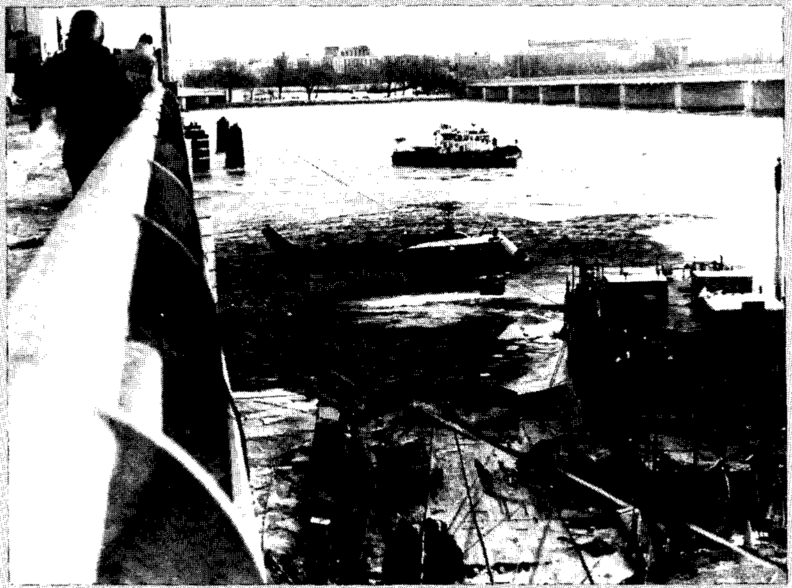
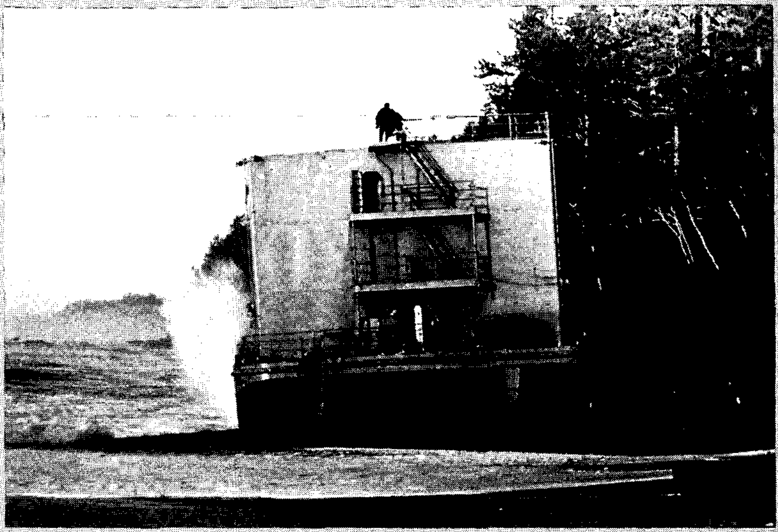
FACEPLATE

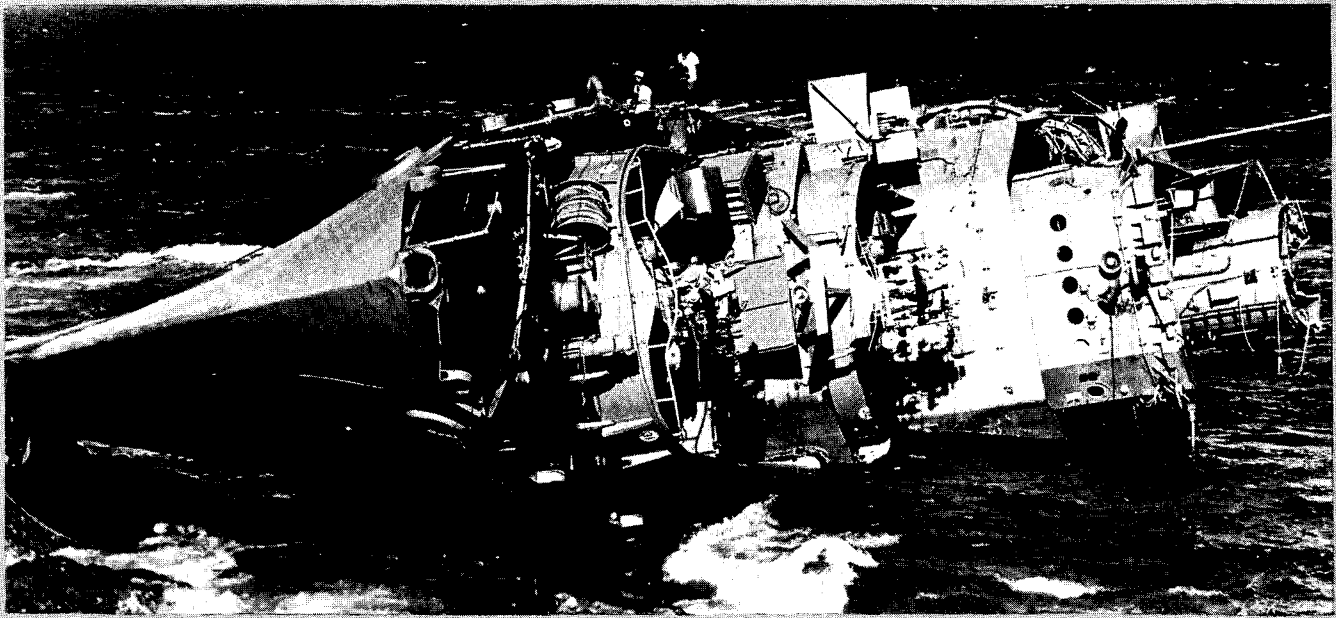
THE OFFICIAL MAGAZINE FOR THE DIVERS AND SALVORS OF THE UNITED STATES NAVY



Left: U.S. Army helicopter equipped with impulse radar system hovers above icy Potomac River during search for Air Florida Flight 90 wreckage (page 16).



Right: YRBM-26 washed ashore after parting from towing pendant at Vancouver Island (page 8). Below: Philippine Navy destroyer DATU KALANTIAW in tragic aftermath of Typhoon Clara (page 26).



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VOLUME 13, NO. 1

FRONT COVER: Recovery of tail section of Air Florida Flight 90, Boeing 737 aircraft, which plunged into the Potomac River after takeoff from Washington National Airport on January 13 (see page 16).

BACK COVER: Research divers adjust camera bar during fluid motion experiment (see page 23).

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

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SOUNDINGS

Chief Richardson Receives First Novello Award

The Sam A. Novello Memorial Award for Scholastic Excellence was presented on March 6, 1982, to MMC(DV) Eugene Richardson at the 5th annual Institute of Diving banquet in Panama City, Florida. The award will be presented annually to the first class diver graduate who has demonstrated the highest scholastic achievement at the Naval Diving and Salvage Training Center (NDSTC) during the previous year.

Chief Richardson was the top honor student for 1981, with a grade average of 96.79. The first annual presentation of the award was presented by CWO Bill Woodward for the Commanding Officer of NDSTC.

Chief Richardson hails from Jackson, South Carolina, and is a veteran of nine years of Naval service. He is currently assigned to the Explosive Ordnance Disposal detachment at Keflavik, Iceland.

CWO Bill Woodward presents MMC(DV) Sonny Richardson (right) with the first annual Sam A. Novello Memorial Award for Scholastic Excellence during ceremonies in Panama City, Florida, on March 6.

Sam Novello, for whom the award is named, was a Navy diving school honor graduate who attained the rank of Master Chief Boatswain's Mate. He made many noteworthy contributions to the Navy diving community during his 37 years of service. A diver for 26 years of his Navy career, Sam was a good friend and shipmate who served his country with honor. His distinguished career ended abruptly on April 16, 1980, when he became the victim of a terrorist assassination while serving as Department of Defense Liaison to Turkey.

Sponored by the Institute of Diving, the award is a bronze likeness of late Master Chief Novello affixed to a walnut plaque. As an incentive to future deep-sea diving students, the award will be displayed at NDSTC. The names of subsequent recipients will be added to the plaque annually. A smaller replica of the award was presented to Chief Richardson, and so will be presented to each future recipient.

1140 Community

LCDR Rob Wells has relieved LCDR Bill Bacon as 1140 Community Detailer at the Naval Military Personnel Command in Washington, DC.

LCDR Wells was previously Commanding Officer of USS BEAUFORT (ATS 2), Pearl Harbor. LCDR Bacon has reported for duty as Commanding Officer, EOD Mobile Unit TWO, Fort Story, VA.

All 1140 Officers are reminded to keep their Preference Cards and Officer Data Cards updated. To contact the detailing office, call AUTOVON 224-694-8328 (or commercial, 202-694-8328).

CDR Bruce Banks *CDR James Nelson*

NDSTC Change-of-Command

In change-of-command ceremonies in Panama City, Florida, on April 16, CDR Bruce C. Banks relieved CDR James Rad Nelson as Commanding Officer of the Naval Diving and Salvage Training Center.

CDR Banks graduated from the Deep Sea Diving School as a Diving Salvage Officer in 1966. Subsequent assignments included duty onboard USS PRESERVER (ARS 8); Harbor Clearance Team FOUR, Republic of Vietnam; and Naval Underwater Systems Center, Newport, RI. After qualifying as a Helium Diving Officer and, later, as Saturation Diving Officer, he became Executive Officer of USS BEAUFORT (ATS 2). After graduating from U.S. Navy Destroyer School in 1973, he served aboard USS CHARLES P. CECIL (DD 835).

In 1976, CDR Banks became Executive Officer of the Navy Experimental Diving Unit, and in 1978 received orders as Commanding Officer of USS RECLAIMER (ARS 42). Before assuming his duties at NDSTC, CDR Banks received his Master's degree in Management from American International College.

CDR Nelson, who will retire later this summer after 36 years of service with the Navy, previously served as Commanding Officer of the Naval School of Diving and

Salvage in Washington, DC, before it was disestablished and moved to Panama City.

Hydrogen-Fueled Back-pack Heater

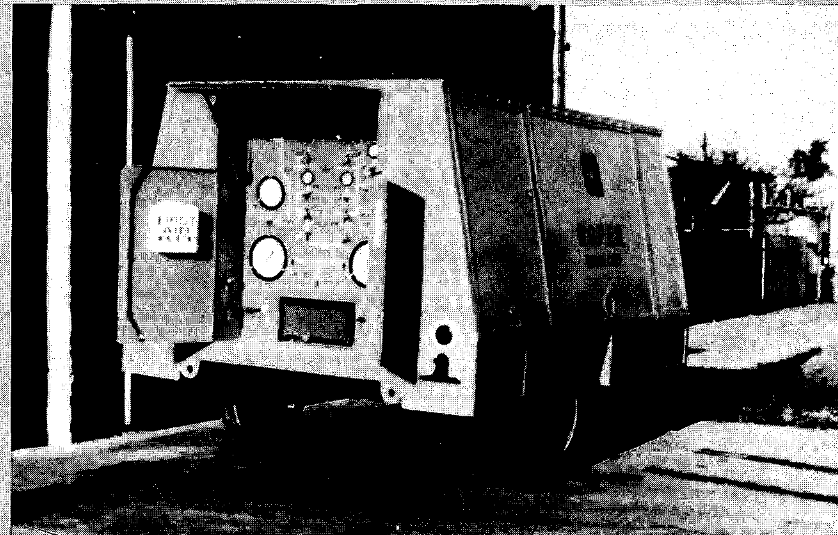
As part of the Diver Thermal Protection Program at the Naval Coastal Systems Center, Panama City, Florida, Battelle Columbus Laboratories is designing a hydrogen-fueled back-pack heater for divers. The system will provide up to two kilowatts of heat for as long as six hours at depths of 450 FSW.

Although propane heaters have been developed, they are depth-limited because of the low vapor pressure of propane. A hydrogen heater does not have this limitation.

The hydrogen-fueled heater will contain a catalyst bed of aluminum oxide/platinum pellets, over which a recirculating flow of pure oxygen will be maintained by a gas ejector. When heat is required, a small flow of gaseous hydrogen will be introduced into the catalyst bed. The hydrogen will burn flamelessly in the presence of oxygen. Other than heat, the only combustion by-product will be water.

Heat will be removed from the catalyst bed by a water jacket and circulated to the diver's suit with a pump powered by thermoelectric elements. The design also will include an internal protection system to prevent overheating and build-up of hydrogen concentrations.

To conduct the study, Battelle initially will analyze methods for controlling gas flow and heat output, as well as analyze ways to inject hydrogen into the catalyst bed. After a model is fabricated, field experiments will be conducted and the data will be used to construct a full-scale system.



The Ready Over-Pier Emergency Repair Diving Cart, designed for surface-supported dives with the MK 1 and MK 12 SSDS.

New Diving Cart Is Highly-Mobile Air Source for MK 1 and MK 12 SSDS

The Ready Over-Pier Emergency Repair (ROPER) Diving Cart introduces a new, highly-mobile air source for conventional surface-supported working dives with the MK 1 mask and MK 12 SSDS in shallow pierside depths. It is a totally self-contained system and provides sufficient air supply to conduct over three hours of continuous operation with two MK 1 divers (six hours with one MK 1 diver); or over two hours with two MK 12 divers (four hours with one MK 12 diver). The Diving Cart may be rapidly deployed with no ancillary support.

Recharging the system with the high-pressure flasks is normally carried out upon completion of the working dive, but can also be accomplished during diving operations.

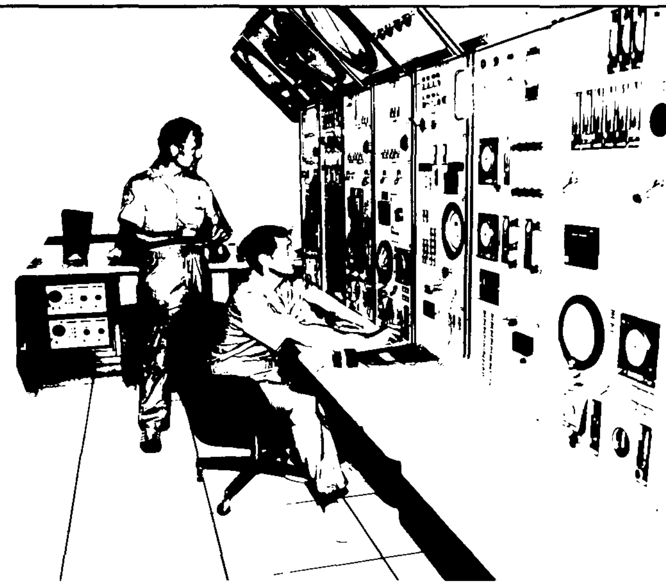
Commander Submarine Development Group ONE, San Diego, California, conducted operational tests of the unit under the direction of CDR C. J. Duchock, Jr., and ENCM(MDV) Robert Cave. The tests were conducted in January with highly satisfactory results. The ROPER Diving Cart is delivered as a certified system, ready for immediate service. Only minimal familiarization with basic operation is required. The first unit will be delivered to Mobile Diving and Salvage Unit TWO. Outyear procurement of eight units has been authorized.

Conceptualization, hardware development and completion of all requisite documentation for the system was accomplished in an eight-month time frame. The program manager was Mr. Walt Bergman, U.S. Naval Sea Systems Command (NAVSEA OOC-3), Washington, D.C.

ASR's Reunion

A reunion will be held for those who have served aboard USS TRINGA (ASR 16), or other ASR's, on September 17-19, 1982, at the Groton Motor Inn, Groton, Connecticut. For further information, contact Don Garvin, 23 Luce Ave., Niantic, CT 06357.

NEDU Reports



Manned Evaluation of the Pre-Production MK 16 Underwater Breathing Apparatus. *C. G. Gray and E. D. Thalmann.* NEDU Report 13-80. AD No.: A091500.

Abstract: The MK 16 Underwater Breathing Apparatus (UBA) was evaluated to assess its breathing characteristics, duration, and technical characteristics at 150 FSW on N_2-O_2 and 300 FSW on He-O_2 in the Navy Experimental Diving Unit Ocean Simulation Facility Hyperbaric Chamber Complex. The oronasal pressures, inspired and expired oxygen and carbon dioxide, electronic oxygen control and failure warning system function were monitored. The results indicate that the oxygen alarms function well, breathing resistance is acceptable at both depths, and the canister durations were adequate for mission support. The electronic control of oxygen was consistent, but the UBA is unreliable because of oxygen valve malfunction and erratic watertight seal integrity. Additionally, the high negative static load experienced in the horizontal or head-down position caused extreme diver discomfort.

MK 16 Mod 0 UBA TECHEVAL Report. *M. J. Harwood.* NEDU Report 14-80. AD No.: A091842.

Abstract: The Technical Evaluation (TECHEVAL) of the MK 16 Mod 0 Underwater Breathing Apparatus (UBA) was conducted by the Navy Experimental Diving Unit (NEDU) from 5 May through 13 June 1980. Specific objectives were to achieve 100 hours bottom time at depths of 150 FSW and to verify Mean Time Between Failures (MTBF) and Mean Time To Repair (MTTR). The results of the TECHEVAL revealed many deficiencies which should be corrected and tested prior to OPEVAL.

Test and Evaluation of Bauer Portable High-Pressure Breathing Air Compressor, Model Varius G-3. *R. L. Bowdish.* NEDU Report 15-80.

Abstract: A gasoline-engine-driven, high-pressure breathing air compressor, Bauer Varius G-3, was evaluated by the Navy Experimental Diving Unit to determine its suitability for Navy use. Results of the 50-hour test showed that the portable compressor delivers breathing air at an average charge rate of 2.07 CFM, charging twin 72-cu.ft., twin 50-cu.ft., and single 80-cu.ft. scuba tanks in 71, 44, and 39 minutes respectively. The unit is easily maintained, sturdily constructed, and economical in gasoline fuel consumption. The Bauer high-pressure breathing air compressor (Varius G-3) is recommended for placement on the list of equipment Approved for Navy Use (ANU).

United States Coast Guard Emergency Underwater Escape Rebreather Evaluation. *C. G. Gray, E. D. Thalmann, and R. Syklawer.* NEDU Report 2-81. AD No.: A100769.

*Abstract:*The United States Coast Guard Emergency Underwater Escape Rebreather (UER) was evaluated at the Navy Experimental Diving Unit. Physiologic testing in the dry laboratory, monitoring breath-to-breath O_2 and CO_2 levels, delineated the factors used in selection of 40% O_2 as an appropriate and safe breathing mixture. Tests during exercise provided the maximum usable duration in cold water to be 2 minutes. Pool studies evaluated the suitability for in-water use of the UER to a maximum working depth of 6 FSW. The

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 Technical Information Center (DTIC), Cameron Station, Alexandria, VA 22314. Prices vary according to the individual report. Include report's AD Number with each request.

results demonstrated the UER to be an acceptable shallow depth emergency escape device. The use of a nose clip or face mask is recommended to minimize gas loss and possible aspiration of water through the nose. Minor shortcomings in the breathing characteristics of the device may be improved by changes in the breathing bag configuration.

Standardized NEDU Unmanned UBA Test Procedures and Performance Goals. *James R. Middleton and Edward D. Thalmann.* NEDU Report 3-81. AD No.: A105609.

Abstract: This report represents the most recent developments in a continuing effort by NEDU to accurately simulate the physiology of a working diver during unmanned UBA performance testing. The unmanned test procedures outlined in this document simulate the physiology of a diver performing graded exercise from light to extreme work rates. CO_2 absorbent canister duration studies duplicate the standard NEDU manned test scenario.

Performance goals are listed for all types of UBA according to their operational characteristics. These goals do not represent minimum acceptable performance levels. Rather, they are goals which when met by a piece of life-support equipment, will insure that the UBA is not the limiting factor in diver performance. Acceptance of any given piece of equipment for military or commercial use must be based on specific operational requirements.

Manned Evaluation of Field Change 985 to the MK 11 UBA CO_2 Absorbent Canister. *C. G. Gray and E. D. Thalmann.* NEDU Report 4-81. AD No.: A103352.

Abstract: Field Change #985 to the MK 11 Semi-Closed Circuit mixed-gas UBA underwent manned evaluation at a depth of 650 FSW in 35°F water. FC 985 splits the hot water supply to the diver with part heating sheath-surrounded breathing bags and hoses and part being routed to a heat exchanger inside the CO_2 absorbent canister. The results of 6 manned canister duration studies showed that the canister effluent CO_2 was less than 1 mmHg after canister times ranging from 5 hrs 10 min to 6 hrs 2 min. This was a significant improvement over canister duration times of previous MK 11 configuration studies. A canister duration of 6 hours was assigned to the FC 985 canister. No significant differences in breathing resistance from the previous MK 11 configuration were noted. Inspired gas temperatures exceeded the minimum inspired temperature limit of 60.3°F at 650 FSW.

Salvage of a USAF F-106 Delta Dart. *Colin A. Kidman and R. A. Bornholdt.* NEDU Report 5-81. AD No.: A105610.

Abstract: As formally requested by the U. S. Air Force and under the official direction of the Chief of Naval Operations, the Navy Experimental Diving Unit (NEDU) directed the search, location and recovery of an F-106 Delta Dart which had crashed into the Gulf of Mexico in 80 FSW. The operation covered a span of 20 days. NEDU was assisted in the salvage effort at various times by local units from the Navy Diving and Salvage Training Center and the Naval Coastal Systems Center. The assistance provided by the Air Force in the way of an 85-foot drone recovery boat and three divers greatly reduced the overall cost of the operation. The out of pocket expenses incurred by NEDU ($15,000) included the purchase of braided nylon line and dive gear turned over to the Air Force to be used on future operations. Recycled air plane scrap metal recovered during the effort was estimated to be valued at in excess of $40,000.

Market Survey and Analysis of Commercially Available Flowmeters for the MK 12 SSDS—Air Mode. *E. H. Randall.* NEDU Report 6-81. AD No.: A105611.

*Abstract:*This report is a market survey and analysis of commercially available flowmeters for possible use with the MK 12 Surface-Supported Diving System (SSDS)—air mode. It was found that a differential pressure-type flowmeter met the listed specifications most completely. A mechanical flowmeter could not be located for less than $400.00. Also, no flowmeter could be found which did not require some type of conversion table.

Evaluation of MK 12 Surface-Supported Diving System (SSDS) Modified Helmet Locking Devices. *E. H. Pahl.* NEDU Report 7-81. AD No.: A105654.

Abstract: Modified helmet locking devices to secure the MK 12 SSDS Helmet to the Neck Breech Ring were tested by the Navy Experimental Diving Unit (NEDU) to determine whether a new method could be incorporated into the equipment to prevent the helmet from accidentally separating from the breech ring. Test results demonstrated that a modified arrangement consisting of a new helmet locking device and safety pin will greatly reduce the possibility of the helmet and neck ring accidentally separating. It is recommended that the present MK 12 helmet locking device be replaced, as an interim measure, with the modified configuration. For a permanent solution to the problem, a helmet locking device similar to that used on the MK 11 Dry Hat should be investigated.

Cost Analysis of NEDU's Helium Reclaimer. *E. H. Randall.* NEDU Report 9-81. AD No.: A105611.

Abstract: The analysis compares the cost effectiveness of reclaiming helium from the Navy Experimental Diving Unit's Ocean Simulation Facility Hyperbaric Chamber Complex using a helium reclamation system manufactured by DIVETEC Systems, Inc., to purchasing pure helium from the U. S. Department of the Interior Bureau of Mines. The cost of electrical power, maintenance and upgrade of the helium reclaim system is considered along with the effects of various inflation rates. A discounted cash flow analysis is provided.

YRBM-26 – THE RELUCTANT BARGE

LT K.T. Gross, CEC, USN
NAVSEA OOC

While under tow by USNS SIOUX (T-ATF 171) in the Straits of Juan de Fuca on December 5, 1981, the berthing and messing support barge YRBM-26 parted from her towing pendant and was forced aground by heavy seas near Pachena Point on the south end of Vancouver Island, British Columbia.

High, But Not Dry

At the time of this incident, wave heights were in excess of 20 feet. Winds gusting to more than 62 knots, accompanied by six-to-eight-foot swells, had broached the barge beyond the surf zone 15 to 20 feet above the mean high water mark approaching the tree line.

The on-scene commander, CDR Gary Cassat, Commanding Officer of Mobile Diving and Salvage Unit ONE, and the salvage liaison officer, LT Jim Bloomer, of Naval Shipyard Puget Sound, were transported to the grounded vessel by SH-3 helicopter provided by NAS Whidbey Island on December 7. Inspection of the barge revealed partial flooding of three of the six voids, with leakage into a fourth void. Salvage calculations based on this inspection indicated a ground reaction before dewatering of 695 tons, and 546 tons after patching and dewatering of the voids. The expected retraction force was estimated to be 240 tons after removal of a six-foot-high sand and gravel bar which had accumulated seaward of the barge due to heavy surf activity.

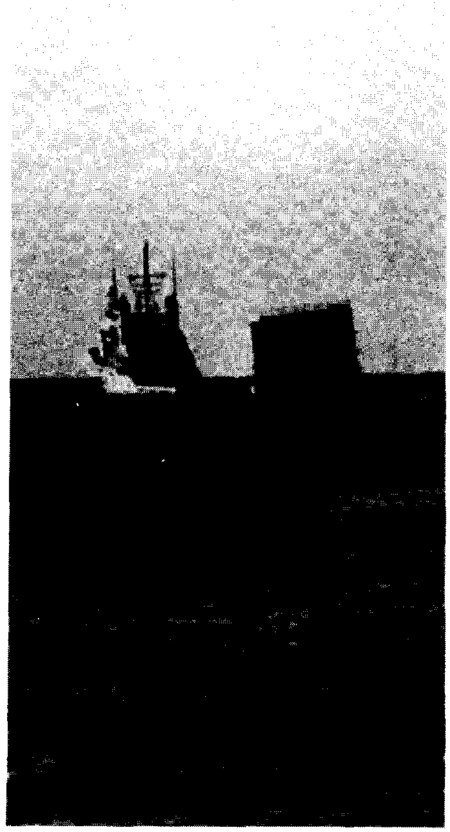
Assets Mobilized

By December 15, the salvage team and equipment had been assembled at Naval Shipyard Puget Sound for transfer to the isolated salvage site to meet USS RECLAIMER (ARS 42) and USNS SIOUX. The salvage team was composed of personnel from Mobile Diving and Salvage Unit ONE and Mobile Diving and Salvage Unit ONE Detachment, San Diego, California. Salvage equipment was shipped from FADS TWO assets in Pearl Harbor and from the Emergency Ship Salvage Material pool in Stockton, California.

The severity of the weather at the salvage site had decreased by December 17 when personnel and equipment began arriving. Due to continued heavy seas, CH-47 helicopter support was provided from U.S. Army resources at Fort Lewis, Washington.

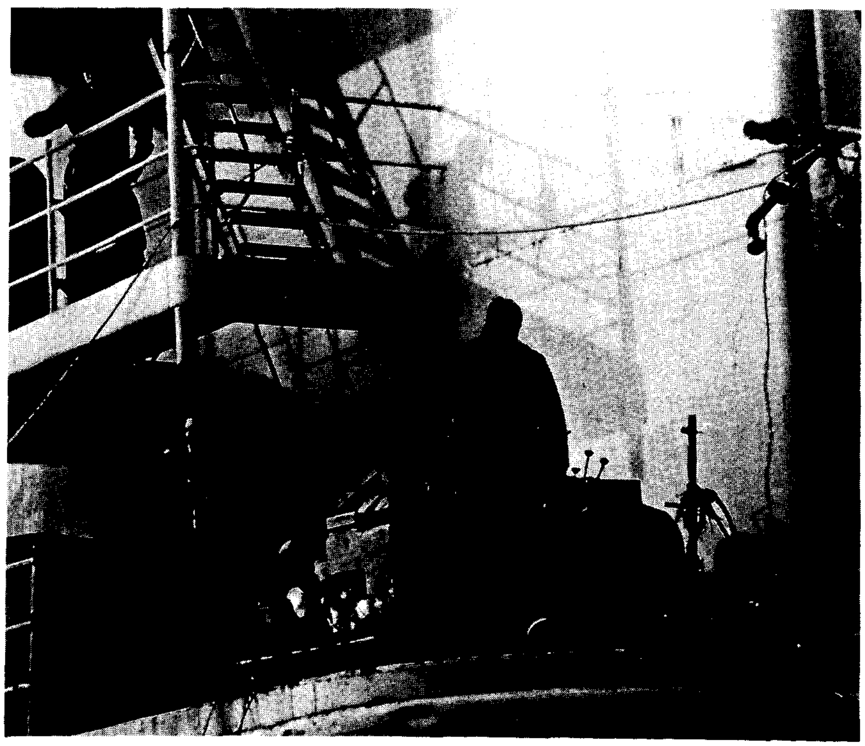
First Attempt Fails

With USNS SIOUX in harness, a full strain bollard pull was begun at high tide on the morning of December 17. But this effort was to no avail, as the anticipated tidal lift did not materialize. Deteriorating weather conditions and little hope for sufficient tidal lift potential through December 25 forced a temporary delay of the salvage effort. Consequently, RECLAIMER was directed to proceed to Naval Shipyard Puget Sound for reprovisioning, voyage repairs, and preparation of two legs of beach gear for



the second attempt. USNS SIOUX proceeded to Port Angeles in order to remain close to the salvage site in the event of a favorable tide or unanticipated opportunity to extract the barge. Meanwhile, members of the salvage team began removing topside weight, making repairs to double bottoms, and completing welds on attachment points for beach gear legs.

Opposite page: YRBM-26 hard aground and water-filled on Vancouver Island. This page, counter-clockwise from top: USNS SIOUX attempts retraction; the salvage team; dewatering operation; under way after successful retraction on December 21.



Back to Sea

On the morning of December 21, YRBM-26 unexpectedly became lively at high tide. After the Royal Canadian Navy Fleet Diving Unit, Pacific, blasted a three-foot-deep, 200-foot-wide channel through rocks and sand seaward of the barge, USNS SIOUX attempted another bollard pull with successful retraction.

Later that day, with 1,000 feet of tow wire payed out and making six knots, USNS SIOUX headed toward Bremerton, commencing the final leg of a far from uneventful tow.

A DIVER'S NIGHTMARE

Thirty years have passed since the following diving operation took place. Equipment and procedures have certainly improved since that time, but some advice from one who experienced a very close call remains sound: Don't panic, and have faith in your diving associates.

LCDR Robert F. James, USN (Ret.)

In 1952, prominent South Carolina attorney J.U. ("Red") Watts was shot and killed. The murder weapon was desperately needed to solve the crime and prosecute the apprehended prime suspect.

Find the Weapon

An informant told authorities that the weapon was thrown into the Great Pee Dee River, just across the county line from the murder scene near Darlington, South Carolina.

Soon thereafter, the U.S. Navy received a request for diver assistance, and, in turn, elected USS PETREL (ASR-14), out of Key West and undergoing regular overhaul at the Charleston Naval Shipyard, to provide the required diving services.

A diving officer, master diver, 11 first-class divers—oh, yes—and one Cocker Spaniel mascot "Stormy" (at the Commanding Officer's insistence), were dispatched by Highway Patrol vehicles to the scene—a good day's journey distant.

Upon arrival, the divers' adventurous excitement was quickly depressed (to put it mildly).

The July temperature was in the humid, high 90's (F), the river was a 35-foot-deep, raging stream at flood stage, with innumerable treacherous whirlpools. Water temperature was in the 40°F area, and the surrounding woods abounded with rattlesnakes and water moccasins! At riverside, what was mistaken for a man with a black shirt at a short distance, proved to be a man bare from the waist up covered with mosquitos!

Setting Up

So much for the good stuff. The diving gear selected for this effort consisted of a truck-mounted air compressor on the bridge spanning the river; a standard diver's air hose leading over the bridge rail 60 feet below; two small aluminum boats lashed together for a diving platform; and two Jack Brown masks.

A jack-stay line was rigged for the search as follows: a three-inch manila line from the bridge to a 300-pound weight on the river bottom; a 200-foot manila line from the 300-pound weight stretched taut downstream to a 50-pound weight. The 50-pound weight was surface-marked with a small cork buoy. A diver's descending line led from the diving platform to the 300-pound weight.

All this was before sophisticated body-warming wet suits. The divers were protected (momentarily) by regular woolen underwear. When wet, this provided protection against skin cuts and abrasions, but little from the cold—which was a never-diminishing shock after an hour or two in the heat!

Traveling the jack-stay downstream was a breeze—you searched with one hand and hung on with the other, letting the bottom current propel you to the weighted end. Upon arrival, the diver would shake the cork buoy to signal his position, tighten up the jack-stay, and move it one linear foot. Simultaneously, the 300-pound weight at the bottom of the bridge would be moved one foot in the same direction by tenders on the bridge. The diver's tender would give him the hand signal to continue his search back to the boat platform.

The entire round-trip took approximately 20 minutes, and the diver was enthusiastically prepared to get out of that cold water, especially after the exhausting crawl search back up against the three-knot current. The divers were teamed into three sets (four divers per set): the first set diving out of the platform, the second tending the compressor and jack-stay weight, and the third resting from their last diving trick.

The work hours were from 0600

The master diver, in swim suit only, leaped into the water, . . . ignoring the excruciating cold . . .

The distressed diver could hear the master diver actually breaking the limbs from the (submerged) trees over the roar of the river.

to 1800, and took 12 days to reasonably cover the river bottom area within which it was possible to throw a gun.

Subterranean Tangle

If the bottom had been clean and sandy, as initial dives indicated, it would have been only *mildly miserable*, but an additional handicap of monumental proportions provided the nightmare that is the prime motivation for this literary effort.

The visibility was zero immediately below the water surface, so the descending line, jack-stay line, and hand signals from the tender were unquestionably the diver's life lines. The current was so strong that, unless the diver was lying flat on the bottom, it tended to remove his face mask, even with his back to the current.

Among our party, there were some who could tolerate the cold water better than others. Comedians attributed this ability to the amount of alcohol consumed the evening before, whereas the analytical mind attributed it to a larger layer of fat on these divers.

The one diver in the group most adversely affected by the cold water was a "Charles Atlas" type with no fat and all raw, bone muscle. He was the master diver supervising the operation and, therefore, didn't participate in these frigid excursions on a regular trick basis.

The lateral jack-stay movements were accomplished easily across the sandy bottom. Later, however, the gradual appearance of small, sunken trees became a veritable forest of enormous trees with branches of huge proportions, which eventually ensnared the jack-stay and wove it into an unbelievable tangle.

Ditch the Gear?

One diver attempting to travel along the fouled jack-stay fought his way toward the end, but unknowingly laced his umbilical through the trees many times. Finally, in a true, living nightmarish situation, he found himself standing upright facing the river current, unable to get down low, unable to turn around, completely fouled at every angle, and his face mask half torn off! His tender in the boat could not feel him and he could not feel the tender. The distressed diver was bordering on hysteria but afraid to ditch his diving gear in this entanglement.

Composure eventually returned and the diver managed the life line/air hose umbilical enough to send continuous jerks in a series of four-four-four pulls.

"I've Got 4-4-4!"

As stated earlier, a routine dive of 20 minutes was painfully chilling. On this dive, over 30 minutes had now passed. At last, the tender screamed out, "I've got 4-4-4 – he's in trouble!" The master diver, in swimming suit only, leaped into the water, tightening up his face mask in mid air, followed the diver's umbilical into the sunken jungle of trees, and, ignoring the excruciating cold, actually started breaking the limbs from the trees. The distressed diver could hear this over the roar of the river against his mask, which by now he held over his face with both hands.

The master diver eventually reached the ensnared diver and moved him a few inches at a time, while breaking away trees and clearing the jack-stay. Finally unfouling the diver's umbilical, he and the semi-petrified diver once more arrived at a reasonably clear bottom and then transited along the jack-stay back to the sanctuary of the diving platform. The entire elapsed time now was one hour and 30 minutes – an eternity for the parties concerned!

From One Who's Been There

If there is a lesson to be learned here, it is probably this: No matter what the existing circumstances, do not panic. And, have unquestioned faith and trust in your diving associates; supervisors are designated and assigned because they have proven that they can be entrusted with the lives of their men.

There is an unwritten understanding among professional divers – "I *am* my brother's keeper."

There is an unwritten understanding among professional divers — "I am my brother's keeper."

Prior planning, eternal vigilance, and confidence in yourself as well as the professional expertise of your associates will invariably bring satisfactory results in any situation.

Oh, yes – I almost forgot about the murder weapon. The informant had lied; the gun had never been in the river at all.

The "ensnared diver" of this story is the author; the master diver who came to his rescue, retired Chief Metalsmith Cyrus Earl Alleman. The 13 U.S. Navy divers involved in the operation received citations from South Carolina Governor James F. Byrnes.

NMRI'S Hyperbaric Medicine Program Center

TACKLING DIVING PROBLEMS ON SEVEN FRONTS

This is the second of a two-part article on the Naval Medical Research Institute (NMRI), the U.S. Navy's primary center for biomedical research in diving. The first part described NMRI's new Hyperbaric Research Facility and Chamber Complex (see FACEPLATE, Winter 1981).

Mr. John C. Naquin
CAPT Mark E. Bradley, MC
Mr. Lomaye Hurley

The research conducted by the Hyperbaric Medicine Program Center at the Naval Medical Research Institute (NMRI) Bethesda, Maryland, is in support of U.S. Navy diving operations. In adition to conducting the Navy's major biomedical research program in diving, this Center also provides a 24-hour treatment and medical consultative capability for decompression sickness and cerebral air embolism resulting from diving and altitude exposure.

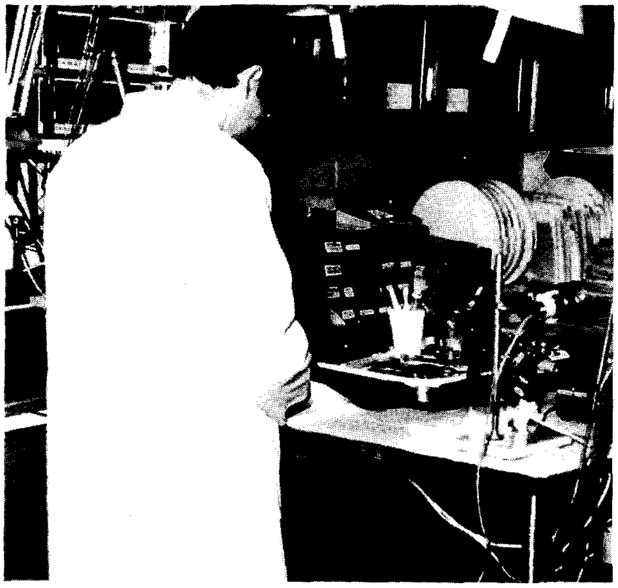
NMRI is the major U.S. Navy facility in the Atlantic states capable of providing therapy for decompression sickness and air embolism, and also provides the capability of hyperbaric treatment for gas gangrene, carbon monoxide poisoning and other diseases amenable to hyperbaric oxygen therapy. The research program of the Hyperbaric Medicine Program Center is composed of projects which are balanced in such a manner as to fill immediate Fleet needs, as well as to develop new methods for effective diving to depths beyond current operational capabilities.

The diving biomedical research program of this Center encompass seven program areas.

1. Decompression Studies

The first of these areas is the study of the principles and physiology underlying safe decompression. Difficulties with decompression procedures impose significant limitations on current U.S. Navy operational diving capabilities. An example of this limitation is

Respiratory experiment with plethysmograph at one of NMRI's medical laboratories.



A multi-disciplined staff investigates immediate and future U.S. Navy diving needs in seven different program areas.

the need for decompression schedules for subsaturation helium-oxygen diving to 600 feet-of-seawater (FSW). Some operational scenarios involve decompression procedures that are beyond our present capability. Underwater Demolition Team/Seal missions involve complex dive profiles and include use of a constant oxygen breathing apparatus for which only limited schedules currently exist.

To meet both immediate and long-term operational requirements, we need to be able to formulate decompression schedules. Formulation of rational decompression schedules requires an understanding of the mechanisms governing inert gas transport in the human body. Therefore, our approach has involved a systematic approach to the measurement of mathematical modeling of the physical and biological processes that underlie decompression. Ongoing research includes the determination of the solubility of inert gases in body tissues and fluids, as well as the development of an understanding of the factors that regulate bubble formation and growth during decompression.

With the use of radioactive gases, we have obtained quantitative information regarding the kinetics of inert gas uptake, transport, and elimination in discreet portions of the body. Other projects are evaluating various environmental factors as they affect the decompression of divers. These factors include pulmonary status, exercise, cold, gaseous composition and pressure profile. The U.S. Navy's diver population now includes women. Therefore, we are performing studies to determine if decompression presents any hazard to fetal development. If it does, this would affect the operational status of female Navy divers. The final objective work in this area is to develop safer and faster decompression schedules for Fleet use.

2. Decompression Sickness and Embolism

A second program area is the development of improved methods to treat diving accidents, to wit: decompression sickness and cerebral air embolism. In order to rationally develop therapeutic procedures for decompression sickness and cerebral air embolism, we are seeking an understanding of the basic pathophysiological processes involved in these diseases. Research is in progress to develop improved recompression treatment guidelines. Since recompression therapy is not always curative, therapeutic adjuncts to recompression are needed. Much of this work, which involves evaluation of the efficacy of pharmacological agents to enhance recovery, is performed in clinical human trials.

3. Respiratory Research

Considerable research effort is directed to the study of respiratory function in the diving environment. Recent diving operations and experimental work has demonstrated that breathing resistance in some underwater breathing equipment is excessive. We have research which is defining the ventilatory loading which a diver can safely tolerate and which will provide an understanding of the response of the lungs and respiratory muscles to this loading. The results of this work will permit us to define the limits of resistance permissible in the divers' breathing equipment and provide the basis for the improved design and development of underwater breathing gear.

Other work in this area is determining the effects of both short and long exposure to various gases at high ambient pressures on respiratory function. For instance, work on respiratory control in diving is attempting to ascertain what is the normal respiratory state to be expected of divers in the hyperbaric environment. This information is needed as a baseline for the physiological monitoring of divers and for testing diving equipment.

Because of the considerable amount of heat loss from the respiratory system in deep diving, the U.S. Navy now requires that divers' breathing gas be heated during dives in excess of 500 FSW. Therefore, research is being conducted to determine the changes in lung function which occur while breathing hot or cold gases. This work will provide criteria for safe minimum and maximum temperatures of breathing gases in the diving environment.

Because of the loads imposed on the respiratory system by the diving environment, a diver's ability to sustain adequate gas exchange is impaired. To assist ventilation and gas exchange, we are examining methods which will enhance ventilation. The most promising technique presently is the use of a high-frequency, low-volume system which could be incorporated into a diver's breathing equipment.

4. Oxygen Poisoning

The use of oxygen at increased pressures can enhance the safety and efficiency of diving operations. It would be desirable if decompression time from deep dives could be shortened and the risk of decompression sickness reduced by increasing inspired oxygen concentration. At present, we do not know whether this is feasible or safe to do. Thus, we are conducting research which will allow for the early detection of oxygen poisoning as well as quantitatively determining the rate of development, severity, and rate of recovery from varying degrees of oxygen poisoning. This work will provide the basis for determining whether present schedules for oxygen exposure (including recompression therapy schedules) should be modified.

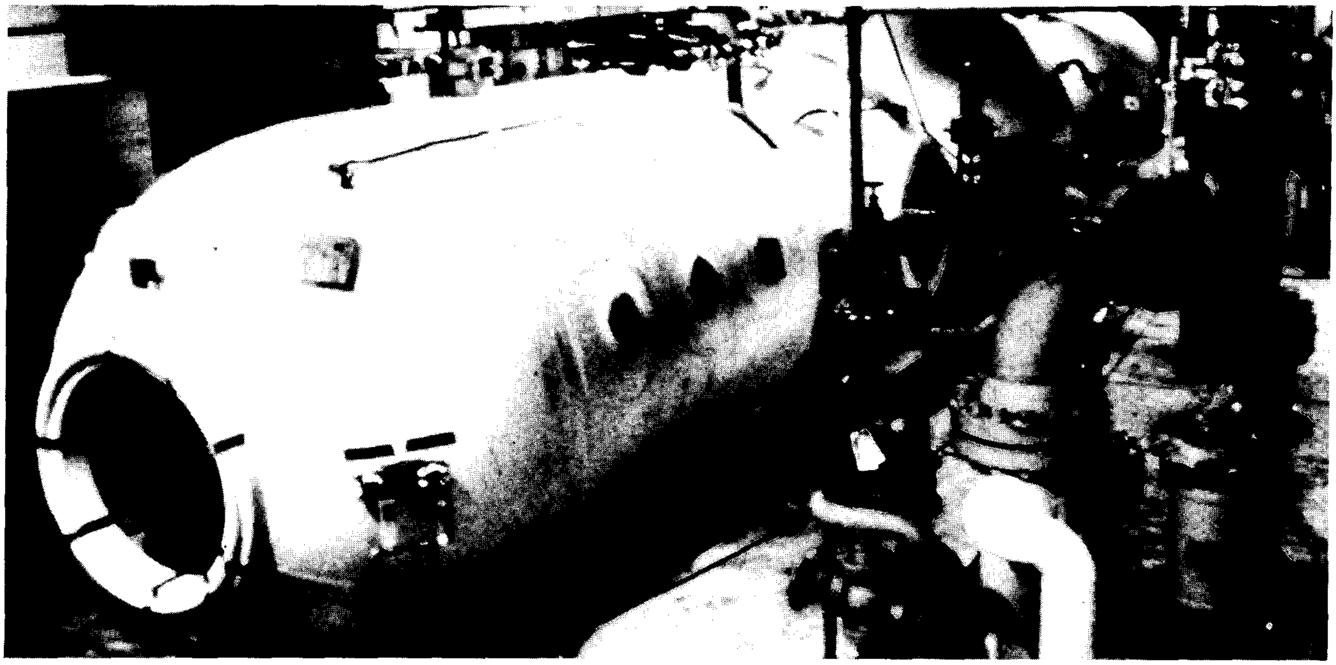
5. Effects of Exposure

The effects of exposure to the diving environment on cardiovascular performance are being studied. Of particular interest is the effect of exposure on cardiac output and regional blood flow, since changes in either of these can limit work capacity and alter the uptake and elimination of inert gas. Work in this laboratory has shown that cardiac arrhythmias and other forms of cardiovascular dysfunction can occur as a result of arterial air embolism and decompression sickness. Therefore, we have work ongoing which is devising and testing better therapeutic approaches for the treatment of these problems.

6. Thermal Studies

Cold is pervasive in the diving environment. Where thermal drain is encountered, a diver's performance is first affected and subsequently his safety may be jeopardized to the point where mere survival is at stake. The study of cold stress in diving has several objectives. First of all, we are working to determine the physiological events that occur in cold stress and to define suitable measurement or combinations of measurements to indicate the

NMRI's Hyperbaric Research Facility.



A view of the Hyperbaric Chamber Complex.

degree of cold stress. Secondly, we are working to determine the amount and distribution of heat needed to maintain a diver in an adequate, functional and safe condition. This will permit us to propose guidelines to equipment designers with regard to the heating requirements of a diver for optimal function.

We are also beginning research which will provide improved procedures for rewarming a hypothermic diver in each of the operational settings where divers work.

7. High-Pressure Biology

The seventh, and final program area, high-pressure biology, comprises a potpourri of research projects concerned with defining the effects of high-pressure environments on divers.

Diving beyond 1,000 FSW is currently tenuous because of problems arising in divers in the form of tremors, vertigo, nausea, and certain performance problems. These problems are collectively named the high-pressure nervous syndrome. Because it is necessary to determine whether man can effectively dive beyond 1,000 FSW and perform work safely, research is in progress to define the nature of this disorder and the fundamental mechanisms involved. As part of this research, we are attempting to devise methods to attenuate or eliminate the high-pressure nervous syndrome in Navy personnel. Both short- and long-term exposure to hyperbaric environments may potentially have detrimental effects on body tissues and cells. Research is therefore quantifying the effects that these environments have in the functional capacity of the immune and renal systems, as well as on certain constituents of blood, such as platelets. The final work unit in this program area focuses on task performance of divers in various conditions. This research is providing desriptive and quantitative data on performance degradation associated with various environmental factors, and the development of methods to minimize performance degradation by the application of human engineering techniques.

Diving Research and Beyond

To prosecute this research program, the Hyperbaric Medicine Program Center has an investigative staff which is multi-disciplined. Investigators trained in the physical sciences, such as physics and chemical and electrical engineering, work hand-in-glove with neurophysiologists, cardiovascular and respiratory physiologists, and biochemists.

As can be seen, this is an extraordinarily large and diverse research effort which is providing answers and solutions to major operational problems in diving today. Because the conduct of excellent basic science and elucidation of mechanisms are fundamental prerequisites to the development of solutions to Fleet problems, there is considerable spinoff of our research from many areas of clinical medicine which are far afield from diving. Examples of these areas are the improved monitoring of critically ill patients, as well as improved methods for treatment of stroke and spinal cord injury.

THE RECOVERY OF AIR FLORIDA FLIGHT 90

LCDR Stephen W. Delaplane, USN
and PH2 Mark Faram, USN
Mobile Diving and Salvage Unit TWO

U.S. Army photos by Sp4 Alan Adams and SSG Gary Kieffer, courtesy Maj. Sam Bruce.

On January 13, 1982, the late afternoon snow was falling like pillow cases in the nation's capital. Many government offices had already closed, sending thousands of employees to fight their way home through frozen streets. National Airport had secured operations earlier, owing to the extremely poor visibility and runway conditions, but had reopened at about 1500.

Fateful Takeoff

Air Florida Flight 90, with a total of 79 passengers and crew members onboard, had been waiting for operations to resume for about two hours. At 1559, the tower gave Flight 90 permission to take off at "pilot's discretion".

The Boeing 737 began to roll on a scheduled flight to Tampa, Florida. However, as soon as the aircraft cleared the runway and headed out over the Potomac River, it apparently began to lose power. After struggling to attain a maximum altitude of about 400 feet, it plummeted down, striking the 14th Street Bridge, one mile north of the airport. After impacting the bridge, the aircraft struck the river, the ice shredding the

Recovery operations in progress on the Potomac River at the 14th Street Bridge. Washington National Airport, one mile south, is visible at top of photo.

"This salvage operation was a tragic human drama of unusual proportion. The members of the joint services team shared the physical and emotional stress, and responded with a spirit of spontaneous cooperation, selfless professional dedication, and extraordinary compassion . . . . They faced almost impossible odds and extreme adversities of weather. Yet, with a methodical perseverance and resolve, they achieved the impossible."

LCDR S.W. Delaplane, USN, On-Scene Commander

Recovery of tail section on January 17, during relatively mild 17°F temperatures. Wind-chill factor on previous day was −47°F.

fuselage like a serrated knife. The tail section separated and allowed five passengers to exit into the frigid water to be rescued by a U.S. Park Police helicopter and other units responding to the disaster. As nightfall descended, rescue operations continued. The bodies of seven additional passengers were recovered before operations were secured by Deputy Chief Connors of the Metropolitan Police Department.

"Blueprint" Operation

In the aftermath of this disaster emerged a salvage effort which can be best characterized as a blueprint in professionalism and cooperation. At the request of the Police Department, Department of Defense resources were mobilized throughout the night to support the recovery of missing passengers and aircraft wreckage. By 1300 the next day, a joint services recovery team had been assembled.*

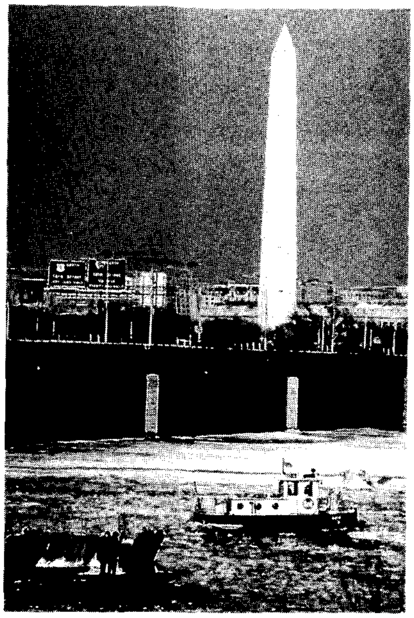
Three surface-supplied diving units were established under the overall supervision of MMCS (MDV) Wetzel. By mid-afternoon, Dive Unit 1, comprised of Army and Coast Guard divers operating from a barge, commenced survey operations. Dive Unit 2, comprised of Mobile Diving and Salvage Unit TWO (MOBDIVSALU TWO) personnel under the supervision of MMC(DV) Herman, began setting up the fly-away diving system onboard a U.S. Army LCM-8 from the 464th Transportation Boat Company.

Dive Unit 3 was to be manned by Explosive Ordnance Disposal (EOD) personnel under the supervision of GMGCS Richardson and HTCS(MDV) LeJeune. The diving boat from the EOD School had been operating in the Patuxent River, in Maryland, but was ordered to proceed to the crash site shortly after the crash. Ice jams were hindering the transit, so the USCG Cutter CAPSTAN was dispatched to break ice and escort the EOD diving boat to the site.

Ice Floes and Wind-Chill

Friday, January 15, dawned in the glaze of a −20°F wind-chill, an environmental factor which would prevail throughout most of the operation. A briefing was conducted for all dive unit personnel. The briefing detailed the operational organization and addressed the aspects of press relations, the body recovery procedures, operational safety and cold-weather

*The joint services team included detachments from Mobile Diving and Salvage Unit TWO, Little Creek, VA; Naval Explosive Ordnance Disposal School and Technology Center, Indian Head, MD; Coast Guard Atlantic Strike Team, Elizabeth City, NC; and the 86th and 115th Engineering Detachments, Fort Belvoir, VA. LCDR Stephen Delaplane, Commanding Officer of MOBDIVSALU TWO, was designated On-Scene Commander.



Above: Crash site at bridge, near Washington Monument. Right: U.S. Army divers from 30th Engineering Battalion, Ft. Belvoir. Below: U.S. Navy MK 12 diver from MOBDIVSALU TWO.

medical precautions. In some respects, this "all-hands" meeting was like a class reunion, as many Navy, Army and Coast Guard divers were reacquainted after graduating from the Navy diver training facilities at the Navy Yard in Washington, D.C., and Panama City, Florida.

After breaking and moving the ice floes which had formed overnight, Dive Units 1 and 2 set about their assignments. Initial surveys showed that the aircraft was badly demolished but well concentrated. As bodies were located, they were brought to the surface and turned over to representatives from the Medical Examiners Office. After a 36-hour transit, the EOD dive boat arrived in the afternoon.

Diving operations commenced from all three dive units at 0800, Saturday, January 16. U.S. Army engineers set up a grid of the impact area which was utilized to establish the location of the wreckage. Surveyors on the beach would, at the request of Dive Unit supervisors, provide a grid location which was correlated to a specific diver's location. As a result, a very detailed map of the impact area was developed.

The flight recorders were of very high interest to the National Transportation Safety Board investigation. These units were equipped with underwater "pingers" and had been located by divers. However, access and recovery were precluded by a large pile of debris which was resting on top of them. At the end of the day, the tail section was rigged for lifting; the bodies of 50 victims had been recovered so far.

The next day, winds of 30 knots plunged the wind chill to −47°F and necessitated terminating diving operations. The respective teams spent most of the day just running equipment and maintaining adequate cold weather protection. Diving operations were attempted, but exhaust and air control valves kept freezing in the frigid air.

Into High Gear

Monday, January 17, brought a "tropical heat wave" with temperatures rising to 17°F. The tail section was lifted and an additional seven bodies were recovered. A U.S. Army underwater radar topography unit sonar-scanned the impact area by helicopter and inflatable boat to develop an underwater picture of the wreckage. The results were then coordinated with dive unit assignments.

Above: On January 20, one week after crash, main fuselage was recovered. Flight recorders and cockpit were brought up the same day. By the twelfth day, 95 percent of the wreckage and all of the victims' bodies had been recovered. Below: Dive team from U.S. Army 30th Engineering Battalion, Ft. Belvoir, Virginia.

Attempts to lift the main fuselage and cockpit on January 19 had not been successful. However, the next morning, the flight recorders were located and recovered on the first dive. The main fuselage was rerigged and successfully lifted. The cockpit and instruments were also recovered. At the conclusion of this "tonnage day", approximately two-thirds of the wreckage had been recovered; all but six bodies had been recovered.

Bittersweet Conclusion

Operations on January 21 and 22 were very productive and at the commencement of diving operations on Saturday, January 23, about 85 percent of the aircraft had been recovered. There remained but one body to recover; that of a six-month-old infant boy. Considering the odds against recovering all the bodies the results to date were considered phenomenal; yet, with a fervent resolve, the divers began operations intent on achieving the impossible. At 0730, thirty minutes into the first dive, the child's body was recovered. The remainder of the day was spent recovering aircraft

(Continued on page 30)

A Job That "Brought Out the Best in People"

Story and photos by
PH1 Jim Preston, USN

Wednesday, January 13, had been a fairly routine day in Little Creek, Virginia, for Mobile Diving and Salvage Unit Two (MOBDIVSALU TWO) and its Commanding Officer, LCDR Stephen Delaplane. Heading out the door, LCDR Delaplane remembered that one last call that had to be made. Returning to the quarterdeck, he called his Executive Officer. LT Andrew Hammond answered with a startling statement: "You won't believe what I just heard on the radio. A plane crashed in the Potomac River near Washington National Airport."

LCDR Delaplane rushed to a nearby television room to confirm the news. In a blinding snowstorm, Air Florida Flight 90, a Boeing 737 jet aircraft en route to Tampa, Florida, from Washington, D.C., had struck the northbound span of the 14th Street Bridge after takeoff and plunged into the icy Potomac River.

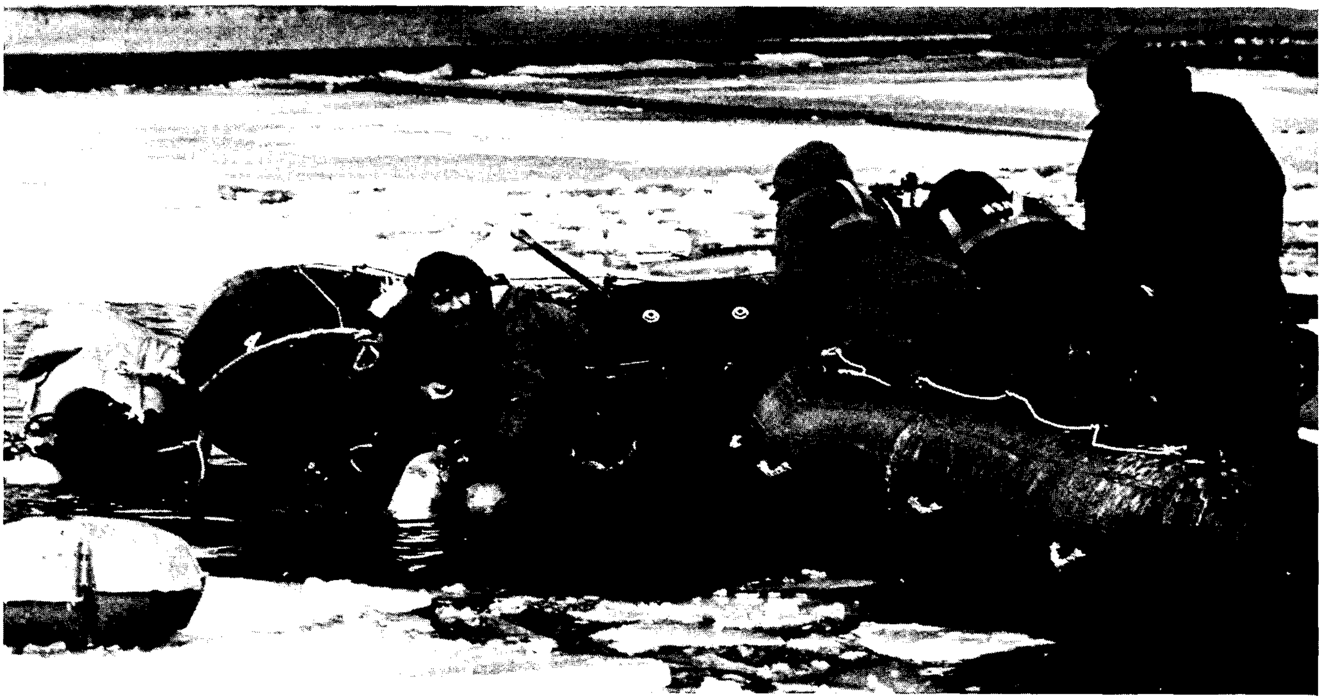
Units Mobilize

As the disaster unfolded, LCDR Delaplane put a diving crew on standby and began preparations to deploy a support team, should his unit be tasked.

At 0230, January 14, the call for assistance came.

Meanwhile, members of the Naval School, Explosive Ordnance Disposal (EOD), Indian Head, Maryland, were also being mobilized.

By the afternoon of the day following the crash, LCDR Delaplane had been designated On-Scene Commander of the recovery and salvage operation which would involve divers from his unit, the EOD School, the Coast Guard Atlantic Strike Team from Elizabeth City, North Carolina, and Army divers from the 86th and 511th Engineering Detachments, Fort Belvoir, Virginia.



Boat crews assisting divers during search for wreckage and victims of Air Florida Flight 90 near the northbound span of the 14th Street Bridge.

To support effectively the Washington, D.C., Police Department, which had overall responsibility for the recovery operation, and the investigation team from the Department of Transportation Air Safety Board, LCDR Delaplane and a joint military staff went to work.

"Within 60 hours of the accident, we had three diving platforms in operation," he said. "That kind of effort was to become indicative of the cooperation and support that was given by all participants. Everybody knew the job we faced; it was obviously a big objective to achieve.

"At first it was difficult to handle the logistical support available. We once asked for six cubic yards of gravel to put a better footing on the river bank, and before we knew it, we had six truck loads coming."

The aircraft was thought to be confined to a relatively small area, roughly 700 feet long, 250 feet wide and 30 feet deep. The only visible portion of the aircraft was the tail. Locating and recovering the victims and the wreckage in the ice-covered water was a monumental task.

Divers vs. the Cold

In a variety of cold weather suits, the divers literally had to feel their way around in the dark, murky waters. "Visibility down there was anywhere from six inches to the length of my arm," said RMC Ron Campbell, an EOD School instructor. "You can't tell where you are, so you rely on the line handlers and the phones in order to stay on track.

"Once, my line snagged on a big rock, and I couldn't tell if I was getting line-pull signals from the surface or what. Come to find out, I was just talking to the rock."

It was much the same for HM2 Bob Walker, who let most of the air out of his dry suit so he could crawl around on the eight-inch mud bottom. During his 87-minute dive, his only discomfort was cold feet.

Chief Campbell explained that, contrary to what most people believe, a diver is comfortable in such conditions. "I'd rather be down there in the water than up here manning the station where you're contending with the cold."

"About 90 percent of the diving work is done on the surface," HTCS(MDV) David Lejeune said. "Without the support and communications, productivity would be nil after five minutes in the water. Safety and the welfare of the divers is our first concern. Then we concentrate on accomplishing the mission."

This was especially evident on the first Sunday after the accident. That morning, the temperature dropped to five degrees below zero, with winds blowing across the river surface at 30 mph. Two of the diving operations had to be canceled for the day.

"The EOD boat was the only platform with inside spaces where the divers could stay warm," Master Diver Lejeune said. "You can't put divers out in those elements for 45 minutes while they get ready for a dive. By the time they're ready to go into the water, they're pretty well shot. We don't have any reason to take those kind of risks."

But even the remaining operation had to consider the cold. The first diver's exhaust valve froze, and his suit inflated, forcing him to the surface. As he was being helped aboard the boat, his gloves froze to the ladder. "He was instant icicles," HM2 Walker said.

The divers spent the rest of the morning changing to hot-water suits and a different breathing rig. Hair dryers were employed to melt the ice from the equipment.

As the week went on, the divers surveyed the river bottom in braille fashion, pinpointing the wreckage of Flight 90. With the aid of the Army Topography and Survey Unit and a Coast Guard crew, a precise picture was created of the impact site. This proved invaluable in locating the victims and aiding with the salvage operation and accident investigation.

Besides the cold, the ice, freezing rain, and snow, the divers had to deal with another factor. "Working in a tragic situation like this causes a lot of stress," LCDR Delaplane said. "It's been a drain emotionally, physically, and mentally.

"We are all recognized as professionals, but underneath those wetsuits are hearts that feel great emotion. When we're dealing with a tragedy of this nature, it's essential that we work together and, above all, be each other's shipmate. It's a tough time; there's no doubt about it.

Emotional Release

"On the way up here," LCDR Delaplane continued, "I was thinking of the possibility of recovering all of the victims. The odds were so astronomically against us that I knew it would take a tremendous stroke of luck to recover them all. But we never once ruled it out."

A week after the accident, all but one victim had been recovered: an infant, whose mother was one of Flight 90's five survivors. Since the mother had also lost her husband in the accident, the divers were determined to recover the baby.

"It wasn't something we talked about, but around the troops I could feel that we were going to find the baby. Nobody seemed to lose that feeling," LCDR Delaplane said.

"There was no doubt we would find him, it was just something that everybody knew and felt," said GMCS Charlie Richardson. "We would have spent another six days looking if that's what it would take. Communication over the phones is never very clear, but there was no mistaking it when a diver said he had found him. A lot of eyes went wet."

LCDR Delaplane added, "When I heard it, I looked outside. On each of the barges, there were people with arms around each other. It was some emotional release."

Later, LCDR Delaplane said the diver told him, "Hey, Captain, it was an easy dive. I had 60 guys diving with me this time."

"There's no kind of feeling comparable to that kind of human commitment. It's humbling," LCDR Delaplane said.

Despite extreme weather and brutal diving conditions, members of the joint military operation succeeded in recovering all of the crash victims as well as wreckage essential to the investigation of the accident.

City's Appreciation

The Commander of the Special Operations Division, Washington, D.C., Police Department, Deputy Chief John C. Connor, said that the military performed magnificently, working 10- to 12-hour days in the most brutal of conditions. "I don't think the operation could have been as successful and completed as quickly without the professional expertise brought to the site by the Navy.

"There was tremendous cooperation for such a joint operation. Credit has to be given to all the services for the 100 percent recovery of the victims under such extreme conditions of ice, snow, visibility, temperatures and the havoc of the wreck itself," Connor said. "It was an amazingly successful recovery – one which would have been remarkable even under ideal conditions."

Reflecting on the week, CDR R.W. Schroeder, the Diving Medical Officer for MOBDIVSALU TWO, remarked, "It's like an old saying I remember hearing back around World War II. Sometimes it takes the worst to bring out the best in people. That was sure evident here."

RESEARCH DIVING – A SCIENTIFIC PERSPECTIVE

Navy divers provide the Naval Research Laboratory with specialized support to measure subsurface fluid motions in experiments off Bermuda, Puerto Rico and Key West.

Diver dispenses dye next to a drogue during experiment to measure turbulence and shear motion in the upper ocean.

James R. McGrath, PhD
Naval Research Laboratory
Washington, D.C.
PHCS(DV) David J. Graver, USN
NAB Little Creek Detachment
Norfolk, Virginia

Scientists have long known that fluid motions near the ocean's surface have pronounced effects on temperature distributions, both at the surface and in the water column. Specifically, near the ocean's surface, turbulent and shear motions appear to dominate heat and mass transfer rates between the atmosphere and water. Turbulence and shear motions in the upper ocean are not, however, completely understood. A more complete knowledge of these processes would aid in estimating the drift of oil spills, dispersal of pollutants, movement of biological materials and variation of mixed-layer depths.

Experimental Dives

To improve our understanding of these processes, scientists of the Physical Oceanography Branch of the Naval Research Laboratory planned a subsurface flow visualization project depending heavily on underwater photography of dye motions. In 1979, the Naval Research Laboratory (NRL) requested several divers from Underwater Demolition Team 21 and from the Fleet Audio-Visual Command, Little Creek Detachment, to support such an oceanographic experiment.

To date, five experimental diving periods have been completed, each requiring 10 to 14 days. Operations were carried out near

Bermuda; near Vieques, Puerto Rico; and off the coast of Key West. These locations afforded excellent diving and photography conditions. Scuba-diving operations generally took place at depths between 30 and 60 FSW. Initial efforts were devoted to equipment development and procedural training for both diving and scientific personnel, while subsequent work addressed the measurement program.

Specialized Approaches

Both specialized methods and equipment were devised to carry out this experiment. Underwater motion pictures were taken in the conventional way. The underwater still photography, which was used for three-dimensional analysis, required special equipment, since the films were subsequently submitted to the Naval Intelligence Support Center for computerized photogrammetric processing. The still photography was accomplished using three Nikonos cameras with 90° lenses mounted on a bar. The end cameras were about one meter from the center and were canted inward 20°. The chainsprocket mechanism was fitted to this camera-bar arrangement, permitting all three cameras to advance the film and to cock and to release the shutters simultaneously. The results yielded time series of three photographs, each from a different perspective of the subject, suitable for three-dimensional photogrammetric processing.

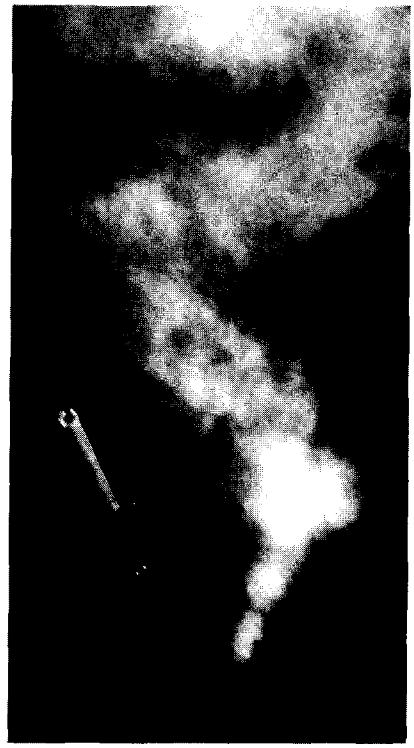
Other specialized equipment was developed to provide observations and measurements of vertical and horizontal dye patterns in the water column, in addition to the camera bar. One is a dye-dispensing "T"-bar. It consists of a 10-foot long, ½-inch diameter copper tube with holes drilled every 2 inches along its length. The "T"-bar is connected by hoses to a dye pump located on a boat. To avoid temperature-induced buoyancy effects, water from the dispensing depth was pumped to the surface, where it was mixed with dye and returned to the dispensing depth at the same temperature as the surrounding seawater. Although directly coupled to the surface craft by hoses, this neutrally buoyant suspension system successfully eliminated surface-induced motions at the dispenser.

Another experimental tool developed was a dye bomb. This was a T-11 XBT body filled with several dye tablets. These dissolve and leave a dye trail as the dye bomb free-falls through the water. Combined with a vertical underwater scale (also NRL developed) this approach provides a means of identifying shear-layer depths and of measuring shear magnitudes.

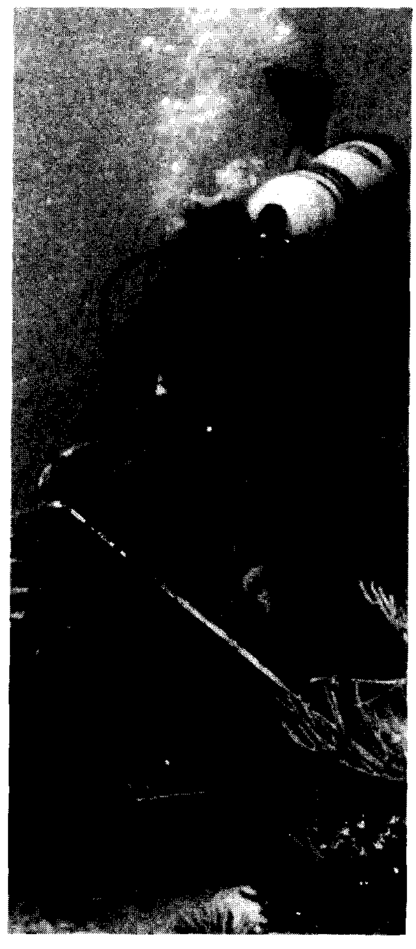
Navy Diving Support

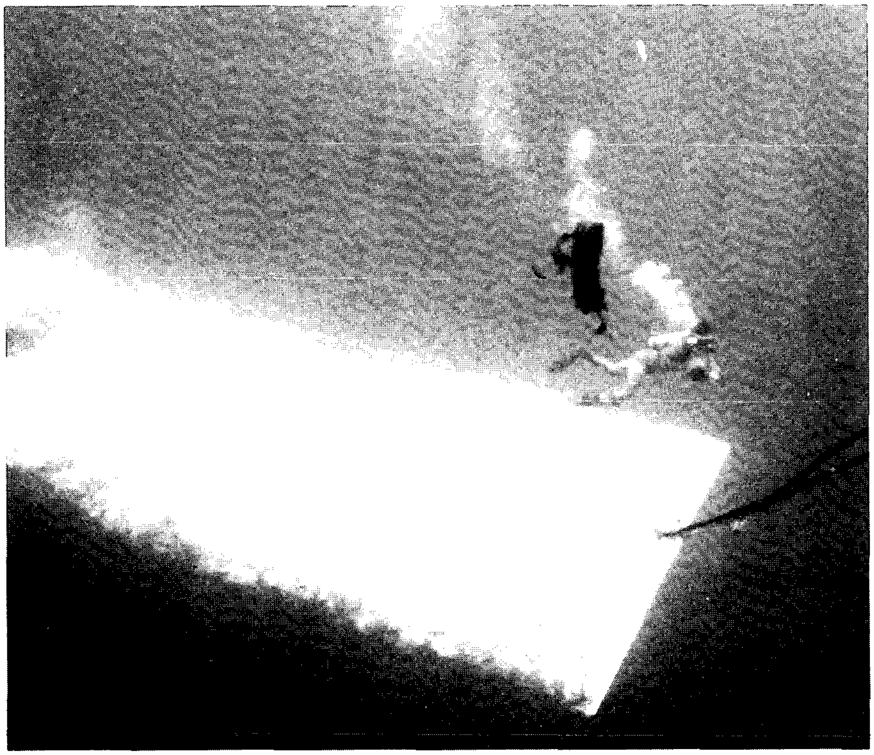
Navy diver participation in the experiment was a resounding success. They not only produced the photographic results sought, but also contributed to the final design of some underwater equipment. For example, divers designed a system for the attachment of one or more flotation bags (BUWEPS, MK 138 Mod 1) to the hoses supplying the dye dispenser, completely eliminating surface-wave induced motions at the dispenser depth. Another example was the divers' ability to operate small craft and to do interim engine repairs, contributing greatly to uninterrupted scientific operations. They also assisted in practical efforts to make the camera bar neutrally buoyant and more manageable under water.

Experience in this work shows that divers are an invaluable asset in carrying out oceanographic experiments. Perhaps the most obvious advantage is the ability to manipulate or adjust equipment *in situ*. Another advantage in having underwater motion picture coverage is a visual record of the



Above: A dye-dispensing bomb. Below: Diver adjusts very-high-frequency sonar for measuring water velocity.





Above: A horizontal dye sheet is dispensed from a T-bar at the mixed-layer depth during a flow visualization experiment. Below: A research diver in his working environment.

undersea environmental conditions at the time of the measurements. Such a record is an invaluable analysis tool for oceanographers, who ordinarily must deal with data from untended, remote instrumentation. Finally, having a Navy-trained diver/scientist as project leader and underwater supervisor not only helps the other divers focus on the scientifically interesting aspects of the dye pattern, but also provides the option of redirecting efforts during the dive. Redirection during scientific diving operations is an economy and advantage not usually available.

Results

The results of this oceanographic research program are more fully discussed in NRL Memorandum Report #4509, 22 May 1981. The report includes details of the use of synchronized stereophotographic records to obtain fluid-motion measurements—a primary experimental objective. Other experimental objectives have also been met. First, dye sheets have been dispensed above the mixed layer, at the mixed layer, and below the diurnal mixed layer depth. Second, equipment tests have been successfully conducted under operational conditions. Finally, the ocean's upper hydrographic structure has been characterized in support of the experiment's analytic needs.

The combination of underwater photography and scientific investigation has proven to be successful for conducting physical oceanographic research. The interaction between the diving and scientific communities has led to the development of effective underwater equipment and procedures. The combination of science and underwater photography provides an effective approach for flow visualization experiments in the water column from the surface to 60 FSW.

TYPHOON CLAIMS PHILIPPINE NAVY DESTROYER

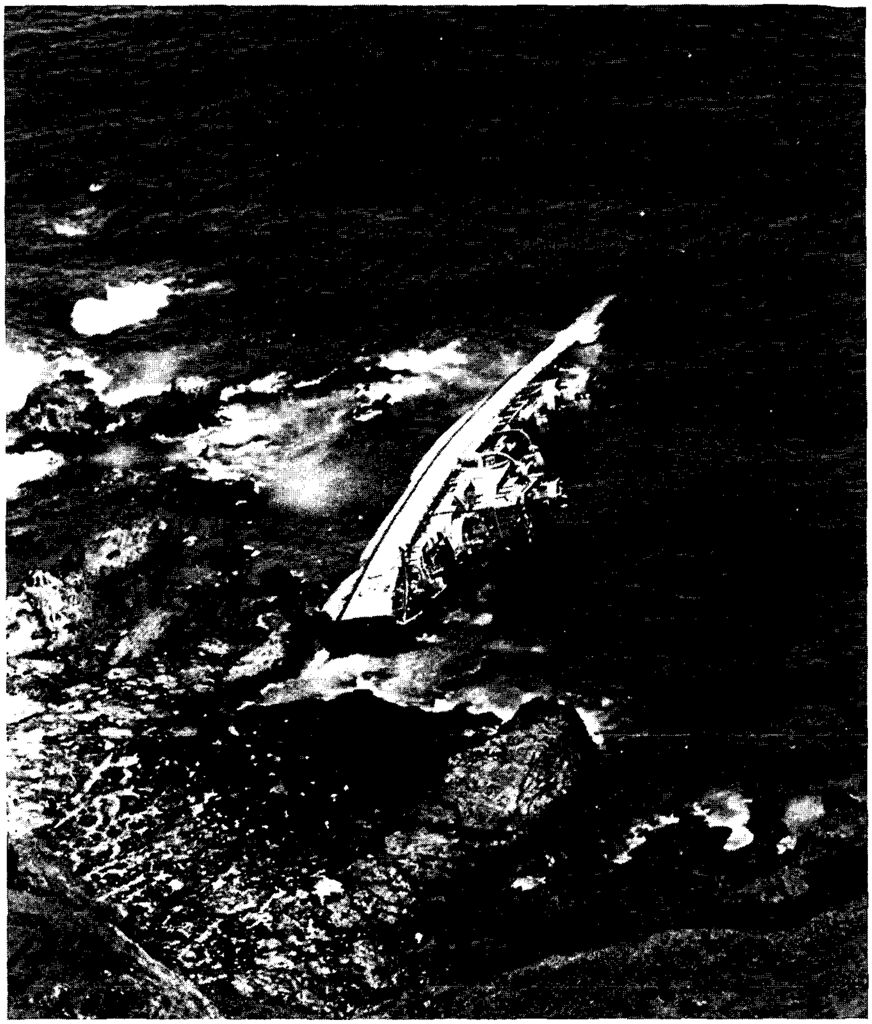
USS MOUNT HOOD and EOD Mobile Unit ONE, Detachment 21, conduct search and recovery operations in the aftermath of the tragic loss of the Philippine Navy destroyer DATU KALANTIAW, driven onto a coral reef off Calayan Island by Typhoon Clara.

Photos by PH1 Felimon Barbante, USN

Damaged bow of the beached and overturned DATU KALANTIAW as she lies on her port side with rescue ship USS MOUNT HOOD (AE 29) anchored nearby during search and rescue operations off Calayan Island, Republic of the Philippines.

LTJG J. V. DeSimone, USN
EOD Mobile Unit ONE,
Detachment 21
USS MOUNT HOOD (AE 29)

On September 20, 1981, Typhoon Clara swept through northern Luzon in the Philippine Islands. The Philippine Navy destroyer DATU KALANTIAW tried to ride out the storm at anchor off Calayan Island, 340 miles north of Subic Bay, but was overtaken by the high winds and heavy seas, and was driven ashore.



Although most of the destroyer's 97 crewmen perished when the ship was swept ashore, some were believed to be trapped inside.

Emergency Call

USS MOUNT HOOD (AE 29), en route to Ship Repair Facility, Subic Bay, for upkeep after 89 days on station in the Indian Ocean, received an emergency request to carry out a search and rescue mission for the destroyer and its crew. MOUNT HOOD was chosen for the operation for several reasons: its diving capabilities, explosives load-out, helicopter platform, and its attached unit, Explosive Ordnance Disposal Mobile Unit ONE, Detachment 21 (DET 21).

Upon docking at Subic Bay, the ship was met by Navy officials, who briefed MOUNT HOOD's captain, CDR M. E. Burke, on the details of the incident. Information from a P-3 aircraft overflight revealed that DATU KALANTIAW was hard aground on a coral reef off Calayan Island, and that the crew had suffered major casualties.

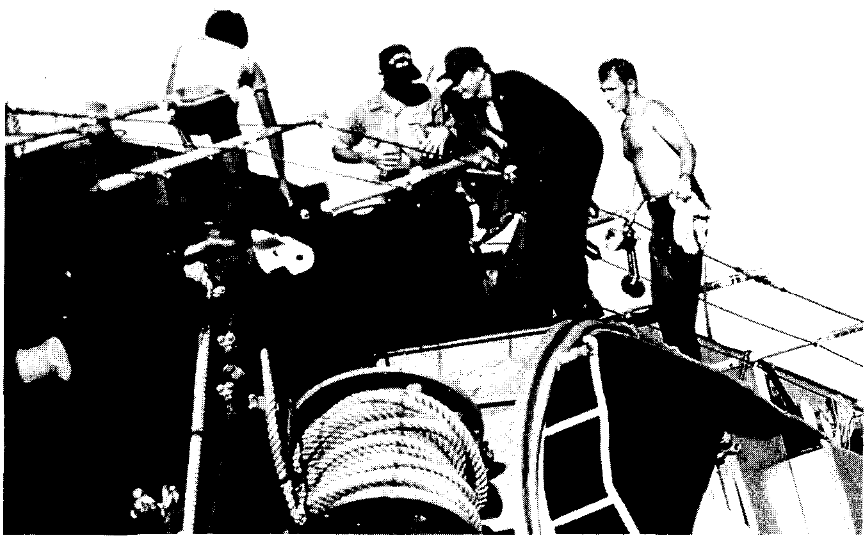
MOUNT HOOD's mission was to rescue any crewmen trapped inside the ship, and to recover victims from the water.

The DET 21 rescue team flew by helicopter from MOUNT HOOD to the accident site 60 miles away.

Rescue Team Arrives

MOUNT HOOD and DET 21 commenced load-out of equipment and proceeded to the site at best possible speed. At approximately 60 miles from the island, the DET 21 team flew from MOUNT HOOD by helicopter to the stranded vessel. The team found

SH-3A Sea King rescue helicopter hovers near the stricken ship.


MOUNT HOOD crewmen during inspection of DATU KALANTIAW's accessible spaces.


LCDR Richard Charuhas, Executive Officer of USS MOUNT HOOD, discusses rescue strategy with crew.

DATU KALANTIAW laying on her port side, two-thirds out of the water, with extensive damage to both the port and starboard sides.

Some survivors had already been dispatched to a nearby hospital. Many of the ship's 97 crewmen were, however, found washed ashore, victims of drowning. Four crewmen who remained at the site indicated that most of their shipmates were still trapped in the after crew's berthing area.

The DET 21 team, with the help of additional divers from Ship Repair Facility, Subic Bay, and Special Warfare Group ONE, began an immediate inspection of the vessel. It was determined by pounding on the hull with metal hammers that there was a possibility of a faint tapping from within, in the vicinity of the after engineering space.

Hazardous Access

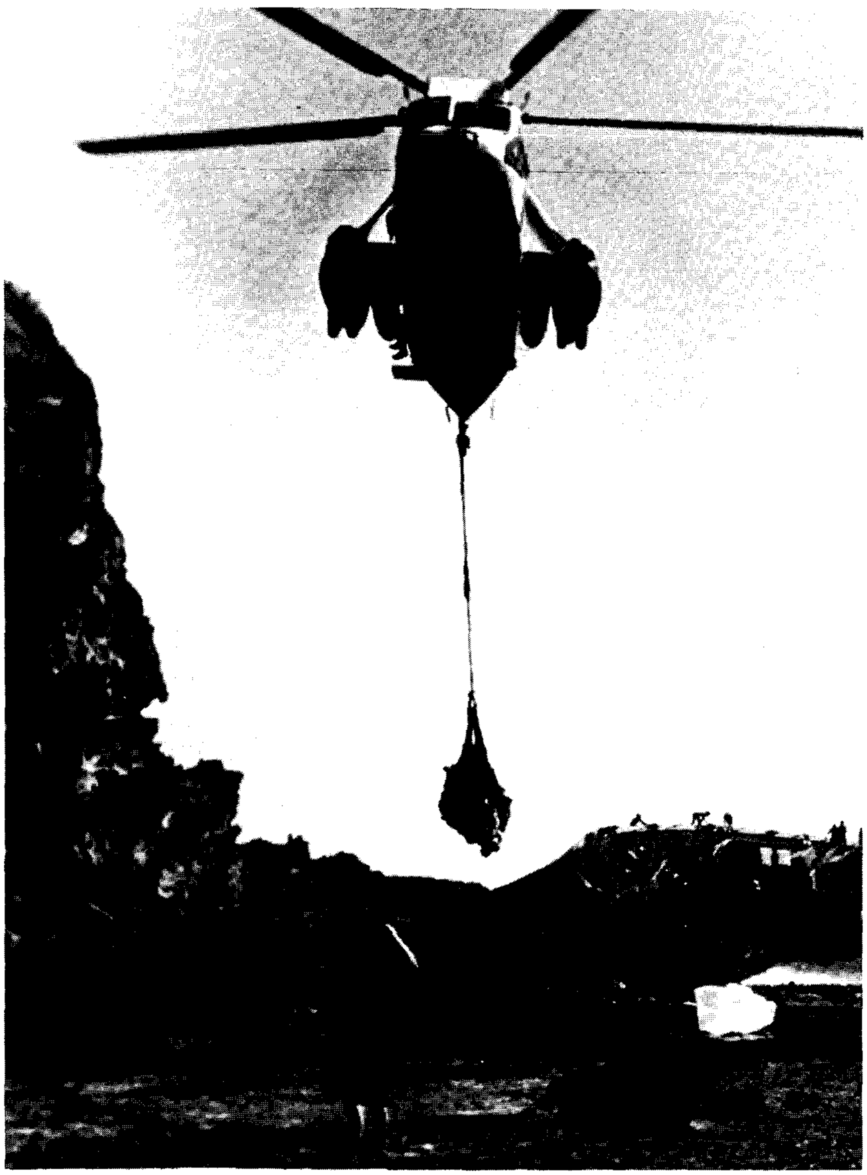
A difficult decision on how to gain access to the space now had to be faced. There were three options:

- ☐ Open a now-submerged hatch to the space. If this were done, water would flood the compartment and drown any crewmen who might still be alive.
- ☐ Cut a hole in the starboard side with an oxygen-acetylene cutting torch. This, without question, would ignite diesel fuel vapors emanating from the vessel's ruptured tanks and endanger the trapped men.
- ☐ Cut a hole through the starboard side by remote flex-linear shape charges. This would possibly ignite the diesel fumes.

It was determined that the best solution would be to use a flex-linear shape charge to partially cut a hole through the hull, then knock the hole the rest of the way through using a 20-pound sledge hammer.

The team set up the charge and

EOD DET 21 team prepares to explode a charge on the hull to gain access to the ship's interior where crewmen were believed to be trapped.



Rescue helicopter from Fleet Composite Squadron 5 (VC-5) during recovery operations.

initiated it electrically. This attempt failed due to an electrical short in the cable reel. The cable reel was repaired, but darkness prevented continuation of rescue efforts.

During the night, the rescue team assembled to review the situation and plan the next steps. Any attempt to put divers in the water was determined to be extremely dangerous due to rip tides, sheer coral, high waves, and the presence of numerous sharks. It was agreed to concentrate efforts on the above-waterline areas.

The Final Toll

At dawn, two holes were cut with flex-linear and MK 7 MOD 7 shape charges and the destroyer's interior spaces were inspected. Unfortunately, no survivors were located.

The final casualty toll stood at 49 crewmen dead and 30 missing. Only 18 crewmen had survived.

MOUNT HOOD was relieved in the late afternoon by the Philippine Navy destroyer BATANUAS (PS 74) and proceeded to Manila with the dead. In Manila, RADM Simeon Alejandro, Philippine Navy Flag-Officer-in-Charge, expressed his personal appreciation to Detachment 21 and the officers and crew of MOUNT HOOD for their arduous efforts to recover the casualties of DATU KALANTIAW.

Rescue Team Personnel

Detachment 21

LTJG DeSimone (Officer-in-Charge)
BM1 (DV) Murphy
GMG2 (DV) Lounsbury
BT2 (DV) Maves

Additional Divers

LCDR Boyd (CTF 73 Salvage Officer)
LCDR Steding (SRF Diving Officer)
HT1 (DV) Hettenhouser (SRF)
BM2 (DV) Brigham (SRF)
BM2 (DV) Smoot (SPECWARGRU ONE)
BM3 (DV) Troutman (SPECWARGRU ONE)
HM3 (DV) Hancock (SPECWARGRU ONE)

Philippine Navy Liaison

LTJG Austria, RPN

Teamwork was exemplary throughout the 12-day operation.

(Continued from page 19)

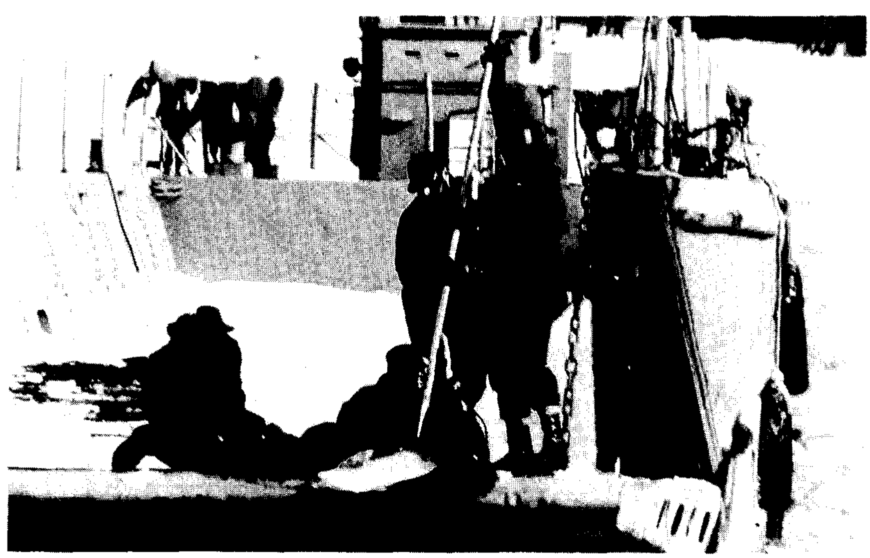
wreckage and planning the demobilization of an extensive, on-scene support "flotilla".

The operation was officially terminated at 1630, January 25, 1982. In the twelve-day operation, 95 percent of the aircraft, all critical wreckage, and 68 bodies had been recovered. Demobilization was progressing according to schedule, and by 1300, January 27, all that remained as a reminder of the disaster and the subsequent recovery operation were a few snow fences which had been erected as security barriers.

Under a Microscope

This operation was technically a routine aircraft recovery operation. The extremely cold weather conditions had caused some delays, but hot-water suits, MK 12 dry suits, and Unisuits provided more than adequate diver thermal protection for over 130 dives with up to three-hour bottom times. The fact that the impact area was relatively small, well-defined, and accessible to land cranes expedited the operation.

A unique aspect of this operation was its nationwide visibility. Every salvage operation has its own set of management requirements and in this operation the visibility demanded the quintessence of professionalism, propriety, and sensitivity from every participant. ADM H.D. Traine II, Commander-in-Chief, U.S. Atlantic Fleet, best summarized this aspect of the operation in his comments: "The performance you demonstrated in Washington is a classic example of what we mean by professionalism. Because of the high interest, you all were virtually operating under a microscope . . . and yet you came through with flying colors and you made the entire Navy and the nation proud of you."



Probing for wreckage in the frozen Potomac River.

The Old Master

How to Spot a Landlubber

This issue's Old Master column is adapted from a letter to FACEPLATE from retired Navy Captain W.F. Searle, Jr., who has gone to war against all of us who may occasionally lapse into the "landlubberly" misuse of good nautical terms.

"Beach gear," as most readers of FACEPLATE well know, is the rigging used by salvors to extract a stranded ship from her predicament. It is heavy hauling rigging intended to float a ship by getting her *off* the beach. But how often do you hear some would-be knowledgeable "salvor" use the term "beaching gear"? When this term is used by someone who actually intends to imply the rigging necessary to extract a ship from the strand, you can rest assured that the person is unknowledgeable in the business.

But what is "beaching gear"? This adverb comes from the verb "to beach"—namely, to run or haul a ship or boat upon a beach, for the purpose of cleaning or repairing its bottom, or to prevent its sinking in deeper water. Also, in the days of sailing ships and particularly in ports at which the wharfage was not developed, the ship, at the finish of a voyage, deliberately was grounded on a designated (and often prepared) muddy, sloping bottom. Beaching gear was then set out, attached to dead men ashore. As the sailing ship's cargo was unloaded the gear was employed to snub her further into shore. Beaching the ship was also undertaken in days before graving docks were available, and when a ship came onto the careening ground for hull cleaning. In more modern history, beaching gear was used to haul float planes and seaplanes (such as the famous PBY's) up seaplane ramps.

The term "beaching gear" is also used in amphibious operations when anchors are set out ahead of a landing craft and onto the beach in order to snub the amphibian's ramp end onto the beach.

Thus it will be seen that "beach gear" equates to getting something *off* the beach; "beaching gear" to getting something *onto* the beach or holding it on the beach.

The word "pennant" comes from the Latin *pennon*, a long, narrow, flag or streamer; for example, one streaming from a lance. The root Latin word is *penna*, meaning feather.

On the other hand, "pendant" derives from the Latin *pendere* meaning "to hang." This latter quite adequately describes the "short rope hanging from the head of a mast," the towing fitting, or other rigging point. Thus, a pendant has come to mean a short length of wire or fiber rope.

Thus, you see, pennants are flags; pendants are ropes. If you follow the seaman's trade and are in the salvage or towing business, use the terms properly and don't chance having people believe that you are a signalman.

Another pair of words sometimes carelessly used are "founder" and "flounder." The salvor should know what is meant by the verb "to founder"—to fill and sink at sea; to be overwhelmed by the sea in deep water.

On the other hand, "to flounder" is to flap around and stir up a lot of silt, like the fish of that name does when disturbed on the bottom. I suppose that if one flounders about long enough he will be in danger of foundering.

W.F. Searle, Jr.
Alexandria, Virginia

To this, we'll add one more. When used in the past tense, the term "pay out" (as, to run out, or slacken, a line) should be written "payed", not "paid," unless you want people to think you're a disbursing clerk.

Ed.

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