).

CDR Jones is a 1957 graduate of Duke University, Durham, North Carolina, where he received a Bachelor of Science Degree in Electrical Engineering. He became a commissioned officer upon graduation from Duke, and served his first tour of duty aboard USS LAUNCHER (YV-2). A registered professional engineer in California, CDR Jones is also a member of the Institute of Electrical and Electronic Engineering (IEEE), a licensed ham radio operator, and a licensed first class commercial radio telephone operator.

Faceplate welcomes CDR Jones to his new post at the Navy Experimental Diving Unit.

CAPT Mitchell Retires/Receives Legion of Merit

After 30 years of service, CAPT Eugene B. Mitchell retired from the U.S. Navy in a ceremony held at the Navy Experimental Diving Unit (NEDU) on November 1, 1973. CAPT Mitchell received numerous awards and commendations, including the Legion of Merit for "exceptionally meritorious conduct" while serving as the Director of Ocean Engineering and Supervisor of Salvage, Naval Ship Systems Command, from May, 1969, through August, 1973.

RADM Walter N. Dietzen, Jr., Deep Submergence Systems Program Coordinator, delivered the main address of the ceremony, referring to the outstanding accomplishments achieved by CAPT Mitchell during his career and introducing the various award presentations.

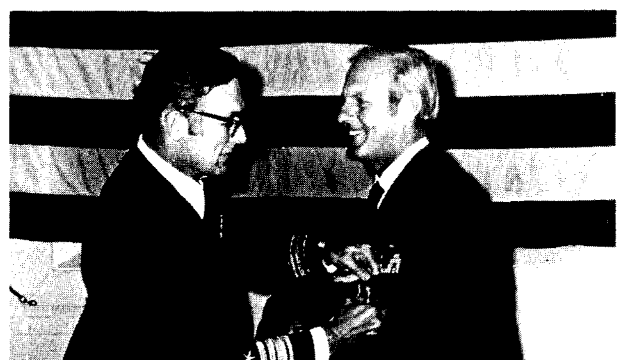
CDR E. E. Henifin, Deputy Director, Deep Submergence Systems Division, read the Legion of Merit citation, while RADM Dietzen awarded the medal to CAPT Mitchell. The citation discussed the Captain's lasting contributions in providing the techniques, equipments, and tools that enable USN divers to work safely, efficiently, and comfortably in the open sea to depths of 1000 feet. Specifically noted were: the raising of the Deep Submersible Vehicle ALVIN from a depth of over 5000 feet in 1969; the location and rescue of a NASA/NRL Solar Eclipse Photographic Instrumentation Package from 6000 feet of water in 1970; and the recovery of 37 of 43 crashed aircraft from 1969-1973.

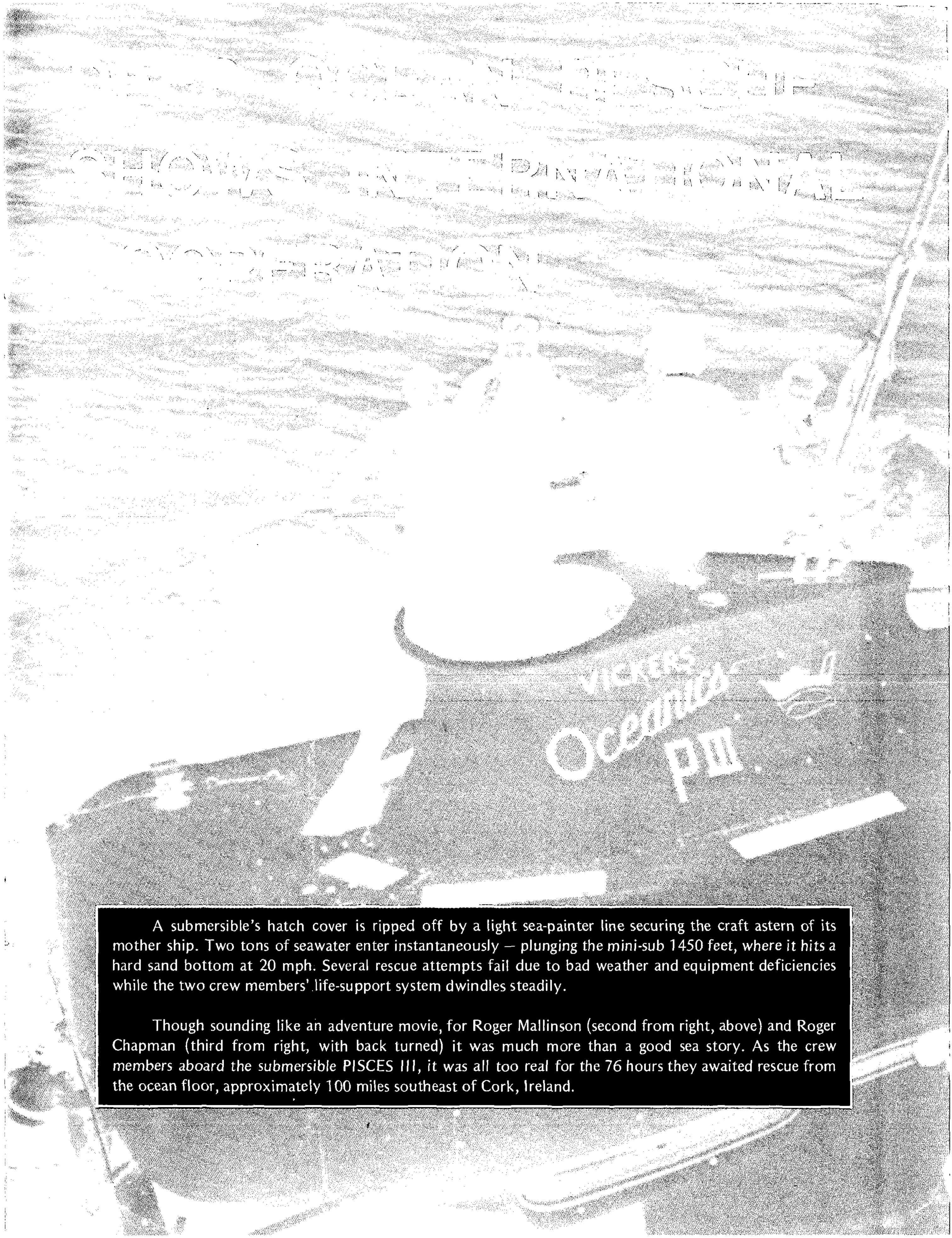
CAPT Mitchell received letters of commendation from RADM J. Edward Snyder, Oceanographer of the Navy; and ADM R. C. Gooding, Commander, Naval Ship Systems Command. A Certificate of Appreciation from President Nixon was also presented to the Captain for outstanding service in U.S. military forces. For being a source of support behind her husband, Toni Mitchell received a Certificate of Appreciation from VADM David H. Bagley, Chief of Naval Personnel, and RADM Kenneth E. Wilson, Deputy Commander, Naval Ship Systems Command.

Faceplate congratulates CAPT Mitchell on his outstanding military career and wishes him well in his new endeavors.

CDR Coleman, CDR Jones, and LCDR Whitaker (Assist. O-in-C).

RADM Dietzen (left) awards L. of M. medal to CAPT Mitchell.





A submersible's hatch cover is ripped off by a light sea-painter line securing the craft astern of its mother ship. Two tons of seawater enter instantaneously – plunging the mini-sub 1450 feet, where it hits a hard sand bottom at 20 mph. Several rescue attempts fail due to bad weather and equipment deficiencies while the two crew members' life-support system dwindles steadily.

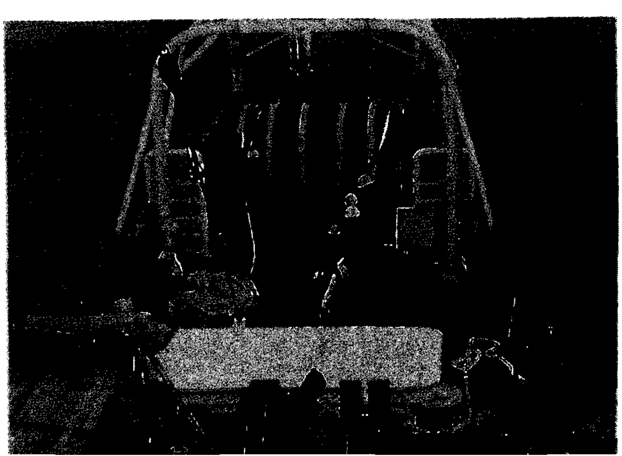
Though sounding like an adventure movie, for Roger Mallinson (second from right, above) and Roger Chapman (third from right, with back turned) it was much more than a good sea story. As the crew members aboard the submersible PISCES III, it was all too real for the 76 hours they awaited rescue from the ocean floor, approximately 100 miles southeast of Cork, Ireland.

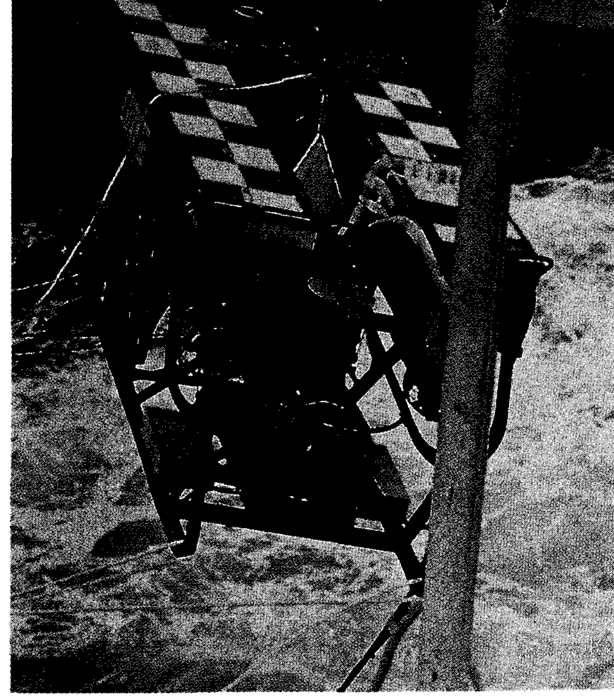
On Wednesday, August 29, 1973, PISCES III, a two-compartment submersible owned and operated by the British firm Vickers Oceanics, Ltd., was operating off the coast of Ireland in water depths of approximately 1400 feet. Surfacing after a 5-hour dive, PISCES III was brought to within 100 yards of the mother ship, VICKERS VOYAGER. Just as VICKERS VOYAGER was about to pick up the 20-foot, 24,000-pound craft, which was being towed on a light line, the line tangled on a hatch cover of the mini-sub and yanked the hatch open, allowing seawater to flood the vessel.

PISCES III sank the length of the tow line, approximately 100 feet, and was stranded for 12 minutes until the line gave way. The craft then plummeted to the ocean floor, landing with its bow up at an 85-degree angle. PISCES III remained in this position during the 3-day rescue operation. A tribute to the integrity of this vehicle is that the impact caused little damage to the battery, life support, or general structure.

Vickers immediately began to coordinate rescue efforts. Two of PISCES III's sister submersibles, PISCES II and V, were flown to Cork by Royal Air Force and commercial air facilities, and loaded on the VOYAGER for the initial retrieval efforts. Vickers also asked the U.S. Navy Supervisor of Salvage (SUPSALV) to provide backup assistance. Preparations were made to air-transport CURV III (Cable Controlled Unmanned Recovery Vehicle) from its home base at the Naval Undersea Center, San Diego, California. CDR Robert Moss, Deputy Supervisor of Salvage, and Mr. Earl Lawrence, SUPSALV Operations Specialist, left immediately for the site of the accident to await the arrival of CURV III and to provide any needed support. Before all rescue attempts were completed, Vickers coordinated a multination effort, which included the Canadian Coast Guard, the British Navy, and U.S. Forces.

CURV III arrived Thursday evening, to be stationed on board the Canadian Coast Guard Ship JOHN CABOT. It was low tide, though, making it impossible for CABOT to rendezvous at dockside with CURV III. To expedite proceedings, CURV III was barged to the support ship before heading for the accident site.





While CABOT approached the rescue site, Vickers launched several unsuccessful rescue attempts. Frustrating obstacles – bad weather, a flooding casualty with PISCES II, and low batteries in PISCES V from 20 hours of submerged time – prevented Vickers from completing the rescue with only their own assets. It was then determined that the combined capabilities of CURV III and JOHN CABOT be utilized immediately.

Since PISCES III is a commercial submersible, the rescue presented several logistical problems. First, commercial submersibles are generally designed to perform specific ocean engineering tasks, so their size, hull form, and equipment arrangements are quite different from fleet submarines. Second, life-support capacity for commercial submersibles is generally limited. Fortunately, in the case of PISCES III, life-support capacity was 72 hours. Third, the hatches on commercial submersibles are not compatible with the McCann chamber or other more sophisticated devices used for the deep ocean rescue of trapped crewmen on fleet submarines. Finally, commercial submersibles are not usually designed for escape by buoyant ascent, eliminating that rescue alternative also.

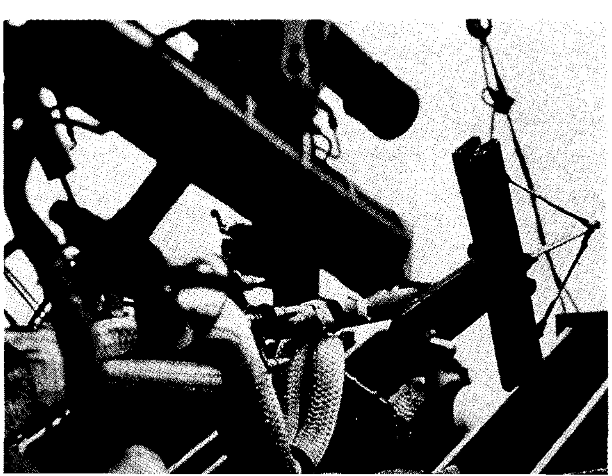
These considerations meant that only one feasible method of saving the lives of the men trapped in the submersible existed: salvage the vessel and release the crew members.

The critical point in the PISCES III rescue was fast approaching. The crewmen were exhausting their life-support capacity at a steady rate, with expiration due sometime the next morning (Saturday). To extend the length of their life-support capability, the crew allowed a higher CO_2 atmospheric ratio than normal and ceased all motions except intermittent communications with topside. They also used two domestic timers as alarm clocks to awaken them every 45 minutes to switch on the CO_2 scrubber. To further reduce oxygen consumption, they lowered the cabin pressure from 30.25 millibars to approximately 28.5 millibars (roughly equal to that of a wet day).

On the surface, as the CURV III team prepared to launch their vehicle, a series of problems arose. The most serious was the failure of a 55-wire electric cable connection, which blew out after being wetted by exposure to salt water. The team estimated it would take 4 hours to rewire the cable directly into the control van on the deck of CABOT. Under the direction of the NUC team, the work was completed within the time estimated, and CURV III prepared to launch again. Another obstacle that had to be overcome before CURV III went into the water involved a gyro failure. To solve this problem, an ordinary diver's wrist compass was attached to CURV III where it could be read by one of its TV cameras.

Both CURV III and PISCES II were repaired and ready to dive at the same time. PISCES II was launched first and successfully inserted a toggle bar in the after sphere open hatch. She then released a buoy and 2000 feet of polypropylene line to float on the surface. The line, with a breaking strength of 12,000 pounds, was considered too light to serve as the primary lifting line because of the heavy seas in the area.

CURV III was deployed early Saturday, carrying a 6-inch, double-braided nylon line with a breaking strength of 50 tons. The nylon line was attached to a large toggle bolt (below) designed and built by Vickers during the rescue and modified by the CURV III team for use with their vehicle.



Utilizing its two underwater TV cameras (with accompanying lights), which are used by the surface operator to guide the craft under water, CURV III made its descent through the rough seas. The stranded mini-sub acted as a sonar target and within an hour after launch CURV III was positioned only 250 yards from the downed PISCES III.

CURV III located the open hatch of PISCES III, moved into proper position, and inserted the toggle bolt into the 14-inch hatch. After CURV III was backed away to test the strength of the line, CABOT commenced lifting PISCES III, using the two lines inserted into the submersible. The rate of ascent was approximately 60 to 100 feet per minute.When their lines entangled, CURV III was abandoned and cut loose from the rising PISCES III to ensure the latter's safe recovery. Divers were in the water waiting when the disabled sub reached 60 feet to attach another line to PISCES III, stabilizing it against the rough seas.

By Saturday afternoon, PISCES III was on the surface. Minutes after breaking the surface, the two crewmembers exited the opened hatch and climbed into the waiting rubber boats. The first man out of the mini-sub looked up at the CABOT, turned and hugged the man working the outboard motor, then collapsed with relief and exhaustion—the 76-hour ordeal was over. Both crewmembers were transported immediately to the VICKERS VOYAGER, where they were pronounced in good health after undergoing physical examinations.

The operation was an amazing success. It was the first time a vessel with a crew aboard had been recovered from such a great depth. Both the occupants and the submersible were recovered in good condition. CDR Moss praised each person involved in the rescue for his tireless efforts. He particularly noted CAPT Gordon Warren of the JOHN CABOT, Robert Eastaugh, Vickers Operations Manager, and CDR Peter Messervy, senior person in the Vickers' group. CDR Moss also pointed out that the success of the operation was directly attributable to the training, skill, durability, and competence of the PISCES III personnel; there was no panic and no waste of life-support. In summary, it was truly a "massive exercise of international cooperation in rescue at sea."

SWIM FOR YOUR LIFE . . .

DROWNPROOFING: A WATER SURVIVAL TECHNIQUE

By LCDR Irve Charles LeMoyne
Office of the Director of Ocean Engineering

"There is something new under the sun . . . ," stated the late Fred R. Lanoue, Professor of Physical Education and Head Swimming Coach at the Georgia Institute of Technology. The "something new" Professor Lanoue referred to in the early 1960's was the technique for survival swimming he had developed and aptly named "Drownproofing."

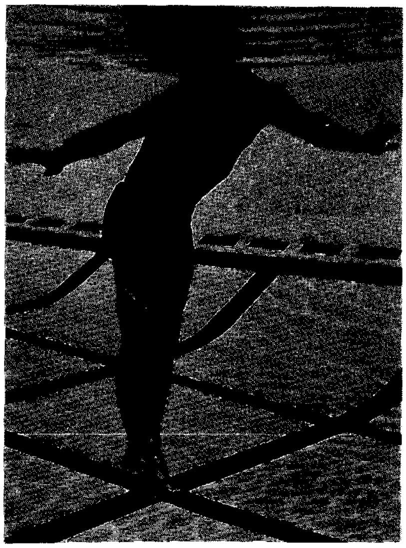
Drownproofing is a straightforward method of combining almost effortless arm and leg movements with a rather precise but relaxed breathing technique to take full advantage of the human body's natural buoyancy. The central emphasis in Drownproofing is always on minimizing the expenditure of energy. This ensures long-term survival of the unaided (no fins) and unsupported (no life jacket) person in the water. Drownproofing places no premium on strength, agility, physical condition, age, or conventional swimming background. Anyone who is willing can learn the basics of Drownproofing in a few lessons and will be able, except in very cold water, to stay afloat for hours and swim for several miles.

The mechanics of the basic Drownproofing stroke are derived from various principles of physics and the unique characteristics of the human body. First, over 99 percent of all men float in fresh water with a full breath of air. In fact, they have a positive buoyancy that normally ranges from 7 to 10 pounds. This buoyancy results from the favorable combination of air in the lungs, fat, bone, and muscle; specifically, air and fat float while muscle and bone sink. The ratio of air and fat to muscle and bone is generally very favorable in children and adult women; thus even more women and children are able to float than men, and usually with greater buoyancy. A second significant factor is that the human head weighs, on the average, about 15 pounds. This weight becomes very critical when trying to support it out of the water.

Under the best conditions, a man can expect to have about 10 pounds of positive buoyancy. If he wants to keep his nose and mouth out of the water and see where he is going, he must keep his head upright. This means constantly using muscular effort to support the 5-pound difference between his 10 pounds of positive buoyancy and 15 pounds of head weight. This 5 pounds becomes greater every time he exhales and even more so when the additional weight of clothing is added. This weight difference may seem too small to be of serious consequence; but as long as continuous effort must be made to support this weight, a person in the water is never truly at rest. The steady energy drain of this muscular effort combined with the added restriction that clothes place on conventional swimming methods cause many drownings.

THE BASIC STROKE

A person trained in Drownproofing approaches a water survival problem quite simply. He does not try to keep his head constantly out of the water; instead, he keeps it and the rest of his body under water for as long as possible. He then has 10 pounds of positive buoyancy supporting him instead of 5 pounds of negative weight pushing him down. The Drownproofer merely raises his head out of the water to take a breath, then drops back into the water to rest until his next breath. His arm and leg movements are designed to get his head out of the water to breathe and keep him at or very near the surface after he lays his head back in the water to rest. The sequence of the basic Drownproofing stroke in fresh water is illustrated in the photos above right.



1. Rest in a face-down position with arms and legs hanging completely relaxed. Make sure mouth is empty of water by spurting water between *compressed lips with the tongue.* DON'T blow it.

2. Get ready to breathe by slowly crossing the forearms in front of head and extending one leg to the front and the other to the rear.

3. Gently sweep arms out to the sides, as in a relaxed breaststroke, and swing legs together. At the same time, exhale through nose and mouth while lifting head to an upright *position with the eyes open.* Immediately inhale and place head back into the water, face down.

4. While laying the head back into the water, give a relaxed downward push with arms and legs. This is important to overcome the downward force induced by the head being out of the water and to keep you near the surface.

5. Completely relax, with arms and legs dangling, while floating the few inches back to the surface.

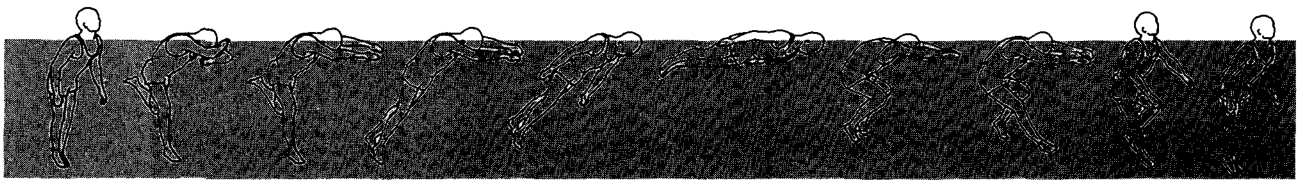
   Rest until you feel like getting a breath, but NEVER until you feel a NEED *for a breath.*

The rest interval will vary with individuals, but it should never be less than 3 seconds. This period usually increases to 6 seconds after a few minutes and should reach 10 seconds after 1 hour. Many people average three or four breaths a minute once they are thoroughly indoctrinated in the basic stroke. True "sinkers" can stay afloat almost as easily as "floaters;" but they must use the travel stroke, a modified technique normally used by floaters to progress through the water.

THE TRAVEL STROKE

By using the same breathing system employed in the basic stroke and alternating it with a propulsive movement, a person can swim long distances, certainly a number of miles. Generally, the average person can do the travel stroke during the second or third lesson after mastering the basic stroke. The sequence of the travel stroke is shown below:

1. **Inhale, starting to sink.**
2. **Lay head forward, bring hands to shoulders, and get ready to kick.**
3. **Extend arms.**
4. **Kick legs.**
5. **Use a slow, shallow sweep of arms to the sides.**
6. **Glide up to and along the surface with head horizontal.**
7. **When you feel like getting a breath, extend hands forward and bring both knees as far up as possible, rounding the back.**
8. **With head still down, extend one foot forward without letting the other knee go back.**
9. **Raise head and breath.**
10. **Begin process again.**



DISABLED SWIMMING

A person trained in Drownproofing finds cramps or disabling injuries to the arms and legs painful and distracting but never truly dangerous. Once the basic stroke is mastered, the Drownproofer realizes his buoyancy is unaffected by injuries or cramps in the limbs, and he can stay afloat quite easily without the use of his arms and/or legs, as the photos above illustrate.

During his career, Professor Lanoue trained nearly one thousand 4- and 5-year-old children in Atlanta, Georgia, in Drownproofing. These children stayed afloat for 1 hour and swam 1 mile. Then, with their legs tied to their waist, they stayed up for half an hour and swam 100 yards. They repeated the same test with their wrists tied behind their backs, showing the capabilities allowed with this stroke under various hardships.

Drownproofing is not completely new to the U.S. Navy. The technique has been taught for several years to all students in Basic Underwater Demolition/SEAL (BUDS) Training conducted at the Naval Amphibious School, Coronado, California. The Explosive Ordnance Disposal (EOD) School in Indian Head, Maryland, has recently had several of its staff qualified to teach Drownproofing and intends to include instruction of this technique as part of the Navy EOD Diving training.

The most complete and definitive description of Drownproofing techniques presently available is found in Professor Lanoue's book, *Drownproofing: A New Technique in Water Safety*, published by Prentice-Hall in 1963.

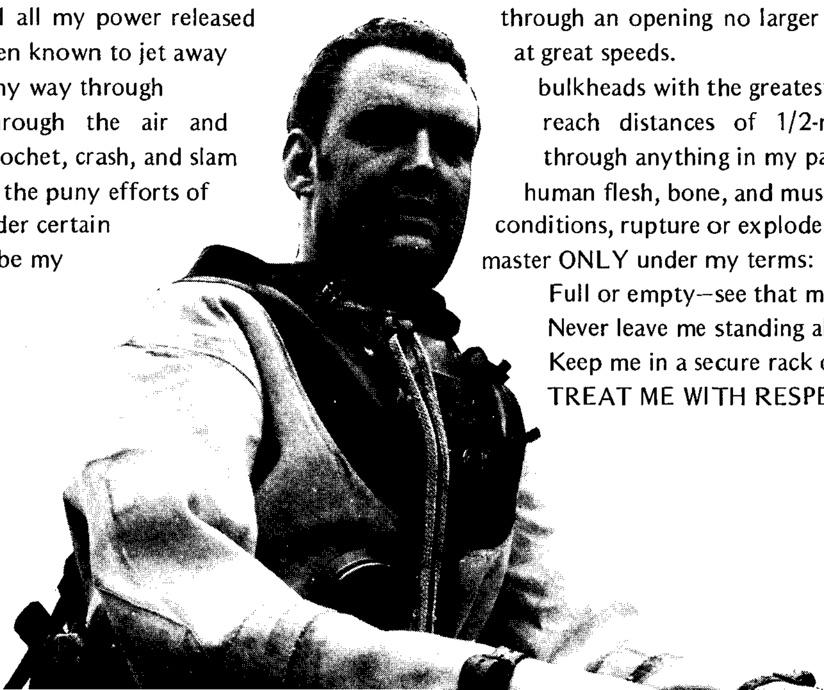
The Old Master Says...

I'm going on leave this one issue and allow a reader's contribution to appear "as submitted." Compressed gas cylinders are nothing to fool around with—so read and take heed of the dangers involved with these "sleeping giants."

BEWARE OF THE SLEEPING GIANT

Here is his description:

I am a compressed gas cylinder.
I weigh in at 175 pounds when filled.
I am pressurized to 2200 psi.
I have wall thickness of approximately 1/4-inch.
I stand 57 inches high.
I am 9 inches in diameter.
I wear a cap when not in use.
I wear valves, gages, and hoses when at work.
I wear many colors and bands to tell what tasks I perform.
I am ruthless and deadly in the hands of the careless or uninformed.
I am too frequently left standing alone on my small base with my cap removed and lost by an unthinking diver.
I am ready to be toppled over—where my uncapped valve can be snapped off and all my power released through an opening no larger than the diameter of a pencil.
I have been known to jet away at great speeds.
I smash my way through bulkheads with the greatest of ease.
I fly through the air and reach distances of 1/2-mile or more.
I spin, ricochet, crash, and slam through anything in my path.
I scoff at the puny efforts of human flesh, bone, and muscle to alter my erratic course.
I can, under certain conditions, rupture or explode. Beware!
You can be my master ONLY under my terms:
Full or empty—see that my cap is on straight and snug.
Never leave me standing alone.
Keep me in a secure rack or tie me so I cannot fall.
TREAT ME WITH RESPECT: I AM A SLEEPING GIANT.



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