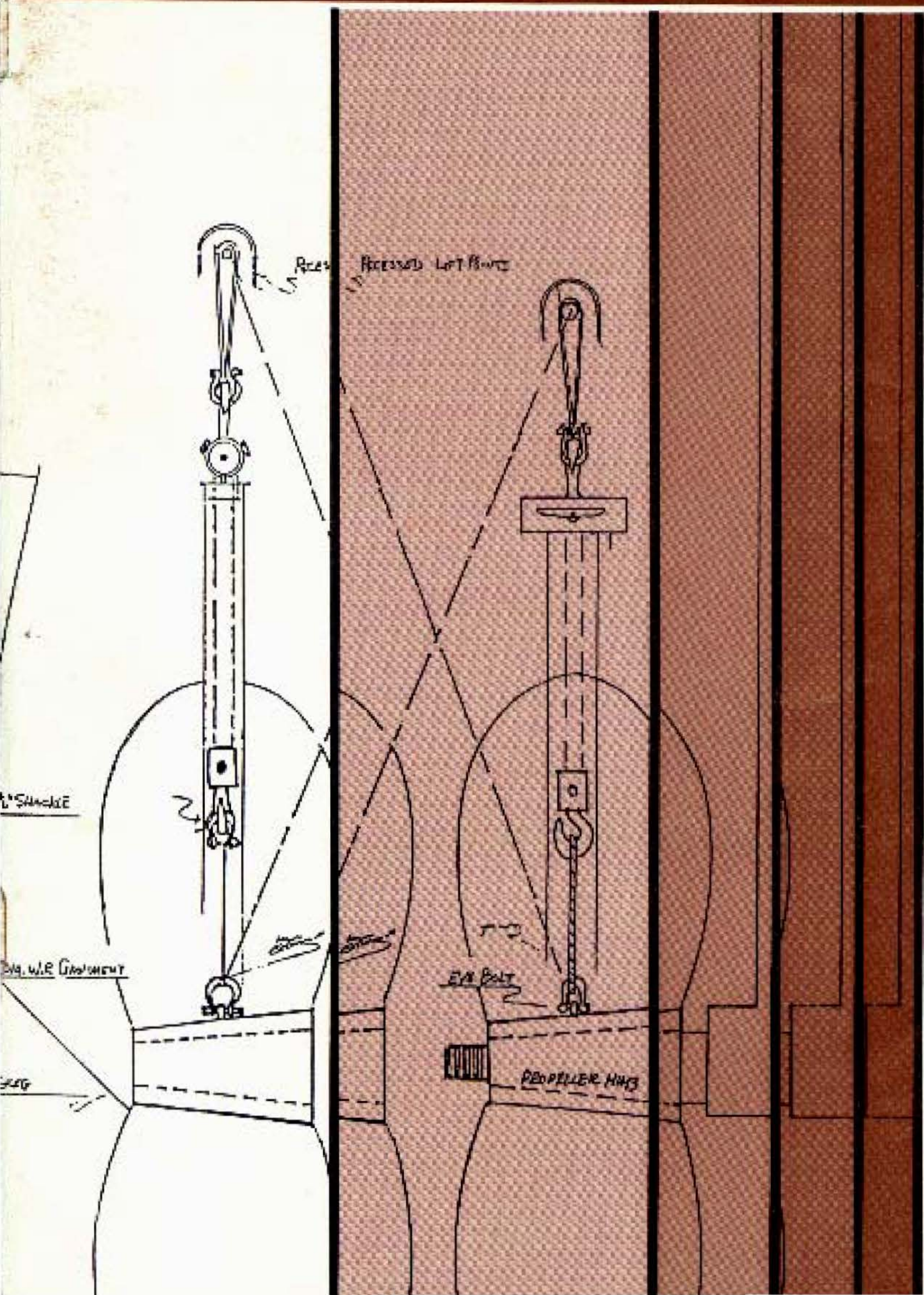
FACEPLATE

The Official Magazine for the Divers and Salvors of the United States Navy



34-Ton Propeller Changed

Fall 1983
Volume 14, No. 3

FACEPLATE

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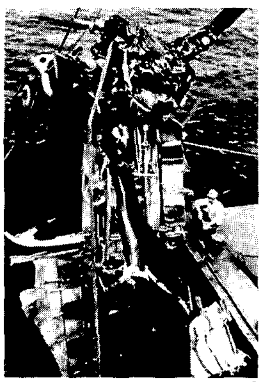
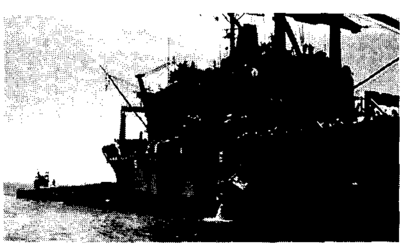
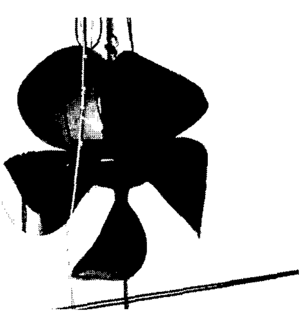


page 6



page 26



page 22

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SOUNDINGS

Change of Command MDSU TWO, Det. 813 Reserve Divers

LCDR Robb Patterson recently relieved LCDR Craig LaPort as Commanding Officer of Reserve Mobile Diving and Salvage Unit (MDSU) TWO, Detachment 813 Great Lakes. LCDR Patterson was formerly Executive Officer of the unit. He graduated from the University of North Carolina at Chapel Hill in 1973 and after graduation served on active duty aboard the USS RECOVERY. On inactive duty, he has served on MDSU's in Jacksonville, Florida; Fall River, Massachusetts; Little Creek, Virginia; and Chicago, Illinois.

LCDR LaPort joined the Navy Reserve in 1979 as Training Officer for MDSU TWO, Det. 813. He held that post for two years, and was Commanding Officer for two years. During that time, he participated in the salvage of the USS INDIANA for the Smithsonian Institution (See FACEPLATE, Spring 1980).

LCDR LaPort graduated from diving school in September 1974 and was stationed on the USS TRINGA (ASR-16) as Diving and Supply Officer, and then on the USS HOLLAND (AS-32) as Diving Officer and Assistant Hull Repair Officer.

He is returning to active duty in the Navy as Commanding Officer of the Wiliamsport, Pennsylvania Reserve Center.

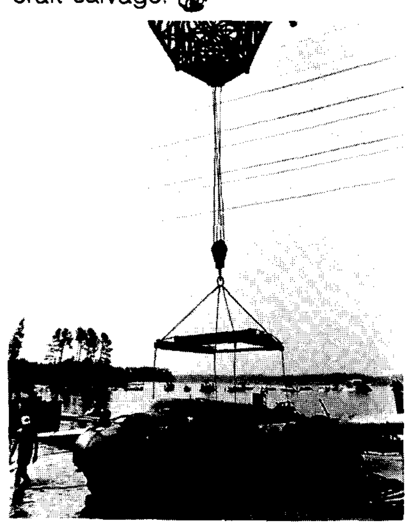
Reservists Salvage WWII Bomber

A B-25 Mitchell bomber that had sunk in Lake Greenwood in South Carolina 39 years ago was salvaged in August by divers from Naval Reserve Mobile Diving and Salvage Unit (MDSU) TWO, Det. 506.

To prepare for lifting the 21,000 pound, 52-foot long plane, the reservists built a hoist with a cradle that would protect the fuselage from breaking. They also constructed steel supports for the wings. Mud and silt were removed from the plane's interior and inner tubes were inserted and filled with air to make the aircraft more buoyant.

Divers used MK 1 masks with surface-supplied air. They raised the WWII plane to within five feet of the surface and then towed it four miles to the beach. Flotation devices made of 55-gallon drums were then used to help bring the plane slowly to the surface.

The salvage job took only two weeks and gave the reserve divers a rare opportunity to work on an aircraft salvage.



The B-25 is pushed and jockeyed into positon under the crane.

Diver Tool Noise Exposure Times

In an effort to increase diver safety and productivity, the diver must be protected from the sound pressure level of extremely loud diver tools. The maximum cumulative permissible time for exposure to tools per diver per 24 hour period and overall noise exposure level of tools is as follows:

Partek Waterjet Tool	**86.4 db**	**5 hr. 15 min.**
Daedalean Coneaver Waterjet Tool	**92.5 db**	**1 hr. 50 min.**
Cavijet Waterjet Tool, 1-B	**92.9 db**	**1 hr. 40 min.**
Stanley Hydraulic Chipper	**88.5 db**	**3 hr. 40 min.**
Stanley Impact Wrench, IW-20	**80.4 db**	**15 hr. 0 min.**

Atlantic Fleet Diving and Salvage Vessels

Changes of Command

Several changes of command have taken place recently on Atlantic Fleet diving and salvage vessels.

LCDR David K. Wallace relieved LCDR Gideon W. Almy III as commanding officer of the USS HOIST (ARS-40) on 25 July 1983. LCDR Wallace came to the HOIST from assignment at NAVSEA in Washington, D.C. He recently completed diver training at the Navy Diving and Salvage Training Center in Panama City, Florida. LCDR Almy was a member of the Atlantic Fleet Propulsion Examining Board before assuming command of the HOIST and is now Chief Staff Officer at Service Squadron (SERVRON) EIGHT.

On board the USS PAIUTE (ATF-159), LCDR James Gibson assumed command on 27 July 1983, relieving LCDR Tim Stark. LCDR Gibson was the Executive Officer of the USS RECOVERY (ARS-43).

LCDR Stark is moving to assignment as Operations Officer on the staff of Commander, SERVRON EIGHT.

LCDR William McAffee, former Executive Officer of the HOIST, relieved LCDR Robert Gray as Commanding Officer of the USS OPPORTUNE (ARS-41) last spring. LCDR Gray is now assigned to OPNAV in Washington, D.C.

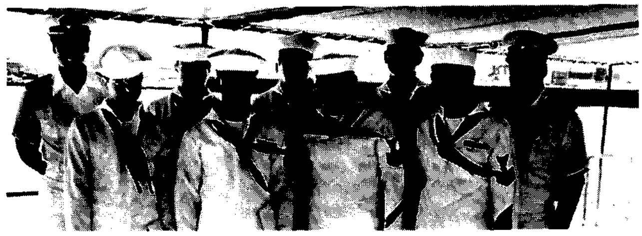
Vortex Foil May Eliminate Need for Harbor Dredging

A device that may ultimately eliminate the need for dredging harbors is currently being developed at the Mare Island Naval Shipyard, in cooperation with the Scripps Institution of Oceanography in La Jolla, California. The device—called the vortex foil—resembles an airplane wing and works by maintaining a current that washes away sediments before they can silt in the harbor bottom.

The idea for the vortex foil came from divers who noticed that water flowing around pilings eventually undercut the piling and washed it away. Because the vortex foils are shaped like inverted airplane wings, they deflect the current upward when positioned on the ocean floor. In so doing, they keep sediment from building up and eliminate the need for repeated dredging.

Three vortex foils were installed on dry-dock caissons at Mare Island from November to May. Reportedly, they worked well at keeping the area clear. Plans are now underway to build 15 vortex foils and install them, in arrays of three, under an ocean-going vessel. This will test how effectively the device eliminates sedimentation beneath ships.

This type of application will ultimately reduce the workload of divers in operations requiring work on the bottoms of ships. Used on a broader scale, the vortex foil offers the potential for keeping nagivational channels open without costly dredging cycles.



RECLAIMER graduates (back row, l to r) LTJG Black, HTFN McCormick, SN Lockwood, OS2 Johnson; (front row, l to r) SN Self, QMSN Carlin, EN1 Koberstein, HT1 Miller, LCDR Evans

RECLAIMER Crew Members Receive Diplomas

Nine crewmembers of the USS RECLAIMER (ARS-42) received their high school diplomas in graduation ceremonies held on board ship 30 June 1983. The diplomas were awarded through the High School Completion Program sponsored by St. Louis High School. The graduates were presented their diplomas by LCDR James M. Evans, Commanding Office of the RECLAIMER.

Of the nine men who successfuly completed the class, two were in their forties; graduate HT1 Herman J. Miller was 46 and MS1 Quai was 42. Other graduates were EN1 Charles D. Koberstein, SH2 Resty Garcia, OS2 Richard A. Johnson, QMSN Michael J. Carlin, HTFN William F. McCormick, SN David A. Lockwood and SN Steven Self.

The men completed the course with the assistance of the RECLAIMER's Education Services Officer LTJG Black, as well as Dr. McKeever and Jeff Hewitt from St. Louis High School. The requirements were met while the men performed their duties board the RECLAIMER and while conducting fleet operations, including preparation for regular overhaul

COMSERVRON EIGHT Introduces Screening Courses for Norfolk Master Diver Candidates

A new diver training program is being developed in Norfolk to prepare master diver candidates for master diver evaluations conducted in Panama City, Florida. The program is designed to reduce the attrition rate presently experienced by master diver candidates. (A similar program has been established at the Naval Amphibious School in Colorado. See the Spring 1983 issue of FACEPLATE.)

There is considerable pressure on master diver candidates during their tests in Panama City. Many do not pass on their first try. The week-long pre-master diver screening course in Norfolk helps divers prepare for that pressure. During that week, they are drilled extensively as they supervise dives. As in Panama City, a board of Navy diving officers and master divers observes the candidates and comments on their knowledge and capabilities. The screening board makes a recommendation to the Commanding Officer who makes the final decision whether to send the candidate to Panama City.

According to SERVRON EIGHT'S master diver, Senior Chief John Cook, it is difficult to comment on the success of the program because it is so new, but the additional training is expected to help the candidate. The first pre-master diver course was conducted in July. Four candidates underwent the initial screening, two were sent to Panama City for the final test, and one passed. Four more candidates will participate in the second pre-master diver screening course, which will be conducted in October 1983.

View from the SUPERVISOR OF DIVING

by LCDR Ray Swanson

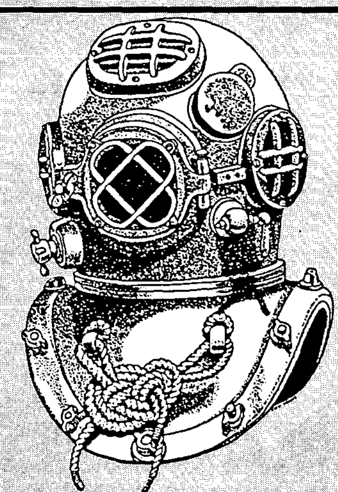
Underwater ship's husbandry is one of the more important functions of the Navy diver today. Through this function, divers help reduce the cost of repairs to waterborne vessels and also assist in getting the ship back on line faster than would normally be possible by carrying out drydock repairs. The recent propeller change on the USS ENTERPRISE (CVN-65) is a prime example of the benefits derived from using the Navy diver in this role.

The successful removal of the ENTERPRISE's 34-ton propeller—the largest waterborne propeller removal ever attempted—was made possible through the combined efforts of several commands using new techniques and tools along with proven diving equipment. By opting to perform this job in the water rather than in a drydock, the Navy saved approximately $2 million and proved that with proper preparation and planning, major tasks can be performed underwater.

Everyone concerned with the ENTERPRISE's propeller removal can justifiably feel proud of a job well done. We should recognize, however, that jobs of this magnitude are rare. The ENTERPRISE propeller change should not overshadow the extensive work being accomplished as a daily routine. The real jobs—the ones that we do day in and day out—are the jobs that really count and, in addition, are the jobs that routinely save the Navy substantial amounts of money.

Design Handbook and Reviews

Many of you have already heard that a new requirement exists for design reviews to be performed by Naval Sea Systems Command. These reviews are separate from certification. They are intended to complement certification and to assure that diving systems are properly designed. All diving systems now under construction must undergo a design review and all drawings must be approved by Naval Sea Systems Command or their authorized agent. Existing



systems will receive reviews in conjunction with certification surveys. Once the program is established, the reviews will be conducted independently. The design reviews will be comprehensive and assist in obtaining certification; but will not be part of the certification process.

To further the aim of the design reviews, we are attempting to provide a handbook or appendix to the Navy Diving Manual outlining the necessary steps along with the specifications and documentation required to achieve certification. You will ultimately be able to go to the handbook to find the applicable certification requirements for any diving system. If the system is installed according to the handbook, you will have no trouble meeting the requirements. It is anticipated that the handbook will alleviate much of the controversy over what can be put in various systems.

Certification is important, particularly to you—the user of diving equipment. It verifies that diving systems and equipment are built to accepted, proven standards. Certification must be comprehensive if it is to work. Although it is difficult for the operator to wade through numerous MIL-STDs and MIL-SPECs to assure that certification requirements have been met, we cannot afford to jeopardize divers' safety because we failed to do a thorough job.

The handbook and design reviews will help alleviate confusion and assure that all future systems will meet certification standards. As the design review program will cover 270 diving units, it will take several years to implement fully. By providing for standardization, the program will also streamline the supply system, reduce material lead time and lower costs. The program will also provide records through which we can begin to evaluate the quality of various diving systems and their components.

Four types of design reviews are being contemplated at this initial stage. Each review will depend on the complexity of the system, *i.e.*, saturation systems will receive the most detailed review followed by, in descending order, mixed gas systems, air systems and finally the smaller charging and diving boat systems. As with anything new, there will be growing pains involved in the process of implementing the new requirement, but I will do my utmost to make the process as painless as possible for all.

Equipment Development

Diving equipment programs are continuing to make progress. The **Standard Navy Diving Boat** has been held in a contractor's shipyard under litigation since January of this year, when the contractor filed bankruptcy. The boat was released last month and delivered to Naval Ocean Systems Center, San Diego. Cost and time estimates are being developed for completing the Diving Boat and Module and the ensuing technical and operational evaluations.

The **Through-Water Communications System (TWCS)** is designed for the SCUBA swimmer and permits conversation between divers or between divers and a submarine. The cost has escalated from less than $3,000 per unit to more than $20,000, which has caused the Navy to reexamine the requirment before TWCS undergoes operational evaluation.

The Navy Experimental Diving Unit is testing the **Morse MK 12/ MK 1 Communication Adapter.** The final report is due by the end of October, at which time a decision will be made regarding approval for use.

The ultra-thermic underwater cutting cable, **Kerie Cable,** is approved for use.

Revision to NAVSEAINST 9597.1

NAVSEAINST 9597.1, Diving Equipment Approved for Navy Use, is being revised. The latest revision should complete the review cycle and be available for distribution by the end of November. The new instruction is not as lengthy as the existing version—many items have been deleted to reduce the amount of equipment listed. For example, many MK 5 Deep Sea Diving (air) parts have been removed from the list as well as buoy markers and tools.

The instruction was originally intended to cover only life support equipment but expanded over the years to include almost all equipment used in the water. Because the removal of some items from NAVSEAINST 9597.1A may cause some problems, OOC will send an AIG 239 message addressing the action taken on the instruction. The revised instruction should give divers more flexibility to perform underwater tasks without any detriment to safety.

SUPDIVE Projects

The Office of the Supervisor of Diving manages more than 80 projects in various Naval and government activities and commercial companies. Given this heavy workload, the number of assigned personnel and today's financial climate, there is no room for wasted effort. Therefore, the number of projects handled by this office will be reduced to a more manageable number, including only those projects which will provide the maximum benefit to the majority of divers. By doing this OOC will be able to utilize available resources more efficiently, resulting in better service and more timely results for divers.

This does not mean that equipment needs unique to one commnity will be ignored; on the contrary, we will continue to meet these requirements. However, rather than devoting valuable time to projects that would merely be nice to have, we will concentrate on those that appreciably increase the effectiveness of the diving community.

As the official magazine for the U.S. Navy diving and salvage community, FACEPLATE publishes information concerning the latest equipment, techniques and procedures as well as other newsworthy events.

For this purpose to be best served — and for you to be best informed — it is imperative that the magazine receive articles from all Fleet and shore-based activities. Without such support, FACEPLATE cannot adequately fulfill its intended mission.

Some suggested areas of interest include salvage operations where divers employed special techniques or completed a particularly difficult job, research and development of diving equipment, training programs in diving and underwater ships husbandry. Articles submitted for publication must be unclassified.

The deadline for submitting manusrcipts for the winter issue is 16 December 1983. Although this office assumes the privilege of limited editorial license, significant changes to manuscript text will not be made without prior consent. Material considered unworthy for publication will be returned to the originator.

FACEPLATE's account of people, programs and operations become a part of the historical record of U.S. Navy diving and salvage. You can be part of it.

Point of contact at NAVSEA OOC is LCDR Thomas Service (SEA OOC-35) at Autovon 227-7606/7/8 or commercial (202) 697-7606/7/8.

LET'S HEAR FROM YOU!

DIVERS PLUNGE 259 FEET

to Recover Downed Helicopter

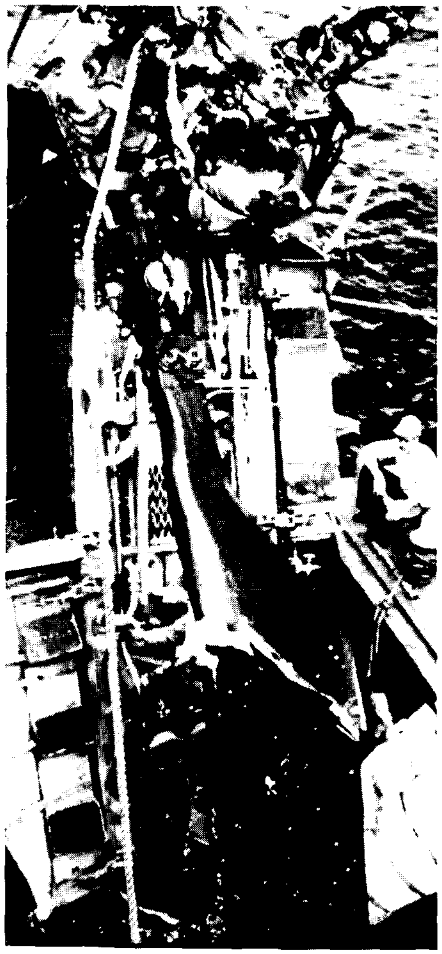
By LCDR James Evans
Commanding Officer
USS RECLAIMER (ARS-42)

Divers from Mobile Diving and Salvage Unit (MDSU) ONE and the USS RECLAIMER (ARS-42), conducting their deepest operational salvage dives in 10 years, recently recovered 99 percent of the wreckage of a Marine Corps CH-46E Sea Knight helicopter. Divers reached depths of 259 fsw (feet sea water) in their efforts to recover the downed aircraft, which had crashed into the sea near Lahaina, Maui on 17 November 1982. This operation was also distinguished by a zero incidence of decompression sickness.

The helicopter was reported to have crashed the month before in an area approximately four and one-half miles southwest of Lahaina, Maui. Airborne for only 15 minutes after a refueling stop in Maui the helicopter had apparently lost directional orientation before it crashed. Three crewmembers were on board, but only the crew chief was thrown clear and recovered by local fishermen shortly after the crash. The other two crewmen were believed to have gone down with the aircraft. A limited amount of immediate rescue efforts resulted in the recovery of helmets, floor boards and other small pieces of the wreckage.

Search for the Wreckage

Search for the wreckage began 31 December 1982, from Marine Corps Air Station Kaneohe Bay, Hawaii. EOD Group ONE, Barber's Point, Hawaii, searched a 13-square mile high probability area, based on the last known direction and location of the helicopter, utilizing a torpedo retriever as the search platform for the Area Point Search System (APSS), which consists of a Sidescan Sonar integrated with a Cubic Precision Navigation System. Included with the APSS were two land based Cubic Navigation Responder sites.



The aft rotor, transmission, engines and aft fuselage of the downed CH-46E helicopter.

photos by LCDR James Evans

The search team was successful in locating a number of sonar contacts within the search area and in mid-January personnel from EOD-Group ONE conducted verification dives on high probability contacts using SCUBA to 130 fsw. Visual verification revealed three or four pieces of wreckage in 260 fsw, scattered over a 50-yard diameter area, and the location of the CH-46E Sea Knight was identified.

Salvage Plan Developed

An initial salvage plan was then developed to utilize the RECLAIMER as the recovery platform, a YC barge from Pearl Harbor Naval Base to load the backup recompression chamber as well as associated compressors and volume tanks to support the MDSU ONE Fly-Away Mixed Gas System (FMGS) Team.

The plan called for a four-point moor to be laid over the center of the identified wreckage area using a 500-yard radius. Each leg of the moor would consist of one shot of two and one-half inch chain attached to an 8,000 pound Eells anchor. Attached to the chain would be 1,200 feet of 1-5/8-inch wire rope connected to a spud buoy followed by 600 feet of seven inch Sampson double-braided nylon. The final 600 feet of wire was rigged so that the spud was free to slide along the wire and thereby increase the search area within the moor.

The YC barge would be moored alongside the RECLAIMER, its stern toward the RECLAIMER's bow with the recompression chamber adjacent to the ship's stern and to the diving station in order to provide diving support. The RECLAIMER's aft boom and capstan would be used with the diving bell, and the forward boom would be used to recover wreckage and place it on the YC.

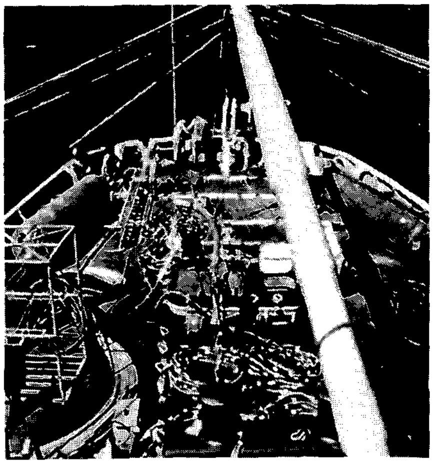
Rigging for the Four-Point Moor

The RECLAIMER began rigging preparations to lay the four-point moor on 3 February. The four shots of chain and two of the 1,200 foot lengths of wire were rigged on the forward deck that afternoon. Yellow gear was off-loaded from the aft salvage hold to make room for additional mixed gas quads.

The following day, rigging for the four-point moor continued as the two remaining 1,200-foot wire ropes were placed on deck. Each bow leg was rigged with two crown buoys, secured to the Eells anchor with 300 feet of one and one-half inch retrieving wire. All bites of chain and wire were stopped off with one strand of five-inch manila line and were placed on deck for transit. The mooring wire was rigged in figure eights on the port side and half-figure eights on the starboard. (Experience later showed that the half-figure eights worked much better because the extreme depth of the water caused the wire to run fast. Some figure eight loops payed out too rapidly when the ship tripped out at moor. This did not occur when half-figure eights were used.)

The forward spuds were rigged on deck below the boat davits so that they could later be rigged over the side, using the davits and chain falls, after lowering the boats at the wreckage site.

The after legs of beach gear were rigged by stopping off the chain and then draping it inboard of the bulwark and on deck for transit. The crown buoys and retrieving wire were rigged over the side forward of the Eells anchor and the 1,200-foot legs of 1-5/8-inch wire were figure eighted on the fantail and stopped off. The aft spud buoys were placed on deck; once at the salvage site, the buoys would be lifted over the side using the after boom and would be stopped off to cleats with several turns of three-inch manila line.



RECLAIMER rigging the four-point moor.

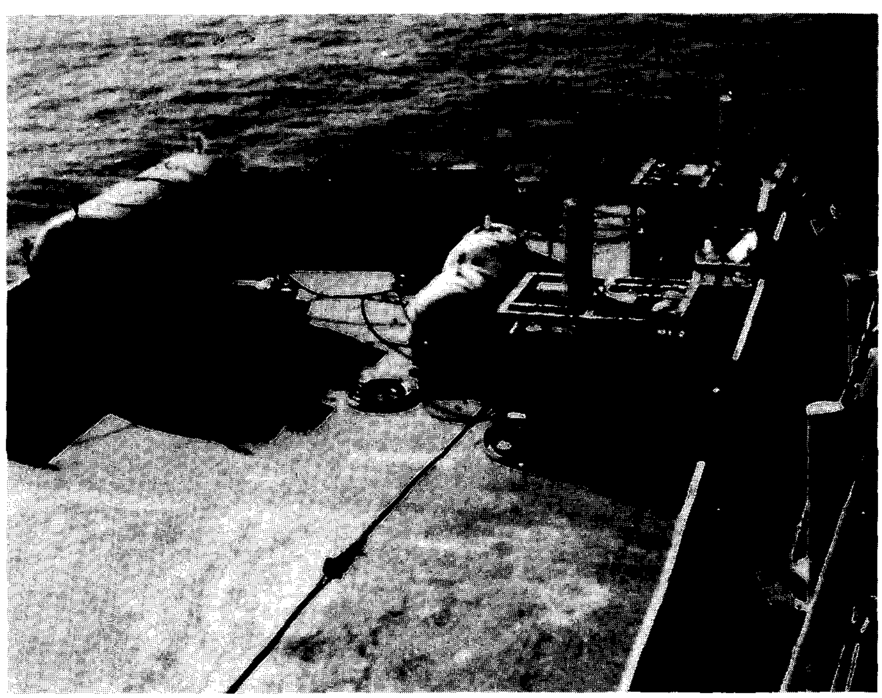
The RECLAIMER was officially tasked to conduct salvage operations for the Sea Knight on 5 February with the Commanding Officer designated on-scene Commander. EOD Group ONE was tasked to provide the APSS with operators who would relocate the wreckage and provide coordinates to establish a precision four-point moor. MDSU ONE was tasked to provide the FMGS and support personnel.

RECLAIMER Underway to the Crash Site

Early on 7 February, RECLAIMER got underway with the APSS and EOD operating personnel aboard, arriving in the crash site's vicinity at 1430. The EOD personnel then set up their equipment and made a practice run by steaming down one of the track lines. The ship then turned around and regained track 1,000 meters south of the wreckage site. Steaming north at five knots, the Cubic Navigation System proved easy to follow. A reference buoy was dropped to mark the wreckage upon return to the site. After the RECLAIMER was anchored, personnel conducted a verification dive using MK 12 on air to 166 fsw. The bottom could not be detected, because the late afternoon angle of the sun had reduced visibility to approximately 50 feet.

Two divers submerged to 190 fsw the following morning but no wreckage was sighted. Use of the Cubic Navigation System showed

YC 1485 alngside RECLAIMER with FMGS Chamber, LPAs and volume tanks aft in the barge.



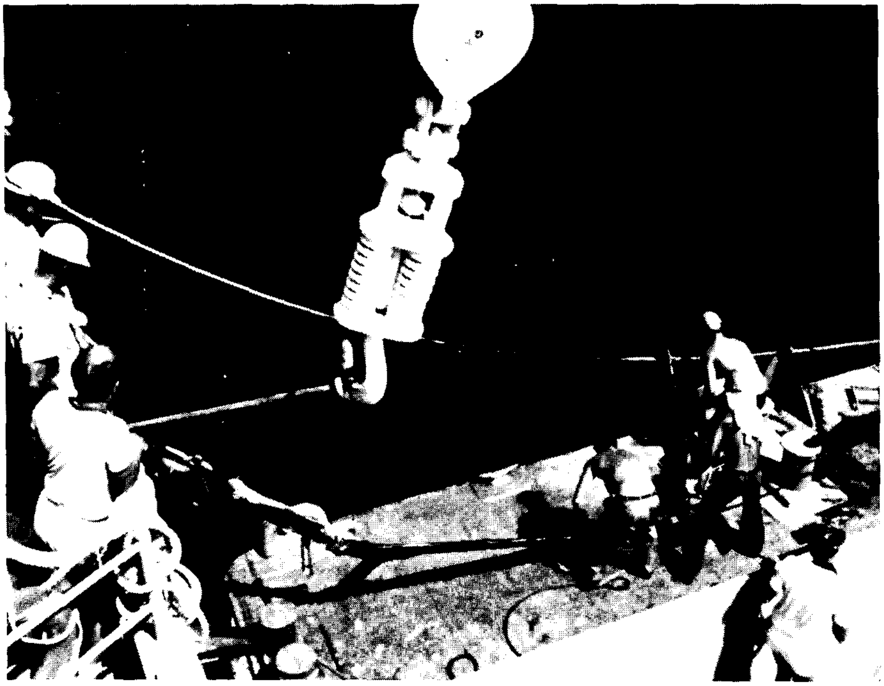
that the ship had drifted 20 meters north and 40 meters east of the site. To maneuver over the drop site, anchor chain was veered and the ship's two 35-foot workboats were used to haul the ship westward. When the Cubic Navigation System once more showed the ship to be over the wreckage, two divers were lowered to 188 fsw. Each diver sighted what appeared to be the main section of the wreckage, and a buoy was placed to mark the spot, with the anchor's bottom position approximately 50 feet south of the wreckage.

The four-point moor was laid using a modified clover leaf maneuver with each anchor dropped 500 yards from the wreckage. Both 35 foot workboats were stationed at the reference buoy to provide a radar image for ranges. In one workboat a quartermaster was assigned to provide stadimeter ranges back to the ship to provide RECLAIMER with additional range information over the radio.

The moor was laid at a speed of five knots, stopping the shaft on the side of the leg being dropped. Buoys were marked by barricade marker strobe lights wrapped in double plastic bags. (A message had been sent to the Coast Guard to request a local notice to mariners for untended buoys.) After all on-scene preparations were complete, RECLAIMER returned to Pearl Harbor to onload the mixed gas diving system and personnel.

The FMGS was onloaded in about four hours, placing seven quads of mixed gas and the console in the midships hold. MDSU ONE had already loaded the YC 1485 barge with the backup recompression chamber. Four legs of seven inch Sampson double braided nylon line, 600 feet long, were faked on deck in preparation for rigging into the moor.

With 16 personnel from MDSU ONE, including a master diver and the Marine Corps Liaison Officer, and the FMGS onboard, RECLAIMER got underway on 10 February, towing the YC 900 feet astern on a seven inch Sampson double braided nylon line. An eleven knot speed over ground was maintained for the 73 mile trip. At the wreckage site, the YC was brought alongside to starboard while rigging into the moor. Two legs of the moor were connected before nightfall.



The first lift—divers hooked the helicopter's rotor blade.

Divers Reach 259 FSW

The final two legs of the moor were connected the next morning and dive stations were set up. Dives were made on air to 186 fsw and divers spotted three or four pieces of wreckage approximately 70 feet from the stage. The rest of the afternoon was spent repositioning the ship in the moor in order to place the diving station as directly as possible over the wreckage. The APSS was not aboard at the time and this precluded verification of which pieces were spotted and RECLAIMER's exact position.

Divers descended to 259 fsw on 12 February using the MK 1 Mod O Light Weight Diving System. Upon reaching the bottom, they were only 20 feet from the wreckage. They surveyed the wreckage and attached lifting pendants (wire straps) to the aft section of the helicopter. The wire straps and retrieving line were then lowered down the descending line using a shackle. Total bottom time for the first dive was 32 minutes.

Because of the depths involved in this operation, all decompression schedules were extended to the next depth and time. Workup dives were also made to acclimatize the divers to working at such depths. Surface decompression on oxygen was used to increase the divers' comfort and safety. The nine-week operation had a zero incidence of decompression sickness. Workup dives used in a similar salvage operation conducted in Subic Bay last fall (see FACEPLATE Spring 1983) may have helped bring the anticipated rate of decompression sickness down from 25 percent to an actual rate of 8.6 percent. The zero rate of decompression sickness in this operation is largely attributed to the use of workup dives, the conservative approach to diving tables and the fact that divers were well rested before beginning the operation.

Lifting Operations

The first lift brought up only one rotor blade, which had broken free from the rest of the tail section. Divers descended again, but the helicopter wreckage was too far from the diving bell for divers to haul and connect the retrieving line.

The aft section of the helicopter was finally lifted the next day by means of the ship's forward boom. It was then placed on the YC.

On 14 February, the ship was repositioned in the moor to what was believed to be the site of the forward section of the wreckage. Three investigative dives were conducted to 259 fsw. An approximate 100-foot circle search was performed on all dives and a few scattered pieces from the wreck were recovered. Between each dive, the ship was repositioned in the moor.

Plans the next day called for moving the ship in the moor while divers descended to 210 fsw. This plan had several advantages: less gas would be used because of the shallower depth; diver exertion would be minimized, decompression times were shortened and more area could be searched at one time, since the divers were observing from a station 50 feet off the bottom and were moving constantly.

On the fourth dive, the forward rotor head assembly was spotted and divers continued to the bottom, 260 feet below, where they attached wire straps for lifting. The forward rotor head and transmission were lifted along with two of the rotor blades.

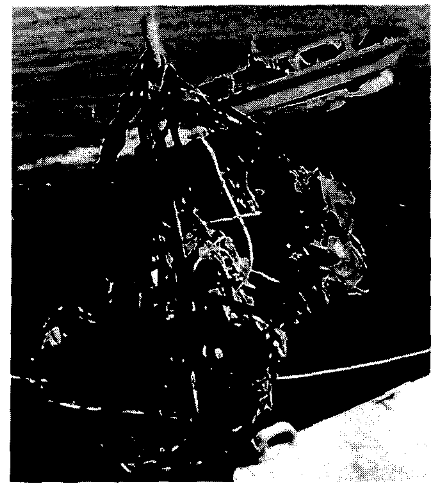
The following day, during the third dive at 210 fsw, two pieces of the helicopter were spotted, but bottom time limitations prevented divers from descending to attach lifting pendants. These were connected by the fourth set of divers. The starboard portion of the fuselage, control console and aft bulkhead of the cockpit's right side were all lifted out of the water. By this point, 95 percent of the wreckage had been recovered but only 20 percent of the original supply of mixed gas remained.

After two sets of dives the following day yielded negative results, a decision was made to secure from operations because of insufficient gas on board. Without the APSS to identify contacts, continued searching would have little chance of recovering the wreckage that remained. The dive station was broken down, the moor recovered and RECLAIMER headed back to Pearl Harbor.

Divers Return to Salvage Remaining Wreckage

Upon RECLAIMER's return to Pearl Harbor it was decided that the remaining five percent of the helicopter wreckage was significant enough to require a second search. EOD Group ONE personnel were again dispatched to the area with the APSS and on 26 February they located what were believed to be the remaining pieces of the downed helicopter.

Divers onboard inspect the salvaged instrument panel.



The instrument panel is raised.

On 7 March, the RECLAIMER headed back toward the salvage site. Units on board were the MDSU ONE FMGS team, the EOD Group ONE APSS team, the Marine Corps Investigating Officer and four master diver candidates. YC 1485 was again used for staging the backup recompression chamber. At the wreckage site, the YC was again taken alongside RECLAIMER, stern to bow, and a trackline run was made to drop a marker buoy using the Cubic Navigation System. A two point moor was laid using a 3,000 lbs. lightweight anchor with a one inch wire aft and the port hawser anchor with nine shots of 1-5/8 inch dielock chain forward. By adjusting the position in the moor and using the ship's workboats for athwart ship control, the diving station was placed directly over the sonar target believed to be the cockpit section. Divers using the MK 1 Mod O Diving Masks descended to 260 fsw and connected lifting slings and a recovery line to the cockpit section. The divers then recovered the port side pilot's seat and the cockpit heater. Due to the failure of the attachment point on the cockpit section, an additional dive was required to complete recovery of the aircraft.

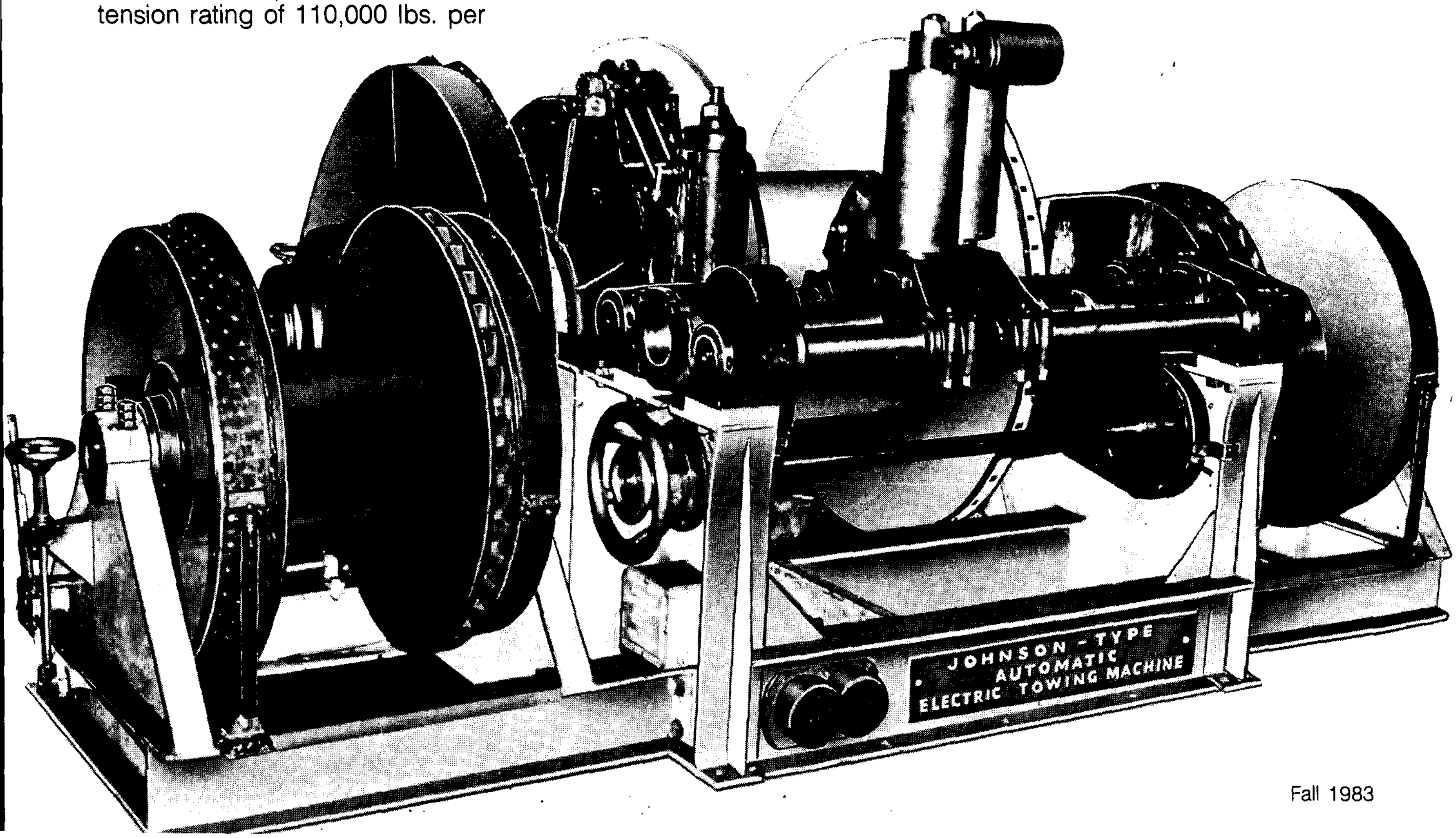
Nine weeks after it began, 99 percent of the helicopter was recovered and, with no incidents of decompression sickness among participating divers, the salvage operation was terminated.

Automatic Towing Machines

The Johnson-type automatic towing machine has a long history of development by the U.S. Navy. At present there are 17 of these machines in service. The first of four new generation dual-drum towing machines—the 322 series—will soon be introduced on the Navy's new class of salvage ships, the ARS-50. (A training system for these new towing machines was discussed in the Summer 1983 issue of FACEPLATE.) With an automatic tension rating of 110,000 lbs. per average layer, the series 322 machines are the strongest towing machines yet developed.

Forty years ago, the Johnson-type series 222 automatic towing machine was being used on ships such as the USS CREE (AT-84). The machine was originally installed with constant potential drive, using power from one of the CREE's four propulsion units. The original automatic tension rating of the machine was 48,000 lbs. This figure was developed by the Navy based on ratings of the Lidgerwood machines which had been installed on the first three AT class vessels—APACHE (AT-66), CHEROKEE (AT-67) and SEMINOLE (AT-68).

The evolution from the 48,000 lb. rated series 222 machine to the series 322, with more than twice the



40 Years of History

rating, was largely based on reports from service engineers. On board ship, service engineers operate the automatic towing machines and have a chance to evaluate first-hand the strengths and weaknesses of the machinery. The following excerpts from a report submitted by the CREE's service engineer on 27 April 1943 describe a towing operation between San Pedro and San Francisco, during which the CREE used its series 222 automatic towing machine. By looking back into history, present-day divers can gain insight into the operational problems that affected later technological developments.

Service Engineer's Report

USS CREE (AT-84)
27 April 1943

"We arrived in San Francisco at 2000 hours Tuesday with one section of drydock in tow. We had cleared San Pedro at noon on Sunday and had heavy seas throughout the voyage. The first 36 hours saw heavy ground swells plus a fresh wind from the north. The wind increased toward evening and it was necessary to reduce engine speed to prevent the runaway of the screw from overspeed due to churning in midair.

"We started with three engines on screw at 100 revolutions and one engine on the towing machine. With about 1600 feet of hawser out approximately each 15 minutes, the machine would pay out not more than five feet and then promptly reclaim the lost line.

"Our speed at 110 turns was about seven knots. This is equivalent to about 12 knots running light (without a tow). At 0400 Monday it was again necessary to reduce speed to prevent the screw from coming out of the sea. We proceeded with 100 revolutions on the wheel. Wind increased slightly and the towing machine would pay out and reclaim each 15 minutes. Maximum deflection was six inches.

"The tension control was set at 32,000. Winds fell and then strengthened again Tuesday, but the towing gear was inactive throughout the wind change. At 1700 hours as we neared San Francisco, we reduced speed, shortened the tow line to 500 feet and proceeded at full ahead (110 revolutions) into the channel. At this time we were in the trough and subject to heavy rolling. The tow was also subject to considerable disturbance — the machine would pay out on heavy surges to as much as 20 feet. This payout was rapid—approximately 1,000 to 1,200 RPM of motor—yet within limits so as not to set the C-H brake.

"At times the surges were so great that reclaiming was not complete until payout was repeated. With this short tow line, the towing machine was subject to constant payout and reclaiming. We continued this procedure for approximately half an hour. The skipper, satisfied with the machine's ability to take care of surges, ordered more tow line. We veered about 150 feet of hawser and continued into the harbor. Surges with 650 to 700 feet of hawser were encountered approximately every five minutes as we proceeded at full ahead. At 1800 hours we shortened hawser to 150 feet and proceeded at one-third into the harbor. Heavy tide conditions caused us to trip the tension controller twice and this relieved the strain on the hawser. We let go of the tow at 1930 hours and proceeded to the pier at San Francisco.

"Everyone aboard was pleased with the action of the towing machine. We marked the towing hawser with twine and found that we had lost about 10 feet of wire the first night. This I attribute to the clutch brake slipping. We prevented any further loss by setting up on band. I tripped the tension controller and the 10 feet of wire were immediately reclaimed."

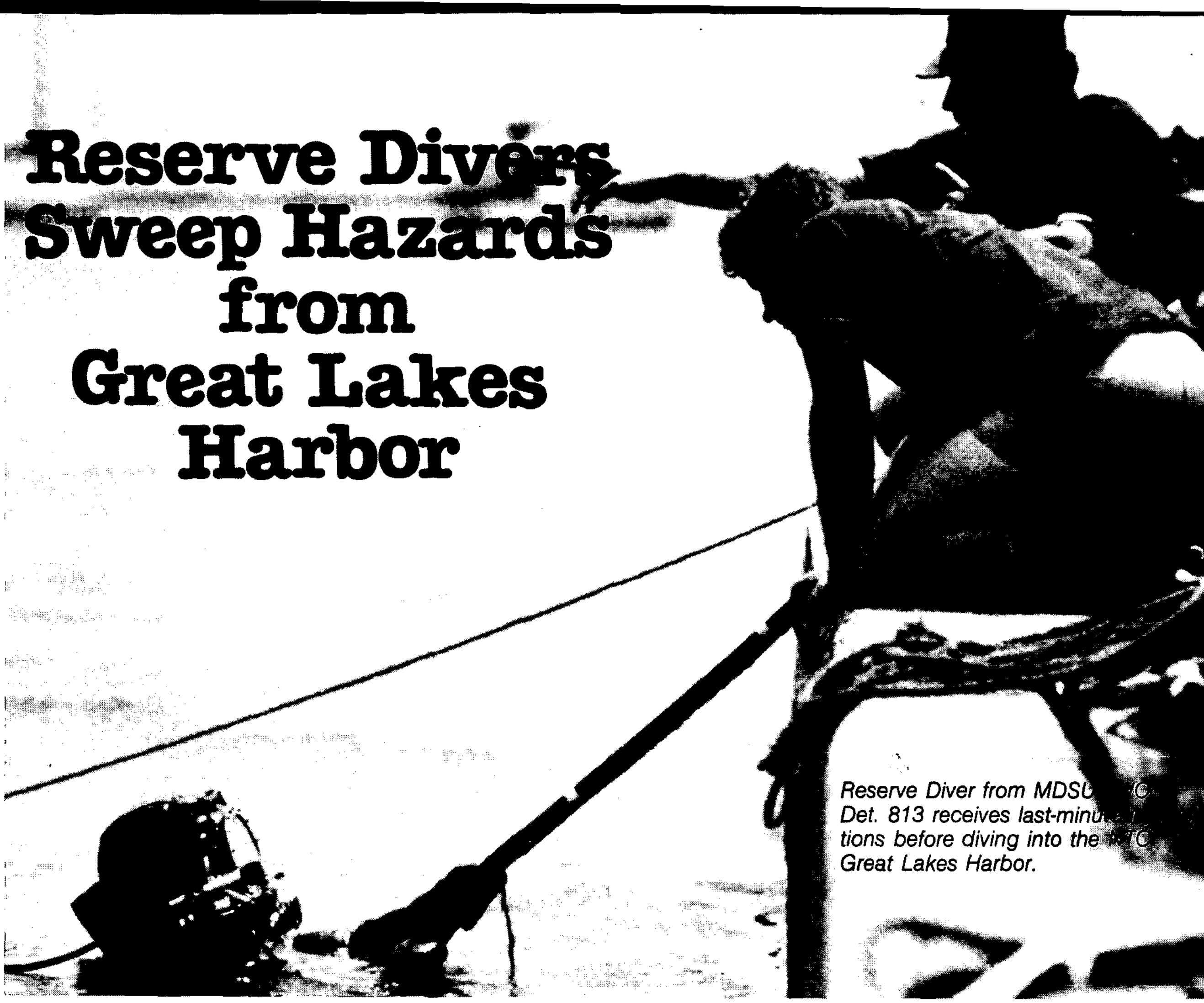
A noteworthy feature of the older towing machines such as the one installed on the CREE was that they used power from one of the ship's four engines. When the Navy decided to use all four propulsion units for driving the vessel, the electrical systems on the towing machines were modified so that they could be powered from the ship's service generators.

The machines were installed with variable voltage drives with DC/DC motor-generator sets and variable voltage controllers which are still in use. At the same time, the maximum automatic tension rating of the machine was increased to 60,000 lbs. hawser pull based on the average layer. The series 222 machine was subsequently upgraded to an 80,000 lbs. rating (not on board the CREE, however, which retained its original tension control and reclaiming systems and a rating of 60,000 lbs.).

The new series 322 machines are a rebuild of the series 222, with modifications to the planetary systems, clutch-brake and other portions of the drive to make it commensurate with the 125 HP driving motors with which the 322 units are powered. These new units have an automatic tension rating of 110,000 lbs. based on the average layer.

The development and improvement of the automatic towing machines is but one example of how the lessons learned during fleet operations are used continually to upgrade equipment for use by Navy personnel.

Reserve Divers Sweep Hazards from Great Lakes Harbor



Reserve Diver from MDSU … Det. 813 receives last-minu… tions before diving into the … Great Lakes Harbor.

photos by LCDR Christopher Nemeth

By LCDR Christopher Nemeth
MDSU TWO, Det. 813

Diver shows three of the steel studs that were ground off the face of the harbor's main pier.

Hydraulic tools were successfully put to use by the Reserve divers of Mobile Diving and Salvage Unit (MDSU) TWO, Det. 813 in a two-week clean-up of the Naval Training Center's Great Lakes Harbor last June. By using the oil-powered underwater tools, developed under NAVSEA OOC, the Reserve divers along with crews from Assault Craft Unit (ACU) One and the local Naval Reserve Center quickly and thoroughly cleared the harbor and seawalls of old pilings and steel studs that were posing a threat to the steel hulls of ACU's LCM-8 landing craft (Mike boats).

Hydraulic tools are more powerful yet quicker and easier to control than the corresponding pneumatic models. (See the Summer 1983 issue of FACEPLATE for an article describing new hydraulic tool systems.) Pneumatic tools, because they are designed on an open system that releases air through the turbine, are extremely noisy and often difficult to control. Hydraulic tools operate through a closed system that greatly reduces the noise level —oil is never released. In addition, the hydraulic power source is not appreciably affected by the depth at which the tools are used. As the MDSU TWO, Det. 813 divers learned, hydraulic tools allow divers to complete more work while exerting less energy and can be a major advantage in maintenance and repair operations.

Most of the work in the 20-foot-deep harbor involved cutting and removing wood pilings, attaching protective timber to the concrete piers and cutting off protruding steel spuds. To accomplish this work, the divers used an Onan hydraulic power source, hose and reel; the IW-20 impact wrench and a hydraulic chainsaw provided by Naval Coastal Systems Center. Technical assistance was provided by UTCS

A.L. Calvert of MDSU TWO, Norfolk. UTCS Calvert was a member of the team which originally developed hydraulic tools for the Navy.

UTCS Calvert spent the first day of the project explaining the three major pieces of equipment the divers would use. Each diver must participate in on-land orientation before using the hydraulic tools underwater so that they understand all tool components and procedures for safe operation.

"If divers would just use the tools as they're configured, they'd find they're very effective," Calvert said. "Some take a while to accept new ideas like these hydraulic tools. The reserve MDSU took the saw and wrench and went to work right away. They went by the book, and the book worked."

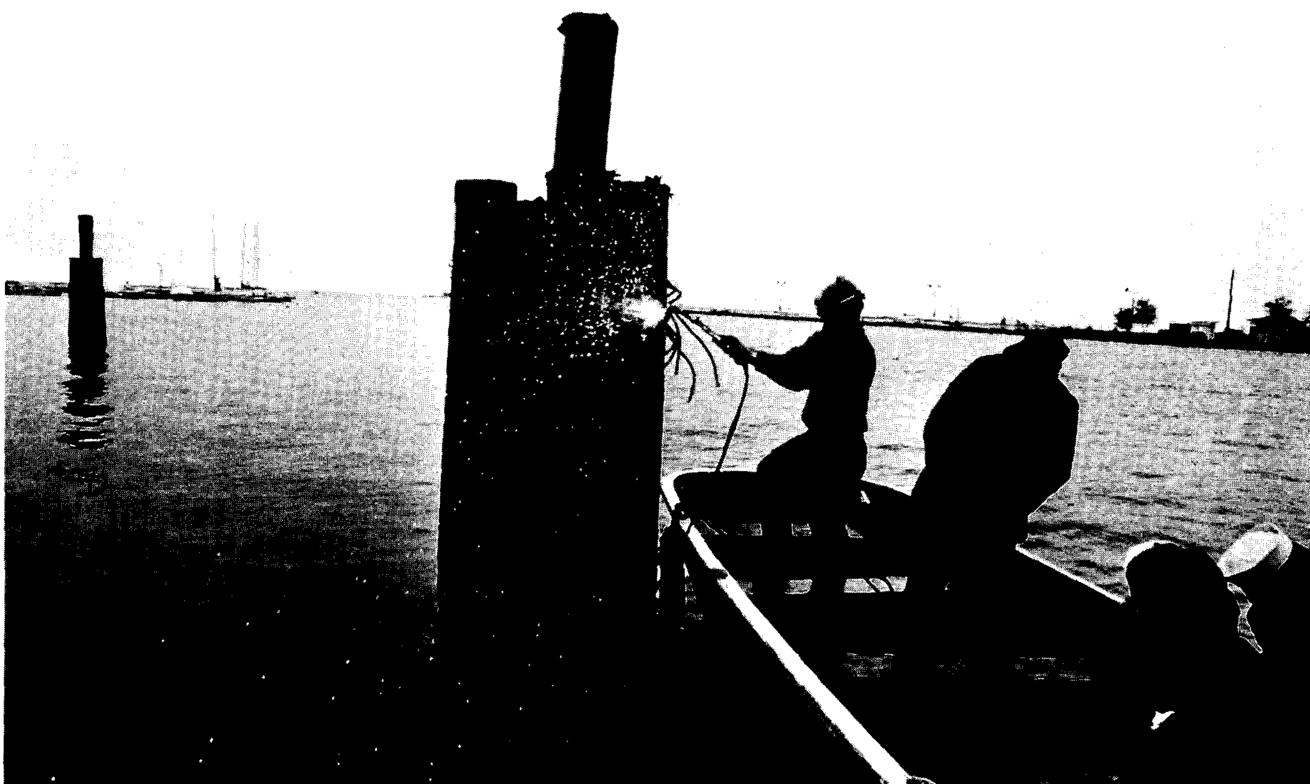
After a day of on-land training, the reserve divers were ready to use the tools in the water. Their first task was to remove wood pilings, most of which were as wide as telephone poles, from along the harbor quaywalls. Wearing the MK 1 mask in SCUBA mode, each diver worked his way along the north and south quaywalls. They used both hands to feel around each piling for obstacles, then positioned themselves in the mud, using a rock or other materials as an anchor. Once positioned, the divers could call for power and begin operating the hydraulic chain saw to cut the pilings.

A hydraulic hose connected the underwater saw to the power source. The flow of oil was controlled by a bypass valve installed at the hose reel. Using voice communications, the diver would call for power on or off to the topside crew member manning the valve. With each request, the valve operator would instantaneously cut or restore the oil flowing to the saw. (The oil flow rate was 10 to 14 gallons per minute.)

The bypass valve is an important safety feature of the hydraulic chain saw because it prevents any residual flow of oil through the system while the saw is not in use. The valve allows divers to maneuver and reposition the saw without leaving the blade in motion. Safety was an important consideration, when operating the 14 horsepower saws, as they are powerful enough to cut

The flow of oil to underwater tools is controlled with a bypass valve mounted on the hydraulic hose reel.

Diver uses a cutting torch to remove the heavy steel cable holding seven pilings togehter.



Reserve divers are briefed on how to operate the Onan hydraulic power source.

Divers practice using the hydraulic saw.

through thick wood pilings in as little as 40 seconds.

In addition to being safe, the hydraulic chain saw proved to be fast and effective. "They got results right away," UTCS Calvert reflected. "That chain saw delivers 14 horsepower to the blade. In only four working days, the divers cut through 58 pilings over a foot and a half thick. . .as many as 16 in a single day."

Cutting pilings was only one of the three major jobs the MDSU divers performed. A five-diver team fastened 130 feet of 6-inch X 6-inch timber to the 12-inch X 12-inch horizontal pier cross member running the length of the ACU's mooring area. Using the IW-20 impact wrench and a yard-long auger to drill pilot holes, the team installed 70 lag screws to fasten the timber.

The timber acts as a stand off between the concrete pier and the steel hulls of the Mike boats. It absorbs shock and thereby prevents the damage to the hulls that results from contact with concrete.

MDSU divers also located and removed steel studs—metal rods from 1 to 1-1/2 inches thick—which protruded dangerously from the face of the south quaywall and main pier. Damage caused by these pins to the hulls of the Mike boats had originally called attention to the hazards in the NTC harbor.

The studs were left over from portions of the pier which had been installed years earlier. As boats rubbed against wooden portions of the pier they gradually wore it down, leaving the steel pins protruding beyond the pier walls. While the spuds posed little problem to the small sport boats in the harbor, they could seriously damage the deep, straight-sided Mike boat hulls, which came into more direct contact with the pier.

The spider is attached to the MK 1 diving mask.

Divers parctice running the hydraulic impact wrench fitted with an auger they used to drillholes in pier timbers.

During the final five days of the project, as many as four divers at a time worked underwater to remove the steel spuds. Using SCUBA gear and wielding pneumatic three-inch grinding wheels, divers cut and removed the steel rods. Each diver held the wheel of the air-driven grinder, spinning at 20,000 rpm, against the stud where it entered the quaywall. After approximately half an hour of grinding, the stud was sufficiencly cut through to allow the diver to place a steel pipe over the stud and wrench it off manually. The studs were made of dense, hardened steel and as such were difficult to sever. Some divers used gravity to help them pry off the studs, by standing up on the pipe and bouncing up and down on it until the stud was broken off. By the end of the project, 51 studs had been removed.

The entire project was completed in two weeks of active duty training. Throughout most of the effort, visibility was restricted to less than three feet and the average temperature of the water was only 53°. Despite these difficulties and the fact that the reservists were using hydraulic tools for the first time, there were no injuries or loss of time due to casualties. The divers' work brought praise from NTC Great Lakes Harbormaster Ed Chambless:

"Now that the pilings have been cleared away, we can use both sides of the main pier," Chambless said. "Boats will be able to moor there without fear of hitting a piling and damaging their hull or engine. We won't have to worry about a storm knocking a piling loose from the bottom of the harbor and damaging a boat, either."

The work of the reserve divers of MDSU TWO, Det. 813 also showed that divers can learn to use the complicated hydraulic tools on the job and operate the tools quickly, safely and effectively.

Divers confer on use of the hydraulic chain saw.

34-Ton Propel

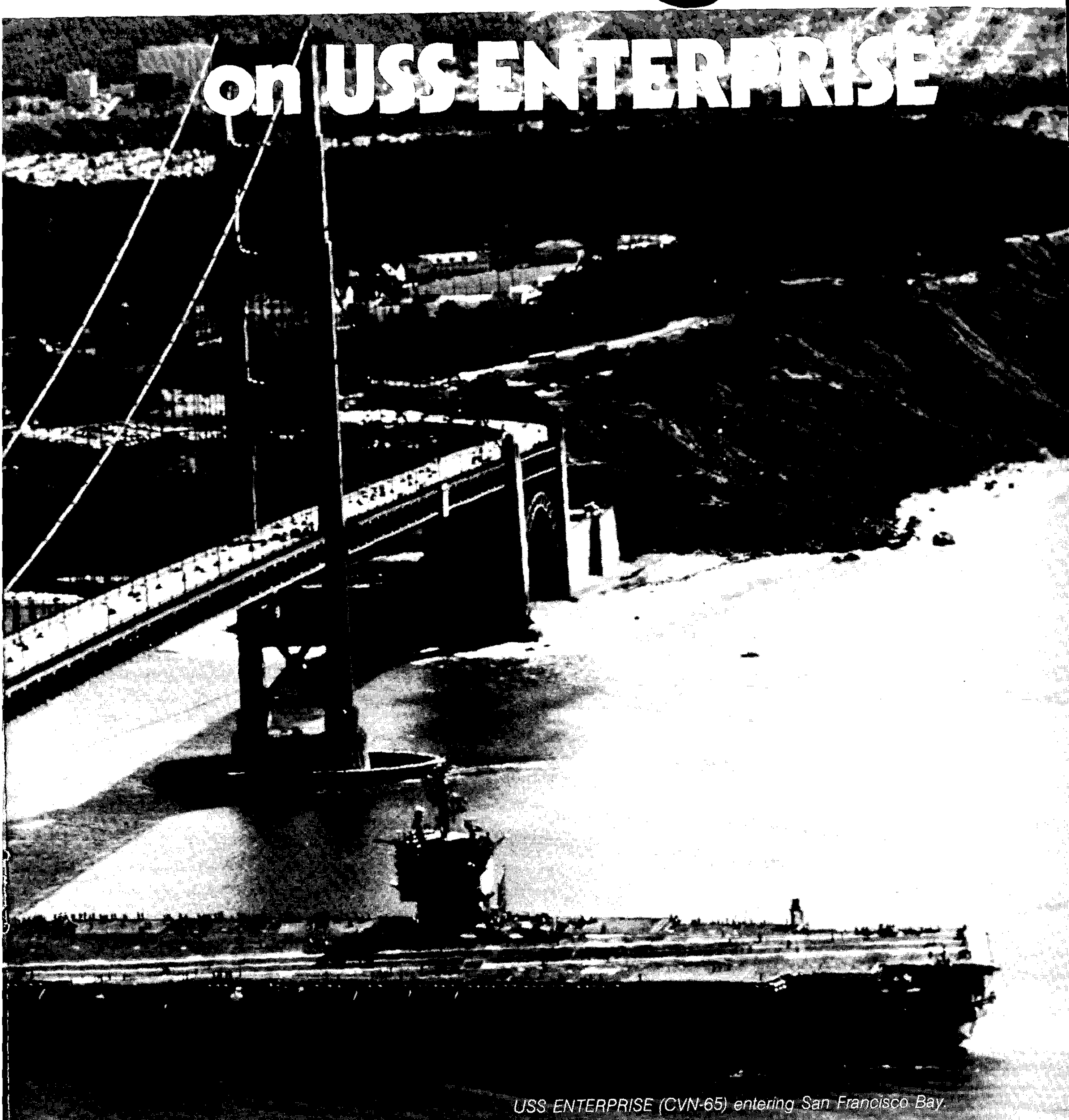
By CDR Wheeler
Former Repair Officer
USS HECTOR (AR-7)
Clark Mallder
NAVSEA OOC

A waterborne propeller change on one of the Navy's largest ships — the USS ENTERPRISE (CVN-65) — was completed last spring by divers from USS HECTOR (AR-7), who were assisted by Mobile Diving and Salvage Unit (MDSU) ONE and MDSU ONE Detachment. Command and logistic support were provided by Commander, Naval Air Forces Pacific (COMNAVAIRPAC); Commander, Naval Sea Systems Command (NAVSEA OOC and 56 X4)and Supervisor of Shipbuilding, Conversion and Repair (SUPSHIP), San Francisco.

ENTERPRISE's propeller weighed 34 tons and measured 21 feet in diameter. The propeller's replacement while ENTERPRISE was waterborne represented the first time the Navy has accomplished an underwater propeller change on a ship of that size. The operation also gave the participating divers an opportunity to learn and apply special techniques, equipment and rigging procedures. Finally, and most importantly, by conducting a successful waterborne propeller change, the potential delay and expense of drydocking ENTERPRISE were avoided.

ENTERPRISE grounded in San Francisco Bay 21 April 1983, resulting in damage to the #1 propeller. To avoid conflicts with a previously-scheduled ships restricted availability, the non-availability of a nuclear certified drydock and insufficient channel depth in the approaches to existing drydocks in the area, it was decided to explore the possibility of changing the damaged propeller in the water. On 9 May a meeting was held at the of-

ller Changed



USS ENTERPRISE (CVN-65) entering San Francisco Bay.

fice SUPSHIP San Francisco. Representatives from COMNAVAIRPAC, NAVSEA, Mare Island Naval Shipyard; and Commander, SUPSHIP San Francisco met, evaluated results of the ENTERPRISE hull survey and decided that the propeller must be changed and that there was a high probability for successful waterborne replacement.

In an operation of such magnitude, it was inevitable that divers would encounter some difficulties. For example, the project was delayed a few days because divers had to learn a new technique to cut the propeller nut. The use or adaptation of other equipment such as air hoists, hydraulic pancake jacks and a specialized rigging techniques are further examples of the technical knowledge gained during the ENTERPRISE propeller change.

Salvage Plan

Initial planning called for Navy divers to unseat the propeller then yard and stay it from under the ship. Three 50-ton pneumatic chain hoists specially modified and tested for the underwater operation would be rigged to remove the propeller and suspend it alongside a work barge. The propeller could then be moved within reach of the 100-ton floating crane for transfer ashore and the new propeller could then be similarly installed.

A detailed plan of action and milestones with assigned responsibilities was prepared 13 May 1983 by SUPSHIP San Francisco. It included the concept of operations, personnel support requirements, material support requirements, milestones and contingency/backup planning.

The Navy chain of command sought to carry out the propeller change using Navy assets to the greatest extent possible. Arrangements were made for divers from the USS HECTOR to perform the propeller change, with support from MDSU ONE and MDSU ONE Detachment. Diving technical assistance and technical control of operations were provided by NAVSEA OOC. The overall responsibility and operational control for the propeller change was assigned to CAPT Venezia, the HECTOR's Commanding Officer.

On 16 May 1983, COMNAVAIRPAC concurred with the proposed plan of action and directed that the project proceed accordingly. Preparations began for the divers to commence in-water operations on 31 May. This included identifying material requirements, testing the modified pneumatic chain hoists and staging equipment and familiarizing divers with the equipment.

Special Equipment Requirements and Modifications

As planning got underway it became necessary to make provisions for the special equipment required to change such a large propeller underwater. Through innovative use and/or modification of existing equipment the Navy diving community extended its capabilities to a new limit and demonstrated its ability to accomplish a broad range of underwater tasks. The use of special equipment and techniques was a key factor in the successful completion of the ENTERPRISE propeller change.

Initial planning for unseating the propeller hub from the shaft taper called for a specially modified strongback, six hydraulic pancake jacks and a special steel collar.

During the propeller change, the six hydraulic jacks were coupled together and mounted on the strongback pressure plate. Their total force of 660 tons was expected to be sufficient to unseat the propeller. These jacks were also used earlier in the operation to break the propeller boss nut.

The strongback on which the jacks were mounted had been additionally reinforced and modified for this project by the HECTOR crew. The pressure plates on which the jacks were mounted were 1½-inch thick steel plates.

The HECTOR crew at work with the work barge alongside.

A special steel collar was designed and fabricated to protect the shaft end cap and permit the force from the six hydraulic pancake jacks to be applied directly against the shaft shoulder. Three 50-ton chain hoists were specially procured to handle the 34-ton propeller. The 50-ton hoists were operated on compressed air (minimum 500 CFM-100 psi) which was supplied by a mobile compressor located on the pier.

The chain hoists were specially modified and tested for operation underwater. Modifications to each chain fall included removing the exhaust muffler and installing an air exhaust hose to prevent water from entering the motor. A low pressure (20 psi) air line was installed to the midsection housing to pressurize the inside and keep water out.

Dunce Cap Removed

The ENTERPRISE was moored in 50 feet of water, 85 feet from Pier 3 at the Naval Air Station in Alameda, California. The barge was positioned on the starboard side of the carrier near the stern, between the pier and the carrier. The barge was equipped with a balance beam mounted to the deck. A 50-ton air-driven chain hoist was attached to the beam. Two hydraulic units, a counterbalance weight, diver control station, divers' air compressors and equipment were also situated on the barge.

With the barge and equipment in position, the dive team was ready to begin the propeller change. The first step was to remove all but four screws from the dunce cap and gland seal. The remaining section of the rope guard (all but two retaining nuts), the lifting eye plug and the fill-drain plugs were then removed.

The lifting eye was installed in the dunce cap and the two remaining retaining nuts were removed. Two two-ton chain hoists were then attached to the ENTERPRISE pro-

peller lifting shell fittings and rigged to the dunce cap. The aft chain hoist was used to pull the dunce cap off the hub. The dunce cap was then brought alongside the barge in a yard-and-stay arrangement using a grip hoist and snatch block attached on the barge deck.

After the dunce cap was removed to pierside, the forward chain hoist was temporarily moved to the aft propeller lifting shell fitting so as not to interfere with the jacking of the screw. The screw was jacked over, and the retaining bolts were removed from the forward retaining ring.

Boss Nut Removal Attempted

Removing the boss nut was the next major step in the propeller change. Divers first attempted to remove it using a boss nut wrench, but this method ultimately proved unsuccessful.

A nylon line was rigged to the aft propeller lifting shell fitting and the boss nut wrench was yard and stayed into place. The wrench was then fitted and aligned onto the nut. Two attempts to loosen the nut using 20 tons (100 foot tons) of pull were made counterclockwise, one from the 1 o'clock position and one from the 11 o'clock position. Neither attempt produced any movement. The wrench was repositioned, and a 1.125-inch wire rope was attached from the crane to the wrench. An attempt to tighten the nut by rotating clockwise succeeded in moving the nut circumferentially 1¼ inches.

The screw was then positioned with the jacking gear to move the wrench to a 5 o'clock position for a third pull at 100-foot tons — this third attempt was also unsuccessful.

Two counterclockwise pulls of 200- to 250-foot tons, using the 50-ton pneumatic chain fall that was attached to the balance beam, failed to move the boss nut, as did a sustained pull for 10 hours at 200-250-foot tons. Several additional pulls were made in both directions at 200- to 250-foot tons, still to no avail.

The final pull was made using the 50-ton pneumatic chain hoist and setting off an explosive charge on the handle of the boss nut wrench. The impact from the explosive charge was intended to provide a shock to break the static friction force between the nut and the propeller hub, but failed to move the boss nut.

A subsequent pierside inspection of the wrench revealed that the extensive pulling force had elongated the wrench's keyways. A further review of the data indicated a

Diver using hydraulic jack.

strong possibility that the boss nut was galling on the shaft threads and that subsequent attempts to remove the nut by turning would damage the threads. It was therefore decided to remove the nut by cutting and splitting it, using the Kerie Cable cutting method.

Cutting the Boss Nut Begins

Cutting the boss nut began 10 June 1983 at a depth of 30 feet with a water temperature of 59° F. Underwater visibility was limited to approximately 12 inches.

The first cut was made in the boss nut keyway at the 9 o'clock position (facing forward), which required the diver to cut from a left-hand position. Divers began initial rough cutting along the aft face of the boss nut starting from the outer beveled edge at the keyway and working inward toward the shaft threads. Care was taken not to get closer than one inch to the shaft threads during the rough cutting. The diver would then start his next rough cut, deepened until the final pass reached within one inch of the propeller hub. Roughed out, the initial kerf extended from the aft face of the nut to within one inch of the propeller hub, and at a depth of approximately four inches.

Progress on the first day was slow as divers experimented and cut with exceptional care. Divers noted that slag built up more during underwater cutting than during surface cutting operations. A pneumatic chipper was required to remove the slag before inspecting progess. For most cutting, divers achieved the best results by directing a freshwater hose jet near the kerf to flush away slag and gasses and improve visibility of the kerf.

Divers also learned that if they attempted to cut too fast or burrow too deeply into the metal while rough cutting with the Kerie Cable, a small explosion or blow-back would occur. To overcome this problem divers had to refine their technique to avoid cutting too fast or gouging out large bites.

Day Two of Kerie Cable Cutting

The second day cutting commenced on the one-inch portion remaining at the forward face of the boss nut. The first cut was smoothed to a width of approximatley 2½ inches (the keyway width) and trenched to a depth of five inches. Hydraulic jacks were then test fitted and found to require approximately 1/2 inch shims.

The shaft was then jacked over to align another keyway selected for the second cut in a 12 o'clock position. This position was relatively easy to work because it afforded good visibility and because all gas was vented straight up. The second cut was completed in only four hours and 50 minutes, a substantial reduction in time over the first cut. The second kerf was then dressed up as smooth as possible. With kerf 1 and 2 now dressed up, eye bolts were installed in each half of the boss nut; two hydraulic jacks with shims were put in each cut, and a first attempt was made to break the nut with pressure reaching 12,000 psi. The boss nut did not break.

The third work day began with another attempt to break the boss nut, but problems arose with the hydraulic jacks. The jacks were sensitive to uneven surfaces and would jam when cocked and consequently would not compress to permit repositioning. As a result of increasing the pressure, the seals were damaged and the jacks started to leak and were rendered unusable. All jacks were then removed and it was decided to install only two jacks in kerf #1.

The Boss Nut Breaks

Cutting began the next day in an attempt to reduce the one-inch portion remaining at the shaft to a possible 1/2 inch. Both kerfs #1 and #2 were trenched out as close as possible to the threads. Divers had become so comfortable with the Kerie Cable technique and had such positive control that they were able to cut to within a quarter of an inch of the threads.

Two hydraulic jacks were then positioned in kerf #1. A pressure of 13,000 psi (112 tons) finally broke the kerf. Attempts to reposition the jacks and break kerf #2 failed. A new type of shim, a 1/2 inch semi-cylindrical bar, was attached with countersunk screws to the face of each ram and under a pressure of 18,500 psi, the nut broke.

A grip hoist was rigged to remove the smaller portion of the boss nut. Attempts to pull loose or unscrew the remaining part of the nut only served to bend the eye bolts and part a 5/8-inch wire rope.

It was decided that another cut would be necessary to remove this larger portion of the boss nut. To prepare for cut #3, the bent eye bolt was cut off, and a hole was burned through near the edge of cut #1 to attach a securing line. The other half of the nut was secured with an eye bolt.

Cut #3 began along its keyway using 12 mm Kerie Cable. Approximately 300 feet of cable was used in about three hours of rough cuttin to shape a trench, which was then smoothed out with 9 mm and 6 mm Kerie Cables. Because cut #3 was in an 8 o'clock position (looking forward), divers had to be on the underwater staging and cutting upward. Many reported they could not see the top of the cut: gases and slag diminished visibility. As a result, kerf #3 was extremely rough. In addition, to deepen the trench as much as possible at the aft face, the kerf was sloped from about 1/2 inch at the aft face of the boss nut to about 1½ inches of the propeller hub. Later, when the jacks were installed and pressure applied, the crack could be seen starting at the aft edge of the nut and following along the base of the cut toward the propeller hub. The remaining section of the boss nut broke at 2,020 psi.

Divers uncrate the pilgrim nut backing plate.

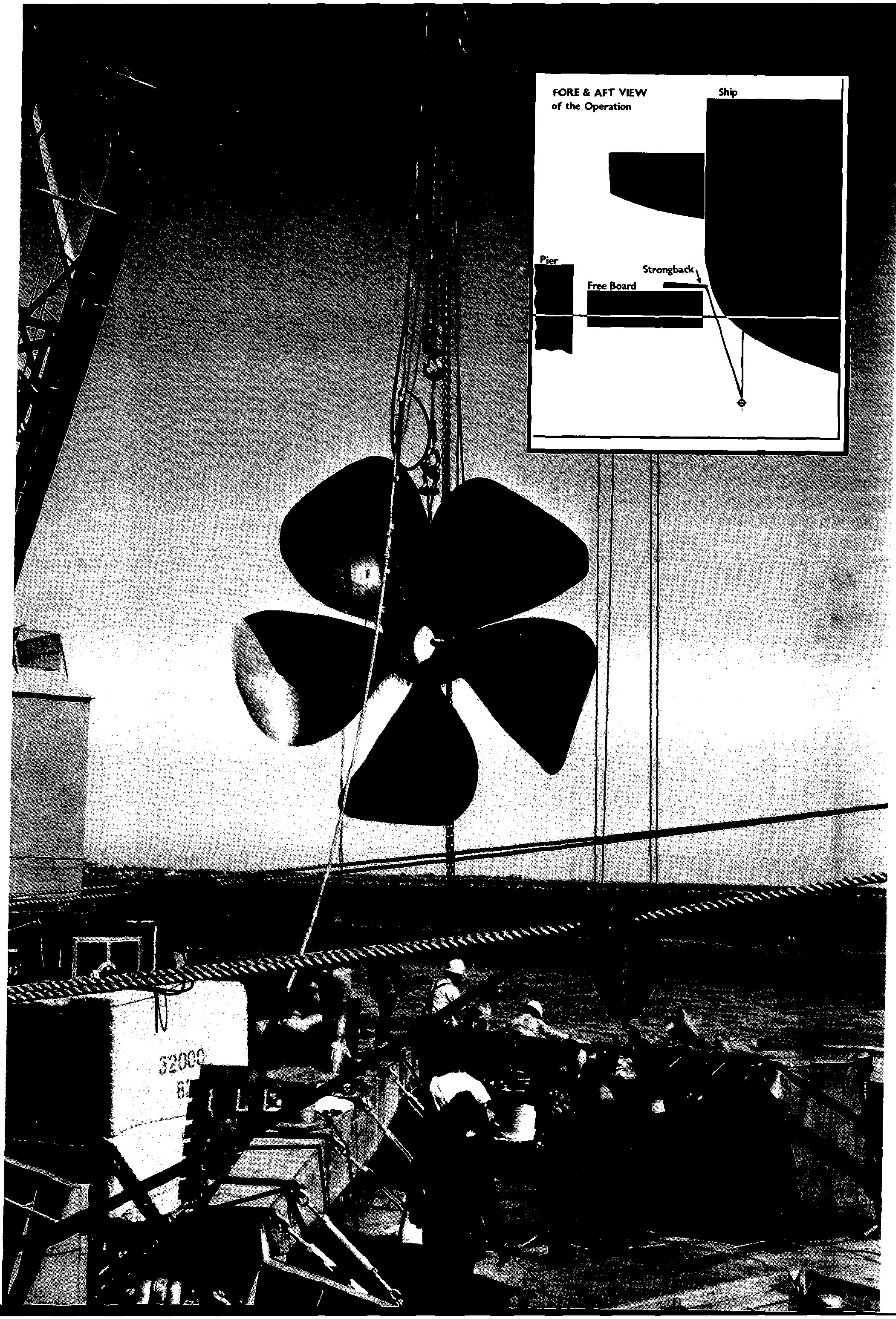
The damaged boss nut is laid on the pier.

Divers Prepare to Remove Propeller

After the boss nut was broken off, the shaft threads were checked and chased. All appeared to be in perfect condition. The threads were cleaned, wrapped with 9-thread line and the entire shaft was then covered with canvas and a thin protective sleeve.

A 7′ × 1⅜″ diameter wire rope grommet and 2½″ shackle were attached in each of the propeller lifting shell fittings. A snatch block and a tight grip wire were attached to the after fitting in preparation for rigging the 50-ton chain hoists. Propeller removing studs were machined down .040 inches and installed.

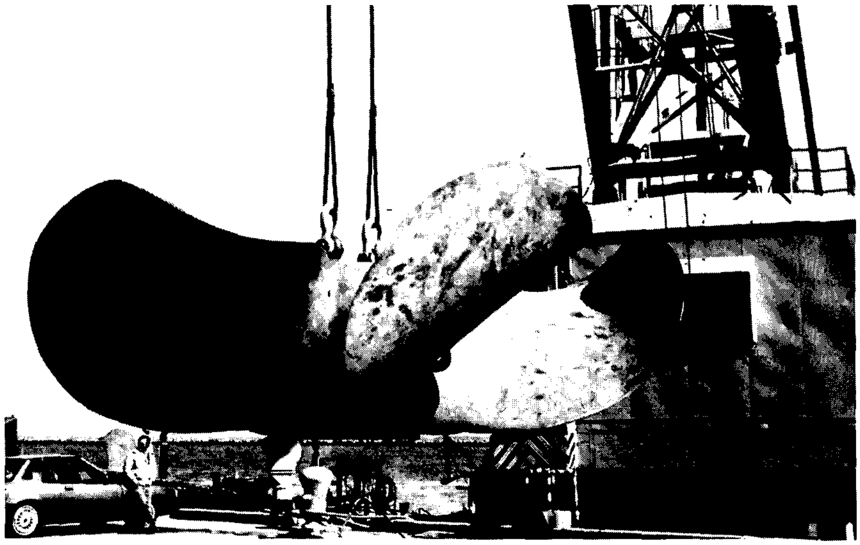
Two, 50-ton chain hoists were placed on board the barge by the pier crane. The barge was then repositioned alongside ENTERPRISE in line with Frame 228½ where a tight grip wire was attached to the ENTERPRISE aft hull fitting.


FORE & AFT VIEW
of the Operation
Ship
Pier
Strongback
Free Board
32000

← *The damaged propeller is lifted out of the water.*

One snatch block was attached at the ENTERPRISE aft hull fitting and two additional snatch blocks were attached on the barge deck. Lines rigged through the snatch blocks were controlled by grip hoists located on the barge.

The 50-ton chain hoist was then hooked onto the tight grip wire which would support its weight and guide its movement. Once in the vicinity of the aft hull fitting, it was disconnected from the tight grip wire and lowered so it could be attached to the grommet and shackle which were already on the aft hull fitting. The procedure was repeated to locate the other 50-ton chain hoist temporarily on the aft hull fitting. The shaft was then jacked over to position the propeller studs at 3 and 9 o'clock.



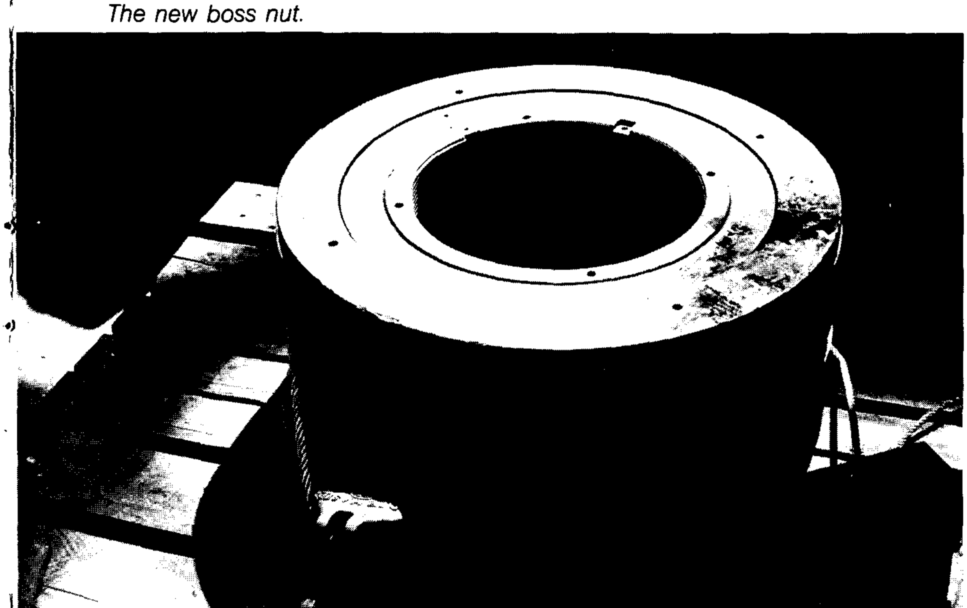
Divers lay the damaged propeller on the pier.

Divers Use Pilgrim Nut And Backing Plate

The pilgrim nut method was chosen for unseating the propeller after learning from NAVSEA 56X4 that an excess of 700 tons would be required to unseat the propeller from the shaft. Preparations were made to install the pilgrim nut on the shaft and the backing plate on the propeller studs as soon as the backing plate had arrived from Puget Sound Naval Shipyard.

The pilgrim nut was tested pierside using a 10-ton concrete block.

The new boss nut.



The barge was then positioned alongside the carrier and the pilgrim nut was yard and stayed into position on the propeller shaft. The backing plate followed into its position on the propeller studs. The stud nuts were installed on the propeller studs, the pilgrim nut was tightened and 4 × 6 inch wooden blocks were placed at 3 o'clock and 9 o'clock positions to absorb some of the impact when the propeller was unseated. Ten thousand psi of pressure was applied to the pilgrim nut to break the propeller free from the shaft taper. The propeller moved 3/4 to 1 inch along the shaft in two extensions of the pilgrim nut (maximum extension is 9/16 inch).

The stud nuts, backing plate and pilgrim nut were then removed.

Damaged Propeller Removed

The damaged ENTERPRISE propeller was removed by the yard and stay method from the forward to after air hoist. Once off the shaft, the propeller was positioned alongside the barge. It was suspended on the 50-ton air hoist which had been connected to the propeller balance beam.

The barge was warped to within reach of the YD 116 floating crane, which hooked onto the propeller, lifted it from the barge balance beam and laid it down on the pier. The propeller studs were then removed and lifting eyes installed so it could be lifted onto the flatbed truck.

The impact from the grounding had reduced the distance across the propeller blade tips from 21 to 17 feet.

After underwater inspection of the other ENTERPRISE propellers, the #1 shaft was inspected to verify that there had been no damage during removal of the old propeller. The shaft taper run out was checked using dial indicators. A mounting fixture was specially fabricated to fit on the strut barrel and hold the three dial indicators. The shaft was then jacked over and readings taken at designated 12, 3, 6, 9 o'clock positions and again at the 12 o'clock position. Shaft alignment was satisfactory.

New Propeller Installed

The installation of the new propeller was relatively straightforward. After arrival and visual inspection, the 34-ton, 21-foot replacement propeller was lifted from the flatbed truck and placed on the pier, using the 100-ton floating crane. A lifting eye had been installed in the propeller hub. This would allow the dive team to rotate the propeller 90° on its axis before lowering it into the water alongside the barge. (This was accomplished by utilizing the 50-ton chain hoist.)

Before the propeller was lowered into the water alongside the barge, all gland ring studs and dunce cap studs were installed and torqued. The propeller and the attached 50-ton chain hoist were then lowered and secured to the barge's balance beam. The barge was then repositioned alongside the ENTERPRISE at Frame 228½ and divers installed the "O"-ring and gland ring on the shaft.

The propeller was rigged from the barge's balance beam under the ship to the aft 50-ton chain hoist in a yard-and-stay arrangement. Using a yard and stay arrangement with the forward and the aft 50-ton chain hoists, the propeller was positioned onto the shaft and advanced up the taper. A six-ton chain fall attached to the strut assisted in advancing the propeller up the taper to within 1/2 inch of its final seat.

The pilgrim nut with its attached wire sling and snatch block was yard and stayed into place and screwed onto the shaft until it was hard against the propeller hub. It was pressurized to 14,000 psi, retightened and pressurized to 16,000 psi — thus seating the propeller home. The pilgrim nut and the three, 50-ton chain hoists were removed.

The boss nut, already installed in its speed wrench, was yard and stayed from alongside the barge to the after propeller lifting hull fitting. It was then yard and stayed into place on the threads by forward and aft rip hoists. The nut was advanced by wrapping and pulling wire about the nut's circumference. Once in place, it was tightened with the nut wrench. The lock pin hole was lined up, the pin installed and the wrench was then removed.

The dunce cap was rigged under the ship using the aft grip hoist wire, its "O"-ring installed and rigged into position against the propeller hub, using the forward grip hoist wire. The dunce cap stud nuts were installed, torqued to 575 ft. lbs. and the cover plates screwed on.

The forward gland ring nuts were installed and torqued to 105 ft. lbs. The propeller and dunce cap were flushed with preservative MIL-C-16173-B until no water was present. The screw cavities were then filled with preservative. Vent and fill plugs were installed. The dunce cap was pressurized to 25 psi, checked for leaks, then filled with preservative and plugged. The dive team had successfully completed the propeller change on the waterborne USS ENTERPRISE.

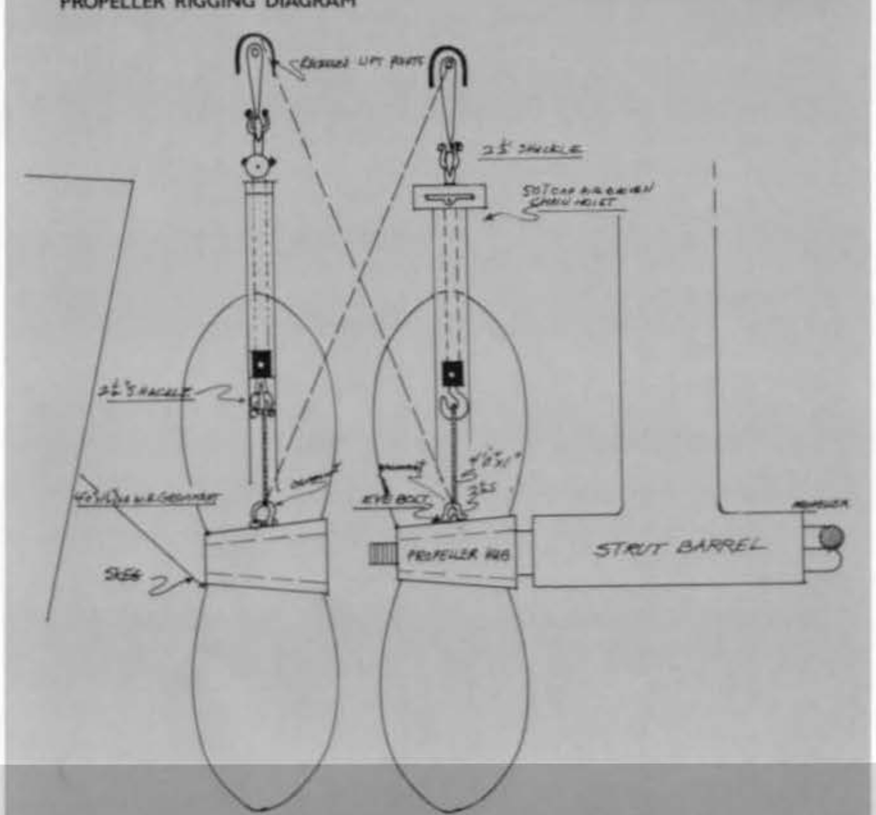
Lessons Learned

The most important lesson learned from the ENTERPRISE propeller change was that it is possible to accomplish an underwater propeller change on one of the largest ships in the U.S. Navy. Difficulties encountered throughout the operation increased the knowledge gained.

The use of the Kerie Cable cutting technique, for example, was proven applicable to underwater operations. The problems with the hydraulic pancake jacks taught divers that the jacks are sensitive to piston pressure when the face and the case are not parallel. Self-aligning procedures and modifications are needed when the surfaces to which force is being applied are not parallel.

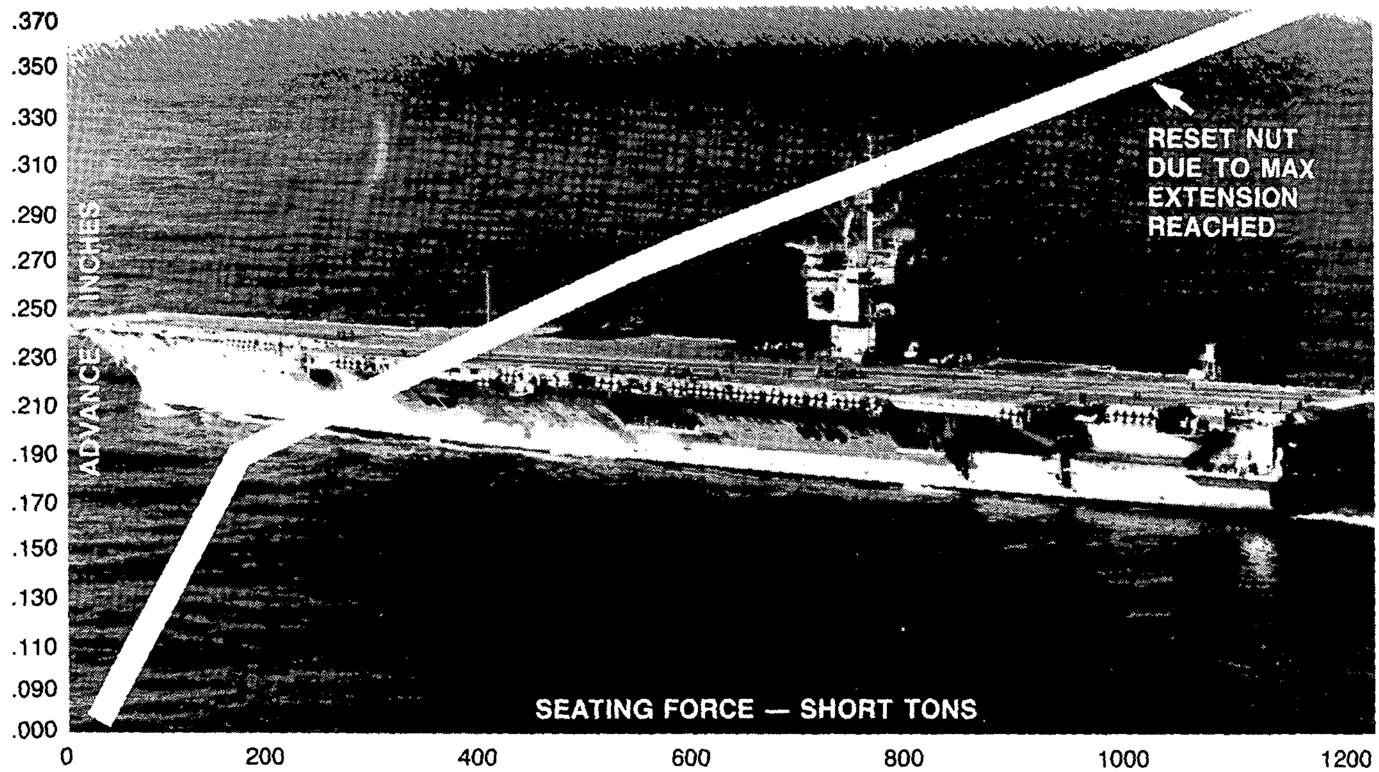
The procedures, techniques and special equipment used to execute this project — and the lessons learned in their execution — can be relied on for future waterborne propeller changes on the largest U.S. Navy ships.

PROPELLER RIGGING DIAGRAM



USS ENTERPRISE CVN65 NR ONE PROPELLER INSTALLED IN WATER BY USS HECTOR AR-7

28 JUNE 1983



Participating Personnel:

OPERATIONAL CONTROL
USS HECTOR (AR-7)
- Commanding Officer — CAPT Venezia
- Repair Officer/Project Manager — CDR Wheeler
- Diving Officer — LTJG Hall
- Diving Supervisor — HTC Laurich

OPERATIONS TECHNICAL ADVISOR
- LCDR James Peck (CO, MDSU ONE)

TECHNICAL CONTROL OF OPERATIONS
- Mr. Clark Mallder (NAVSEA OOC)
- Mr. Frank Zaher (NAVSEA 56X4)

RIGGING COORDINATOR
- Mr. Ron Green, Master Rigger (Long Beach Naval Shipyard)

PROPELLER

SERIAL NO. 26453	**CERT. 50507A 12 JUN 30, BY DORAN CO., OAKLAND**
STOCK NO. NSN 2010-00-804-8293	**DIA. — 21 FT. PITCH AT .7R-24 FT. 1.42 IN.**
DWG. NO. CVA (N) 65-203-1737516 REV. L	**WT. 67453 LBS.**
STBD. FIVE BLADES MN-BRZ	

DIVING TECHNICAL ASSISTANT
- TMCM (MDV) Bill Gholson (NAVSEA OOC)

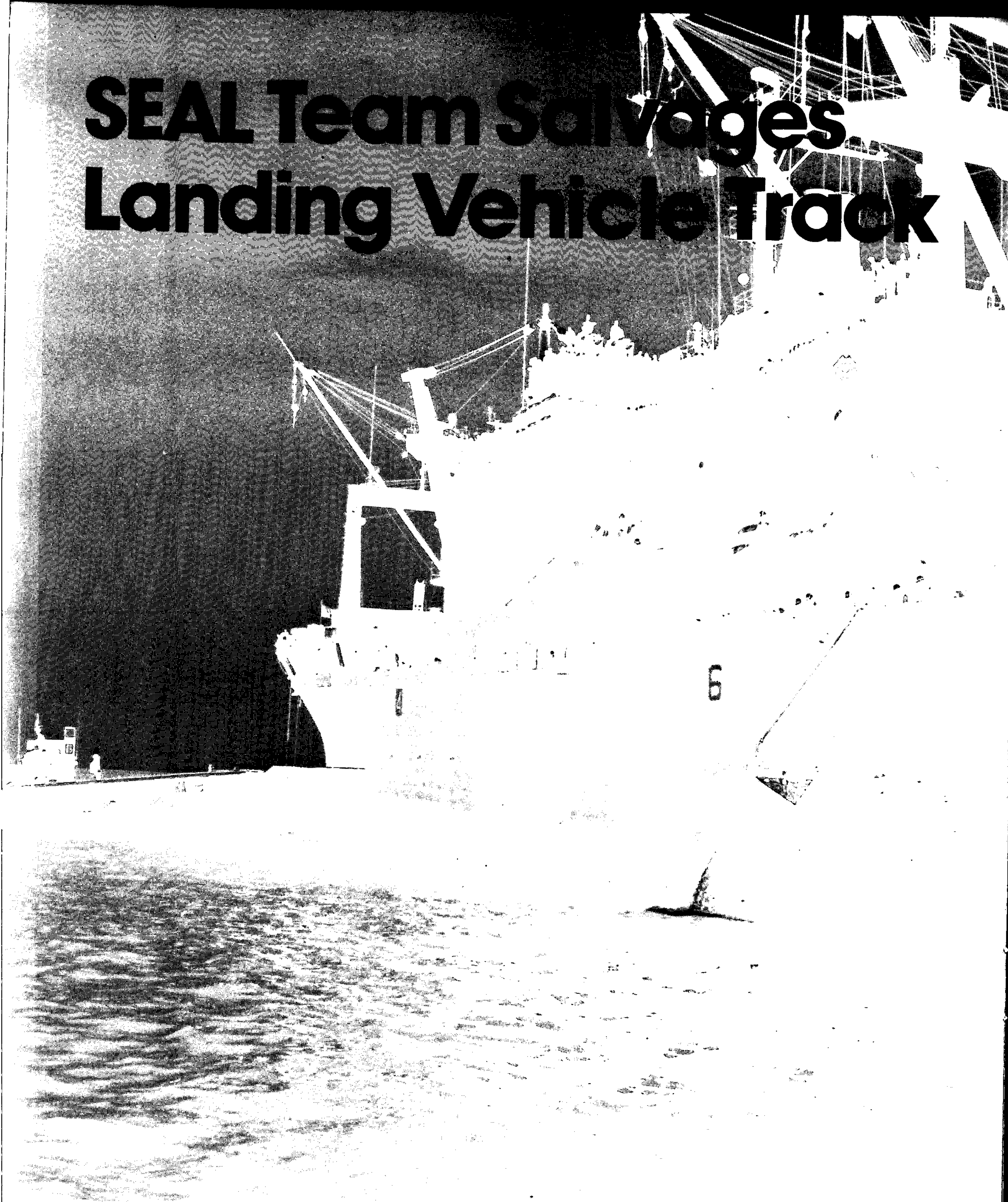
DIVING PERSONNEL
USS HECTOR (AR-7)
- HTC(DV) James Dirk
- EN1(DV) Vance Tripp
- MM2(DV) Bruce Partlow
- 1C2(DV) John Reiss
- BM3(DV) Peter Belury
- EN3(DV) Ruben Rodriguez

MOBILE DIVING AND SALVAGE UNIT ONE
- BM1(DV) Edward Delanoy
- HT2(DV) Mark Lewis
- HT2(DV) James Septer
- HM2(DV) Richard Gilliam
- HT2(DV) Daniel Marlow
- PN3(DV) Wally Waipa

MOBILE DIVING AND SALVAGE UNIT ONE, DETACHMENT
- GMCS(MDV) George Rekow
- BMC(DV) Don Tonkin
- MM2(DV) James Nichols
- HT2(DV) Christopher White

SURFACE FORCE ATLANTIC OBSERVER
- HTCS(MDV) Brad Cole

SEAL Team Salvages Landing Vehicle Track



By LT Terry Murray
Commander Task Force
SEVENTY THREE

Divers from Seal Platoon KILO, Special Warfare Unit ONE salvaged a landing vehicle track (LVT) that had sunk last spring in Dingala Bay, Republic of the Philippines. Neither the SEAL team nor the USS DURHAM (LKA-114), which provided booms for lifting the LVT, is specifically trained in salvage operations; however, they worked together efficiently to perform a successful salvage operation.

The casualty to the LVT occurred on 14 May, after two unsuccessful attempts to board the USS SCHENECTADY (LST-1185) following Exercise Balikatan/Target Flash. The LVT began taking on water, lost power and, within three minutes, sank in approximately 20 fathoms of water, one nautical mile from shore. The three crewmen and 10 embarked troops were safely rescued, but seven M-16 rifles and two M-203 grenade launchers remained inside the sunken LVT. A surface buoy was left to mark the spot where the craft sank.

Because the weapons were easily accessible to civilian and foreign divers, it was desirable to recover them quickly. Efforts began on 19 May, when a five-man dive team flown in from SRF Subic Bay found that the surface buoy was missing. Several unsuccessful attempts to locate the LVT by swimming compass courses followed. The bottom report, citing factors such as the 120-foot depth, 15-foot visibility and barren sandy bottom, indicated that conventional diver search methods—circle search, jack stay—would not be effective. Instead, divers devised a plan to drag a horizontal, weighted line over the bottom using two inflatible boats. The horizontal line would be attached to two vertical weighted lines being pulled parallel to each other over the search area.

Dragging for the LVT began on 24 May, under the direction of Commander Task Force SEVENTY THREE Diving and Salvage Officer LT Terry Murray and LT Biff Dougherty of SEAL Platoon KILO. Navigational landmarks used by the SCHENECTADY while the LVT was backloading could not be used by personnel with hand-held compasses in small boats. To compensate, the SEALS plotted the salvage site on their combat charts and by placing platoon members with radios and hand-held compasses at new landmarks, they could then use reciprocal bearings to direct the boats into position from the shore.

The SEAL Team located the LVT on the second day of the search in 120 feet of water. In a series of three dives they recovered the rifles and grenade launchers as well as radios, confidential publications and miscellaneous military gear.

Once the LVT was located, the DURHAM sailed from Subic Bay. DURHAM's 70 and 40 ton booms were well-suited to lifting the 27-ton LVT. Because the boom's maximum lifting range was only 100 feet, three, two-inch wire rope straps—120, 80 and five feet in length—were rigged sequentially to lift the LTV to the barge deck. DURHAM was kept on station by heaving in and veering the forward anchor and by using Mike-8's as pusher boats.

Shackling the lifting sling to the LVT began on 29 May. Initial attempts were unsuccessful because of the weight of the 1-1/4-inch wire rope sling and the two-inch wire rope lifting strap. There were also difficulties holding the DURHAM over the LVT.

The salvage plan was modified to include fairleading a line from the DURHAM through an attachment point on the LVT to the lifting sling. This provided the option of winching the sling to the LVT if divers were unable to pull the sling in place. However, the lifting sling was shackled in on the first dive of the second day without using the fairlead.

By alternating between the 70- and 40-ton booms using successively shorter straps, the LVT was successfully recovered.

The LVT is raised out of Dingala Bay.

Sunken Dredge Removed from Channel

By LT Frank Magaraci
USS Edenton (ATS-1)

The remnants of the LEIGH, a dredge sunk in the 1940s which was obstructing the Big Foot Slough channel near Ocracoke, North Carolina, were excavated and removed from several feet of hard packed sand last winter by divers from Mobile Diving and Salvage Unit (MDSU) TWO.

The dredge and the sandbar that had built up around it had posed a major obstruction to navigation for several years. In addition, currents had gradually silted in the channel opposite the dredge. Previous flattening and removal operations had provided only temporary solutions to the problem. As the channel grew narrower and the overall obstruction grew larger, local shipping and ferry traffic entering and exiting the harbor had to pass closer to the obstruction each year. In addition to being a navigational hazard, the obstruction was also causing delays in scheduled dredging operations to widen the channel. The situation eventually drew the concern of the U.S. Coast Guard and the Army Corps of Engineers (ACOE).

Part of the A frame crossmember is lifted from the water. Note its proximity to the channel marker buoy.

ACOE initiated a request last winter to Commander Service Squadron Eight, who in turn tasked MDSU TWO to remove the obstructing dredge.

A pre-operative diving survey had revealed that the forward end of the dredge—specifically the "A" Frame, ladder, shafting and cutter head—extended into the navigable channel and was covered by as much as four feet of hard packed sand. These obstructions would have to be removed.

An Army snag boat out of Wilmington, North Carolina, assigned as the diving and salvage lift platform, proved to be an excellent craft to support the operation. Comparable to the Navy sea plane wrecking derrick, the snag boat has a large, unobstructed forward deck and a low freeboard. Mooring spuds projecting through the vessel allowed it to moor solidly to the channel bottom. The snag boat is also equipped with a highly maneuverable articulating crane, which has a 10-ton lift capacity.

In addition to the snag boat, a 41-foot Coast Guard Patrol Craft was on the scene at all times to act as a chase boat, provide logistic support and keep the area clear during demolition operations.

Survey and dredging operations that had been scheduled for the channel imposed time constraints on the proposed salvage and increased the necessity for an efficient salvage plan. It was decided that an eight-man dive team, using SCUBA equipment and explosives, would excavate the partially buried obstructions, attach lifting slings and remove the dredge. SCUBA gear was chosen because in shallow water such as the Big Foot Slough channel, hard hats and hoses of heavier diving rigs would have been unnecessarily cumbersome and would have restricted the divers' mobility. In addition, because there was no need to salvage the dredge, the possibility of damaging the dredge with explosives was not a problem.

Little technical data was available on the dredge. Forces such as weight, bottom suction and the cutting effect of the underwater explosive could only be estimated and these factors required the divers to revise their original work plans as the job progressed. For example, much of the dredge was covered by silt. Although explosives eventually exposed projections large enough for attaching chains and wires, the weight of sand, mud, water and sea growth on the portions of the dredge that were still covered created a suction that resisted the divers' attempts to excavate the various pieces of wreckage. In addition, the riveted construction of the dredge often weakened the effectiveness of cutting charges. (Cutting charges must be placed directly against a metal surface to work properly.) The minor problems caused by these and other similar factors were all resolved early in the effort.

Excessive strain on the pulling line during initial lifting attempts parted the one-inch doubled wire. Divers investigated and found that excavation with explosives was exposing only half of the A-frame's 24-inch wide I-beam. Because a large portion of the beam was still imbedded in the sand, the divers would need to use a pulling line stronger than the one used in the initial attempt.

As bad weather halted salvage operations for a couple of days, divers had time to procure heavier chain and wire. The dimensions of the riveted construction I-beam were measured and a rough estimate of its weight calculated. Meanwhile, 1-5/8-inch wire and 1-1/4-inch chain were delivered to

Team members prepare explosive charges.

The electric priming assembly is made up to initiate main charge explosives.

the job site. The larger rigging eliminated the problem of gear parting for the remainder of the operation.

Lifting attempts continued with the heavier rigging, as the team attached a wire strap to a 30-foot section of twisted I-beam. A partially severed piece of the beam was broken off by pulling with the crane. Removing this piece exposed more of the LEIGH's forward projections. Before the dredge could be removed, however, the divers had to blast away some of the cover of sand. Positioning the explosives was an important factor. Any force from explosives laid on top of the sand would only be directed through the water—the explosives had to be placed in a confined spot under the sand to make full use of their blasting force. To prepare the site for laying the explosives, MDSU TWO divers first cut and welded pieces of pipe into hoe-shaped tools. These were used to dig a two-foot trench along the I-Beam and MK-8 hose charges were then placed in the trenches. Each hose charge is 25-feet long and two inches in diameter. When detonated in this confined trench, the charges produce a high velocity shattering effect.

Detonating the MK-8 hose charges exposed and severed the I-Beam. During the post-detonation survey, the divers located and marked the cutter head, which had also been partially exposed as a result of the blast.

The I-Beam projecting above the surface was choked by wrapping chain and wire around the beam. The crane took a heavy strain on the I-Beam, so heavy that the snag boat's deck listed to the surface of the water and the port side and main deck were awash. The I-Beam did not move. Since the weather was deteriorating rapidly and night was approaching, operations were secured for the day. The strain was slacked off and a marker light was attached to the projection to warn vessel traffic in the channel.

Diving operations began the next day with the snag boat moored at the work site and divers placing a cutting charge at the base of the projecting I-Beam. The conical shape of the cutting charge forms a gas jet powerful enough to cut through metal when the charge is detonated. At the LEIGH worksite the charge worked well—divers were able to remove a 15-foot section of the I-Beam with a Choker strap after the cutting charge had been detonated.

The following day, upon completion of the moor, divers placed explosives in and around the cutter head and shafting. This was then choked with wire and chain. The crane pulled at the outboard end of the assembly, making use of its mechanical advantage and exerting its maximum force. At the same time, the snag boat's engines were backed down against the mooring spuds to produce a scouring effect that loosened the sand near the dredge. After 45 minutes, the assembly still held fast to the bottom. The first inspection dive—conducted the following day—confirmed that the cutter head bull gear was half exposed as a result of the previous day's scouring action. A strong current had augmented the effects of the mechanical scouring and loosened even more sand. This left sufficient room for divers to dig out around the bull gear and place a section of MK-8 hose charge underneath. An additional 50 pounds of explosive was placed in a trench, which had been excavated by hand around the shafting and alongside portions of the cutter head ladder. The charges were detonated to loosen the LEIGH.

On the first lift following detonation, the dredge's bull gear, tail shaft bearing, and cutter head were removed intact. The second lift brought up the remaining cutter head blades. As the sections were removed, the depressions that were left facilitated the scouring action of the current around the cutter head ladder, which was excavated on the third lift. To accomplish this, a 1-1/4-inch doubled wire and 1-1/4-inch chain were placed around the ladder. As the ladder was lifted, the snag boat heeled to a 12° list, held steady momentarily and gradually decreased to 8°, indicating that the suction had broken. Lifting continued gradually until one end of the ladder was above water. Additional straps were attached by divers and connected to the Number Two hook on the crane, providing extra support for handling the weight. The entire ladder was then lifted out of the water and placed on deck.

Despite limitations imposed by the frigid water, strong currents and visibility that did not exceed five feet, the team successfully concluded the mission one day earlier than the alloted time. With the LEIGH removed, a final survey determined that the channel was clear for both navigation and the scheduled dredging operations.

MDSU TWO Divers Recover Downed A-7

By CDR Steve Delaplane
USS EDENTON (ATS-1)

In addition to the LEIGH dredge salvage, divers from Mobile Diving and Salvage Unit (MDSU) TWO were involved in another recovery effort last winter—salvaging an A-7 aircraft for the Virginia Air National Guard which had crashed in Pamlico Sound in February 1983. Shortly after the crash, MDSU TWO had been tasked with the recovery of the aircraft and a team was enroute to the wreckage site, approximately 20 nautical miles south of Stumpy Point, North Carolina. The salvage effort initially appeared to be routine. Available information indicated the plane had been in a shallow dive before impact. As markers had been placed at the reported point of impact within an hour of the accident, the salvage team did not anticipate a great deal of difficulty locating pieces of the wreckage.

By 13 February, the seven-man dive team from MDSU TWO and four-man Explosive Ordinance Disposal (EOD) team from EOD Group TWO rendezvoused with the U.S. Army Corps of Engineers boat SNELL at Wanchese Industrial Park, Roanoke Island. All personnel and fly-away diving equipment were loaded on the SNELL and were quickly underway for the crash site.

The adverse weather that would remain with the salvage team throughout the operation began almost immediately with winds of 20-30 knots and seas from 4-6 feet. After reviewing the marine forecast for the area, the Salvage Officer and Master Diver jointly agreed diving that day would be a wasted effort. The SNELL changed course and headed for Stumpy Point in order to reduce transit time from its berth to the crash site.

The next day the salvage team was on site and diving to locate the wreck. After completing five dives with 50-foot circling lines the divers had located only one small six-by-twelve inch piece of wreckage in the murky water. Increasing winds and sea states that afternoon again required the team to suspend diving operations and caused the SNELL to return to port.

It had become obvious that the plane wreck would not be as easy to locate as originally anticipated. Hand-held sonar devices eventually allowed the salvage team to target in on the wreckage. Wearing earphones, the divers moved the 18-inch circular sonar devices in a slow circular motion until they heard a change in the sonar pulse. They would then swim toward the pulse —sometimes discovering only a fish or wooden debris. Eventually the primary area of wreckage recovery was discovered, approximately 200 yards west-southwest of the previously marked area. Few pieces of wreckage larger than one foot square were recovered, indicating that the aircraft had deteriorated rapidly upon impact. Divers also located an eight-by-ten-foot depression, shot through with gravel-sized pieces of debris.

Once the main area of the wreckage was discovered, the salvage effort turned to the tedious task of locating and retrieving small bits of wreckage. The divers worked painstakingly, placing each piece in a large steel mesh salvage basket which rested on the hard packed sand bottom. Each dive lasted approximately one hour. Although there were no dramatic tonnage lifts, with tail sections, wings or fuselage in this operation, the work was salvage at its best. The dive teams took meticulous care to recover all available wreckage for use by the investigating board. By 23 February, the salvage team had recovered all elements necessary for the investigation into the accident.

MDSU TWO Divers Observe Canadian Ice Diving Exercises

By MMCS (MDV) David Buehring
Mobile Diving and
Salvage Unit TWO

Divers from Mobile Diving and Salvage Unit (MDSU) TWO reaped some benefits from Canadian divers' expertise when they travelled to Nova Scotia's frigid coastal waters last winter to receive training for diving underneath the ice.

Although the American climate offers fewer opportunities to ice dive than does Canadian weather, there are operations in Lake Michigan and other parts of the northern U.S. that require divers to develop special skills to overcome the hazards encountered in ice diving. These dangers arise largely from the extreme temperatures and limited visibility below the ice.

In an effort to improve its ice diving capability, MDSU TWO sent a four-man scuba team from Norfolk, Virginia to the Fleet Diving Unit-Atlantic (FDU-A) Nova Scotia to participate in the Canadian Forces Ice Diving Exercise.

Equipped with wet suits, dry suits, lifelines, saws, shovels, raised platforms, a toboggan and other tools, the divers prepared a station on the ice for their dive. During an ideal ice dive, the ice will be at least six inches thick and covered with snow. When selecting a diving site, divers must consider these conditions as well as wind, tides, water and air temperatures and the proximity of the nearest hospital or recompression chamber.

Four divers generally work from the site—two submerged and two on the surface. The site used during the training exercise was a circle with a 150-foot circumference, divided into six sectors by paths cleared by the divers. The paths, also called spokes, extend from the circle's center to the circle's border. They form windows in the snow which are visible at 60 feet to the divers below the ice. The windows are a vital part of the safety procedures in ice diving.

A work area was cleared in the center of the circle where the spokes had crossed and divers used a chainsaw to cut a six foot triangular hole in the ice. Raised platforms (pallets) were placed on each side of the triangle to help equalize weight distribution and keep topside workers raised off the ice. The ice surrounding the hole will deteriorate quickly with the constant movement of surface personnel and from divers' air bubbles circulating warmer water from below.

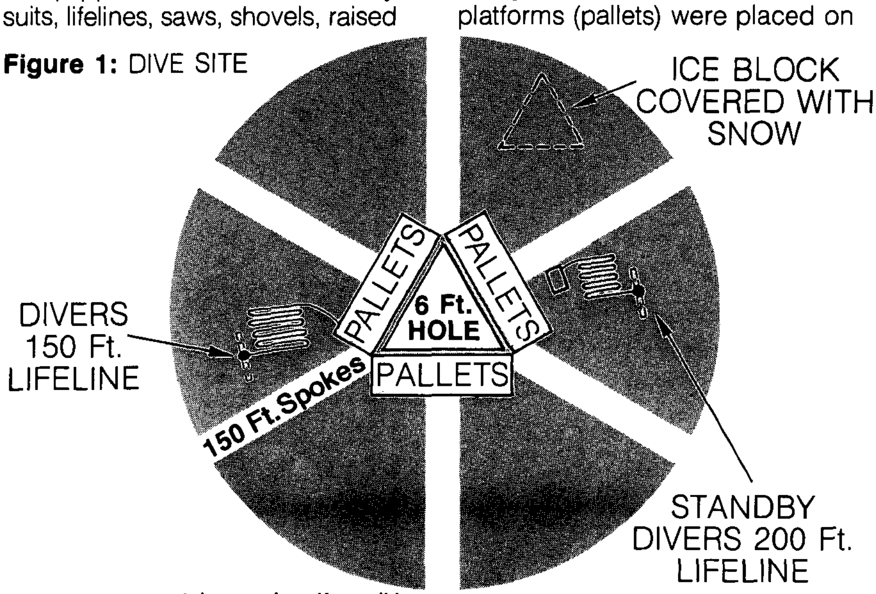
Divers keep in contact with those on the surface through 150-foot polypropelene lifelines which are secured in the ice by placing a half-hitch around wooden planks 2 feet X 4 inches X 4 inches. These are lodged firmly into holes in the ice at least 20 feet from the center hole. During the exercise, divers are trained to respond to emergencies such as a snapped lifeline. If a diver were to lose his lifeline he would find his way back to the center hole by following a spoke. If no spokes were visible the diver would ascend straight up, inflate his bouancy compensator and wait. The standby diver would enter the water, travel down a spoke nearest to the lost diver's last known direction and, keeping the slack out of his life line, circle in a direction to snag the lost diver. In drill situations the standby diver routinely was able to recover a lost diver in less than three minutes.

After completing the diving exercise, the MDSU TWO dive team had an opportunity to make a dive in the Diver Lock-Out Submersible (SDL-1) which has capabilities of descending 2,000 FSW (feet of sea water) and diver lock-out capabilities of 150 FSW.

Canadian divers use the Superlite 17 diving helmet. The MK 12 is the applicable model for U.S. divers. Though the MDSU TWO team could not dive with the Superlite 17, they were able to observe all phases of the Canadian training exercise.

It is expected that the FDU-A will send divers to MDSU TWO for an advanced divers supervisor course and salvage training exercise.

Figure 1: DIVE SITE



1) **Remove ice block in one piece if possible.**
2) **Cover ice block with snow to prevent melting.**
3) **Replace ice block when securing dive site.**
4) **Cover dive hole with pallets and mark hole.**
5) **Never leave dive site unattended until after secured.**

Not to Scale

The OLD MASTER

Is Your Equipment in the Weapons System File by Command UIC?

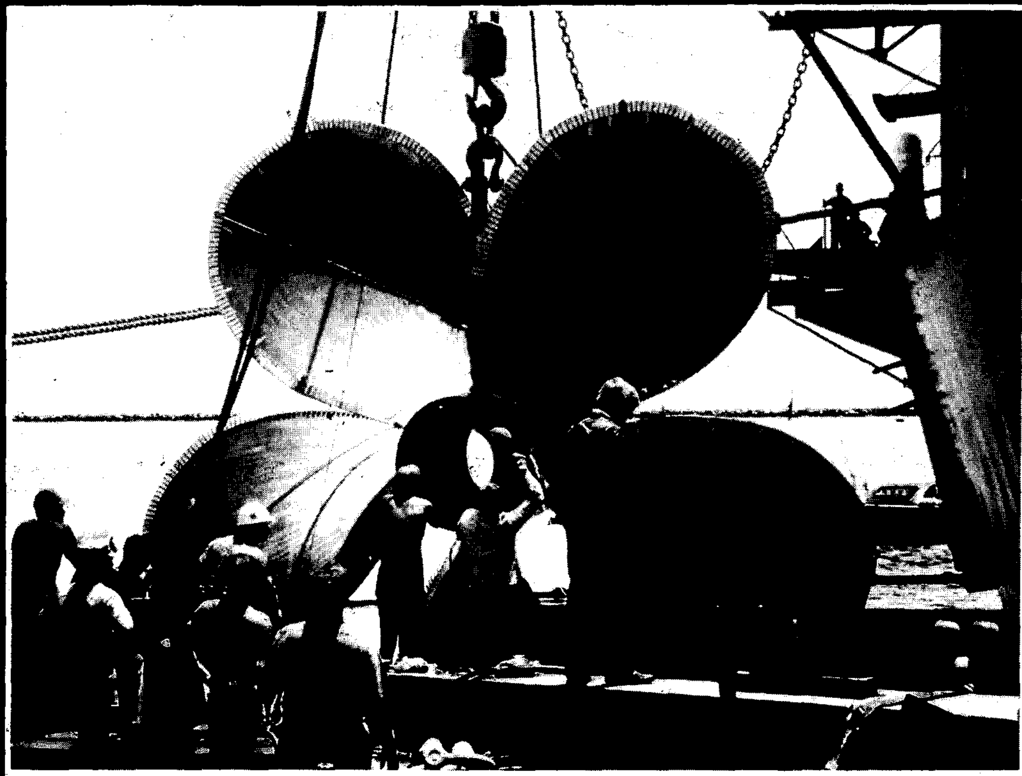
Let's talk for a few moments about a matter that is close to all our hearts: logistic support for our equipment (or lack of it, as it seems at times). It is easy enough for divers to point a finger at the supply system and say that they don't help. But what do you do to help the supply system?

The supply system can be helped in two ways. The first is through the SPCC computer file. SPCC puts out an instruction that all of us should know about. Unfortunately, few of us are aware of this instruction and even fewer of us use it. The instruction is the Coordinated Shipboard Allowance List, SPCCINST 4441.170 (chapter five is the most pertinent). Read it! It will help both you and the supply system.

Let's use MK 12 diving equipment as an example of how the SPCC instruction can help. To date, 54 diving commands have received MK 12 diving equipment, but only nine of those commands have submitted the OPNAV 4790/CK (configuration change) form as required. Proper submission of this form allows the supply system computer to identify a need to stock MK 12 parts vice MK 5 parts — this is done in support of the nine commands that submitted the form. What about the other 45 commands? They've missed the boat.

The second method is, to the greatest extent possible, order your spare parts from the supply system. This identifies to SPCC that a need exists for these items to be stocked (demand base items). The computer will eliminate parts from the system if we abuse the open purchase method of buying parts!

The bottom line is, use the SPCC instruction system and the system will become responsive. By using the instruction, things can only get better. Again, the best way to receive help from the system is to give help to the system. So put in configuration change forms for your equipment and order your parts from the system as often as you can.



The ENTERPRISE's new propeller is positioned for installation.

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