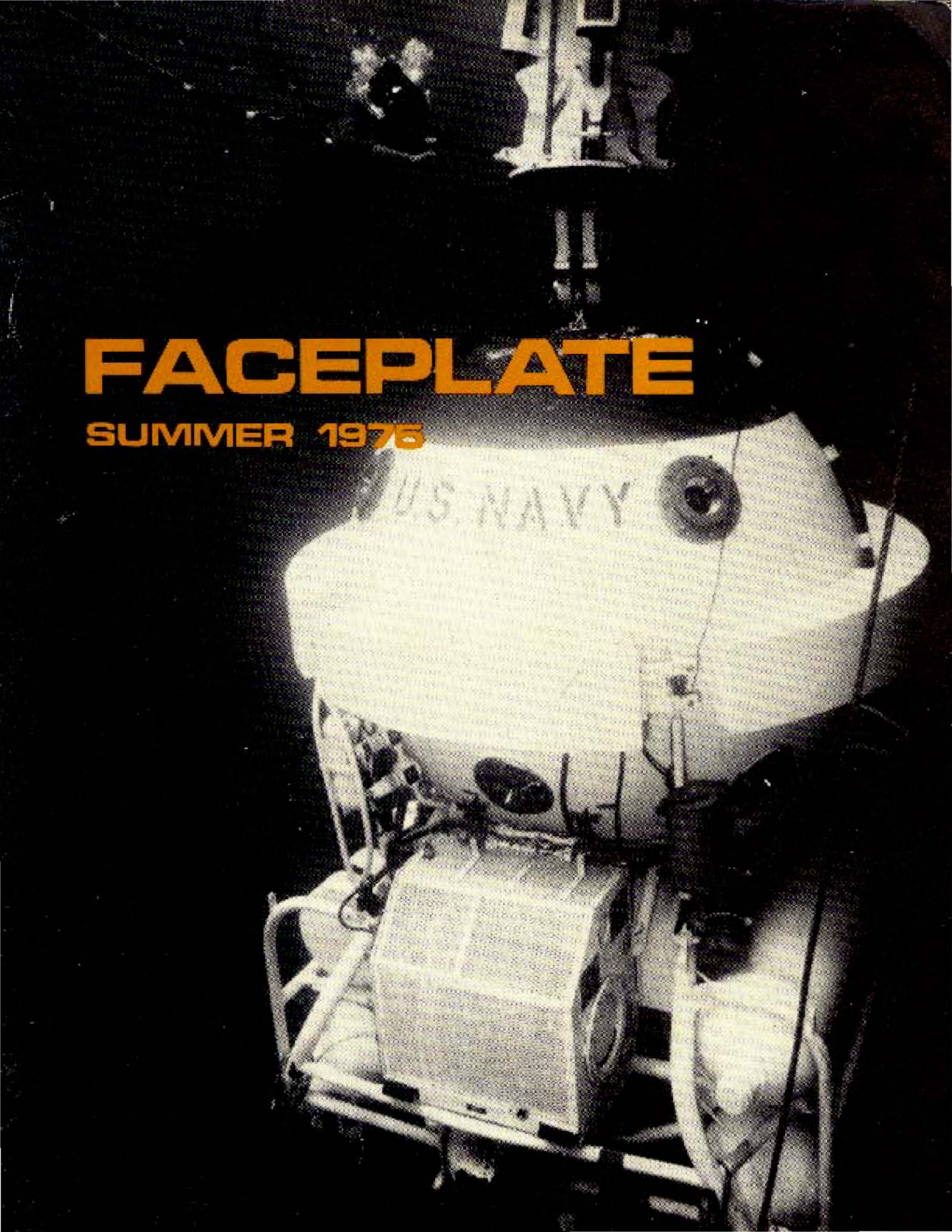
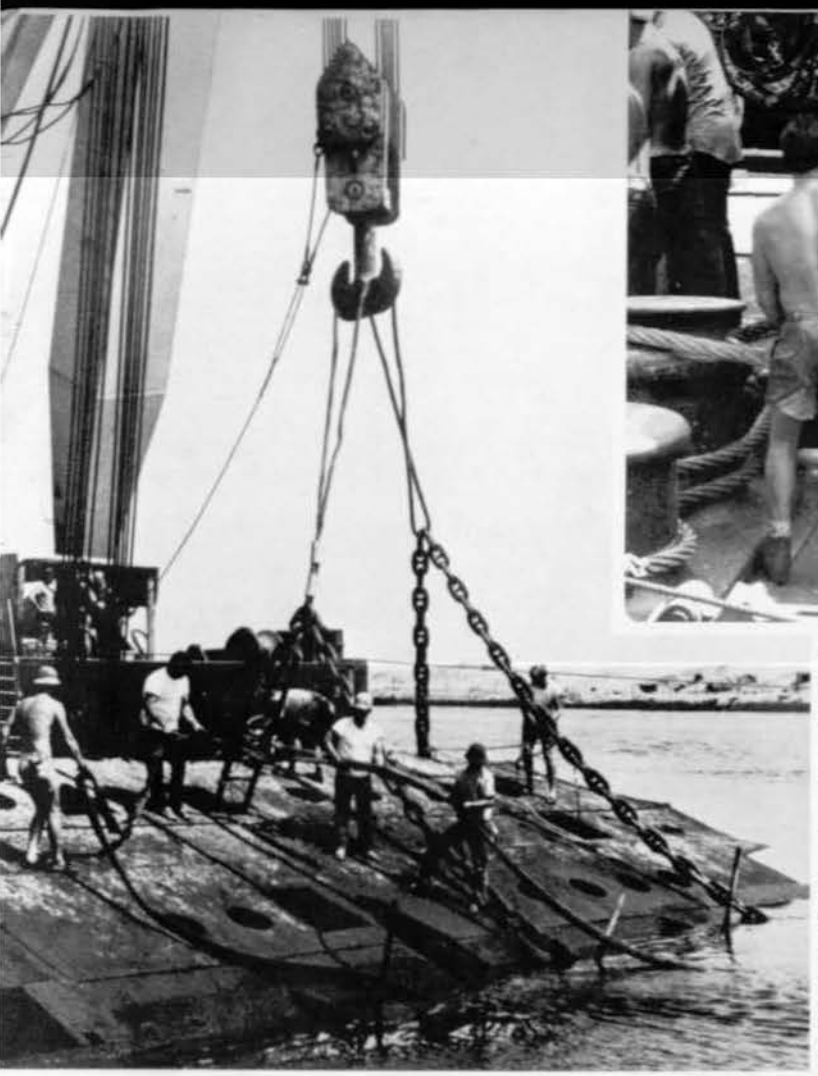

FACEPLATE
SUMMER 1976
US NAVY



FACEPLATE

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

VOLUME 6, NO. 2

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

Requests for distribution copies or for changes in distribution should be directed to FACEPLATE, Supervisor of Diving, Naval Sea Systems Command, Washington, D.C. 20362. Telephone (Area Code 202) OX2-1400 or AUTOVON 222-1400.

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Front cover photo was taken during Mk 1 DDS descent in Navy's record-breaking dive. See page 26. *(Photo courtesy of NCSL Photography Department.)*

Inside front cover shows various scenes of the efforts of salvors and support personnel during the Suez Canal Clearance operations. See page 32.

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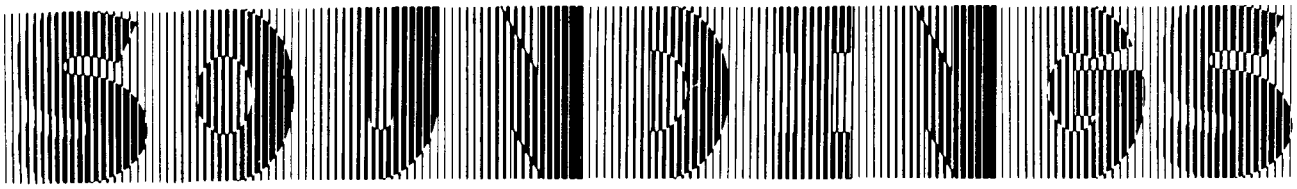


CALL FOR PAPERS: WORKING DIVER 1976

A call for papers is being issued for THE WORKING DIVER – 1976 Symposium to be held at Batelle's Columbus Laboratories, Columbus, Ohio, on March 2-3, 1976.

Sponsored by the U. S. Navy, Battelle-Columbus, Marine Technology Society, and the American Society of Mechanical Engineers, the Symposium will acquaint attendees with significant advances in equipment for working divers and new techniques in areas of diving equipment, use of divers and equipment in underwater work or salvage operations, breathing gas technology, and extreme environment diving.

Persons wishing to present papers at the Symposium should send a 250-word abstract by October 1, 1975, to:

Mr. Peter Riegel
Battelle-Columbus Laboratories
505 King Avenue
Columbus, Ohio 43201
Phone: (614) 299-3151
(before July 20, 1975)
(614) 424-6424
(after July 21, 1975)

FLORIKAN GETS A 4.0 RATING

The 33-year-old USS FLORIKAN (ASR-9) received high commendations for her overall outstanding materiel condition from the Navy Sub-Board of Inspection and Survey, Pacific, after their inspection of the ship in January 1975. The following remarks, which are excerpts from a letter to the President of the Navy Board of Inspection and Survey from the Pacific Sub-Board, indicate the degree of excellence exhibited by FLORIKAN's personnel.

All too often, inspection reports consist of a familiar litany of deficiencies and of grossly neglected, deteriorated, and unsafe conditions. By contrast, Sub-Board inspectors were unanimous in singing the praises of this excellently maintained older ship and her inspired crew. The ship was immaculately clean and smart, and her PMS program was being followed meticulously. There was an unusual degree of cohesiveness about the ship's company, whose members were apparently connected by common principles of self-reliance, shared responsibility, ship spirit, and pride.

CAPT John L. Kauth, USN, the Senior Inspector, quizzed the Sub-Board inspectors and met with FLORIKAN crew members in an attempt to identify factors contributing to FLORIKAN's success. Several "inside" factors that were considered major influences are described in the following excerpts.

A cohesive group of CPOs who, on the whole, are more knowledgeable, harder working, and more full of pride than their contemporaries.... Unusual comraderie among the crew members, ... The favorable influence of divers (approximately 25) included in the ship's company. Divers are an elite group, who tend to be smarter, more physically fit, and more highly motivated than the average ship population.... High quality command leadership and materiel awareness provided by LCDR R.W. Drake, whose submarine training is an asset....

Faceplate joins in extending a hearty WELL DONE to FLORIKAN's crew!

LCDR J.M. MARTINEZ RETIRES

LCDR J. M. Martinez, Jr., retired from the U.S. Navy on April 1, 1975, after serving for 27 years. His career began in 1948 in the enlisted rates, steadily progressing until he was commissioned an officer in 1965. His first sea tour as an officer was aboard USS RECLAIMER (ARS-42). LCDR Martinez was assigned to the Naval Ship Systems Command in 1968, followed by a 2-year tour as Commanding Officer of USS TAKELMA (ATF-113). Before his last assignment as Supervisor of Salvage Representative, West Coast, he served with the Staff, Commander, Service Squadron FIVE. A letter of appreciation from VADM R.C. Gooding, Commander, Naval Sea Systems Command, states that LCDR Martinez "served well in [his] many assignments and can indeed take pride in [his] contributions for a better Navy."

EVIDENCE IN FAVOR OF SOCKET HEAD SCREWS

By Mr. John Mittleman
Naval Coastal Systems Laboratory

Divers are often faced with the chore of removing and replacing flathead cap screws when performing various ship husbandry tasks. This particular assignment becomes more difficult, however, if the

screws are slotted. The use of socket head cap screws not only eases this job, but also provides more reliable fastening.

Divers prefer socket head screws for several reasons. An allen wrench will stay in a socket head screw by itself. The use of slotted screws requires the diver to push the screwdriver into the screw, and the diver ends up pushing himself away instead. A second reason is that ordinary allen wrenches provide much more leverage than ordinary screwdrivers. In addition, divers are less apt to fumble or lose socket head screws since they can be put on the wrench before inserting the screw.

Another important factor is that sockets are less prone to being stripped than slots because alignment is automatic with an allen driver. This also lessens the possibility of cross threading.

The fact that socket head screws can be set with higher torque and higher reliability than slotted screws was verified by an experiment conducted in August 1973. Divers in saturation training at Submarine Development Group ONE, San Diego, California, tightened more than 50 screws of each type (slotted and socket head) using screwdrivers with identical handle sizes. The setting torque was indicated by the final thickness of lead balls that were crushed by each screw.

The results showed that the average setting torque for socket head screws was 1-½-times greater than that for slotted screws; and the range of torque values for socket head screws was only 40 percent of the range for slotted screws.

With this evidence of higher torque and higher reliability, in addition to the finding that socket head screws are easier to handle and less prone to stripping, it is recommended that socket head screws be specified in preference to slotted screws during both the initial ship design phase and in the replacement of existing cap screws during underwater repair and maintenance.

For further information or details of the experiment, contact: John Mittleman, Naval Coastal Systems Laboratory (Code 710.5), Panama City, Florida 32401, (904) 234-4388, Autovon 436-4388.

QMC MCLEAN RETIRES

QMC Percy O. McLean was piped over the side by his fellow chiefs onboard the USS KITTIWAKE (ASR-13) after completing more than 21 years of naval service. Chief McLean's tours of duty include five ASR's and the Navy Experimental Diving Unit in Panama City, Florida. Following his retirement, Chief McLean will continue working with NEDU as an employee of a civilian firm.

NEDU COMPLETES FIRST SATURATION DIVE AT OSF

L-r, Standing: Mr. T.W. Cetta, HTCM (MDV) R.A. Driscoll; Seated: EM1 (DV) J.D. Pelton, HT1 (DV) T.M. Kincannon, EMCM (MDV) R.K. Merriman.

Navy Experimental Diving Unit personnel successfully completed the first saturation dive in the NEDU Ocean Simulation Facility, Panama City, Florida, on April 4, 1975. The officers and men of NEDU manned the facility for the 4-day, 100-foot air dive. The diving team consisted of Mr. Thomas W. Cetta, NEDU Engineer; HTCM(MDV) Robert A. Driscoll, USN, Project Master Diver; EM1(DV) Jerry D. Pelton, USN, NEDU Electrician; and HT1(DV) Thomas M. Kincannon, USN, NEDU Gas Field Operator.

The dive was a training and work-up dive for more extensive saturation diving research later this year. During the dive, all systems of the OSF were operated on a regular and repeated basis for training and to obtain reliability data. During decompression, EM1 Pelton was reenlisted by LCDR Ringelberg as the chamber hovered at 69 feet.

Future dives in the OSF will be made to greater depths and for longer periods of time in the development of more precise saturation diving decompression tables.

BARRETT MAKES COMMANDER

CDR Barrett gets new hat from wife Sally.

During the change of command/commissioning ceremony at NEDU, Panama City, Florida, (see page 18), Royal Navy Exchange Officer Bryan N. Barrett, RN, was promoted to the rank of Commander.

CDR Barrett is a Mine Countermeasures and Clearance Diving Specialist. His RN duties have included working in the 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. Before coming to NEDU in July 1973, CDR Barrett was stationed at the Admiralty Experimental Diving Unit, Portsmouth, England.

During his 2-year tour at NEDU, CDR Barrett has served as the Project Manager for the Mk XIV Push-Pull Breathing System. Under his direction, the new system has advanced from the design stage to the building of a prototype system.

CDR Barrett will be returning to England in September 1975, to assume new duties within the Directorate of Naval Operational Requirements in the Ministry of Defense, London, England. He will be relieved at NEDU by LCDR Julian G. Malec, RN, who will arrive in Panama City in August.

Faceplate extends congratulations to CDR Barrett on his promotion and best wishes in his new endeavors as he returns to England.

NEDU REPORTS:

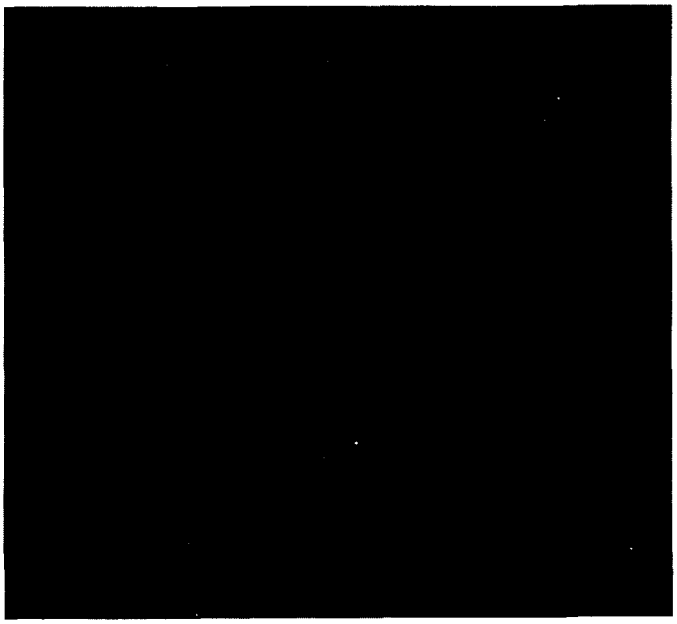
Navy Experimental Diving Unit Report 12-73. *An Evaluation of the Aquadyne Diver Life Support System When Used in the Semi-Closed-Circuit Mixed Gas Mode.* S. D. Reimers, H. C. Langworthy.

Abstract: The Aquadyne Diver Life Support System, manufactured and distributed by General Aquadyne, Inc., of Santa Barbara, California, was subjected to evaluation testing at the Navy Experimental Diving Unit. The System consists primarily of a mixed gas helmet, a backpack scrubber, and a neckring assembly that may be used with either neckseals or dry suits. Neckseals were used during most of the tests conducted during this series. The system was tested for sound levels and ventilation efficiency using specially built test manikins. It was tested for diver comfort in a series of 16 manned dives. Since many of the testing methods used were new, a discussion of the procedures used as well as the results obtained is presented. The sound levels existing in the helmet were found to be below the damage risk levels when the system was used in the semi-closed-circuit mode. Noise exposure time in the system was considered to be unlimited as long as the total open-circuit time did not exceed 45 minutes per 24-hour period. The ventilation efficiency of the system was found to be generally adequate for diving in the depth range of 0 to 300 fsw, although the total helmet flow rate fell below the desired 4.5 acfm at depths below approximately 200 fsw. The system was regarded by the divers as generally much more comfortable than the standard USN He-O_2 diving outfit. However, diver's complaints of jock strap discomfort were common at work rates approximating or exceeding moderate work.

Navy Experimental Diving Unit Report 14-73. *Evaluation Testing of the David Clark Model S-5005 Air and Mixed Gas Diving System.* S. D. Reimers, J. K. Summitt, W. F. Aichele, T. W. James.

Abstract: The David Clark S-5005 Air and Mixed Gas Diving System was subjected to evaluation testing at the Navy Experimental Diving Unit. The system was tested for diver comfort in the open-circuit air mode in a series of 25 manned dives. The helmet used with the system was tested for sound levels in both the open-circuit air and semi-closed-circuit mixed gas modes by means of a specially constructed test manikin. The helmet was found to be uncomfortable in the water due to extreme noise and excessive buoyancy. Manned diving with the system in the open-circuit air mode was suspended when one of the test divers complained of abnormal hearing subsequent to his dive, and audiometric examinations performed on him and the preceding test diver revealed significant temporary hearing losses in both men. Further evaluation of the system in the open-circuit air mode was terminated when the sound level tests revealed that the sound levels in the helmet in the open-circuit air mode were so far into the damage risk levels that safe use of the helmet was judged impractical. All evaluation efforts were subsequently terminated when it was learned that David Clark was discontinuing its line of diving equipment.

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



Underwater ship husbandry encompasses repair, maintenance, and inspection tasks performed by divers as a service to waterborne ships. In the U.S. Navy, the execution of these tasks is primarily the responsibility of shipyard, tender, and repair ship diving crews. The Supervisor of Diving (SUPDIVE), USN, funds and monitors research and development efforts whose objectives are to upgrade the capabilities of ship husbandry divers through hardware developments and information transfer. The Naval Coastal Systems Laboratory (NCSL), in Panama City, Florida, is the primary laboratory performing ship husbandry research and development (R&D) for SUPDIVE.

NCSL hosted the first Navy-wide Underwater Ship Husbandry Workshop on January 7 and 8, 1975, sponsored by SUPDIVE. Representatives from the Naval Sea Systems Command, shipyards, tenders, repair ships, ship repair facilities, and laboratories participated in 2 days of group discussions and presentations. The completed goals of the workshop were as follows:

- To familiarize the workshop participants with the scope and nature of underwater ship husbandry work performed by each represented activity.
- To document the state of the art in each of the following nine task areas: Tools; hull and dome cleaning; propeller changing; underwater paints and adhesives; shallow water dive gear and inspection systems; submarine work and ship design changes; zinc changing, blanks, and cofferdams; underwater welding; and shipyard diving.
- To suggest technological and managerial improvements in each task area stated above.
- To educate workshop participants through group discussions and through demonstrations of recently developed hardware.

Highlights and recommendations from the Underwater Ship Husbandry Workshop are presented here, categorized according to the audience that each set of highlights most nearly addresses.

Ship husbandry is a tool that can save considerable costs, especially on maintenance operations. Maintenance, being more predictable than repair, should be open to more sophisticated management techniques than "crisis management." In order to take full advantage of ship husbandry capabilities, however, the manager must take the time to acquaint himself with what can be done by divers.

Hull cleaning, for surface ships especially, is under intensive study at several levels within the Navy. As yet, no universally accepted data exists upon which a decision may be made concerning the extent to which underwater cleanings should be practiced on Naval surface ships. Fuel economy is the alleged reward; but the cost will be measured in terms of actual dollars per cleaning, related research and development expenditures for improved cleaning hardware, and the probable requirement for significant increases in the total number of Navy diving billets. Viewed in terms of fuel economy, hull cleaning would be a periodic maintenance operation. Other ship husbandry jobs that should be thought of as periodic maintenance rather than emergency "fixes" include zinc replacement, sea chest cleaning, patch painting, and propeller grooming. An unsatisfactory condition reporting system should be recognized as the natural complement of recent breakthroughs in underwater inspection and power tools capabilities.

It is the mutual responsibility of divers and management alike to understand and promote the current capabilities of ship husbandry diving. The high cost and restricted availability of drydocking services make any unnecessary drydocking completely unacceptable. When drydocking is required, waterborne preparation, including selective hull cleaning, can greatly reduce indock time, sand blasting grit expenditures, the occurrence of silicosis, and the unpleasant odor of fouling organisms in the drydock.

In order to maintain the highest level of competency in ship husbandry divers, formal diving training may require some modifications. Notably, more emphasis is needed on lightweight surface-supplied diving gear. Also, if underwater welding is to become an acceptable perma-

nent repair technique, more intensive training must be given to a small number of divers, with provisions made for regular practice sessions. Another consideration is that the present requirement to wear deep sea gear when welding is a deterrent to the successful development of our underwater welding capabilities. Finally, more thorough familiarization by divers of underwater hull features is required.

Manpower shortages affect ship husbandry teams severely; failure to maintain diving gear properly, failure to man recompression chambers at all times, and failure to abide strictly by U.S. Diving Manual instructions are symptoms of this problem. Both in civilian and military diving, the rate or civil service classification of "Diver" is absent, so that as soon as a diver leaves the water he may be recalled to his primary responsiblity. Furthermore, in civilian diving, no provision is made to differentiate between men of varying degrees of experience. Such differentiation could be made if diving were a recognized civil service classification with five grade levels, as is the common practice for other shipyard related classifications.

The manpower shortage in shipyard diving lockers could be eased by a more vigorous campaign to recruit

ex-Navy divers. Here again, a civil service rating for divers would be of great value.

Diver tool research and development is sponsored by NAVSEA at NCSL and by the Naval Facilities Engineering Command (NAVFAC) at the Civil Engineering Laboratory (CEL), Port Hueneme, California. The current demand for power tools is large enough to amply justify the 8 years of R&D sponsored by SUPDIVE. The demand level now forbears the onset of a more formal program, requiring fleet and laboratory input to define operational requirements for further tool development.

At present, there are numerous tools and support equipment readily obtainable through NCSL. These include the SUPDIVE power source, mobile hydraulic power source, various rotary power tools, diver-operated hydraulic pump, several cylinder-actuated tools, hydraulic intensifier, hydraulic come-along, flow divider (variable), and the SUPDIVE 750-pound lift bag. A complementary tool program at CEL has several new items under development that may also have ship husbandry applications. The Underwater Damage Assessment Television System (UDATS), already out of the R&D stages, is now a powerful management tool as well as a tool used by other R&D efforts. It is, perhaps, the single most important new tool in ship husbandry diving.

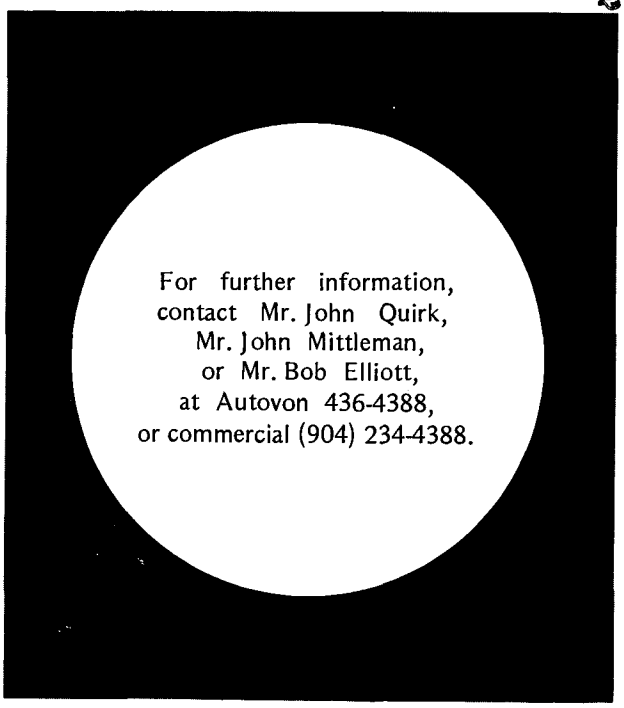
Several other areas in which R&D may benefit ship husbandry divers are underwater nondestructive testing techniques, seawater hydraulics, standardized communications for use with the Jack Browne mask, and head-mounted UDATS (under development at NCSL). Additional areas include techniques for using UDATS in extremely turbid water (conceptual design completed at NCSL); and underwater appliable paints, anticorrosive and antifouling (under joint investigation by NCSL and CEL).

A final area of ship husbandry related to R&D is hull cleaning. At the present time, NAVSEA is organizing an effort to study the cost effectiveness of this procedure. Should hull cleaning prove to be desirable, R&D work will be required in cleaning hardware and in hull coatings compatible with frequent cleanings.

There are numerous areas in which current ship design practices are not compatible with current ship husbandry capabilities. The use of socket head cap screws, as opposed to slotted screws, would facilitate more reliable fastening and would make the fasteners easier to handle under water. Shipyards, tenders, repair ships, and ship repair facilities should all be able to accomplish propeller changes under water. The incorporation of features permitting hydraulic pulling and resetting of propellers would make underwater propeller changes easier and less risky. Welded-on ropeguards must be removed in order to remove propellers with detonating cord and, in some cases, in order to change zincs. This procedure is needlessly time-consuming and laborious. In low visibility water, the underside of a ship is like a great unmarked desert. Divers unanimously feel that location aids or frame markings should be provided. Standardization of hull openings would permit more rapid and effectual blanking and reduce the need for "one-of-a-kind" cofferdams. The use of studs, rather than welded straps, to hold zincs in place would make zinc replacement much simpler. Lifting pads below the waterline should be load tested and certified during drydockings.

Several of these examples have received attention within the diving community. What is most lacking, however, is viable dialogue between divers and ship designers. All fleet contributions are most welcome, especially from the ship design codes.

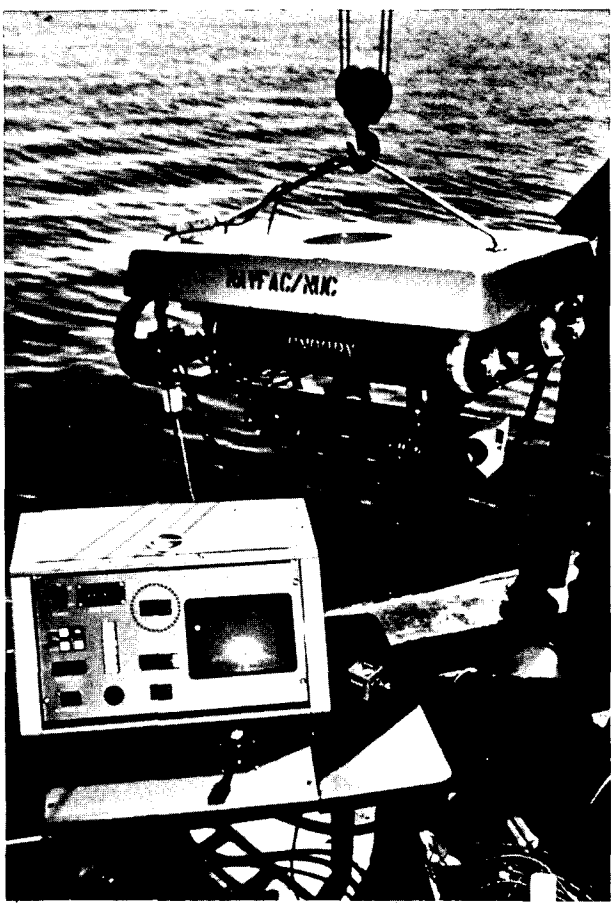
The workshop proceedings include presentations by representatives of participating activities, presentations by work group leaders, results of an Opinion Summary questionnaire, and a breakdown of jobs by task and tool.



For further information,
contact Mr. John Quirk,
Mr. John Mittleman,
or Mr. Bob Elliott,
at Autovon 436-4388,
or commercial (904) 234-4388.

NAVFAC'S NEW 1500-FOOT-DEPTH SLEUTH

LTJG Edward H. Peterson, CEC, USN
Naval Facilities Engineering Command



The Naval Facilities Engineering Command's (NAVFAC) Ocean Construction Equipment Inventory will acquire its newest piece of major ocean construction equipment in July 1975. This latest addition to the planned 18- to 20-million-dollar equipment inventory is the remotely controlled site survey and ocean facility inspection system called the "NAVFAC SNOOPY." SNOOPY will be used by the Navy's Underwater Construction Teams (UCTs) to perform their Navy mission of underwater construction, which includes a variety of projects generated by both NAVFAC and fleet requirements. For example, Navy Project Engineers require site survey information and documentation of the condition of fixed ocean facilities to complete the required planning for ocean construction projects. SNOOPY will greatly enhance the capability of the UCTs to provide this information.

The system will complement construction divers during traditional underwater surveys and will also be used independently to provide valuable information about the condition of deeper underwater facilities. Such fixed facilities as pipelines, cables, chain and anchor assemblies, and ocean structures of all types will be inspected by the new system. SNOOPY's 1,500-foot operational depth capability allows it to work at depths far beyond those at which divers can be used efficiently.

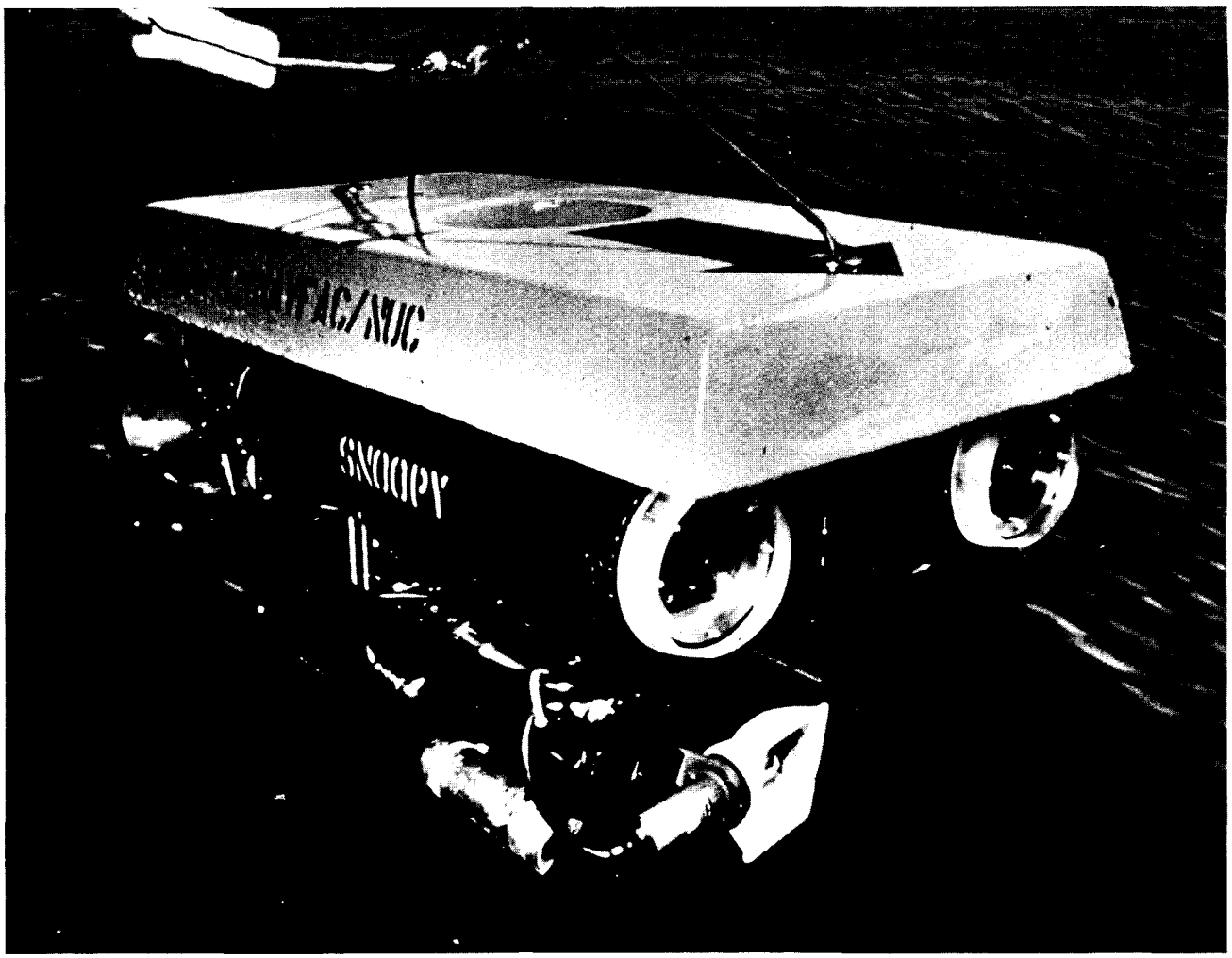
The system includes a video tape system with a low light level camera that can "see" more than the human eye. In addition, the video tape monitor in the control console provides a "real time" inspection capability to the topside operator. For a permanent record, the video signal can be fed into a standard video tape recorder. Additionally, SNOOPY incorporates a Super 8 millimeter motion picture camera. The camera has a 50-foot film cartridge and can be operated in short bursts at 9 or 18 frames per second. A 250-watt quartz iodine light provides illumination for photography and the television camera.

SNOOPY's endurance, control, photographic, and video tape capability make it an ideal tool for extended pipeline and cable surveys and for large area searches.

SNOOPY requires minimal surface support and can be operated from any ship of opportunity that can furnish 115-volt, 3-kilowatt, 60-hertz, 1-phase power. The simplicity and light weight of the vehicle minimize the problems associated with launch and recovery operations. A simple boom or davit is all that is required.

The entire system, including the vehicle, control console, power and signal conditioning unit (PSCU), and umbilical cable weighs 603 pounds (in air). It is capable of rapid deployment by air, sea, or land transport to any operating area. Installation of the system aboard ship can usually be accomplished in less than 2 hours.

With the addition of SNOOPY, the capability of the UCTs to provide ocean facility inspection services to the fleet has been greatly increased. Through use of this unique inspection tool, the Naval Construction Force can contribute significantly to the capabilities and readiness of the fleet to carry out their assigned missions. SNOOPY was designed and fabricated for NAVFAC by the Navy Undersea Center, San Diego, California.



"We are here to dedicate a very unique Navy facility. Throughout the world there is not another like it." In his opening remarks, CDR Colin Jones, then Commanding Officer of the Navy Experimental Diving Unit, was speaking for Navy and civilian personnel alike who had been working toward this formal dedication of the Ocean Simulation Facility on May 23, 1975. The new Panama City, Florida, home of NEDU at the Naval Coastal Systems Laboratory is now officially ready for full operational testing of man and equipment at depths to 2,250 feet of seawater.

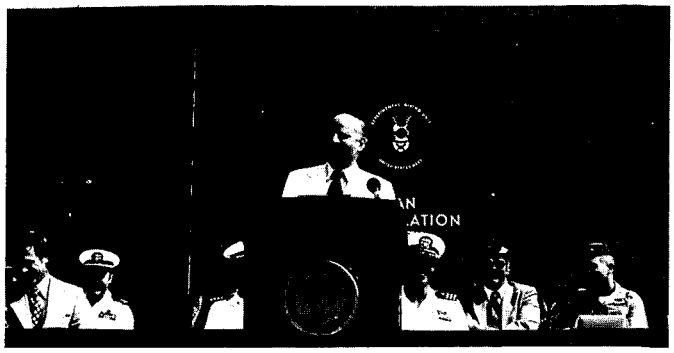
CAPT R.T. Quinn, Commanding Officer of NCSL, called the ceremony to order, welcomed participants and attendees, and introduced the numerous guests of honor present. CDR Jones then gave the opening remarks, including a brief history of NEDU and what the capabilities of the OSF will enable the Navy to accomplish in the future.

While discussing several major highlights of diving technology in the past, CDR Jones noted in particular the major breakthrough in the 1950's of the development of saturation diving techniques. CAPT George F. Bond, MC, USN, who was the principal developer of these techniques while stationed at NEDU, is now on the staff of NCSL. Commenting further that it would be impossible to cite all contributors, CDR Jones did single out one group, the Navy enlisted divers. He referred to this group as "The men who made possible the improvements. The men who risked their lives and health to prove the techniques and procedures. The men who invented, developed, designed, and built the equipment."

In closing, CDR Jones added:

"As we dedicate this building and the equipment it houses, let us remember that the Ocean Simulation Facility represents a major step in aiding man toward his goal of conquering the sea. From the programs to be conducted in this facility will come the tools, methods, and knowledge that will help man on his journey into the deep."

Following CDR Jones at the podium was the Honorable Robert L.F. Sikes, U.S. Congressman for the state of Florida, who stated that the Laboratory and the new facility marked the beginning of a new and epochal period of Navy history. Congressman Sikes also commented on the recent announcement that the Navy diving and salvage training center will be moved from



California to the base in Panama City, noting "how important all aspects of diving are."

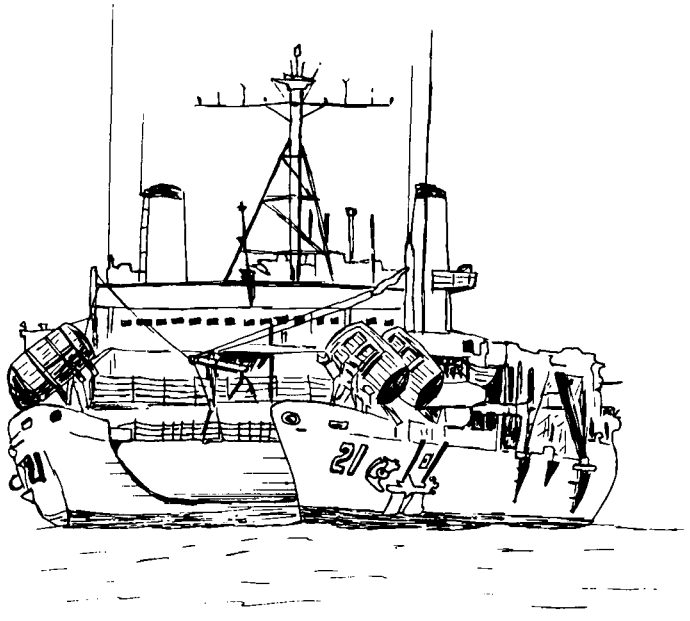
Dr. Malcom R. Currie, Director of Defense Research and Engineering, in the dedication address, said that the new facility will be a key to exploring the ocean and changing it from an unknown into an ally for shaping the future. He noted the timeliness of the OSF, stating that "on the eve of the Bicentennial, this new facility provides us with an important link to the future." Dr. Currie also discussed the vast resources that await discovery within the oceans, stressing that "in order to survive on land, we must venture into the sea," and that the capabilities of the OSF represent a great step in that venture.

Following Dr. Currie's address, CAPT E.L. Pickett, of the Naval Facilities Engineering Command, presented the symbolic gold key to CAPT Quinn and CDR Jones. The ceremony ended after Congressman Sikes, Dr. Currie, CAPT Pickett, CAPT Quinn, and CDR Jones unveiled the gold OSF plaque, which carried both the NCSL and NEDU seals and which stated "Dedicated to the Advancement of Hyperbaric Technology."

Various dedication scenes: Page 12: Dr. Currie speaks to assembly. Top left: CAPT Quinn; ADM Frederick Michaelis, Chief of Naval Material; and ADM Isaac Kidd, Commander-in-Chief, Atlantic Fleet; read OSF plaque. Top right: Congressman Sikes speaks during ceremony. Middle row, left: CAPT Pickett, CAPT Quinn, CDR Jones, Dr. Currie, and Congressman Sikes have just unveiled the OSF plaque. Middle, right: CAPT Pickett presents OSF gold key to CDR Jones and CAPT Quinn. Above: CDR Jones gives ceremony's opening remarks.

(Photos by PH2 B. Douthit, NEDU.)

USS PIGEON: "A Bird of a Different Feather"



LT Stan Cwikinski, USN
USS PIGEON (ASR-21)

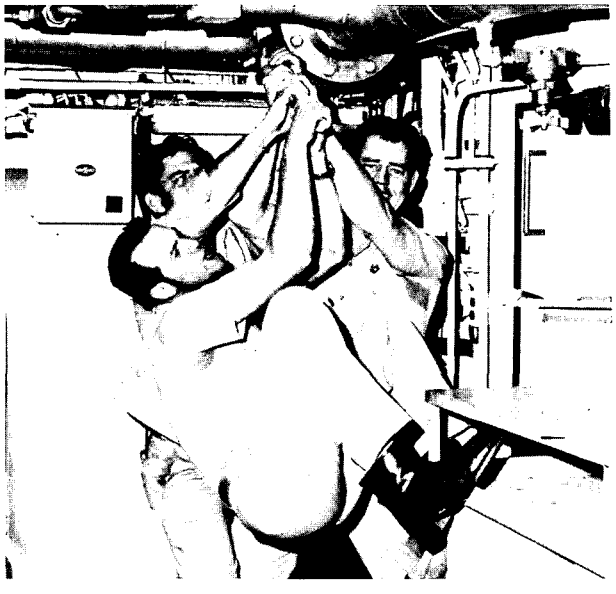
USS PIGEON (ASR-21) and her sister ship USS ORTOLAN (ASR-22) are the Navy's largest, newest, and most uniquely configured diving platforms afloat. A unit of Submarine Development Group ONE, San Diego, California, and commanded by CDR W.J. Doyle, USN, PIGEON carries a crew of 160. There are 35 diving personnel on board, including saturation, first and second class divers, and Diving Officers. This catamaran-hulled ASR houses an impressive array of advanced diving equipment and capabilities to complement her equally impressive DSRV handling equipment, underwater tracking hardware, and deep mooring system.

Included in her diving arsenal are the sophisticated deep diving system (DDS) Mk 2 Mod 1 saturation diving complex, apparatus for SCUBA and deep sea air and mixed-gas conventional diving, an open diving bell, and the McCann submarine rescue chamber.

With the arrival of PIGEON, gone are the days of the old ASR "bottle parties" (the ever-burdensome task of manually loading aboard numerous helium-oxygen and oxygen "K" cylinders) for PIGEON divers. On board, within her two hulls, are permanently installed banks of storage flasks affording an optimum and overwhelming storage capacity for 332,000 scf of helium at 3,800 psig; 88,000 scf of oxygen at 3,000 psig; 48,000 scf of helium-oxygen at 3,800 psig; and 40,000 scf of compressed air at 3,000 psig. To this capability, add PIGEON's other unique diving support equipment features -- a helium reclaiming system capable of recovering for reuse 98 percent of the helium expended during a saturation dive, two helium-oxygen mixmakers able to provide helium-oxygen mixtures from .5 to 40 percent. oxygen, two oxygen and two helium/helium-oxygen pressure booster and gas transfer pumps, and two 3,000 psig hp air compressors and the word unique takes on real meaning. Gas logistics self-sufficiency for a long duration, worldwide diving capability is guaranteed.

Although her diving history is limited and not yet impressive, PIGEON has been accumulating some experience by testing its diving system components.

The starboard personnel transfer capsule (PTC) of the DDS Mk 2 Mod 1 made an unmanned, powered-up hydrostatic dive to 935 feet of seawater (fsw) on February 24, 1974. This was followed the next day by a successful



Quality assurance, exacting tolerances, and precision machining enable all of the DDS, Mk 2 Mod 1 components (including this 6" ball valve) to operate "smoothly" and almost "effortlessly."

manned certification hydrostatic dive to 850 fsw. The first manned saturation dive was made on PIGEON in March 1974. This "dry" dive involved four divers being saturated at 35 fsw for 3 days as part of testing the life support system of the DDS Mk 2 Mod 1 complex.

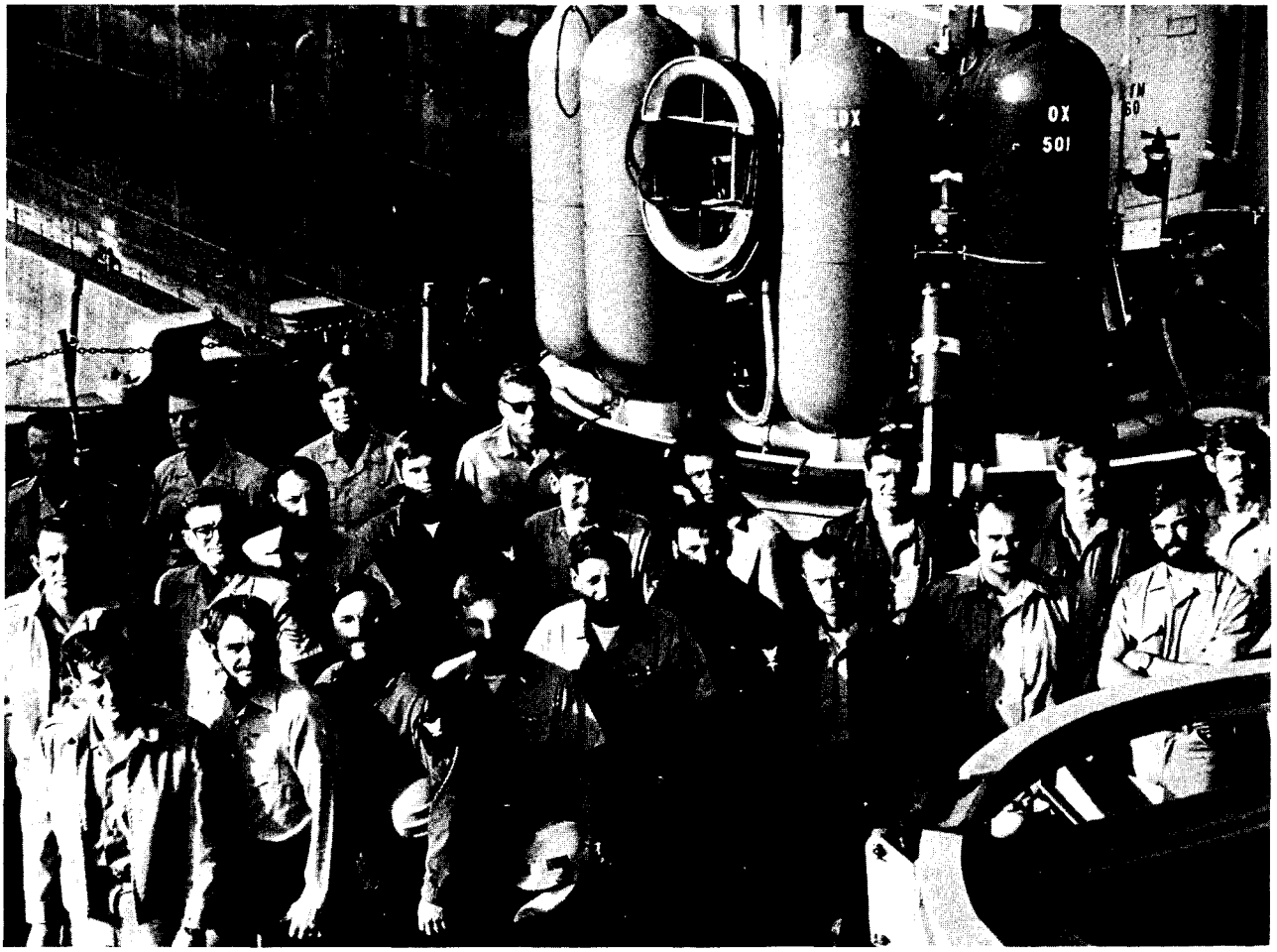
The port PTC made an unmanned, powered-up hydrostatic dive to 935 fsw on May 22, 1974 also followed by a manned certification hydrostatic dive the next day to 850 fsw. On June 4, 1974, a 3-day saturation dive was completed successfully in the starboard complex of the DDS Mk 2 Mod 1 at 35 fsw, thereby man-testing its life support system.

As part of the testing of the diver surface support console (the gas and communication control station for all conventional diving onboard PIGEON), numerous dives were completed using the Mk V diving rig and the USN Mk 1 band mask with the hot water wet suit. Additionally, several open sea dives were performed in PIGEON's refurbished submarine rescue chamber; and the open diving bell was checked out in shallow water.

USS PIGEON is presently completing a restricted availability at the U.S. Naval Shipyard, Long Beach, California. In addition to sea keeping, handling systems, engineering, and habitability modifications, several alterations are being made to the DDS. These include the installation of a unique clean room facility to allow the "in-house" repair, cleaning, and testing of the diving systems' associated piping components. Upon completion of the operational evaluation and certification program of the installed diving systems scheduled for summer and fall 1975, PIGEON will be ready to accommodate practically any diving mission and be capable of "diving the world over" for extended periods down to 1,000 fsw.

PIGEON divers standing by one the two DDS Mk 2 Mod 1 PTC's. Front row (L to R) MRC(DV) Fowler, OS3(DV) Cumnock, EM2(DV) Lawson, LT(jg) Austin, IC2(DV) Miller HM1(DV) Barron, BM1(DV) Marsh, HTC(DV) Conrad, LT(jg) Nibbs. Second row (L to R) BMC(DV) Crotts, BM1(DV) Hobbs, BM1(DV) Gunn, STS1(DV) Eberhardt, EM1(DV) Carella, SMC(DV) Delauter, EN1(DV) Shamrock, EN1(DV) Burgess, HT2(DV) Shirley. Back row (L to R) HMC(DV) Kleckner, HTC(DV) Debolt, LT Cwiklinski, GMCS(DV) Powell

Photo by: PH3(DV) Harry J. Martin, USN



SALVAGE OFFICERS' CONFERENCE 74/75

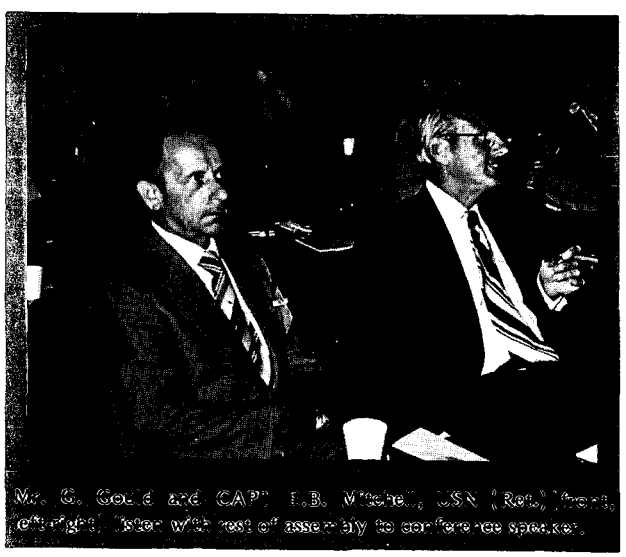
With such operations as the Suez Canal Clearance, the barge MACKENZIE salvops (see *FP*, Fall 1974), and the salvage of the Litton launching platform (see page 20), in addition to new developments in various programs and equipment, there was much to discuss and to learn at the 1975 Salvage Officers' Conference. Hosted this year by the Navy Experimental Diving Unit and the Naval Coastal Systems Laboratory on May 21-23, the 2½-day meeting brought approximately 100 salvors to Panama City, Florida, to discuss the latest in salvage/diving techniques.

Hosts for this year's SUPSALV-sponsored conference, Mr. Gerald Gould, NCSL Technical Director, and LCDR J. M. Ringelberg, Officer-in-Charge of NEDU DET Panama City, greeted the attendees before CAPT J. H. Boyd, Jr., Director of Ocean Engineering and Supervisor of Salvage, officially began the topic presentations.

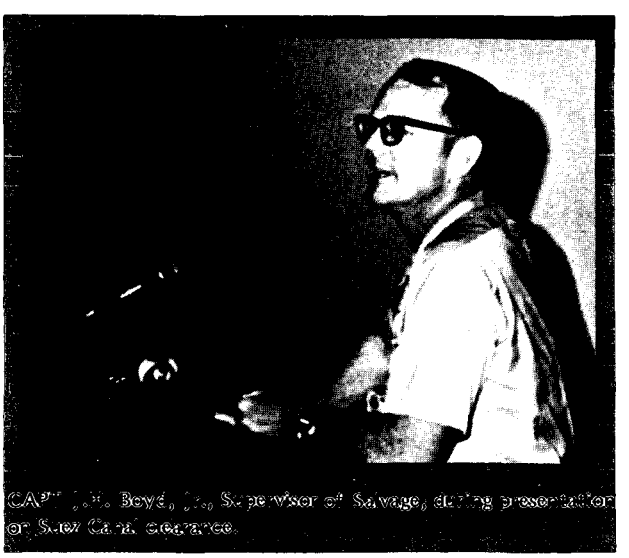
In his opening remarks, CAPT Boyd stressed the importance of critical inputs from fleet representatives not only during the conference but throughout the year. He then began a slide presentation of the Suez Canal Salvops, in which, as Commander Task Group 65.7, he was in charge of removing 10 sunken wrecks. During a question-answer period following the slide show, CAPT Boyd noted in particular that the successful clearance of the Canal was to a great extent the result of effective trim and rig work. Several surprises encountered during the salvops were the water depth being greater than anticipated, the number of divers needed being greater than anticipated, and the extreme unpredictability of the current.

The removal of the barge MACKENZIE from the Galveston, Texas, shipping channel, another formidable salvage task, was the next topic of discussion. LCDR Charles A. Bartholomew, Assistant for Salvage and Deep Ocean Systems for NAVSEA OOC, presented a slide show account of the summer 1974 MACKENZIE salvops. He then discussed a more recent salvage effort, the recoevry of the Litton launching platform in Pascagoula, Mississippi, which took place in March and April 1975. LCDR Bartholomew concluded his presentation with slides noting various underwater search and recovery operations during the last 5 years.

Following a lunch break, during which NCSL displayed various new hydraulic tools, LCDR Bartholomew had the podium once again to present a discussion on the use of explosives in underwater salvage. Next, Mr. John Quirk, of NCSL, introduced Mr. John Mittleman



Mr. G. Gould and CAPT L.B. Mitchell, USN (Ret.), front, (far right) listen with rest of assembly to conference speaker.



CAPT J.H. Boyd, Jr., Supervisor of Salvage, during presentation on Suez Canal clearance.

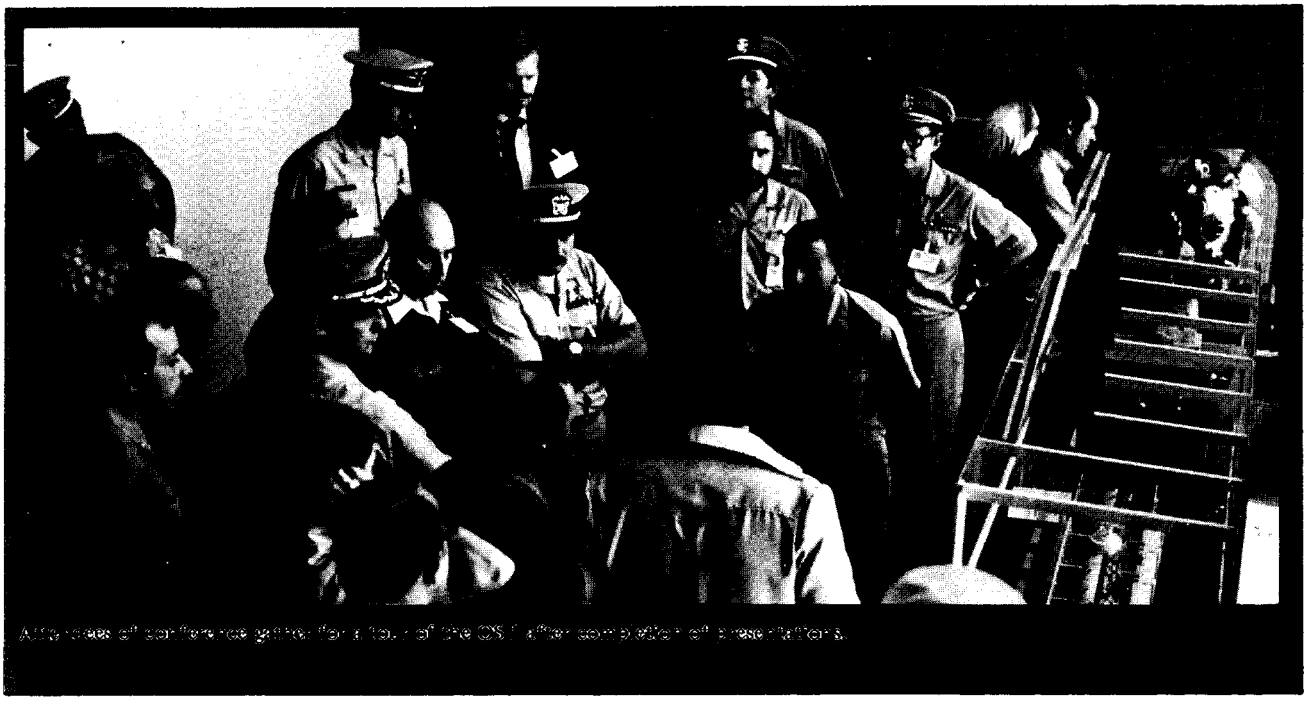
and Mr. Bob Elliott, who gave highlights of the Underwater Ship Husbandry Conference (see page 7) in addition to noting several new tool projects under way at NCSL.

The first day of the conference ended with brief updates on the status of the Mk XIV Push-Pull System, given by LCDR Bryan Barrett, RN, and the progress of the Mk XII Surface Supported Diving System, presented by LCDR Barry Ridgewell, CF.

Mr. Roy Sea, of NAVSEA OOC, began the second day events with an in-depth account of SUPSALV's Oil Pollution Abatement Program and Contingency Plan. As an introduction to his speech, a film on the short and long term effects of oil pollution was shown. One particularly interesting fact brought out during his speech is that the U. S. Navy approach to an oil pollution problem is to use mechanical means to clean up a spill instead of chemical sinking agents, which may have harmful effects themselves on the undersea environment. Mr. Sea also remarked that the next SUPSALV Oil Pollution Abatement School would be held in Jacksonville, Florida, in the fall.

Mr. Jerry Totten, of NAVSEA OOC, spoke next on SUPSALV's hydraulic pullers and new traction winch system, followed by Mr. Dale Uhler's presentation on the Large Object Salvage System (LOSS), for retrieving items from depths to 850 feet. Concluding the morning agenda was a status report on the Reserve Harbor Clearance Unit Program. LCDR John Kjellman first gave a broad overview of the progress thus far (see *FP*, Summer and Winter 1974); LCDR Bob Larrick, of the Office of Naval Reserve, then added more background information and a brief history of the program.

A dramatic film presentation of the SIDNEY E. SMITH salvage operation (see *FP*, Winter 1972) provided an interesting change of pace in the afternoon session. CAPT Boyd then gave a few closing remarks, ending the more structured portion of the conference, before the attendees gathered for a detailed tour of the Ocean Simulation Facility. The conference officially came to a close late Friday morning, following an opportunity to view demonstrations of various underwater equipment and diving systems.



A New Command With A New CO

For Navy Experimental Diving Unit personnel, July 1, 1975, was indeed a memorable day. On that date, NEDU's past accomplishments and potential achievements were formally recognized with the official elevation of NEDU Detachment Panama City to the status of a full command ashore. Until recently, NEDU has been headed by an Officer-in-Charge, with the primary headquarters in the Washington, D.C., Navy Yard and the more recently formed NEDU Det. in Panama City.

After 48 years of operation in Washington, the facility there has now been decommissioned. It was at this base primarily that years of intensive work have brought the recognition of NEDU as the worldwide leader in the testing, designing, and evaluating of all types of deep diving dress as well as the appropriate theory and practice involved. NEDU is now officially and solely Florida-based at the Ocean Simulation Facility and, in the near future, at the Experimental Diving Facility now under construction (see *FP*, Spring 1975).

Not only was July 1 a day of commissioning, it was also a day for the NEDU change of command. In a dual-purpose ceremony on June 30, 1975, CDR Colin M. Jones, USN, turned the duty of Commanding Officer over to LCDR J.M. Ringelberg, USN, who then ordered the ceremonial raising of the flag over NEDU's new home.

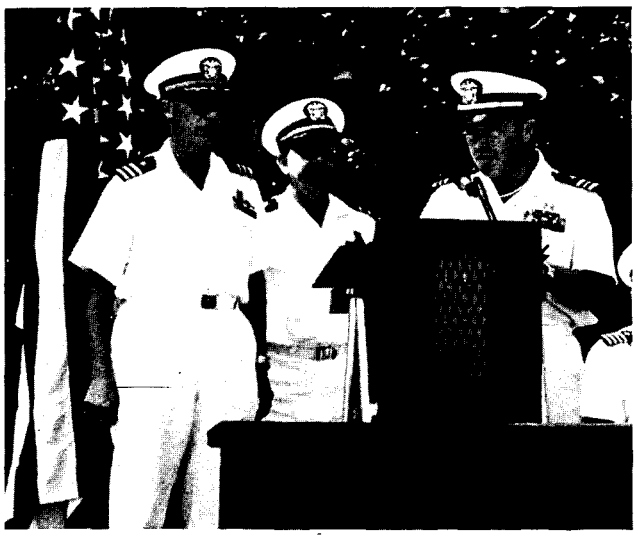
The first order of business in the ceremony was the inspection of NEDU personnel by CDR Jones and LCDR Ringelberg. The presentation of awards came next. SK2 Kiefer, USN, received the first Good Conduct Award, and Mrs. Lillian Owens was awarded the Superior Performance Award by CDR Jones. In addition, Bryan Barrett, Royal Navy Exchange Officer, was officially promoted from Lieutenant Commander to Commander. CDR Barrett is the NEDU Project Officer for the MK XIV Push-Pull Breathing System.

In his remarks, CAPT Robert B. Moss, Deputy Director of Ocean Engineering, Naval Sea Systems Command, noted that it was through the recognition of the importance of the work performed by NEDU and the responsibilities involved in supervising their assigned tasks that NEDU has been designated a full command. He went on to outline CDR Jones' "most successful and unique tour" as the last Officer-in-Charge and the first Commanding Officer of NEDU, which included bearing the responsibility of moving the Unit to Panama City without interrupting their regular chain of activities. CAPT Moss then noted LCDR Ringelberg's qualifications, emphasizing his broad background as a Naval Architect, Marine Engineer, and Salvage Officer. CAPT Moss closed his remarks by reading two messages directed to CDR Jones as outgoing CO and LCDR Ringelberg as incoming CO from VADM R.C. Gooding, Commander, Naval Sea Systems Command.

CDR Jones expressed his gratitude to those who have worked with him during his NEDU tour, and emphasized that he is proud to have been associated with the Navy diving community. He then read his orders of detachment, and turned the podium over to LCDR Ringelberg. CDR Jones leaves NEDU to assume the duties of Repair Superintendent at the Pearl Harbor Naval Shipyard, Pearl Harbor, Hawaii. After reading his orders as incoming Commanding Officer, LCDR Ringelberg officially relieved CDR Jones and received the national flag from him. He then directed HMCM (DV) Paul Heckert to raise the flag over the OSF, signifying the formal commissioning of NEDU in Panama City.

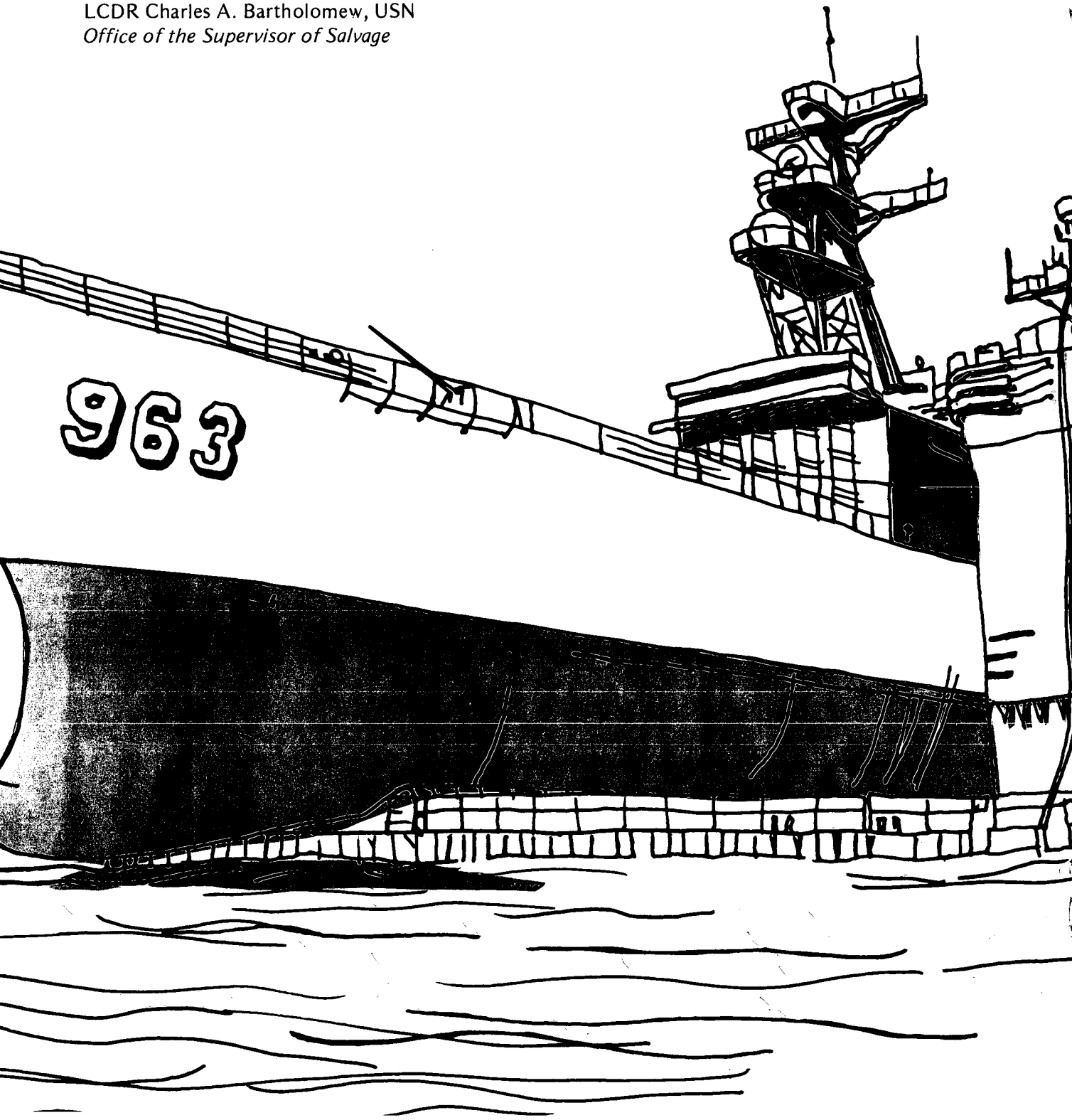
LCDR J.M. Ringelberg graduated from the New York State Maritime College with the degree of Bachelor of Marine Engineering, and was commissioned an Ensign in 1961. After destroyer and shipyard duty he attended postgraduate school at Webb Institute of Naval Architecture, where he was awarded the degrees of Bachelor of Science in Marine Engineering and Master of Science in Naval Architecture. He is also a graduate of the U.S. Navy School of Diving and Salvage. After a sea tour on USS INDEPENDENCE (CVA-62), he was assigned to the U.S. Naval Ship Repair Facility in Subic Bay, Phillippines, with additional duty assignments in the Republic of Vietnam. He served as Fleet Salvage Officer, Commander Service Force, Atlantic, before his assignment to NEDU in Panama City.

Above: CDR Jones and LCDR Ringelberg inspect NEDU personnel. Below: CAPT Moss speaks to assembly. On stage are, l-r: LCDR M.A. Paul (XO of NEDU), CAPT R.T. Quinn, LCDR Ringelberg, CAPT G.F. Bond, Mr. W.R. Bergman, and CDR Jones. Bottom: LCDR Ringelberg reads his orders as new CO.



LITTON LAUNCHING PL
SALVAGED

LCDR Charles A. Bartholomew, USN
Office of the Supervisor of Salvage

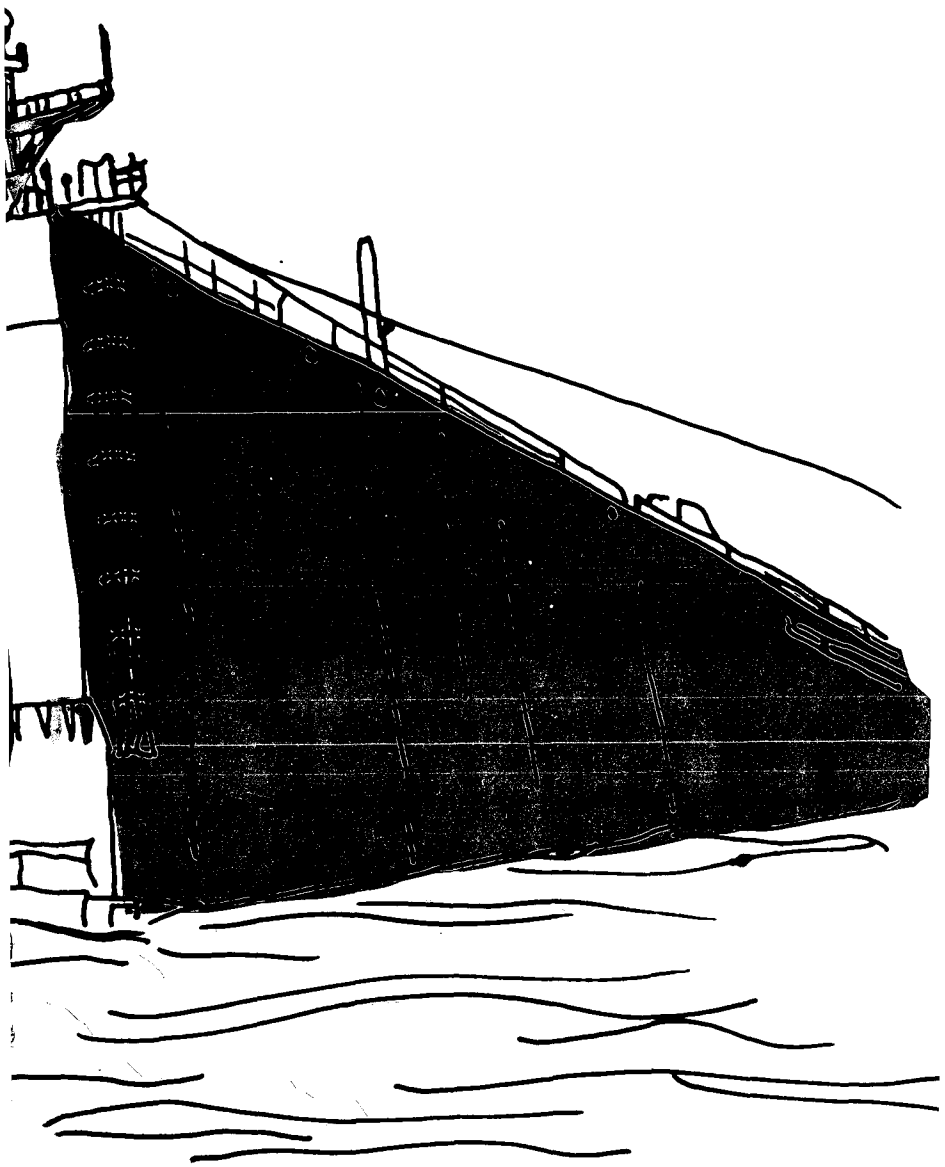


ATFORM

The West Bank Facility of the Ingalls Division of Litton Industries in Pascagoula, Mississippi, represents one of the most modern and efficient shipbuilding yards in the United States. Litton has designed and built a grid of rails and trolleys that allows ship construction in an assembly line fashion similar to that introduced by Henry Ford 70 years ago.

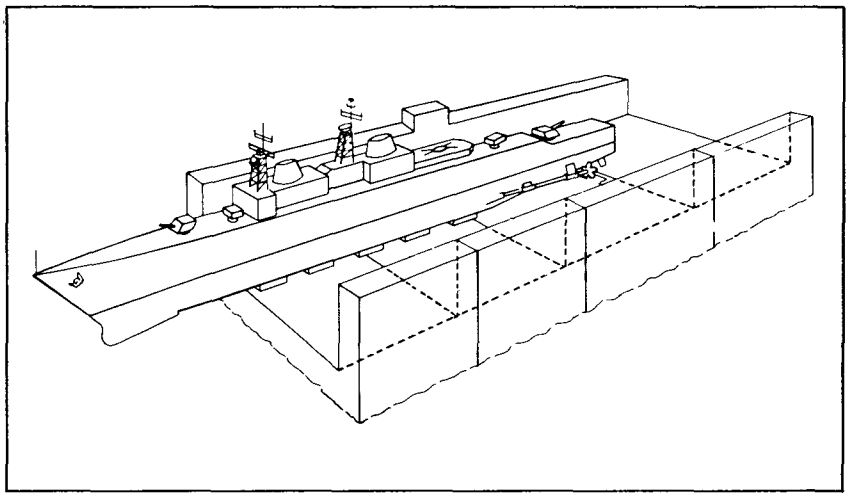
Perhaps the most unique and critical element in the West Bank Facility ship construction process is the launching platform itself. It was designed and built specifically for launching the new construction ships and for any subsequent drydockings required before delivery. Every ship in the assembly line must utilize the platform until completion, thus the loss of this component would ultimately bring the ship construction process to "all stop."

USS SPRUANCE (DD-963) was scheduled for a routine undocking at the West Bank Facility on the morning of March 13, 1975. To reduce the block buildup, SPRUANCE had been positioned on the after portions of the dock. This permitted the sonar dome to hang over and below the pontoon deck (see sketch at left) and allowed the twin screws to protrude into special propeller pits built into the dock. As flooding gradually commenced, a sagging moment was apparently induced as the platform suffered severe buckling amidships. Corrective action was taken immediately to ensure that SPRUANCE did not fall off the blocks. However, as the morning progressed, the forward starboard quadrant of portable wing walls broke loose, the combined buckling and shearing loads broke the platform in two, and the forward half sank to the bottom in 72 feet of water. Corrective action continued on the after half until the ship was successfully undocked with only minor damage. In the process, however, the second half of the platform also sank, adjacent to the first.



Artist's rendition of SPRUANCE in launching platform.

The need to salvage the launching platform and restore it to service as expeditiously as possible was critical to the shipyard. The U.S. Navy was also concerned, since Litton is under contract to deliver five LHAs and 30 DD-963's, and only eight had progressed through the launching phase. The Supervisor of Salvage was tasked by the Chief of Naval Material to assist Litton in their efforts to salvage the launching platform, with all logistic, industrial, and diver support provided by Litton.



Drawing shows SPRUANCE on launching platform (not to scale).

A diver's survey of the platform revealed the extent of the damages sustained. The two sections were lying in approximately the same fore and aft orientation, with physical separation varying between 7 feet on the port side and 2 feet on the starboard side. Some minor involvement of plating and stifferners existed; and both machinery spaces above the safety deck and several tanks were severely damaged and open to the sea. The survey also revealed that the SPRUANCE screws had punched holes in and just adjacent to the propeller pits.

Diving conditions were relatively good. Visibility under water varied from 1 foot near the surface to 8 feet below the thermocline; waves and currents were negligible. All diving was conducted using commercial surface-supplied gear with wet suits and/or coveralls. Desco, Savoy, Swindell, and Kirby-Morgan diving rigs were all used in the operation.

The salvage plan formulated, blowing with air, was one that provided the quickest mode of refloating. The plan involved some risk, however, due to the marginal strength of the port wing wall structure below the safety deck, where the maximum pressure differential would be experienced.

All preparations on the forward half of the launching platform were completed without incident, and the blowing of tanks commenced on March 23. Four 600 cfm and two 750 cfm compressors were available to feed the tanks via a gauged manifold and eight 2-inch hoses. The air bubble was pushed down the wing wall without incident; but as it spread beneath the pontoon deck, massive leakage developed in the vicinity of the propeller pits.

Blowing was secured; and subsequent diver inspection revealed that parts of the concrete patches in the propeller pit area had been blown/scoured away. These holes were patched with external metal patches and concrete, and blowing was resumed. By the time the water level had again been blown below the pontoon deck, two ruptures occurred almost simultaneously on the outboard wing wall. In addition to these obvious ruptures, a thorough internal diver inspection revealed substantial tearing of the shell panels from the vertical stiffeners. These findings raised considerable doubt as to the ability of the upper portions of the wing wall to sustain the required internal pressure differential. The salvage plan to blow the platform to the surface with compressed air was therefore abandoned by the salvors in favor of a more conservative approach using salvage pumps.

During the formulation of the initial salvage plan, which relied upon the use of compressed air to blow the platform to the surface, a reasonable risk of failure was accepted in the interest of expediency. Consequently, a fallback salvage plan based on pumping had already been formulated. The water depth over the pontoon deck precluded the use of conventional pumps without significant cofferdamming and/or holing of the safety decks. Therefore, a scheme based upon placing submersible pumps through the tank top access openings was adopted.

After an intensive re-investigation of the damage to the wing wall area of tank 20 by divers, the salvors begrudgingly agreed that the sustained structural damage rendered it incapable of withstanding the resulting hydrostatic forces if it were made watertight and pumped as originally planned. A second change to the salvage plan followed since the internal watertight bulkheads were not designed to withstand the required pressure differentials between any tanks being pumped and those open to the sea.

The salvors decided to pump compressed air into certain tanks to control the internal pressure and thus maintain the pressure differentials across any watertight bulkheads within acceptable limits. As an added bonus, the air pressure would also

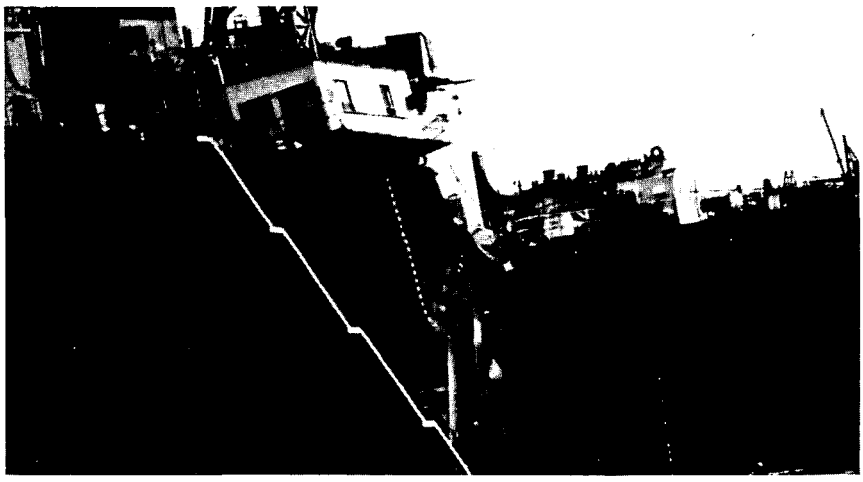


Photo shows wing wall of platform breaking apart.

reduce the apparent pump discharge pressure and thus increase pump flow rate.

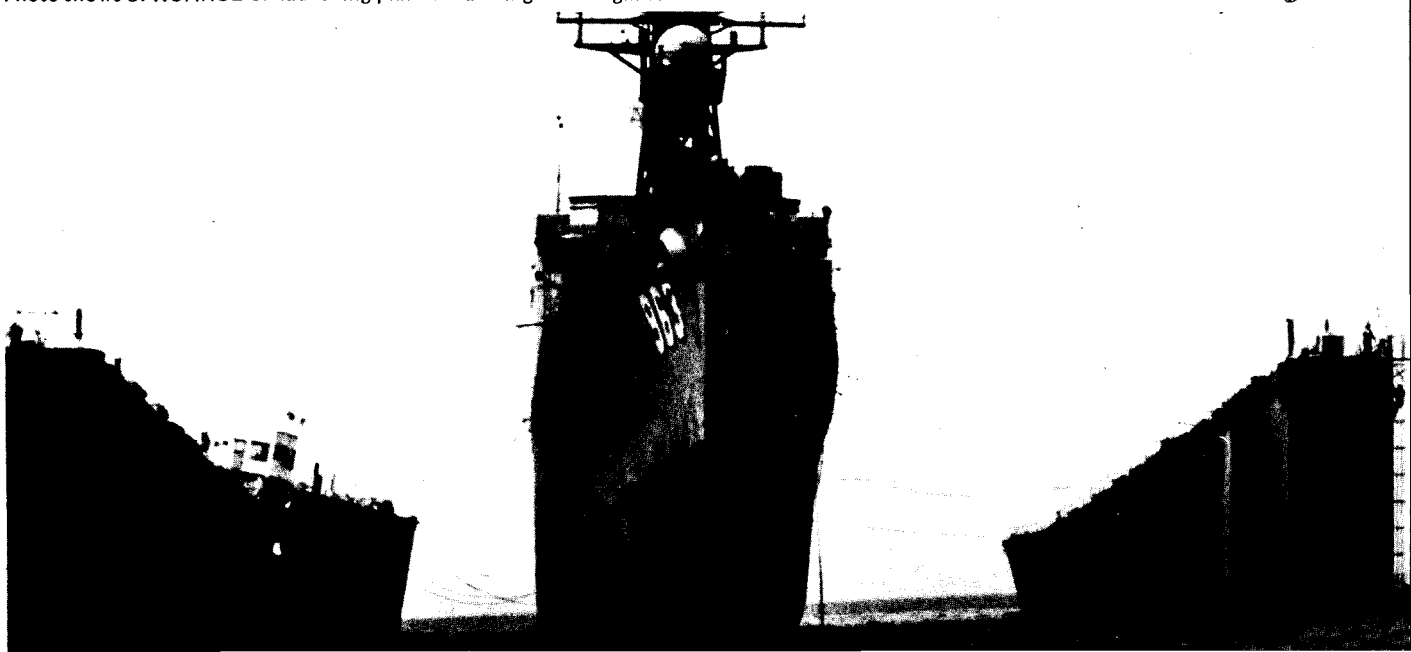
By March 31, twenty five 440V 25 HP 1000 gpm 4-inch submersible pumps had been received from the U.S. Navy Emergency Ship Salvage Material (ESSM) System, and an additional six had been received by Litton from commercial sources. The addition of pnemo lines during pump installation permitted the monitoring of the internal tank waterlines.

On April 1, pumping/blowing of the four starboard outboard tanks commenced, and by late evening the section had been successfully rotated to the attitude desired. The following day, the port-side pumps were lit off, and shortly thereafter the after port corner broke loose from the mud. Approximately 2 hours and 20 feet of trim later, the forward corner broke loose and the section was afloat. A harbor tug, which had been continuously pulling aft, exerted sufficient force to extricate the after section from beneath the control house overhang. That evening, the after half of the launching platform was safely deposited in its normal position over the launching grid on the West Bank.

Final preparations for raising the forward section (using the same submersible pump approach) were completed on April 6, after which pumping/blowing of the four inboard starboard tanks commenced. The necessary air pressure was maintained in the tank tops, and the water levels began to fall immediately. After approximately 8 hours of pumping, thousands of small bubbles were noticed rising to the surface above the submerged starboard edge. Shortly thereafter, great belches of air began bursting to the surface from the installed flapper relief valves; and moments later, the pontoon deck broke the surface and steadied with approximately 4 feet of freeboard from the deck edge. The port-side pumps were then lit off, and soon the entire section was afloat on an even keel. That evening, the forward half of the launching platform was positioned in place alongside its mate over the launching grid.

The successful salvage of the Litton launching platform was accomplished in just 25 days, not a small feat for a structure displacing almost 14,000 long tons and completely broken in two. The unique conditions surrounding the casualty, the fragile platform scantlings, the water depth, the sustained damage, and the industrial urgency presented the salvors with a challenging and formidable task. Neither pumping nor blowing with air proved adequate; but by an innovative combination of the two, the structures were successfully salved. The success of the entire operation was attributed to the ability of the divers to work effectively and efficiently under water.

Photo shows SPRUANCE on launching platform as wing walls begin to break.



DELIVER, PRAIRIE DIVERS RECOVER TA-4F JET

While conducting touch-and-go landings at Marine Corps Air Station (MCAS) Iwakuni, Japan, on February 25, 1975, a TA-4F aircraft crashed into Japan's Inland Sea approximately 2½ miles south of runway number one. While assisting in pilot rescue, the MCAS AVR crew dropped a datum buoy in an oil slick where the pilot was recovered and at a location identified by a local fisherman as the crash site.

MCAS Iwakuni requested salvage assistance, and Commander Task Group (CTG) 73.4 designated USS DELIVER (ARS-23) as the recovery ship. DELIVER, under the command of LCDR Gerald Anderson, was conducting salvage training at that time at Chin Hae, Korea. Seventh Fleet/Task Force SEVENTY THREE Salvage Officer, LCDR Mack, was assigned the duties of on-scene Officer-in-Charge for coordinating the operation between MCAS Iwakuni and DELIVER.

CTG 73.4 instructed DELIVER to send a First Lieutenant and two divers in advance to assist in preliminary salvops with LCDR Mack and a four-man diving team brought in from USS PRAIRIE (AD-15). PRAIRIE, under the command of CAPT Floyd Muck, was located at Yokosuka, Japan, when the incident occurred.

The PRAIRIE team (HTC W. F. Curtis, BM1 R. L. Bowdish, BM2 J. T. Moebius, and GMG2 P. Pehl) arrived on the afternoon of February 27, and immediately proceeded to the crash site with LCDR Mack to survey the area.

Upon the arrival of the DELIVER advance team (W01 Earl K. Maughmer, ENFA(DV) Jeffery A. Smith, and ETR3(DV) John M. Talbot), both teams of divers were given a familiarization tour of the TA-4F aircraft and action got under way for the recovery operation.

Dragging operations brought negative results on February 28 and on March 1, when the search area was expanded eastward from the area already investigated.

The LCM-6's continued dragging operations on March 2; and, as DELIVER workboats were proceeding to their designated area, the LCM-6 crew reported a substantial snag. Diver investigation revealed that they had found the aircraft wreckage. Subsequent compass bearings showed the site to be within 100 yards of the fisherman's buoy.

DELIVER completed a two-point moor over the site and prepared for recovery operations the next morning. A 4-foot by 4-foot by 4-foot basket was constructed for small wreckage recovery; and the fantail was readied for diving stations, recovery lines, and wreckage storage.

The aircraft, which appeared to be fairly well intact, was found upside down with the starboard wing and cockpit section buried in mud. The tail section from the wing aft seemed to be broken from the center section; the wingtips, tail, and horizontal stabilizers were broken off. It was planned to recover as many of the small pieces of wreckage as possible first before attempting to lift the larger sections. This was because some of the critical investigative items were lying around the major structure and could be lost in the upheaval caused by lifting the main body. Included in the list of items desired for the investigation were various parts of the electrical control system in the tail section, several switch panels from the cockpit area, and the control sticks from the cockpit.

Diver operations commenced early March 3. The water depth was between 85 and 90 feet; visibility was approximately 10 to 15 feet; and water temperature was approximately 40° to 42°F. Because of these conditions, it was decided that all SCUBA dives would be made on the 100-foot/25-minute table requiring no decompression. All Mk I dives were made on the 100-foot/30-minute schedule, requiring a 3-minute stop at 10 feet. The Mk V deep sea rig was not considered because of

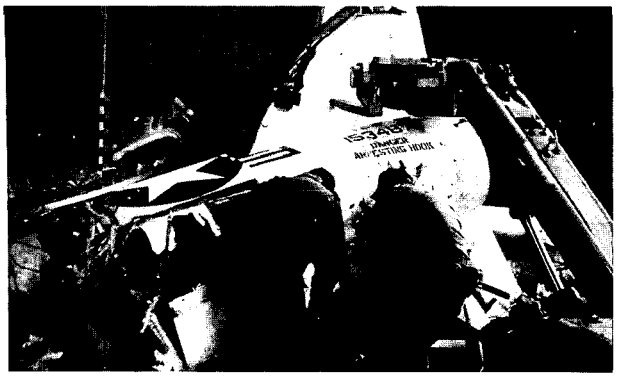
muddy bottom conditions and the substantial distances to be traveled between the basket and various wreckage locations. Recovery dives were continued throughout the morning and early afternoon to retrieve small pieces of wreckage. However, later that afternoon, a combination of 20-knot winds from the northeast and tidal currents held DELIVER 100 to 150 feet from the site, slowing the recovery pace because of the longer distance. Diving was discontinued shortly before dark, and the decision was made to put the ship in a four-point moor.

During the preparations for placing the ship in a four-point moor position, however, DELIVER's boom-handling personnel experienced difficulties with the 8-ton after boom, resulting in excessive compression loading that caused it to buckle and break approximately 8½ feet above the gooseneck. All operations were secured for the day; and the following morning, March 4, DELIVER headed into port to offload the broken boom and to rerig the forward boom for the salvops.

Because of the delays thus far, it was decided to proceed with the recovery of the larger portions of the aircraft instead of spending and more time on the smaller fragments.

Diving operations commenced early March 5. Diver investigation revealed, however, that the previous plan of lifting the wreckage by the tail hook could not be carried out because the tail hook assembly point was broken out of the tail section. Likewise, several strong points for lifting the center section were also found either missing or damaged beyond use. In the new plan of operation, a wire strap was interwoven in and out of various pieces of the center section (including portions of the wing main frames); and the lift was completed successfully.

Operations continued early March 6, with the primary objective being the recovery of the tail section with minimal damage to the control surfaces. Divers



MCAS Representatives inspect wreckage.

passed a wire strap completely through the center of the aircraft from the forward end of the broken tail section through the fuselage and out the exhaust end. The lift was made successfully with very little damage to the section, and the remainder of the day was spent recovering other large pieces of aircraft debris.

The entire day of March 7 was spent recovering additional items of wreckage. That afternoon, a Japanese fisherman returned the plexiglass canopy, which he had dredged up with his fishnet several hundred yards east of the crash site. Divers continued to clean up all significant pieces of wreckage (larger than a few inches across) within a 100-foot-radius of the site. At the close of operations for the day, MCAS representatives estimated that over 95 percent of the aircraft had been recovered.

It had been planned to complete a 150-foot-radius search the next morning, but investigative personnel of MAG-12 indicated that all the necessary aircraft components for their investigation had been recovered. The recovery operations were therefore terminated. LCDR Mack and the PRAIRIE divers departed IWAKUNI; and DELIVER recovered her four-point moor and departed the area, successfully completing the recovery operation.

DIVERS DO IT DEEPEST:

Navy Dive Successful to 1,148 feet

Mr. Harry Rueter
Office of the Supervisor of Salvage

Operating out of the Mk 1 Deep Dive System (DDS), a team of U.S. Navy and Royal Navy divers successfully completed a dive to a depth of 1,148 feet, the deepest ever in the open sea. EN2(DV) Joseph L. Bennoit, USN; HMCS(DV) Lowell E. Burwell, USN; ETC(DV) William R. Rhodes, USN; and CPO Victor J. Humphrey, RN; completed the dive on June 18, 1975, at a location 80 miles southwest of Panama City, Florida, in the Gulf of Mexico.

The four began their deep saturation dive on June 3, 1975, leaving the surface in the Mk 1 DDS deck chambers to conduct multilevel dives to the 1,000-foot level. On the morning of June 6, the personnel transfer capsule (PTC) was launched from the YDT-16 (on which the Mk 1 System is installed) to carry out open sea dives to 1,000 feet. At 11:35 a.m., EN2(DV) Bennoit swam out of the PTC at a depth of 1,030 feet, exceeding the depth of the previous deepest USN open sea dive of 1,010 feet.

The PTC was then retrieved; and, after being lowered again later that afternoon, HMCS(DV) Burwell exited the PTC at a depth of 1,130 feet, setting another depth record. Before returning to the PTC, he reported that with the glare of the PTC's 200-watt light, he could see the bottom approximately 20 feet below him.

Later that afternoon, ETC(DV) Rhodes, after checking his breathing rig with topside control, began the day's third dive from the PTC. Upon reaching the bottom, his depth was checked and a reading of 1,148 feet was logged, the deepest dive to date. Thus, the former record of 1,010 feet was not only bettered once, but three times by three different divers in the same day.

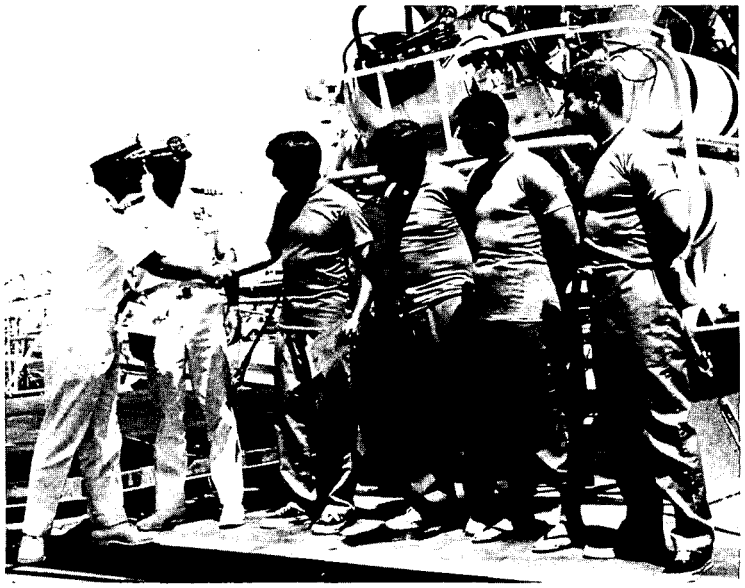
After completing the third dive, the men were brought back to the surface in the PTC, which was then mated to the deck decompression chambers (DDC) onboard the YDT-16 to commence decompression. Chamber temperature was maintained at approximately 85° to 89°F, humidity was kept between 40 to 60 percent. The team "surfaced" on June 18, 1975, after spending 15 days in the Mk 1 DDS; 11 days were used during decompression.

LT Robert G. Lusty, RN, an Exchange Officer with the Mk 1 DDS diving team in Little Creek, Virginia, was the Officer-in-Charge of the diving operations; BMC Tyrone Goacher served as Master Diver for the project. CWO3 Don Roberts, Assistant Officer-in-Charge of the Mk 1 DDS, was the Safety Officer, and LT John Zumrick took charge of the medical duties.

The record-breaking dive series involved the support of several organizations. Harbor Clearance Unit TWO, Little Creek, Virginia, commanded by LCDR J.F. McColgan, was assigned the responsibility of coordinating, conducting, and providing the facilities for the dive project. Commander, Service Squadron Eight, Norfolk, Virginia, to which HCU-2 is assigned, also gave valuable support. The Director of Ocean Engineering (NAVSEA OOC), the Navy Experimental Diving Unit, and the Naval Coastal Systems Laboratory provided technical and logistic support to the project.

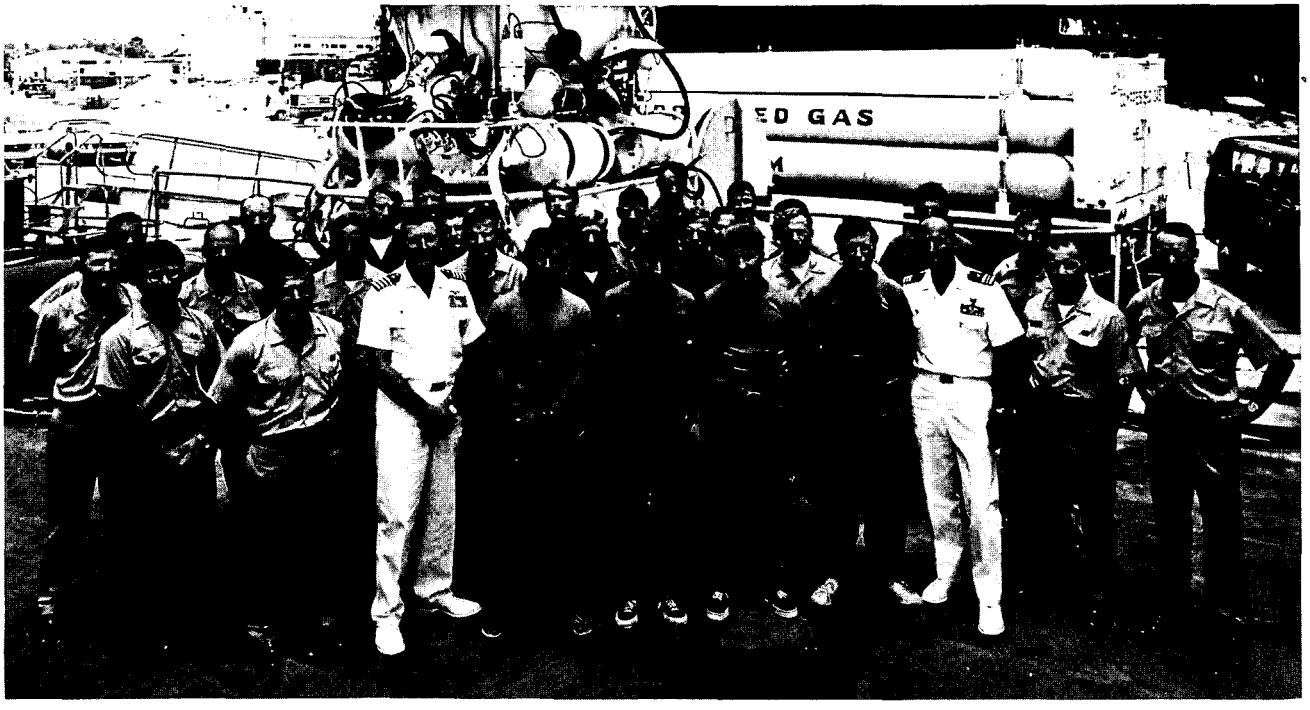
The Mk 1 DDS/YDT-16, assigned to HCU-2, was towed from Little Creek to Panama City by the Navy salvage ship USS RECOVERY (ARS-43) in March 1975. During April and May, the HCU-2 crew performed work-up dives and saturation diving training.

The next phase of the Mk 1 DDS diving program will again involve the British team currently working with the deep dive system. It is planned to conduct trials on the saturation diving tables that have been perfected by USN and RN personnel at the Naval Physiological Laboratory in Portsmouth, England. This upcoming project, which has a completion date of mid-September, will provide an excellent opportunity to exchange information and ideas on diving philosophy, equipment, and operating procedures.



CAPT J.H. Boyd, Jr. (Supervisor of Salvage), presents awards to divers after they "surfaced" on June 18. Left to right: CAPT Boyd, LCDR J. F. McColgan, EN2 Benoit, CPO Humphrey, HMCS Burwell, ETC Rhodes.

Below: Personnel involved: CWO2 D.R. Roberts, Assistant O-in-C of dive (first person, second row, left); First row, r-l: LT John Zumrick, Medical Officer; BMC T.K. Goacher, Master Diver; CAPT G.E. Jacobssen, Jr., CO of SERVRON 8; HMCS L.E. Burwell, diver; EN2 J.L. Benoit, diver; ETC W.R. Rhodes, diver; CPO V.J. Humphrey, RN, diver; LCDR J.F. McColgan, CO of HCU-2; HTC R.O. Brady, Master Diver; LT R.G. Lusty, O-in-C of dive. Remaining personnel (not listed in order): PNSN W.T. Apmadoc; EN1 M.L. Alexander; FN T.H. Belcher; SN R.D. Bishop; EN1 H.J. Bonner; FA J.W. Clark; MS1 G.N. Clippinger; HT1 B.A. Cole; BMC G.L. Comeau; EM1 H.L. English; MM1 J.P. Fair; FN R.B. Gardner; EM2 J.E. Hall; EM3 J.D. Hanson; EN2 B.D. Harkins; EM1 T.R. Harvey; FA J. Hernandez; MRC C.A. Holton; FN J.G. Horne; SA F.D. Huffman; FN G.F. Johnson; BM2 J.P. Johnston; MM2 J.F. Leland; FA R. Lopez; EM3 L.E. Martin; FN R.E. Matthews, Jr.; FA W.M. McCoy; BM1 D.B. McNeil; BM2 T.L. Miles; QM2 V.S. Miller, Jr.; EMC J.B. Nelson; BMC D.H. Nielsen; HTC J.D. Pitscheneder; SK2 R.G. Schmidt; HTC D.J. Smith; BM2 C.E. Stevens; FA A. Thompson; GM1 D.K. Vanderford; ENC R.G. Watkins; MMC C.D. Wetzel; MM1 J.L. Winemiller. *(Photos by NCSL Photography Dept.)*



HCU 104: An "Un-Reserved" RHCU

If HCU-104 is at all characteristic of the other nine Reserve Harbor Clearance Unit Teams, and it appears to be, the RHCU Program may prove to be one of the most "active" Reserve activities in operation. In regards to enlistment enthusiasm, retention rate, and member attendance, the Philadelphia, Pennsylvania-based unit claims a "4.0" standard that reportedly is the rule and not the exception as the first year of growth passes for this relatively new branch of the Naval Reserve. (See *FP*, Summer and Winter 1974.)

HCU-104, one of the larger teams, is presently working toward its goal of attaining personnel and operational readiness for an on-call diving/salvage capability. A basic milestone in their program was recently completed when six team members travelled to the Navy School of Diving and Salvage, Washington, D.C., for Active Duty Training (ACDUTRA) during the week of May 12-16, 1975.

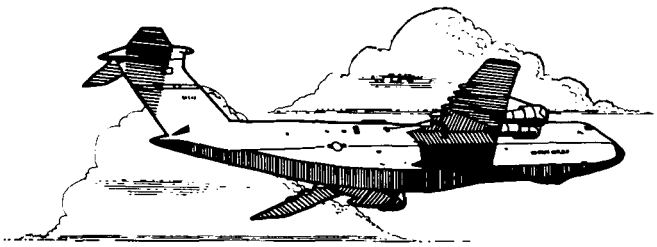
LCDR Lloyd Reynolds, Commanding Officer of HCU-104; LCDR Mike Dipuppo, Executive Officer; LT Dave Peterson, Operations Officer; HTC Gary Boyer; HT2 Keith Bucknam; and EN2 Harold Sicker spent 7 days at the Diving School for "requal" dives in hard hat and SCUBA. Each successfully completed two 500-yard surface swims for SCUBA requal and four project dives in the Mk V hard hat. During the project dives, a Tooker Patch was disassembled and then reassembled at depth by each diver. HMC Charles Heltman, an Instructor at the Diving School, assisted HCU-104 as the Safety Observer during the requal dives.

HCU-104 members basically consist of two groups, either untrained personnel with some civilian diving experience, or Navy-trained divers whose qualifications have lapsed. The first group of this unit is scheduled for 2 weeks of Active Duty Training at Harbor Clearance Unit TWO, Little Creek, Virginia. During this ACDUTRA, HCU-2 instructors will provide initial SCUBA training. In addition, HCU-104 members will be given extensive salvage and rigging exercises to expand their overall capabilities.

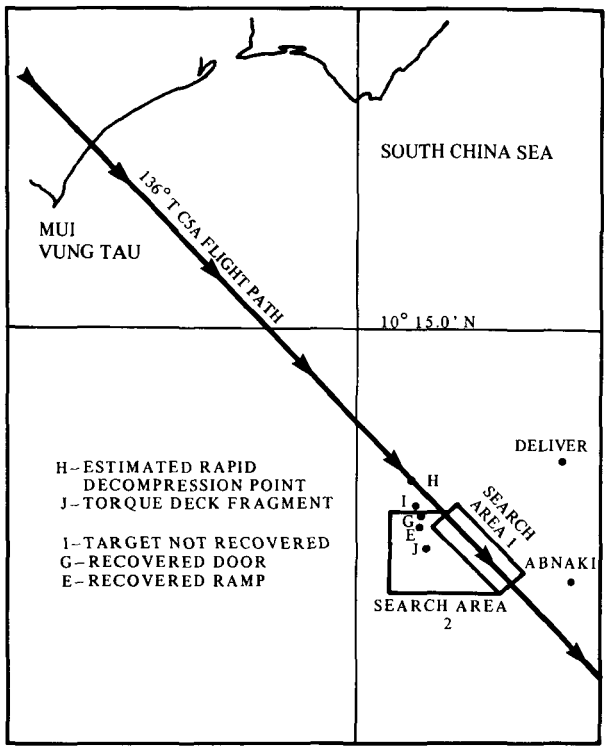
Meanwhile, all HCU-104 team members meet regularly in the Naval Reserve Center at the Philadelphia Naval Base for classroom reviews in diving physics, physiology, diving tables, procedures, safety, and equipment familiarization and repair. In addition, this classroom study is combined with a physical fitness training program. All training is performed in accordance with the U.S. Navy Diving Manual and Navy Diving Correspondence Course curriculum.

Now that HCU-104 has qualified hard hat and SCUBA divers, they are anxious to put their skills to work. Various underwater tasks such as bottom searches, minor structural repair (using SCUBA), hull repair, and augmenting other local civilian needs are now within their capabilities. In HCU-104, as in the other RHCU Teams around the United States, their technical capabilities are rapidly escalating to meet their high level of enthusiasm.

Above right: LCDR Dippuppo and LT Peterson help HT2 Bucknam suit-up. Below: LCDR Dippuppo and HTC Bucknam ready LCDR Reynolds for requal dive.



As U.S. Air Force C-5A #68218 flew outward bound from Ton Son Nhut, Republic of Viet Nam (RVN), on April 4, 1975, it suddenly suffered a rapid and total decompression that carried away the after pressure door and a major segment of the aft cargo ramp. The aircraft, which was the first "baby-lift" flight out of Ton Son Nhut, was cruising at an approximate 23,400-foot altitude at a 253-knot airspeed over the South China Sea when the mishap occurred.



C-5A SALVOPS: "Needle in a Haystack"

Mr. James C. Bladh
Office of the Supervisor of Salvage

The U.S. Air Force Military Air Command (MAC) requested U.S. Navy assistance to locate and recover the door and ramp components. The overall command and direction of the search and recovery operation was tasked to RADM J.D. Johnson, USN, Commander Task Force 73. RADM Johnson, who described the operation as a "needle in a haystack" situation, immediately mobilized Navy salvage and diving assets to find the "needle." Seventh Fleet salvage ships DELIVER (ARS-23), ABNAKI (ATF-96), and QUAPAW (ATF-110)–were mobilized immediately and proceeded at best speed to the search area, which was off shore from Vung Tau, RVN.

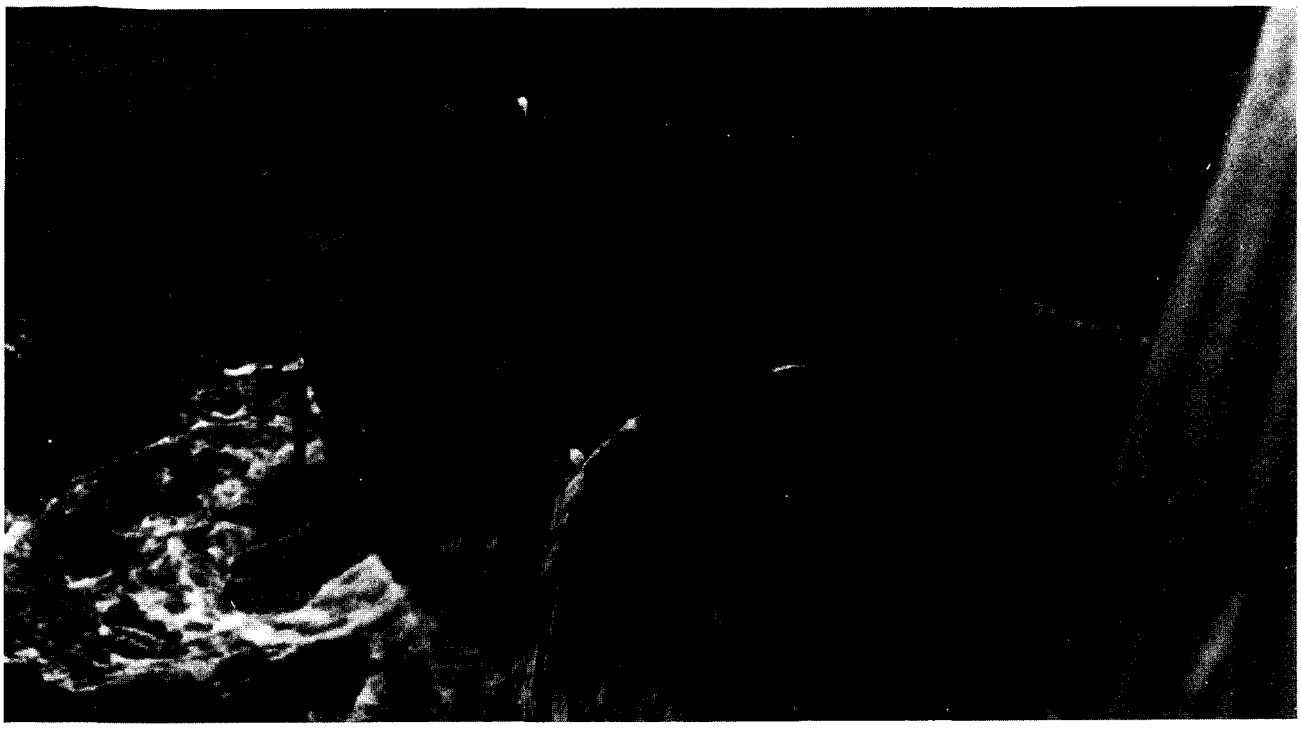
Simultaneously, the Supervisor of Salvage, CAPT J.H. Boyd, Jr., was tasked to provide specialized contractor side-scan sonar and precision navigation services. Mr. Jim Bladh was designated as the SUPSALV Representative; and Seaward, Inc. President, Mr. Ed Wardwell, was assigned as Senior Project Manager to direct the contractor sonar search effort.

The USAF Accident Investigation Board (AIB), headed by MGEN Newby, undertook a computerized ballistic trajectory study to better define the probable impact point of the pressure door and ramp. SUPSALV was tasked to undertake a concurrent study to verify the USAF probability study results.

Mobilization and airlift of SUPSALV contractor personnel and equipment was expedited on an urgent basis by MAC. Time was of the essence since each day saw the North Viet Nam and Viet Cong forces gaining control over much of South Viet Nam.

The imminent evacuation of U.S. and RVN personnel placed heavy requirements on Seventh Fleet ships and required precise scheduling to transport and support the sonar search and diving efforts. LCDR J.A. Mack, USN, Seventh Fleet Salvage Officer, was assigned to plan and coordinate the overall operation.

With LCDR G.L. (Gerry) Anderson, Commanding Officer of DELIVER, commanding the salvage force and directing diver operations, the diver search effort



commenced on April 15 in the area designated by the Air Force as the "high probability" impact area. A total of 34 divers from DELIVER, ABNAKI, QUAPAW, and PRAIRIE (AD-15) conducted over 230 dives, in which they conducted towed trapeze searches through the area. Water depth varied from 70 to 100 feet in the search area, and divers were towed 10 to 20 feet off the bottom.

Diving conditions were hazardous and grueling at best. Divers were constantly plagued by sea snakes and various other annoying "creatures of the deep." In addition, the situation necessitated repetitive dives, which required personnel to spend long hours in open boats in the blistering South China Sea sun. Though hindered by these conditions, the divers did locate small debris fragments before the commencement of sonar search ops that provided vital input towards defining the search area. The fact that these dives were performed without a single personnel injury is a tribute to the professionalism and planning of LCDR Anderson, his Diving Supervisor, and the individual divers involved.

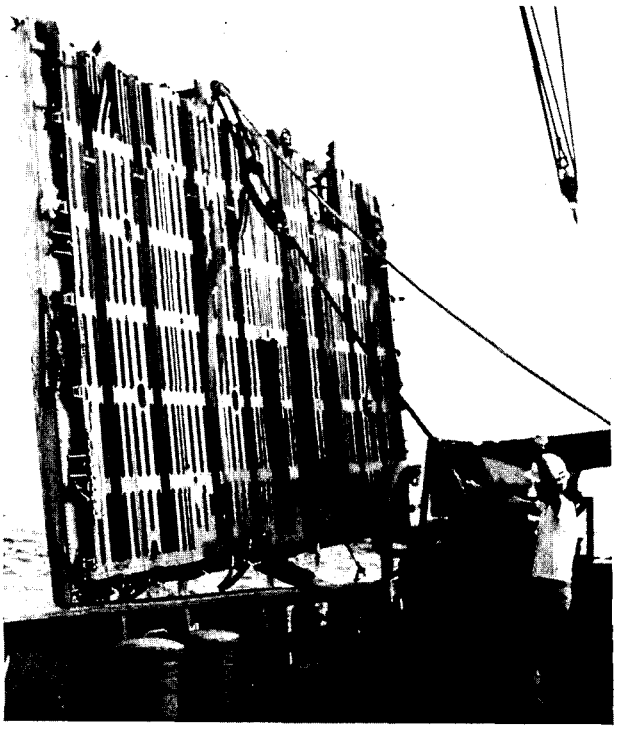
After transit on MT HOOD (AE-19) from Subic Bay, Republic of the Philippines, the Seaward search team arrived on scene on April 22. By this date, the Army of the Republic of Viet Nam (ARVN) could not provide security ashore for search personnel. Therefore, the two precision navigation responders (essential for fine grain control of the sonar search) had to be located on board DELIVER and ABNAKI, each of which was placed in a three-point moor. This was a "first ever" type of navigation installation that raised some early concern about the control of the sonar search. In actual operation, however, navigation control and repeatability proved excellent.

The side-scan sonar and navigation interrogator/receiver were installed on QUAPAW, and sonar search began early on April 23. The well trained officers and crew of QUAPAW quickly picked up the techniques of maintaining accurate course for sonar search lines. However, 48 hours of continuous sonar efforts brought only negative results.

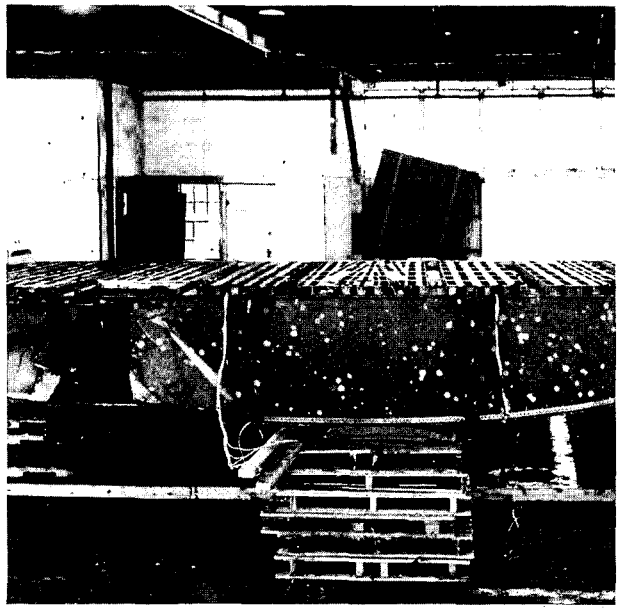
Diving operations continued on an intensive basis and several additional small debris fragments were recovered. The area in which the small debris was located was centered to the west of the original prime search area. Based on this debris pattern and continued USAF and SUPSALV trajectory predictions, an expanded search area was defined.

Sonar operations in the expanded search area identified a strong contact on Friday, April 25. After QUAPAW buoyed the contact, divers identified it as the cargo loading winch and subsequently recovered the winch and small associated debris nearby.

Evidence of increasing pressure on the RVN ashore made search speed more urgent as the weekend of April 26-27 passed. Activity in the mountains north of Vung



After around-the-clock efforts, two significant sonar contacts were received. Divers at last found the ramp assembly and a major portion of the door. Photos at left and below show various scenes during the recovery of the C-5A door segment.



Tau increased Friday night, and the first refugee boat came alongside DELIVER early on Saturday morning. (The boat was directed toward the evacuation task force, which was steaming seaward.)

Computer ballistic trajectory inputs pointed toward a search area south and east of the cargo winch recovery point. However, a day-long sonar search of this area proved negative. Early Saturday evening, an on-scene decision was made to concentrate the sonar search north and west into the area where debris had been recovered previously. Around-the-clock operations through Sunday morning produced two substantial sonar contacts. Buoy drops by QUAPAW marked the two targets; and the divers at last found the "needle," the cargo ramp segment, and, several hundred yards north, a major segment of the door.

LT A.S. (Al) Paton, USN, Commanding Officer of QUAPAW, conned the ship into a three-point moor over the ramp segment. After divers completed an in-situ examination of the ramp on the bottom, rigging for the lift was completed. QUAPAW lifted the 2-ton piece of wreckage onto her fantail late in the afternoon on Sunday, April 27.

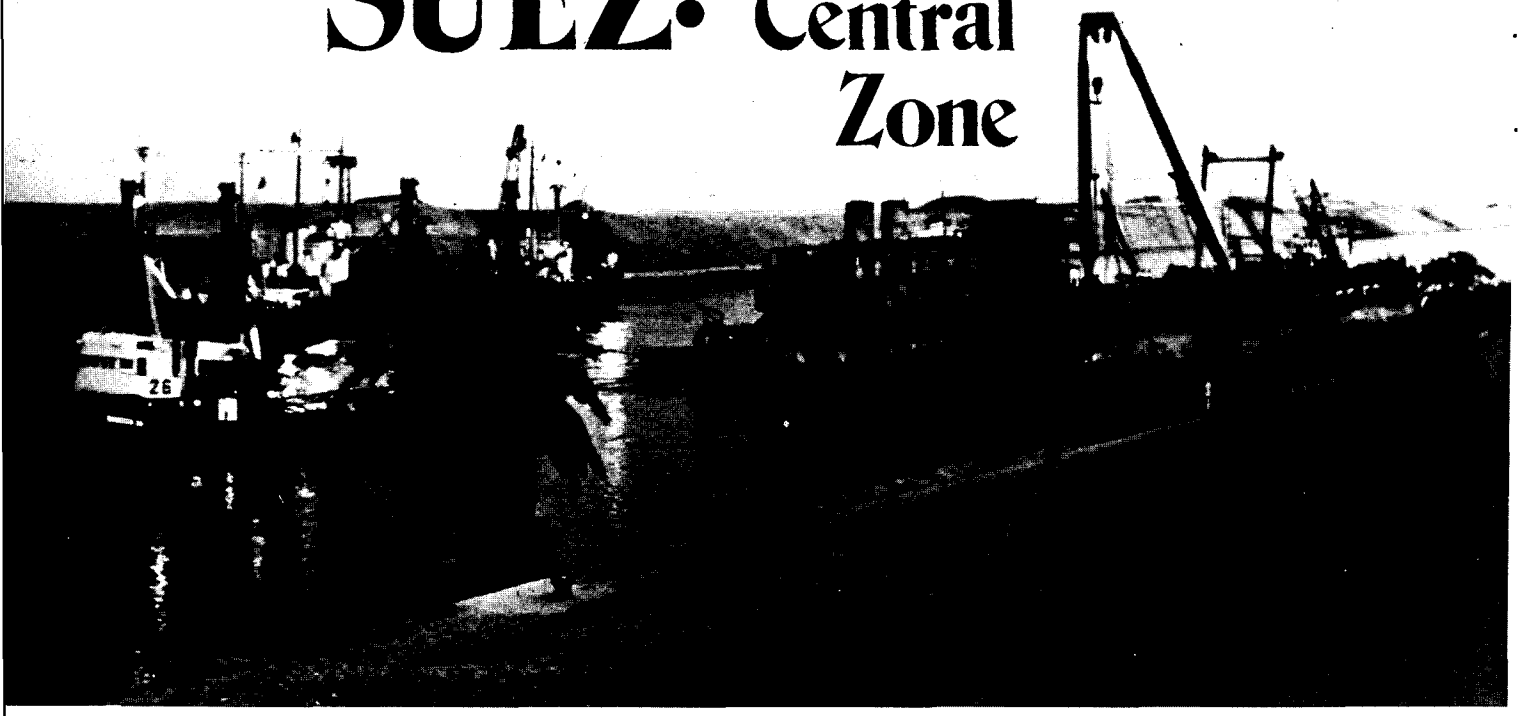
Despite the long day and approaching darkness, QUAPAW pressed on to recover the pressure door, completing this lift at dark. The door was loaded on and lashed to the cargo ramp under the direction of Mr. C.A. Lovelace, the Lockheed Aircraft Technical Representative from the AIB.

QUAPAW began additional fine grain sonar search efforts to further develop another target, which appeared to be the other pressure door segment. Plans were developed for buoying and diving on this target at first light on Monday. However, at 10:30 p.m., Sunday, April 27, Commander Seventh Fleet ordered an immediate cessation of search operations and directed all search and salvage ships to clear the area to seaward. The press of evacuation operations had precluded further search activities inshore of the evacuation force.

DELIVER and ABNAKI broke out of their moors and rendezvoused with QUAPAW at daybreak Monday morning, at which time a small boat transfer of all sonar and navigation personnel to QUAPAW was completed. QUAPAW was then directed to proceed at best speed to Subic Bay to offload the recovered C-5A components and the search team. DELIVER and ABNAKI joined the evacuation force for towing and standby salvage services.

Though the search operations were halted a bit prematurely, the debris recovered was sufficient to enable the Accident Investigation Board to determine the cause of the mishap. The success of this search of an "underwater haystack" is another example of the excellent coordination and cooperation of SUPSALV and his contractor assets with the ever-ready fleet salvage forces. The Supervisor of Salvage joins the USAF and COMSEVENTHFLT in a hearty WELL DONE to all hands involved in this operation.

SUEZ: Central Zone



Tug BUGSIER 26 tows dredge 15 SEPTEMBER to Ismailia with THOR trailing astern.

Five wrecks blocked the Central Zone of the Canal: dredge 23, dredge KASSER, tug MONGUED, the concrete caisson, and dredge 15 SEPTEMBER. Dredge 23 was sunk across the Canal 5 kilometers north of the city of Ismailia. The tug MONGUED and the dredge KASSER were sunk as a combined block in the southern exit from Lake Timsah, 5½ kilometers south of Ismailia. The concrete caisson, one of the more formidable blocks, was sunk across the Canal 11 kilometers south of Ismailia. The fifth wreck, the dredge 15 SEPTEMBER, was sunk near the centerline of the channel just inside the northern boundary of the Great Bitter Lake.

The accompanying chart gives the primary findings of the salvage surveys on the five wrecks. Survey operations on the wrecks in the Central Zone began on July 5, 1974, and continued through July 18, 1974.

VESSEL	CHARACTERISTICS	HULL CONDITIONS	METHOD OF REMOVAL
DREDGE 23	Displ.: 1,600 tons Size: 191' x 40' Attitude: 130° starboard list	Extensive portion of shelter deck carried away; three holes in hull; 1 foot of water over stern, 17 feet of water over bow	Parbuckle, then side lift by YHLCs
DREDGE KASSER	Displ.: 1,200 tons Size: 125' x 44' Attitude: 45° port list	Generally sound except for two scuttling holes at the turn of the bilge; 17 feet of water over starboard quarter, 26 feet of water over starboard bow	Side lift by YHLCs
TUG MONGUED	Displ.: 1,200 tons Size: 125' x 44' Attitude: 12° starboard list	Much of overhead deck cut away; engines removed; holes in machinery spaces; removal of stack and other projections necessary before lift; 8 feet of water over the towing light mast	Side lift by YHLCs
CONCRETE CAISSON	Displ.: 3,800 tons Size: 203' x 44' Attitude: on starboard side	Essentially intact except for three cracks (hairline to 2 inches wide), two scuttling holes, and a damaged area in the bottom; 17 feet of water over starboard bow, 10 feet of water over starboard quarter	Section along primary crack amidships and lift by YHLCs
DREDGE 15 SEPTEMBER	Displ.: 2,000 tons Size: 200' x 44' Attitude: on port side	Wooden superstructure carried away; plating split on a riveted seam; hull dished on starboard side, but wreck suitable for further use. Lay in average water depth of 52 feet	Refloat by parbuckling, patching, lifting, and pumping

[illegible] MONGUED, DREDGE 23, AND DREDGE KASSER SA VOES

Following the survey, trim and rig operations were commenced to prepare the three wrecks for side-lift.

Trim and rig operations in the Central Zone began on August 2 with the trim and rig team operating from BAYOUMI at the KASSER/MONGUED site. Work began first on KASSER by opening the upper gate for the starboard spud with an explosive charge, allowing the dredge to right itself from its 45° list. Other preparations on KASSER included removal of the spuds, dipper bucket, bucket arm, ladder, and turntable. A total of 100 tons of structure was removed.

The trim and rig team moved next to MONGUED. By August 12, all damaged metal that could interfere with the lift wires had been cut away. After a tripod on top of the pilot house had been burned off, the wreck was clear for a navigational draft of 15 feet to simplify maneuvering the YHLCs in the KASSER/MONGUED area.

From September 6-10, the trim and rig team, operating from a diving barge and supported by the SCA 80-ton crane and two scrap barges, worked on dredge 23. Dredge buckets, seven sets of five each, were removed by scarfing the connection plates with oxyarc cuts and shearing with explosive charges. The ladder was then cut into three sections and removed by the same procedure. When the kingpost, two deck winches, fenders, and fender brackets had been removed and lifted to the Canal bank, trimming operations were completed on the dredge.

Silt removal operations were begun on both KASSER and MONGUED on August 21. Although mud depths up to 8 feet were found in the machinery spaces of KASSER, the average throughout the ship was 1 foot or less. Two diving teams were employed on each wreck using 4- and 6-inch airlifts. Silt removal was completed on MONGUED on August 22 and on KASSER on August 24. Only the small amount of silt in the engine room was removed from dredge 23 because the weight of the craft, including the extra weight of the silt, was within the capacity of the heavy lift craft.

Tug MONGUED hangs suspended between YHLC's for transport to dump area.

[illegible] MONGUED

It was decided to lift MONGUED first since it was narrower than KASSER and would provide more margin for the first passage of a wreck around the concrete caisson in transit to the Great Bitter Lake dump area. On August 30, the heavy-lift craft moored over MONGUED, with CRILLEY to the north and CRANDALL to the south, bows to the west bank.

By September 3, 17 wires had been passed, and MONGUED was ready for the first lift. The decision was made to lift the wreck clear of the bottom and to rig the other three wires to achieve a total of 10 pairs of lift wires for subsequent lifts. By days end on September 4, the lift craft had been ballasted down, the lift wires had been tensioned further and pinned down, and the lift craft had been deballasted 50 percent to stretch the wires in preparation for the second lift, which was planned for the following morning. During this operation, an 18-inch lift was obtained and an additional heavy-lift wire was passed. Wire pair number 7 was fouled and was eliminated, leaving nine pairs of wires for future use, with a calculated load of about 75 to 100 tons per wire at maximum lift.

The lift craft were deballasted early September 5, raising them to a draft of 4 meters. The wreck was raised 5½ feet to a keel depth of 17 meters. Using tugs SHAHM, MARINER, LULU, and SHABAR, the nest was pivoted 45° around a shallow spot and moved a distance of 20 meters, where it grounded. Inspection by divers revealed that MONGUED had been lifted out of a 4-foot-deep hole. Ballasting of the lift craft commenced, and later, with the wreck resting solidly on the bottom, the lift wires were tightened and pinned for a new lift.

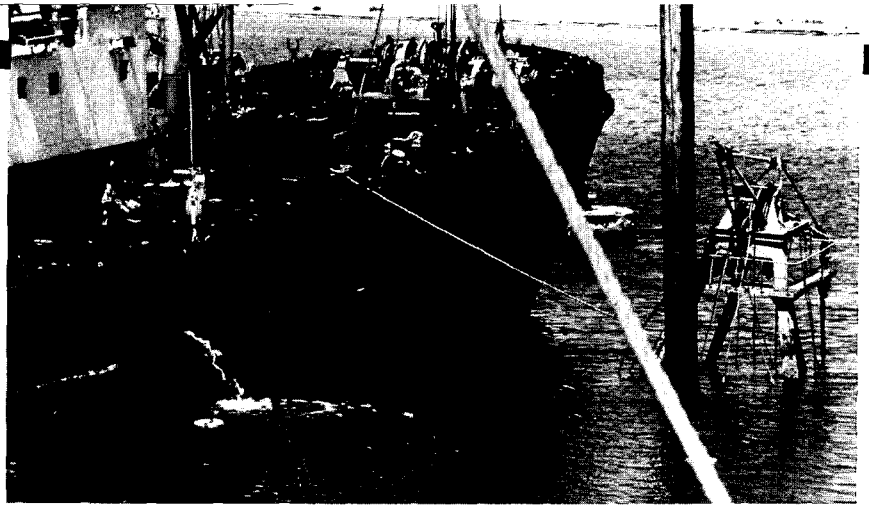
The next day, the craft were deballasted again until they floated at a draft of 4.2 meters, with the wreck suspended between them at a keel depth of 13.7 meters. After working clear of a shallow spot, the nest got under way for Lake Timsah to a new grounding area selected 3.35 kilometers south of Ismailia, just west of the main channel. The two lift craft were towed stern first by SHAHM. MONGUED, suspended between the lift craft, was towed bow first at a slight upward angle. MARINER's tow wire was rigged to the bow of the lift craft to maintain position control of the nest. The tug SHABAR was used alongside as directed. Later that morning, MONGUED grounded and was dragged into bottom at the designated grounding area.

Divers surveyed for a suitable beaching area, but got negative results, finding a general silt deposit of 5 to 7 feet throughout the lake. As a result, it was decided to make another lift in the present location in the expectation that an additional 2-foot rise could be obtained. This rise would permit the nest's clearance of the Deversoir Causeway, which had to be crossed to reach the designated dumping area in the Great Bitter Lake.

The next lift raised the wreck more than 7 feet, a net gain of approximately 2 feet, which was thought to be sufficient to clear the Causeway. On September 8, the nest proceeded to the dumping area with MONGUED slung at a keel depth of 13.4 meters. With precise tug control, the craft and the wreck negotiated the restricted channel between the concrete caisson and the west bank without difficulty. (There were approximately 50 meters of navigational clearance for the 37-meter-wide nest.) For the final leg of the tow, the lift craft had been turned around and were towed bow first by SHAHM and restrained by MARINER.

Early September 8, a recheck of the depth over the Deversoir Causeway showed rocks at 13.0 meters instead of the expected clear depth of 14 meters. The nest was anchored north of the Causeway to await further clearance by the SCA Dredging Division, which was engaged in around-the-clock effort to remove the remaining obstructions. On September 9, the Causeway was cleared to a depth that allowed the successful passage of the nest.

The wreck grounded as the nest turned from the Canal proper into a special access channel, but another lift early September 11 raised MONGUED sufficiently and it was pulled into the dump area. The operation was thus completed, and the lift craft were unrigged on September 12 to begin transit northward to commence lifting operations on KASSER.



Portion of dredge KASSER (right) shows as YHLC's complete lift.

On September 14, CRILLEY and CRANDALL were moored over KASSER, both to stern, using anchors from both craft supplemented by mooring lines run to the Canal bank and to one another.

By September 22, all 17 lift wires were in place. The lift craft were ballasted down, the wires were pinned, and the craft were deballasted to obtain a lift of 7 feet. With an 8-inch line to CRILLEY and CRANDALL, the tug SHAHM managed to pull the nest approximately 50 yards northward to Lake Timsah before grounding.

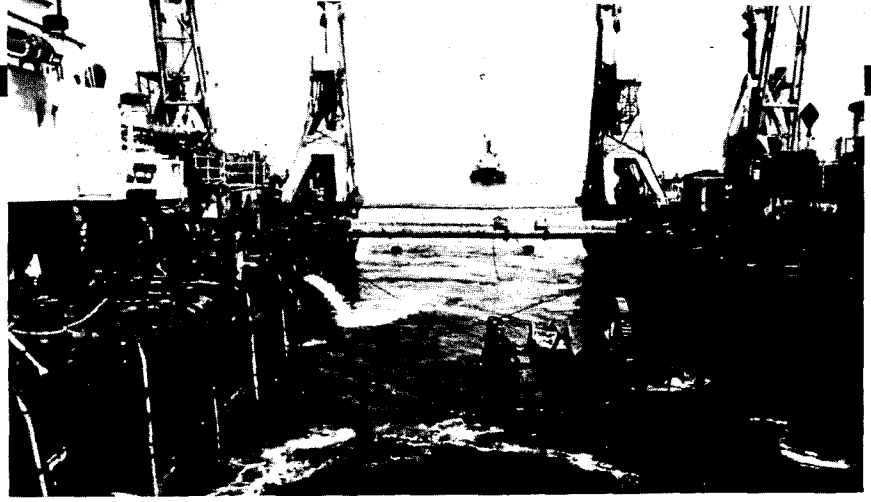
The lift of KASSER was an interesting case of good fortune resulting in a maximum draft reduction that was greater than the capability of the lift craft. The small grounded area encountered in the initial pull by SHAHM caused the wreck to trim by the stern for a total change of 10 feet in trim. The net rise was 7 feet, but the maximum and therefore controlling draft was reduced by 12 feet. The second lift raised KASSER another 7 feet onto a maximum draft of 42 feet, sufficient to permit passage over the Deversoir Causeway. Thus, a planned third lift in Lake Timsah was eliminated.

KASSER was then towed south, grounding in the Great Bitter Lake on September 24. On September 25, a third lift, made with some trim improvement, raised KASSER to a draft of 32 feet fore and aft. This permitted movement into the designated dump area, where the wreck was deposited approximately 200 yards from MONGUED.

The first task in the removal of dredge 23, to parbuckle it to an upright position, began on September 23, when THOR and ROLAND arrived at the wreck site. By September 26, all necessary fenders had been removed, the parbuckling anchors had been set, and the parbuckling wires rigged under the hull and fastened to the anchors.

Two attempts with THOR and ROLAND pulling together failed to parbuckle the dredge to the required position. Thus, the decision was made to employ ROLAND in a direct lift of the dredge gantry to obtain sufficient righting moment and to avoid the hull structural deficiencies that had been encountered. Because of the width of the cranes, it was not possible for ROLAND to plumb the dredge gantry while operating alongside THOR. On the next attempt, ROLAND successfully parbuckled the dredge into an upright position.

CRANDALL and CRILLEY were moved to the dredge 23 site. After departure of THOR and ROLAND, the craft moved alongside the dredge athwart the Canal with the bows of the lift craft to the stern of the dredge.



Dredge 23 hangs suspended between YHLC's during transit to dump area.

Passing and rigging lift wires continued until October 5, when the first lift was made by CRILLEY and CRANDALL.

After the dredge was lifted, the nest proceeded southward toward Lake Timsah. The nest consisted of SHAHM towing, MARINER restraining, and small SCA tugs assisting as necessary. After grounding lightly several times, the wreck grounded hard on an obstruction 2.4 kilometers south of its original position.

A second lift to a maximum draft of 43 feet was made on October 7. The wreck and the lift craft then continued southward, clearing the concrete caisson and Deversoir Causeway, and entering the Great Bitter Lake on October 8. On October 9, the final lift of dredge 23 was made, and the wreck was deposited in the designated dump area between MONGUED and KASSER.

With the dumping of dredge 23, the straightforward heavy-lift operations in the Central Zone were complete, and attention could be directed to the more complex problems presented by the concrete caisson and the dredge 15 SEPTEMBER.

DREDGE 15 SEPTEMBER

The refloating of dredge 15 SEPTEMBER had been determined feasible during the salvage survey. The lift cranes THOR and ROLAND would be employed to accomplish this by parbuckling the dredge into an upright position and lifting it until the main deck was clear of the water. Then positive buoyancy would be restored by pumping the interior of the hull until the dredge was afloat.

On September 25, the trim and rig team arrived at the site of 15 SEPTEMBER, accompanied by the SCA 80-ton crane and a diving barge, to commence preparing the dredge for parbuckling and lifting. Total preparation involved removing fendering strips obstructing parbuckling wires and hooks, removing the large amount of accumulated silt, repositioning the dredge ladder and gantry to alleviate interference with parbuckling wires during rotation, patching numerous hull openings, and rigging parbuckling and lift wires.

Divers commenced work burning the fendering strips at the top and bottom on both the port and starboard sides to facilitate parbuckling rigging. A second diving team inspected the side of the dredge that rested on the Canal's bottom and determined that rigging would be difficult because there was no clearance between the dredge hull and the bottom. Trimming of the fenders continued until September 29, when the trim and rig team was required in the Southern Zone.

They returned to the Central Zone on November 5, to resume work on 15 SEPTEMBER. Divers continued oxyarc-cutting of the fenders and commenced silt removal operations in the forward machinery room, boiler room, and forward storage spaces.

Several days were spent in repositioning the dredge ladder and gantry, while, simultaneously, one diving team removed the spuds, which also had to be removed to permit parbuckling.

On November 15, the trim and rig team left the site of 15 SEPTEMBER to work for 8 days on the concrete caisson. When the team returned on November 22, divers commenced patching operations by closing sea valves where possible and measuring, fabricating, and installing patches on the sea suctions and damaged areas. Patching operations were completed before the arrival of THOR and ROLAND on November 24.

Upon arrival, the two cranes were moored perpendicular to the dredge and to the west of it, THOR to the south, ROLAND to the north.

On November 25, the trim and rig team, working with the crane crews, commenced recovering messenger wires that had been rigged previously.

After running messengers for the ultimate number of lift wires on November 30, parbuckling commenced, requiring just 27 minutes to complete. The lifting force of the cranes provided to be sufficient. The parbuckling force of 950 tons, however, caused minor damage to the hull of the dredge. THOR's starboard wire cut into the deck and port side of the gunwale the width of the wire to a 3-foot depth.

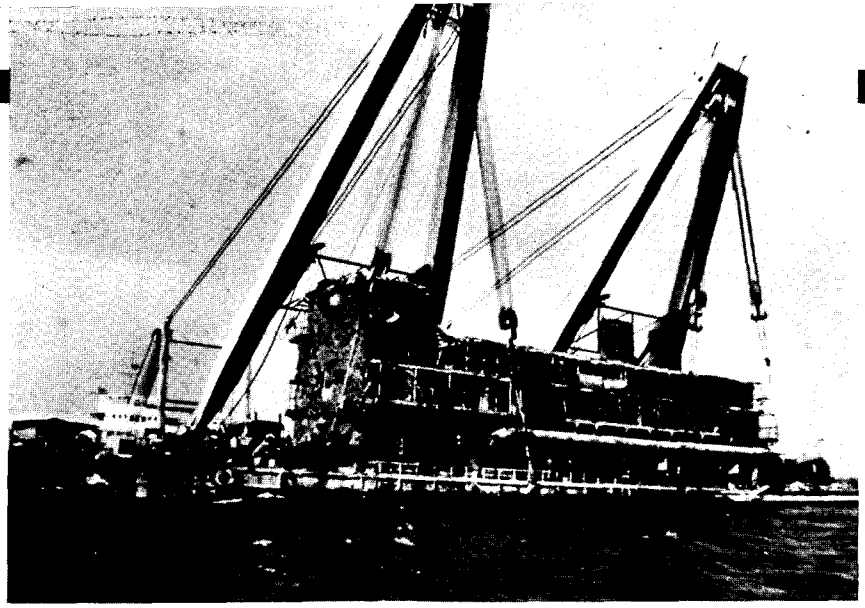
Upon completion of parbuckling, four additional lift wires and chafing plates were rigged. Lifting operations commenced shortly after noon on December 2. After application of 1,600 tons of lift force, using THOR's and ROLAND's main hooks and gin tackle, the dredge was lifted off the bottom. As the hull was lifted and additional structure was raised above the surface, the required lifting force increased. With the 01 deck out of the

water, the lifting force reached 1,900 tons.

Lightening the wreck for further lifting was necessary. All remaining silt and debris were removed by washing out each deck as it became awash, and drain holes were burned when natural drainage did not exist. Removal efforts continued throughout the following day until all accessible silt and debris had been cleared. With application of maximum load on THOR and 10-percent overload on ROLAND, the dredge 15 SEPTEMBER was raised until the main deck was 5 feet out of the water forward and 5 feet beneath the surface aft. At that time, it became evident that the wreck was heavier than had been estimated and that additional buoyancy would be required to surface the remainder of the main deck so the hull could be pumped out.

The after ballast tanks were patched and blown in an effort to generate additional buoyancy. Numerous leaks, however, detracted from the full effectiveness of this measure. Pumping was then undertaken using the casing of the main deck house as a cofferdam. The pumps employed included one 6-inch, nine 3-inch, and several small submersibles. Care was taken during the dewatering to prevent shifting the center of gravity of the suspended wreck toward the already overloaded ROLAND. As more of the main deck lifted, pumping was concentrated aft in order to trim the wreck and lighten the load on ROLAND. With the dredge still suspended by THOR and ROLAND, pumping operations continued throughout the night until 15 SEPTEMBER floated on the morning of December 5. Choppy waters in the Great Bitter Lake and 20- to 25-knot winds prevented release of the dredge by the cranes until the following day.

In late afternoon, 15 SEPTEMBER was taken under tow by the tug BUGSIER 26, with THOR trailing astern holding the 200-ton ladder off the Canal bottom. After an uneventful 22-kilometer tow up the Canal, 15 SEPTEMBER was delivered to the SCA yard in Ismailia at dusk on December 6.



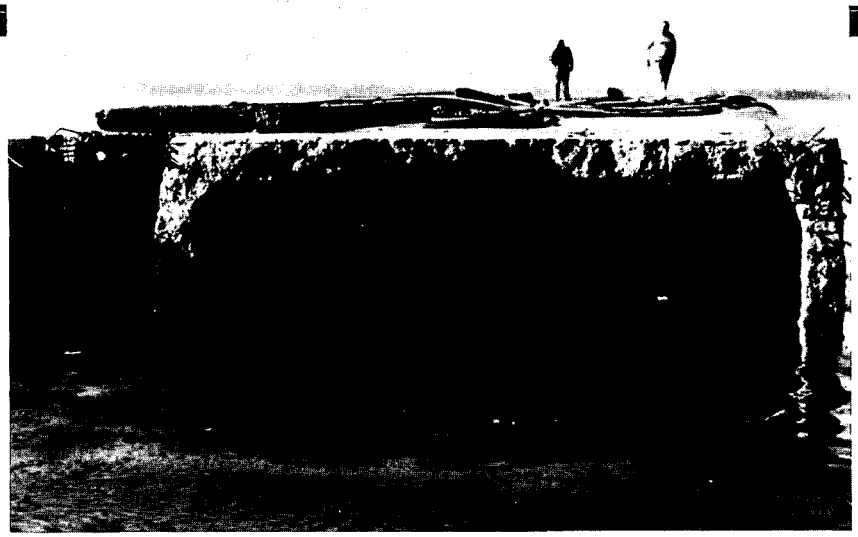
Cranes THOR and ROLAND lift dredge 15 SEPTEMBER.

The initial salvage plan for the concrete caisson called for it to be sectioned into two parts, each of nominally equal weight, by a combination of oxyarc and explosive cutting. The heavy-lift craft would then lift each section in successive lifts to achieve a draft which would permit transit over the remains of the Deversoir Causeway to the dumping area in the Great Bitter Lake.

Operations commenced on August 30 when the trim and rig team, supported by the crane barge BAYOUMI, arrived and began a second survey of the caisson.

This second survey revealed that there was additional damage. The original 2-inch-wide crack had opened up to 8 inches. In addition, there was evidence that explosive charges had been detonated alongside the hull since the previous survey (48 days before). The explosives had created a 12-foot-diameter hole in the eastern end with both concrete and reinforcing bar (rebar) missing, and a 5-foot-diameter hole in the western end with missing concrete and some cut rebar. It was considered that the explosions probably resulted from fishing by fishermen. The forces from the explosions, coupled with the forces exerted from the cantilevered western end, caused the crack amidships to open. The additional damage reaffirmed the salvage plan of sectioning and lifting.

In preparation for sectioning operations, the silt that obstructed the crack line in the mid-section upper and lower compartments was removed to expose the sides and bulkhead of the caisson. Upon removal of silt in this area, it was discovered that the centerline bulkhead had been crushed in about 3 feet. This failure further weakened the structure and created a potential hazard to divers working underneath the caisson. At the same time, a wire was rigged under the hull at the cutline to verify the completeness of the cut by sweeping the wire through the cut. The effort to place this wire by tunneling under the wreck was handicapped not only by numerous pieces of concrete that fell into the tunnel and had to be lifted out by hand as the tunneling progressed, but also by the fluid flow characteristics of the fine granular sand that composed the Canal's bottom. The sand flowed laterally into the tunnel and tended to close it. On September 16, after a



Section of concrete caisson in dump area.

week of effort, the wire was passed and stopped off on the wreck. Cutting operations began on the same day.

The procedure for cutting consisted of shattering the concrete with explosive charges and finishing the cut by oxyarc-cutting of the rebar. Although cutting the rebar was not difficult, it did require considerable time because of the large quantity present. Four-foot linear-shaped charges, packed with C-4 explosive at 3 pounds per foot, were used effectively to cut the lower side.

Silt removal commenced in the 10 compartments in the western end of the caisson using a 10-inch airlift. Removal of the silt from the top of the centerline bulkhead was accomplished first, followed by clearance of the lower compartment. Silt removal operations were completed in the western end of the caisson on October 10. Silt in the eastern end was removed several weeks later, just prior to lift of that section.

On October 11, CRANDALL and CRILLEY moved into position alongside the western end of the caisson, CRANDALL to the north and CRILLEY to the south, bows toward the west. The 16 messenger wires that had been rigged previously were taken aboard, and pulling of the heavy-lift wires commenced. A total of 20 wires were to be used in the lift.

By October 16, the 3-inch heavy-lift wires had been pulled under the wreck with some difficulty. The following morning the lift craft rigged 45-foot spreaders between the craft and ballasted down to both check the vertical clearance over the wreck and to commence pinning down. Overnight, however, the condition of the caisson changed dramatically for the worse. The western extremity dropped 7 feet into a 72-foot-deep depression in the Canal's bottom. The side lift had been premised on lifting the western end 7 feet off the bottom when it was at a maximum depth of 65 feet, followed by a second lift on the side of the scoured out depression around the western end. The increase of the maximum draft now seemed to preclude this plan. Dredging a slope to permit the caisson section to be lifted out of the hole in sequential lifts was not practical since no dredges were available. Thus, on October 19, CRANDALL and CRILLEY unrigged, leaving the messengers in place, and proceeded to other operations while the western end was lightened. The section was estimated to weigh 1,500 tons (wet), excluding any entrained silt. The goal was to lighten it enough for lift by the YHLC stern gantries (1,200 tons total lift capacity).

Lightening of the western end of the caisson called for removal of the upper compartments after cutting them into five sections of 100 to 200 tons each. These pieces would be within the 300-ton dynamic lift capacity of the outboard gantry hooks of a single YHLC, from which they were suspended while transported to the dump area. In sectioning the five sections, all explosive charges were placed from the outside so the divers would not have to enter the hull and encounter the risks presented by the badly cracked concrete structure.

The removal of these five sections, totaling about 550 tons, required cutting 514 linear feet of reinforced concrete. During this sectioning operation, 500 pounds of C-4 explosive, 258 pounds of burning rod, and 185 hours of diving time were used during an 18-day period.

The lower portion of the western end had been lightened to an estimated 900 tons and could be stern lifted by the two lift craft operating together. On November 12, CRANDALL and CRILLEY moored sterns to the western section of the caisson, bows to the south.

Rather than employing chains, as had been done with the smaller sections, advantage was taken of the nine 1-inch messengers that had been rigged for the earlier side lift attempt. Rigging, which proceeded slowly as each wire was fought under the wreck, was completed on November 17.

To preclude the possibility of a disastrous unintentional grounding while en route to the dump area, it was planned to complete the operation with a side lift. (Grounding at the Deversoir Causeway with a 92-foot-wide obstruction was a distinct possibility.) To facilitate this, the caisson section would be lifted from the depression, transported a short distance, and held clear of the bottom while additional lift wires were rigged. The section would then be set down and rigged for a side lift. The side lift

would have a significantly larger margin of available capacity and would hold the section much more securely during the transit to the dump site.

The first lift attempt made on the morning of November 21 was unsuccessful because the east end of the section would not lift free. Divers cleared the rubble and a second lift attempt was made on November 23. In the second attempt, the caisson section was lifted from the depression and moved about 20 meters southward, where it was lowered to the Canal's bottom in 51 feet of water. When the section was lifted on the morning of November 24, two strands of one wire parted. The section was replaced on the bottom, and stern lift operations on the western half of the caisson terminated rather than rerig the failed stern lift wire to move the section only a few hundred meters further south. The caisson had been positively separated and was in a depth where a side lift was feasible.

When the stern lift operations had been completed, CRANDALL and CRILLEY began rigging for side lift of the eastern section on November 26. Eighteen wires were passed and the first lift was made on November 30. The first lift was successful, but some wires appeared to have suffered damage from the sharp concrete corners. To preclude failure, the caisson was set down and approximately 150 tons of mud were removed from the caisson to reduce the weight. To reduce wire loading and to make it more equitable, two additional pairs of wire were passed, and the position and lead of one pair of wires were improved. A second lift was made on December 5. The section was twisted to take advantage of a natural rise of the bottom and regrounded. A third lift was made on the morning of December 8, and the wreck, with a 48-foot draft, was maneuvered toward Deversoir Causeway, where it grounded.

Careful examination of the bottom at Deversoir showed that some additional difficulty could be expected in passing the Causeway. Large rocks were removed by divers and a crane, and high spots were lowered by divers to achieve a 47-foot clearance.

When lifting the caisson anew for the next attempt, the section now drew a maximum of 45 feet. On December 10, the Deversoir was crossed without difficulty. The section grounded only 1 kilometer from the dumping ground in the Great Bitter Lake and was lifted one more time before being deposited in the dump area.

Because of the delay that was experienced with lifting the eastern section of the caisson and because of the availability of the heavy-lift crane THOR (which had just completed the 15 SEPTEMBER), it was deemed expeditious to employ THOR using both crane and gin tackles to lift the western section.

THOR was unable to lift the section because of caisson weight distribution problems. Since it would be necessary to devote considerable time to prepare and balance the caisson section for a type of lift that might not be successful, the continued use of THOR was no longer attractive. This attractiveness was further diminished by the fact that CRANDALL and CRILLEY were capable of handling the job easily. Also, the possibility of damaging THOR, which was a valuable asset needed to remove the last remaining piece of MECCA in the Northern Zone, was an important factor. Hence, a decision was made to employ CRANDALL and CRILLEY to remove the last section of the caisson and to release THOR to assist in the final work on MECCA.

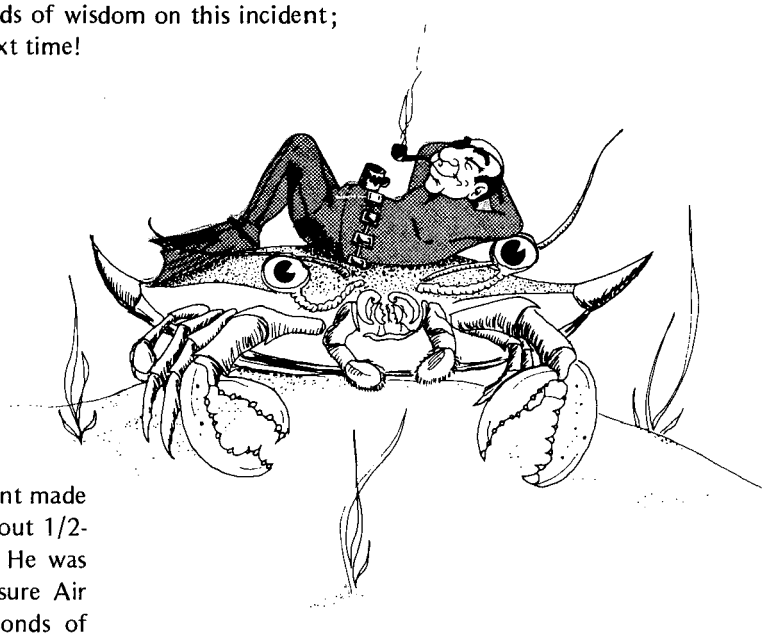
CRANDALL and CRILLEY returned to the western section on December 14, and began work passing six pairs of heavy-lift wires. Rigging and first lift on December 18 proceeded without difficulty. A second lift was made on top of the ridge at Deversoir the morning of December 19, and a third lift just short of the dump area that afternoon. Salvage operations in the Central Zone terminated when the western half of the caisson was dumped at 5:30 p.m. local time on December 19. The removal of all wrecks from the Northern and Southern Zones having been completed earlier, dumping the western section of the caisson marked the completion of ship salvage and clearance operations in the Suez Canal.

Salvage operations in the Central Zone were conducted much as they had been planned. Successive lifting of tug MONGUED, dredge KASSER, and dredge 23 with the heavy lift craft and depositing them in the dumping ground in the Great Bitter Lake was accomplished in classic fashion. Righting, lifting, patching, and pumping evolutions to refloat dredge 15 SEPTEMBER were carried out rapidly and effectively. The minor rigging problems that were experienced in the process of removing these wrecks were typical and not unexpected.

The concrete caisson (particularly the western section), however, presented difficult problems. One setback was the settling of this section into the bottom as the result of disturbances caused by explosive cutting, tunneling, and other forces, coupled with a sudden shift into a deeper hole that prevented lifting with the heavy lift craft. The resultant requirement to commit additional time and assets to lighten it for lift caused some concern as to meeting the overall completion date. Judicious use of available resources was successful, however, in overcoming this setback and meeting the scheduled completion date for the operation.

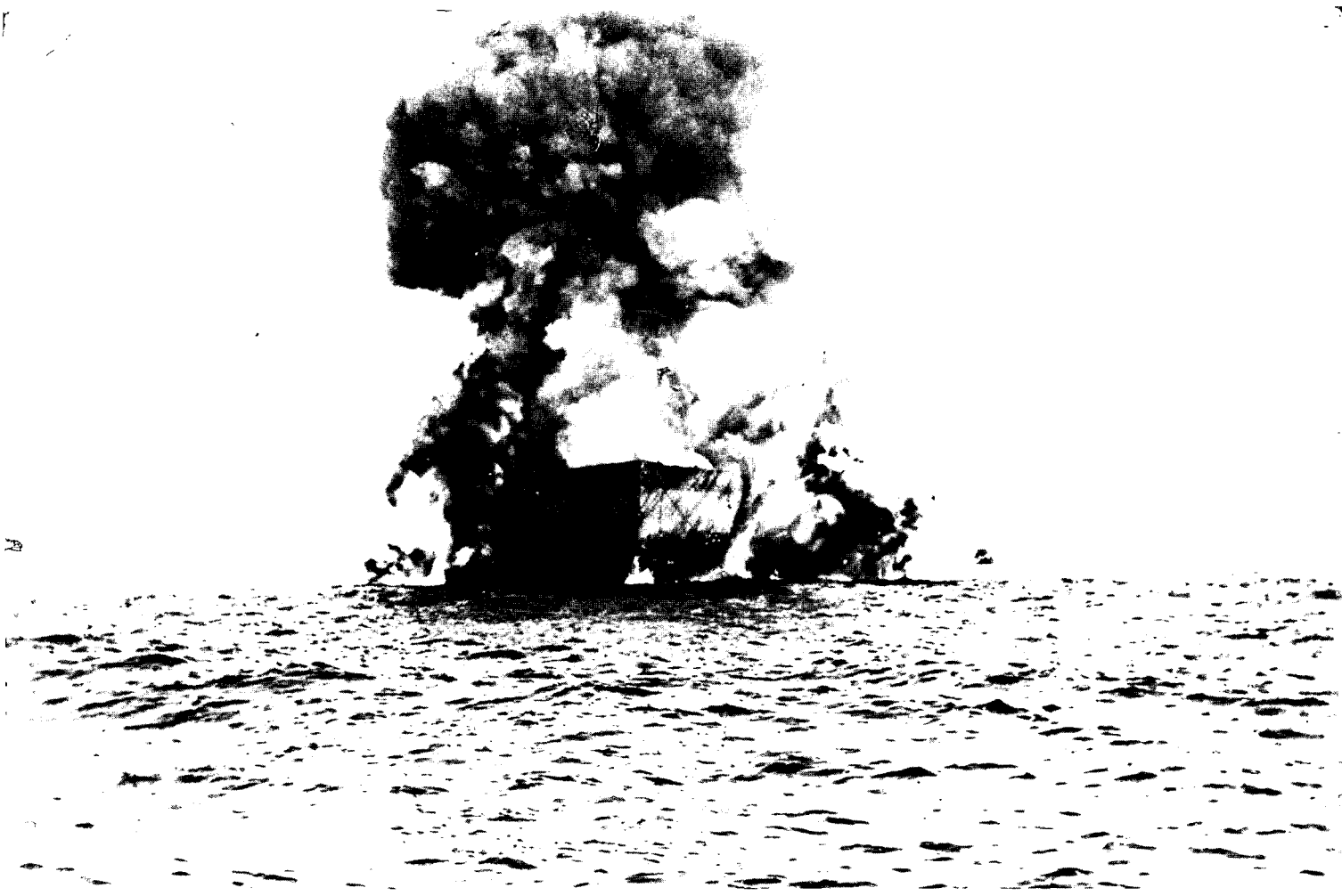
The Old Master ...

It's time once again to sit y'all down and point out a few of the errors some of you have been making. Recently, I received some statistics on diving accidents for the period of January 1, 1974, through December 31, 1974; and I've chosen one to preach to you about. Take heed of my words of wisdom on this incident; hopefully, I won't be describing *your* mistake next time!



Using a deep sea air rig, a diving school student made a 200-foot dive for 10 minutes that entailed about 1/2-minute of actual work while on the bottom. He was decompressed on a 200/10 Exceptional Exposure Air Table, which required 9 minutes and 30 seconds of decompression time. Five minutes after reaching the surface he noted the onset of dull pain in the left groin area, but did not report it. Twenty-eight minutes after reaching the surface, the pain persisted and increased in intensity and he then reported it to the Diving Supervisor. He could not attribute the pain to any strenuous activity. He was then examined by a diving medical officer and treatment started on a Treatment Table 5. He received complete relief of symptoms after 8 minutes of breathing pure oxygen at 60 feet, and completed the treatment symptom free.

In this incident, decompression sickness was probably caused by pushing the decompression table used to the maximum depth and bottom time allowed. There are two serious errors that occurred on this dive. Foremost of the two was the diver's reluctance to report the pain when he first noted it. The U.S. Navy Diving Manual, pages 8-12, article 8.3.2, last paragraph, states "A diver must immediately report any postdive symptoms, even such minor things as a slight itch or a tingling sensation." If not treated, the bubble or bubbles may move in the body to the bloodstream, heart, or brain and cause serious harm. Secondly, the use of an Exceptional Exposure Air Table carries an added risk not normally found with the Standard Air Table. On this particular dive, they were pushed to the maximum limit of depth and time for the scheduled dive, which provides *no* margin for error in the depth gauge. (The allowable error for a depth gauge is ±1 percent of full scale reading for gauges over 3-1/2 inches in diameter, and ±3 percent for gauges 3-1/2 inches and smaller. Ref: NSTM 9870, article 9870.16.5.) If the gauge used was good to 400 feet, the allowable error would be ±4 feet. On a 600-foot gauge it would be ±6 feet. Simply stated, this means that if the depth gauge reads 200 feet and the gauge is in calibration, the actual depth may be anywhere between 196 to 204 feet on a 400-foot gauge, or 194 feet to 206 feet on a 600-foot gauge. Following the philosophy of the Diving Manual and basing all decisions in favor of the diver, the Diving Supervisor must always take gauge accuracy into consideration when selecting the decompression schedule to be followed, particularly when, as in this case, you are at the maximum depth and bottom time for the schedule selected.



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