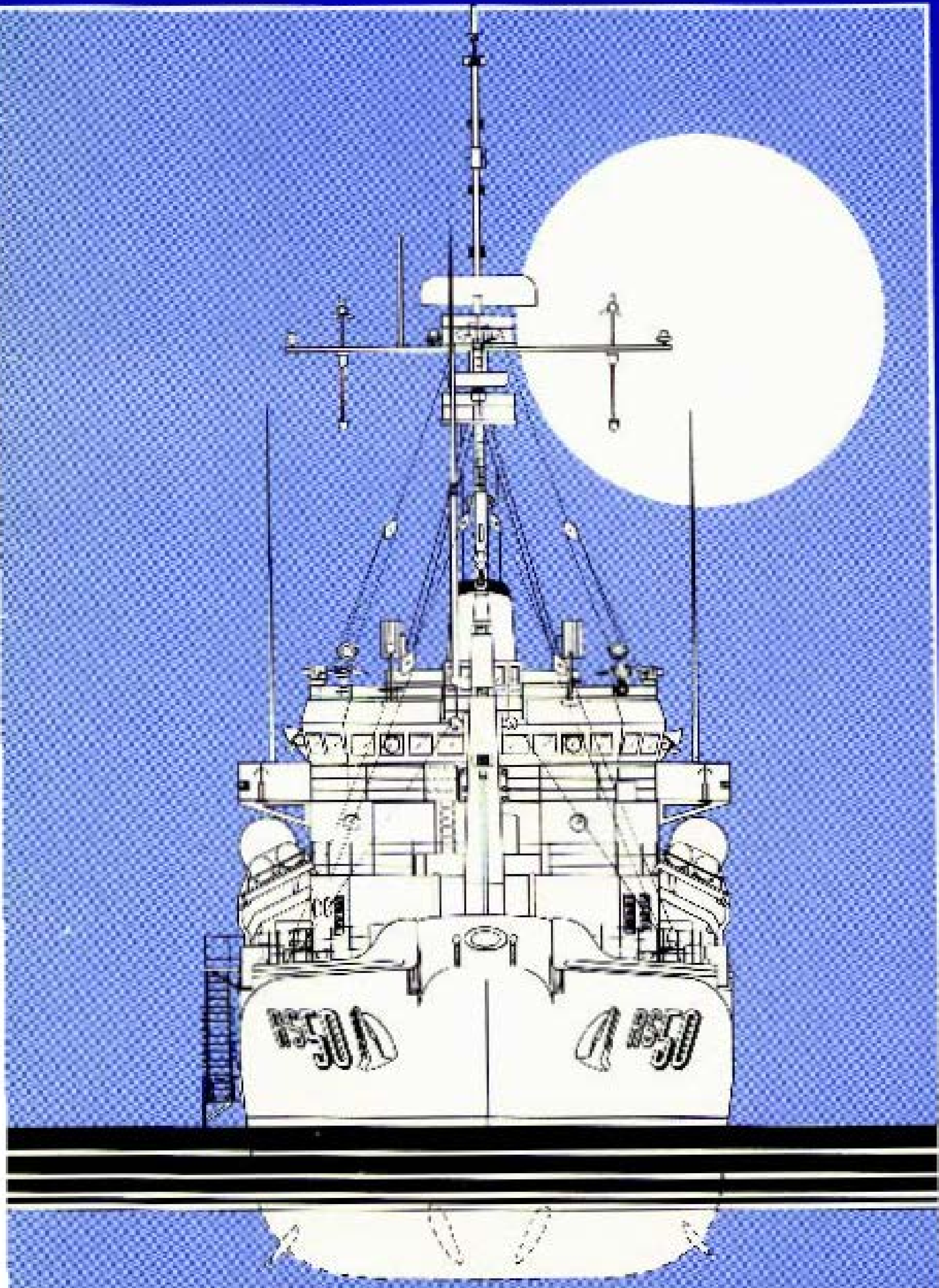
FACEPLATE

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



ARS-50

Winter 1982
Volume 13, No. 4

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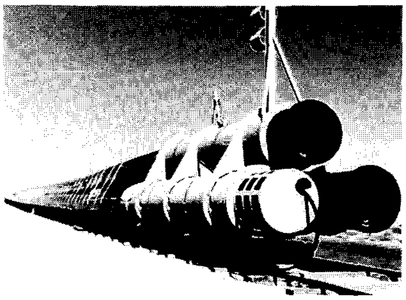

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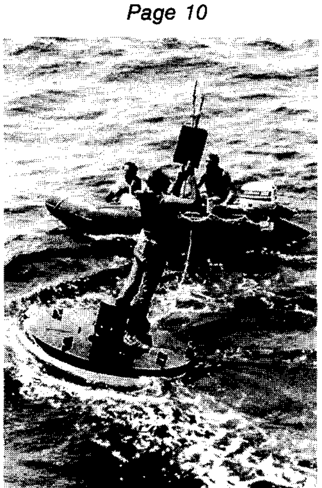

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SOUNDINGS

Meritorious Service Medal

S. R. Foley, Jr., Admiral, U.S. Navy, Commander in Chief / U.S. Pacific Fleet, presented the following Presidential Citation: The President of the United States presents the Meritorious Service Medal to Thomas H. Christensen, Lieutenant Commander, Civil Engineer Corps, United States Navy for outstanding meritorious service as Officer in Charge, Underwater Construction Team TWO from August 1980 through September 1982. LCDR CHRISTENSEN distinguished himself through exceptional leadership, keen personal involvement and engineering applications while successfully completing the Team's two most technically challenging and diverse deployment cycles. His foresight, planning and superb engineering abilities led to realignment of departments, innovative design, implementation of a more serviceable surface supported diving system and improved response to Fleet construction diving requirements. His exceptional management abilities and innovation were key factors in efficient administration, logistical control and execution of complex work scheduling at over 20 deployed sites. Under his leadership a dramatic increase in diver bottom time, number of dives and culmination of more work in place than ever before by a Underwater Construction Team in a similar period were achieved. LCDR CHRISTENSEN's professionalism and devotion to duty reflected great credit upon himself and were in keeping with the highest traditions of the United States Naval Service.

Navy Achievement Medal

LCDR Kirk Boyd was awarded the Naval Achievement Medal for his work as the SEVENTHFLT Diving and Salvage Officer responsible for the salvage of the USNS CHAUVENET (see page 28). LCDR Boyd acted as the SEVENTHFLT Representative on-scene. He was in constant communication with the Commander Task Force SEVENTY-THREE staff. LCDR Boyd's expertise and support were essential to the success of this difficult operation.

UCT TWO DIVING STATISTICS 1982

NO. OF DIVES	LOCATION	BOTTOM TIME (MIN.)	DECOMPRESSION DIVES
34	POOL QUALS (S.D.)	264	
16	ANTARCTICA	330	
36	PMRF PRE-DEPLOYMENT	970	
108	OKINAWA	16,592	
199	DIEGO GARCIA	2,433	
402	BARKING SANDS	20,056	44 (949 MIN.)
14	ARCTIC WEST	472	
419	SAN DIEGO DEPERM	28,601	46 (230 MIN.)
204	SUBIC	20,974	
69	SAN DIEGO MOORINGS	2,782	
40	SEAL BEACH/LONG BEACH	1,624	
50	ALAMEDA	4,890	
404	PEARL HARBOR	16,189	
1995	TOTALS	117,177 MINUTES OR 1,953 HOURS	

NEDU Personnel Changes

LT Kevin Wright, RN, relieved LCDR Stuart Harper as the British Royal Navy Diving Exchange Officer. Prior to his assignment to NEDU, LT Wright was assigned to HMS VERNON's Saturation Diving School. His previous naval experience includes a tour aboard HMS BRONNINGTON, a mine hunter, as Mine Hunter Director and Mine Warfare Clearance Diving Officer. LT Wright will assume duties as NEDU's Operations Officer and Training Officer. LCDR Harper returns to HMS CHALLENGER, the Royal Navy's new SEA BED OPERATIONS (SBO) vessel, as Operations Officer.

CDR BORNHOLDT RETIRES

In a brief ceremony 27 August 1982, Commander Robert A. Bornholdt, NEDU's 4th Commanding Officer, was ceremoniously piped over the side by the Officers and Men of NEDU who had served him during his two-year plus tour.

Commander Bornholdt assumed the duties as Commanding Officer of the Navy Experimental Diving Unit in June 1980. He is a graduate of the United States Merchant Marine Academy at Kings Point, New York and attended the Navy Postgraduate School at Monterey, California in 1971, graduating a Master of Science in Mechanical Engineering. He has served aboard five merchant vessels prior to his commissioning in 1961.

CDR Bornholdt has a distinguished naval career, including service as an aquanaut for the SEALAB III Man-in-the-Sea mission, Repair Officer and Diving and Salvage Officer at the Naval Ship Repair Facility, Guam, and at the Pearl Harbor Naval Shipyard. He also served on the Staff of COMMANDER NAVAL SURFACE FORCE, U.S. PACIFIC FLEET, San Diego, California.

CDR Bornholdt's service awards include: the MERITORIOUS SERVICE MEDAL, the NAVY UNIT COMMENDATION, the MERITORIOUS UNIT COMMENDATION, the NATIONAL DEFENSE MEDAL, the HUMANITARIAN SERVICE MEDAL, the ARMED FORCES EXPEDITIONARY MEDAL, the NAVY EXPEDITIONARY MEDAL and the REPUBLIC OF VIETNAM SERVICE MEDAL.

CAPT Maynard R. Weyers

CAPT Edward Lyon

Captain Weyers New Commander of Naval Special Warfare Group Two at Little Creek

CAPT Maynard R. Weyers relieved CAPT Edward Lyon as CDR, Naval Special Warfare Group TWO at the Naval Amphibious Base July 30, 1982. The featured speaker for the change of command ceremony was VADM J.D. Johnson, Commander Naval Surface Force, Atlantic. Members of the Navy Parachute Team East, "The Chuting Stars," participated.

Naval Special Warfare Group TWO with a permanent duty station at Naval Amphibious Base, Little Creek, Norfolk, Virginia is assigned to the administrative command of Commander Naval Surface Force, U.S. Atlantic Fleet.

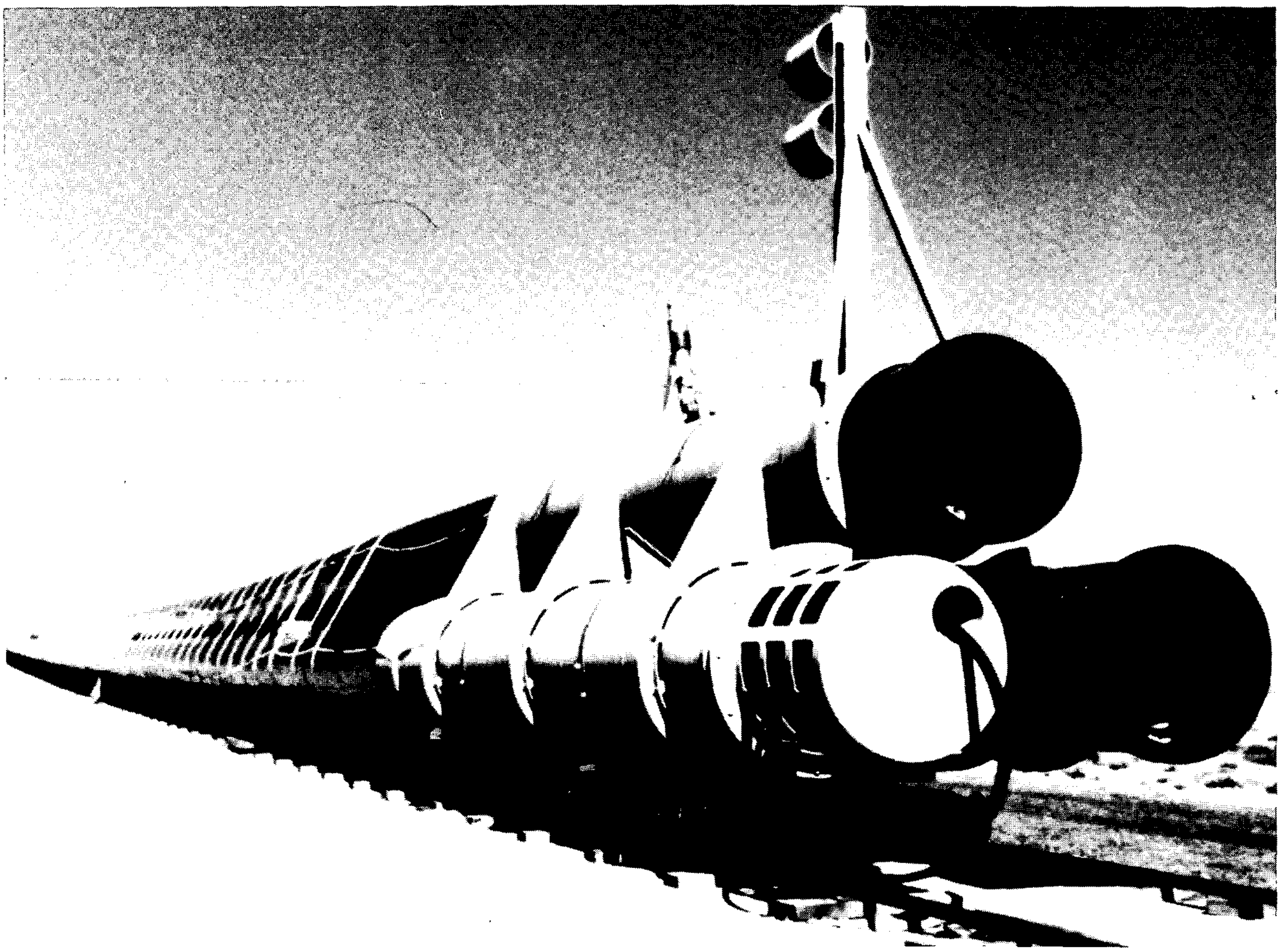
Subordinate commands/units administered by Commander, Naval Special Warfare Group TWO are:

Underwater Demolition Team TWENTY-ONE; SEA-AIR-LAND (SEAL) Team TWO; Underwater Demolition Team TWENTY-TWO; Special Boat Squadron TWO; Naval Special Warfare Unit TWO; and Naval Special Warfare Group TWO Detachment, Caribbean.

Captain Weyers, a graduate of Wartburg College in Waverly, Iowa, assumed his new command after serving two years as head of the Naval Special Warfare Branch, Office of the Chief of Naval Operations. Since beginning his naval career in 1959, CAPT Weyers has served in Vietnam, Korea, had command of UDT-11, participated in the Suez Canal Clearance Operation and has served on the staff of the Joint Chiefs.

CAPT Lyon, a graduate of Pennsylvania State University, becomes the Deputy Commander for Operations for the Commander, Joint Special Operations Support Element, McGill AFB, Florida. Since beginning his naval career in 1958, he has served in Vietnam, the Philippines, England, Washington, D.C., commanded Seal Team TWO and UDT-21 and graduated from the U.S. Army War College in 1977.

Record Recovery –



Lower end steel strainer before launch.

By LCDR Gary Tettelbach
NAVSEA OOC-21H
SUPSALV, Operations Officer

LCDR R. J. Ventgen
CO, USS CONSERVER (ARS-39)

In early June the National Oceanographic and Atmospheric Agency (NOAA) asked the Navy for assistance in recovering a large section of pipe in deep water off the island of Hawaii. The first two questions asked were, "How large is large?" and "How deep is deep?" The answers were a bundle of three pipes, each 4 feet in diameter, strapped together and 2250 feet long, moored 1000 feet below the surface in 4500 feet of water. The Department of Energy (DOE) sponsored the Ocean Thermal Energy Conversion (OTEC) project. It was suspended and the surface platform was removed to Oahu for storage. However, the deep-water suction pipe known simply as the Cold Water Pipe (CWP) was abandoned in place.

OTEC used the temperature difference between the cold deep ocean water and the warm surface water to produce electrical energy. Although the project was quite successful, DOE had to abandon the

2250 feet of Cold Water Pipe

pipe when its budget was cut. Because the pipe was considered a potential navigational hazard, and because the State of Hawaii wanted to use the million dollar pipe for an operational power plant, NOAA, acting as the DOE agent for Ocean Engineering matters, asked for Navy aid in the retrieval.

The pipe, consisting of 2250 feet of polyethylene, is a tough plastic that floats in salt water, with a 57,000-pound steel strainer assembly at the lower end. It has an 18 foot in diameter, 10-foot high, buoyancy collar of syntactic foam at the upper end with a lower steel transition section connecting the pipe bundle to the pipe mooring. This entire buoyant mass was anchored by 1 3/8-inch wire rope, 1 1/2-inch chain and a 50-ton mass weight anchor. When the CWP was operational, it was suspended from the moon pool of a ship moored to a subsurface buoy anchored in 4500 feet of water by a 150-ton mass anchor. When abandoned in April 1981, the pipe configuration was as shown in Figure 1: held by a subsurface buoy and connected by 3000 feet of 16-inch nylon line. The pipe and mooring system was located approximately 20 miles west of Kawaihae Harbor, Hawaii.

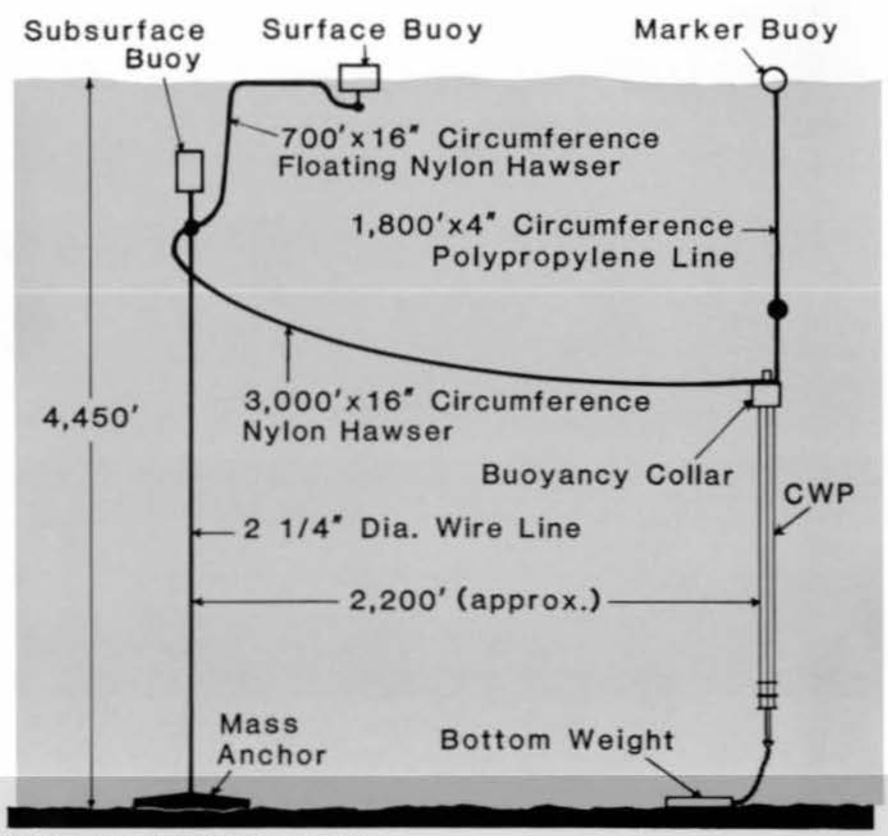
In July 1982, a planning conference was held in San Diego to determine the feasibility of the CWP salvage job and to develop a preliminary plan. Two units, USS CONSERVER (ARS-39) and Deep Submersible Vehicle (DSV) TURTLE, were assigned to conduct the recovery. Later in July, the USS CONSERVER (ARS-39), home ported in Pearl Harbor, Hawaii, and commanded by LCDR R. J. Ventgen, did a survey of the area where the CWP was located and completed the final draft of the salvage plan. Some observers would have said it couldn't be done. The salvage job at 4500 feet and the tow of 2250 feet in length is believed to be a record.

The basic plan was to have TURTLE cut the anchor chain and release the CWP to float to the surface, lift the pipe to a horizontal position and then have CONSERVER tow it into port. Determining how to execute this took two months of planning, research and plain old hard work.

The first job was to convert a brand new barge, YC 1525, which had just arrived at Mobile Diving and Salvage Unit One into a lift barge capable of bringing the weighted end of the CWP to the surface. The barge was equipped with a skagit winch that has a 300,000 pound pull, a four-fold purchase ram tensioner, a 100 ton A-frame and has lifting/auxiliary equipment modifying the YC 1525 to provide sufficient lifting force to raise the lower transition piece of the CWP from 2200 feet to the surface in a sea state three.

Secondly, a method had to be developed so that the DSV TURTLE, under the command of LCDR Don Norris (OIC) could cut the anchor chain at 4500 feet to allow the CWP to float to the surface. DSV

Figure 1. Location of CWP subsequent to 13 April 1981 release.



CWP is due east of mass anchor

TURTLE is attached to Submarine Development Group ONE, San Diego. Thirdly, the attachment to lift the lower end of the CWP had to be figured out.

The design of a lift barge that would be able to raise the massive lower end of the pipe in the open ocean required special equipment. Fortunately, the Ocean Energy Converter, the ship used to deploy and operate the OTEC project, was moored at the Inactive Reserve Fleet at Pearl Harbor. Pearl Harbor Naval Shipyard did the modification of the barge using equipment left on-board. This equipment included a skagit double drum waterfall winch, capable of lifting 300,000 pounds with two 2 1/4-inch IWRC wire ropes, six 4 foot in diameter sheaves for the 2-inch wire rope, a large A-frame and four devices called Regan latches. The static lift could be made with this equipment by reinforcing the barge deck.

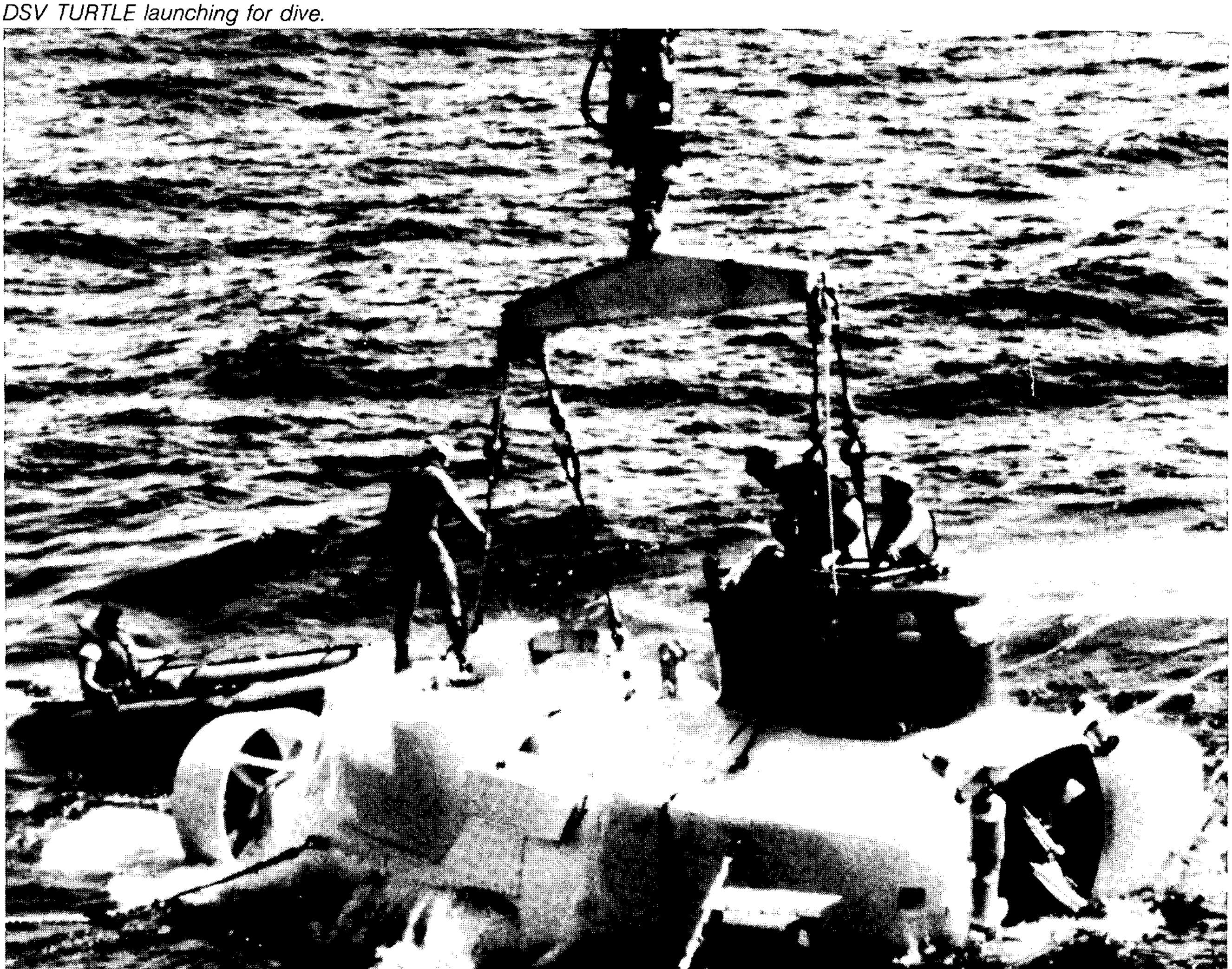
To compensate for the shock or snap loading of the wire while lifting in any kind of seaway, the Naval Civil Engineering Laboratory at Port Hueneme sent out a device called a ram tensioner. This is the same pneumatic tensioner used for highlining and underway replenishment, but modified for use in heavy lift systems. The rigging arrangement required one more piece of equipment, a deck edge roller and sheaves.

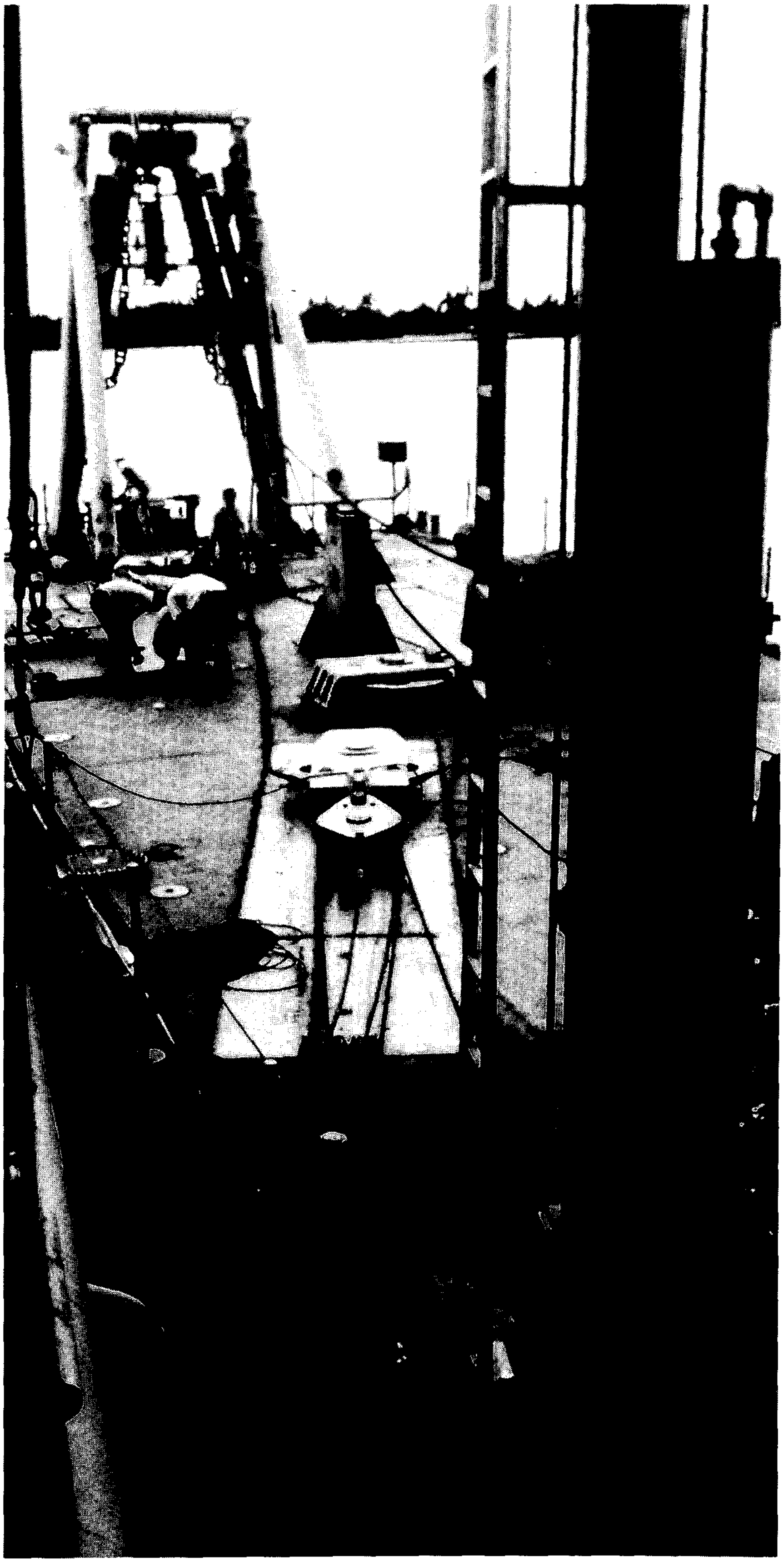
The USS BRUNSWICK was going into overhaul so her stern roller and keepers were mounted on the bow of the barge. YC 1525 was outfitted with air compressors, a generator, Clyde winch, lights and a few tons of lead in the stern to compensate for the lifting moment at the bow A-frame.

While the barge was being designed and constructed, TURTLE was trying to refine and test pyronol torches, a method of cutting the anchor chain at depth. These torches are attached to the chain where the cut is to be made and then fired acoustically once the submersible is safely on the surface. In an untethered manned submersible, safety is paramount, so cutting a chain under load had to be done remotely.

How to hook on to the lower end of the CWP for the lift was a matter of great debate, until some research was done into the Regan latches found on the Ocean Energy Converter. The latches are quick release and attachment tools used on offshore oil rigs for lowering and retrieving large loads. They were also used to lower the CWP when it was launched. Manuals were ob-

DSV TURTLE launching for dive.




YC 1525 lift barge looking forward. A-frame and moving sheave with ram tensioner at right.

tained and technical representatives called out. When the drawings were studied, several Regan latch attachments were shown on the lower end of the CWP, just the right place from which to lift.

Prior to the completion of any of the three planning steps, DSV TURTLE was tasked to do a complete survey of the CWP to determine its condition after more than a year in that depth of water.

This task proved to be more difficult than expected. The weather turned sour and TURTLE not only couldn't find the CWP but was damaged while being recovered after its first dive. While TURTLE was being repaired, CONSERVER went to the site and with a grapnel hooked the 16-inch nylon line. She then put a buoy on a pendant to mark the location of the subsurface buoy, hooked the 16-inch nylon line and located the subsurface buoy. USS CONSERVER then attached a crown buoy to mark the location of the submerged mooring line. Upon return of DSV TURTLE, the search and salvage area was quickly located by proceeding to the crown buoy which served as a visual aid. Three men searched at depths of 4500 feet, inside a sphere 79 inches in diameter packed with electronics, where the temperature is 95° and the humidity is 85 percent. On the third dive, the enormous pipe standing erect on the bottom loomed out of the darkness.

Two more eight-hour dives and the survey was completed. Over 600 still photographs and four hours of video were shot. The survey revealed two surprises. First, the pipe was standing on the bottom and probably was not buoyant enough to float to the surface. Second, the most accessible Regan attachment at the lower end had somehow broken off making a lift attachment more difficult.

On 1 October, USS CONSERVER sailed for the Island of Hawaii with the completed lift barge, YC 1525, in tow. On 2 October, CONSERVER's OIC called his forces together for a final brief to discuss the salvage plan. TURTLE was directed to set the pyronol torches on 3 October, and be ready to fire them and cut the chain at first light 4 October.

At dawn on 4 October, the Navy began bringing the pipe to the surface, Phase I. The cutters were fired, with all ships at a safe stand-off distance, to ensure that if the pipe did rise to the surface it wouldn't impale any of the hulls. The pipe didn't surface.

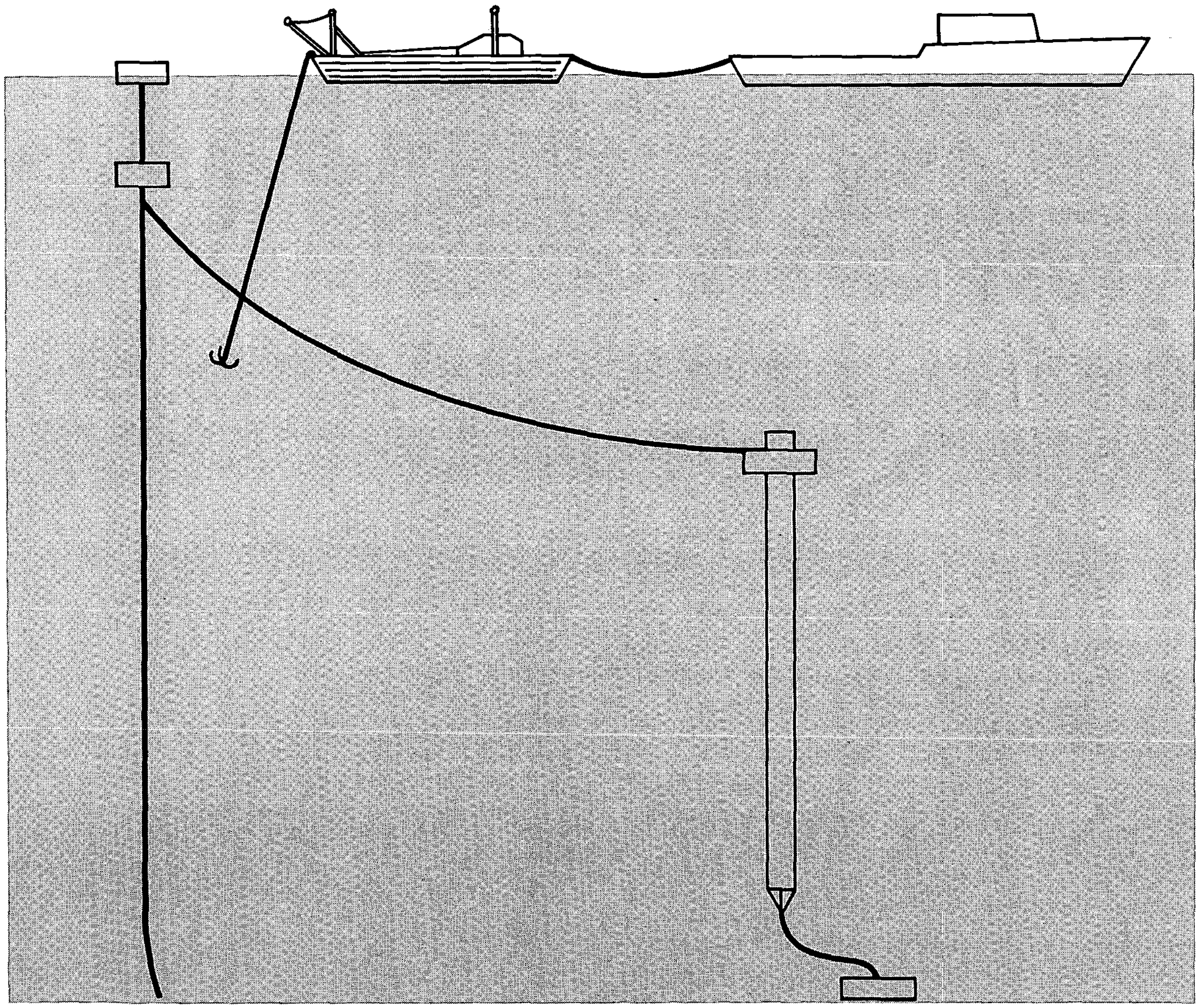
CONSERVER then towed the lift barge with the grapnel hook suspended at a depth of 1200 feet over the site and pulled up the 16-inch nylon. The plan was to have CONSERVER pull the barge away from the subsurface buoy and, as the 16-inch nylon line rendered over the grapnel hook, the pipe would be pulled to the surface. With 56,000 pounds of tension and CONSERVER DIW everyone knew something was wrong. Pulling was stopped and the hook was replaced with a shackle to ensure that the line wasn't binding. More pulling confirmed that the pipe was still anchored.

Early morning on 5 October, TURTLE entered the water to inspect the pipe and determine the problem. The torch had cut through about 95 percent of the chain link and pulling should have broken the rest, but somehow, some of the chain closer to the pipe, had wrapped around a seamount. Due to the fouling of the mooring chain, CONSERVER decided to have TURTLE cut the 1 3/8-inch wire cables that held the pipe to the anchor chain. This was not done earlier because the fishplate connecting the wire ropes to the chain was a good attachment point to lift the lower end of the pipe and might be needed later.

At noon 6 October, TURTLE finished cutting the last cable and CONSERVER took the barge in tow again. With 60,000 pounds of pull, the 16-inch nylon rendered over the shackle on the barge lift wire until at 1715 the OTEC CWP broke the surface.

Through the night CONSERVER gradually reduced strain on the tow wire. This required great care to keep the pipe from going under the barge and holing it, or having the

USS CONSERVER and barge grappling for 16" nylon line.



USS CONSERVER (ARS-39) with sample section of pipe in foreground.

line render back again and resulting in sinking of the CWP. By dawn on 7 October the Navy was ready to begin Phase II.

Phase II of the salvage plan was to tow the pipe to the most shallow water possible for grounding. Then with the lower end stationary, TURTLE could make an attachment for lift or if shallow enough divers could work on it. It was decided to tow the pipe directly behind CONSERVER and not tow the barge with the pipe suspended on the barge lift wire because the bridle of the barge was too weak to allow CONSERVER to exert maximum pull.

Passing the CWP from the barge to CONSERVER was no small feat, considering the consequences of dropping it. The pipe had about 400 pounds of positive buoyancy if all the lines were removed. The weight of one person or a mooring line on top caused the pipe to come very close to sinking. Due to the small margin of positive buoyancy, any slight error in line handling may have resulted in submergence and subsequent loss of the CWP. As the lines were passed and the barge released the CWP, the top slowly slipped beneath the surface.

After a few anxious moments, it bobbed back up and CONSERVER secured it to her port side. For the tow, CONSERVER hooked on to the very top of the pipe where there was a Regan latch attachment. With 1200 feet of wire out and 78,000 pounds registered on the towing machine, CONSERVER was making 2.5 knots toward the beach. CONSERVER finally anchored in 40 feet of water when she could get no closer to shore. The lower end of the pipe rested at 90 feet, air diving depth.

Phase III began the morning of 8 October, as the barge was positioned over the lower end of the pipe. Divers shackled the lift wire into a padeye on the steel strainer assembly of the pipe. The winch hardly strained as the 57,000-pound weight came to the surface. CONSERVER proceeded, with her tow over 1/2 mile in length, to enter Kawaihae Harbor. By the morning of 10 October, the OTEC CWP was peacefully moored adjacent to the breakwater inside Kawaihae Harbor.

UCT-2 Installs Deperming Range

By Keith R. Cooper
Chesapeake Division
NAVFAC

BUCS (DV) Donald R. Bishop
UCT TWO

The SEABEE divers of Underwater Construction Team Two completed the challenging installation of a magnetic treatment and measurement system (MTMS) at the Magnetic Silencing Facility, Naval Station, San Diego. The installation, at Point Loma, required the removal of the existing facility prior to installation of a new 810′ x 220′ sensor garden designed by the Ocean Engineering and Construction Project Office (FPO-1) of Chesapeake Division, Naval Facilities Engineering Command.

The existing facility consisted of magnetometer sensors placed into a series of copper and fiberglass instrument tubes which were aligned into a north-south and east-west axis. Each sensor signal cable was routed across the bottom to a pier mounted junction box. A site inspection disclosed that previously abandoned sensor cables littered the bottom. After removing each existing sensor, SCUBA equipped divers removed the instrument tubes by placing a nylon choker around the exposed tube section and pulling the tube out using a barge mounted 5-ton hydraulic crane. Individual instrument cables were cut at the tube and junction box then removed from the bottom. In several cases, cables were piled in tight bundles on the bottom and were removed using the crane.

UCT-2 diver guides fiberglass instrument tube into jetting stand.

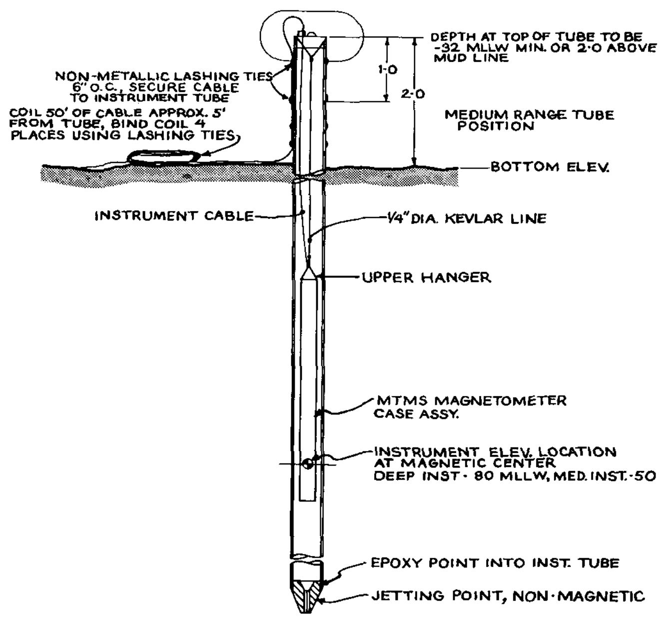
The design parameters of the new installation required the instrument tubes to be installed with an accuracy ± 1.0 foot from the design location and axis line and a verticality tolerance of ± 3°. The position of the existing garden was established using a survey spar. The neutrally buoyant 40-foot long aluminum spar was held on the bottom position by the divers and moved to a plumb position by the topside crew. The top of the spar was surveyed by triangulation sightings from three transit positions located at survey monuments set by PWC, San Diego.

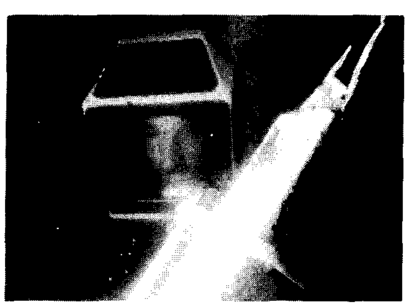
To establish an accurate line for each axis, 3200-pound clumps were surveyed into position and placed at the end of each axis. The survey spar was again used to accurately position each clump. An 850-foot long, 3/16-inch diameter survey wire, premeasured for each tube position, was placed between the clumps and tensioned to 2000 pounds. Using the survey wire positions as a guide, steel pipe stakes were placed into the bottom for each tube installation position.

Filament wound fiberglass instrument tubes (6 ½-inch diameter, 53-feet or 21-feet long) *were jetted to the bottom by using a diver adjustable leveling frame type jetting stand (See Figure 1). The 1200 pound steel frame consisted of a 10-foot* triangular base with diver-operated hydraulically adjustable legs used to level the stand and two center pipes through which the fiberglass tube was passed during jetting operations. The two center pipes permitted side-by-side tubes for adjacent magnetometers.

The instrument tube installation began with a MK12 diver directing placement of the jetting stand. Using a communication loop with the crane operator and diver supervisor, the jetting stand was accurately located over the survey stake and lowered to the bottom. The diver then actuated each leg of the stand in order to bring the center pipe to a vertical position. The instrument tube was prepared on the surface by installing a 35-foot long, 1300-pound steel jetting mandrel into the tube. The mandrel was equipped with a steel jetting point and a 4-inch fire hose connected to a 180 psig/600 GPM pump. The assembled mandrel and tube were picked up by the crane, directed into the stand pipe by the diver, then jetted into the bottom. The diver directed crane operations and monitored the progress of the jetting until the top of the tube was installed to an acceptable elevation. A total of 73 instrument tubes (33 each - 54-feet long, 37 each - 23-feet long and 3 - 40-feet long) were installed.

Figure 1. Instrument Tube Assembly.





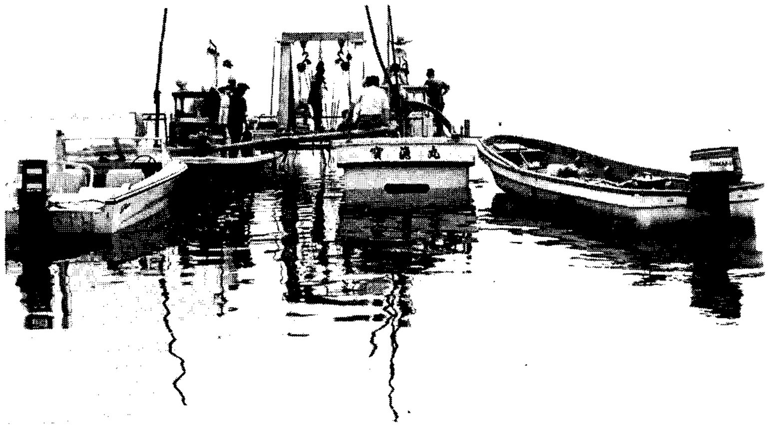
UCT-2 diver adjusts jetting stand leveling legs.

The elevation of each tube was surveyed using a surface transit to sight the spar with a leveling rod. Vertical accuracy of each tube was checked using an electronic logging instrument placed into each tube.

Magnetometer sensors for each tube were assembled with Kevlar suspension lines, instrument tube covers and signal cables then electrically tested prior to the diver installation of each unit. Sensor cables were then placed along specific cable routes to the pier structure where they were run to the surface through PVC conduit for protection. Sensor cables were connected at pier junction boxes to cables connected to a computerized signal processing system at the deperming house.

The four and one-half month project was completed on schedule to allow range support personnel to conduct acceptance tests prior to scheduled fleet support operations. During the project, UCT-2 divers completed 380 dives with a total bottom time of over 438 hours. Using MK12, nearly 300 hours of bottom time were logged during 208 dives.

The project successfully demonstrated feasibility of using a diver-oriented system to accurately install a range system to demanding tolerances and to maintain the quality control required of the project design. The knowledge realized from this project will benefit future facility installations.



MISAWA

Navy Divers Assist in Recovery of F-84 Thunderjet at NAF Misawa, Japan

By JO2 Melissa M. Lefler
PAO/NAF, Misawa

From 60 feet below Lake Ogawara's surface, Navy divers unearthed from entrapping mud pieces of a jigsaw puzzle that had tantalized and baffled local Japanese fishermen, the U.S. Air Force and amateur scuba divers for more than 25 years. They found a fighter jet that had disappeared more than 25 years ago into the northeastern tip of Japan's main island of Honshu, barely five miles from the Pacific coast which borders the U.S. Air Force's Misawa Air Base.

For years, local fishermen had complained of tearing their nets on what was thought to be submerged logs, but rumored to be a jet that had crashed into the lake in the mid-1950's. In 1981, investigative dives by Japanese military determined that object was an Air Force F-84 Thunderjet fighter bomber. This possibility was confirmed by records showing that F-84 squadrons were, in fact, based at Misawa from 1951 through 1959.

"One reason the wreckage has been hard to identify is that records were not kept as carefully years ago as they are now," said 1st LT Susan L. Hankey, Misawa AB Public Affairs Officer, who added that many old records are lost. The findings of the Japanese divers were con-

Top: Divers from Ship Repair Facility, Yokosuka, Japan, set up the salvage apparatus.

Bottom: SCPO Richard A. Booth hooks the tow rope to the winch that hoisted the wreckage. (U.S. Air Force photos by Airman 1st Class Carl Beevers.)

firmed by evidence that the plane may have gone down 9 September 1954, when 1st LT Roderick Griffin crashed his plane into the lake. MSGT Ross Graham, Base Historian, noted Griffin survived the crash after being pulled out of the lake by a helicopter. "I'm 99 percent sure it was this F-84G that was pulled onto Misawa's beach 20 August," said Graham.

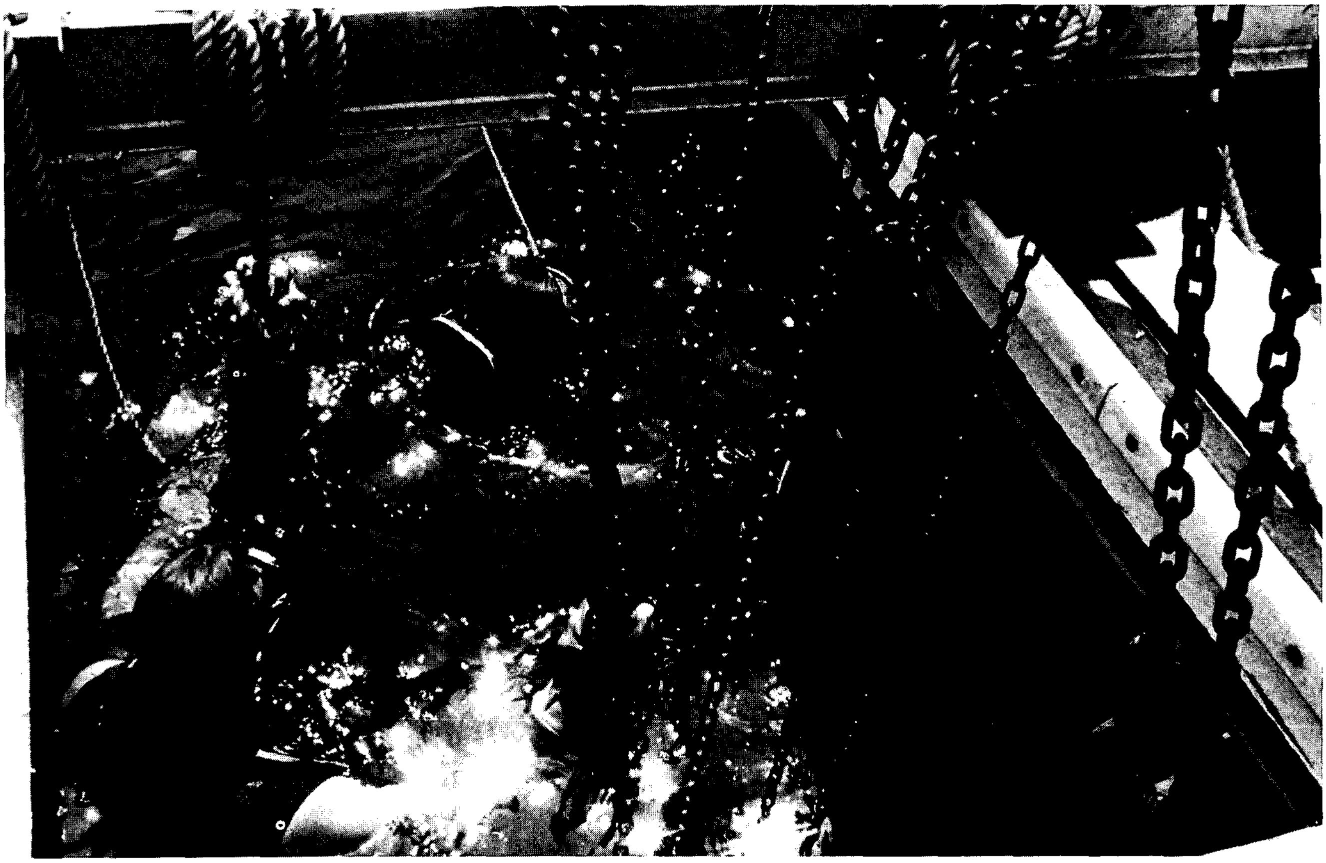
The recovery of the F-84 thunderjet was carried out in two phases. A team of five Navy divers and three Japanese divers employed by the Ship Repair Facility, Yokosuka, Japan, made a preliminary dive in June, returning 16 August to salvage the wrecked aircraft.

After three days of survey work, including six to seven hours of diving, LT Edward M. Kruk, Team Diving Officer, commented that the job offered some interesting challenges. "It was a real mess down there," commented Kruk. "The metal was chewed up; things were buried in the mud and difficult to see. About 40,000 pounds of fishnet and other debris on the plane would have to be cut away with knives and wire cutters. The boats available for our diving platform were small. Since the lake is landlocked, it was impossible to get a larger boat with more lift capability, so we knew a special apparatus would have to be constructed."

One key problem was the lake's water temperature, which rarely rises above 55°, even in August. On the surface, the water is relatively warm, but below 15 feet, it rapidly becomes much colder. Visibility on the lake's bottom seldom exceeded 5 feet, although the survey divers carried powerful lanterns. At times it was no more than a foot visibility.

Anticipating recovery problems, three days were spent at SRF

PO1 Timothy O'Rourke, left, diving team corpsman, and SCPO Richard A. Booth, cut away the net and seaweed collected on the fuselage. (U.S. Air Force photo by Airman 1st Class Carl Beevers.)



Two divers from Ship Repair Facility, Yokosuka, Japan, enter the water beneath the chain fall rig.

LT Edward M. Kruk, Diving Officer, Ship Repair Facility, Yokosuka, Japan, inspects the chain fall used to haul up the biggest pieces of the wreckage. (U.S. Air Force photos by Airman 1st Class Carl Beevers.)

Yokosuka constructing an A-frame to be assembled on the lake. Kruk designed it using two fishing boats shaped like canoes, 30-feet long by 5-feet wide. These were locked together with an A-frame construction, made of 12-inch aluminum. It resembled a twin hull catamaran. A 10-ton chain fall was suspended from the A-frame and two 5-ton falls were also used.

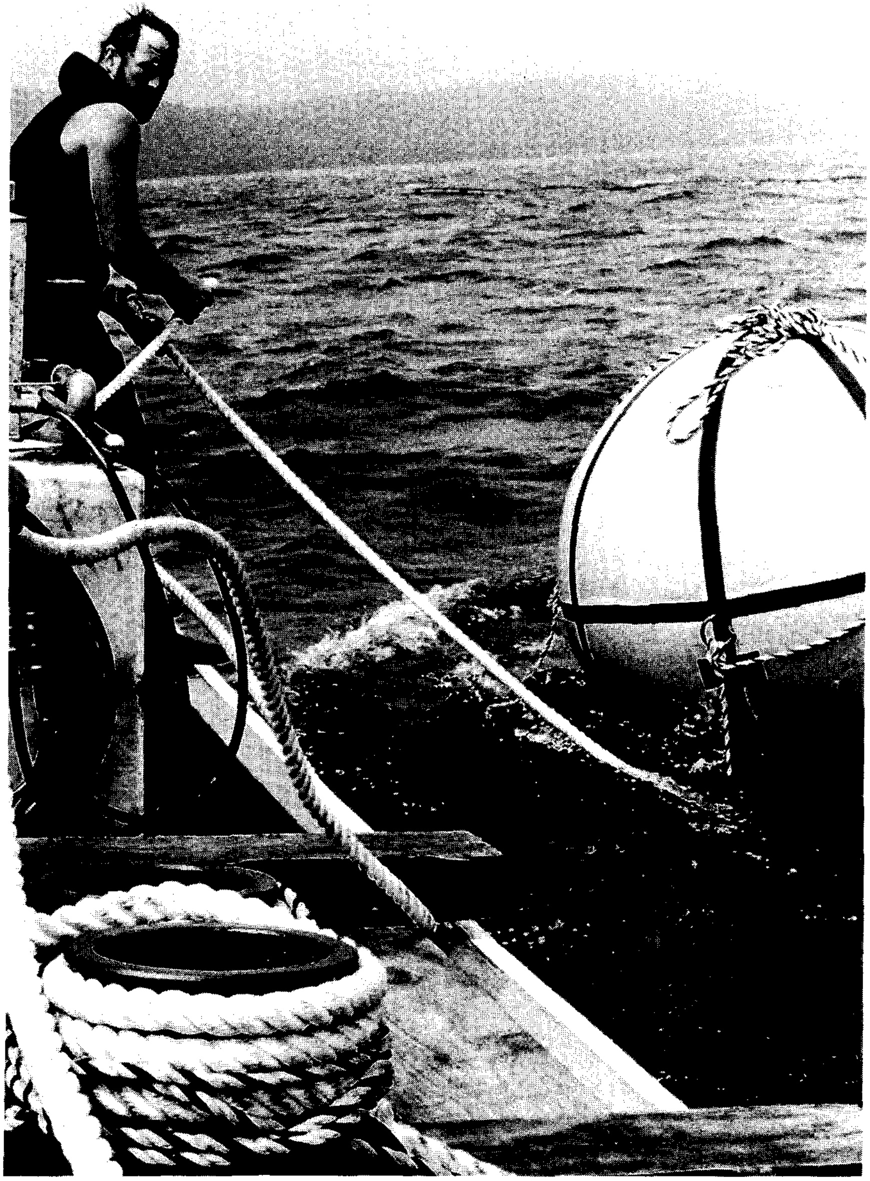
The team returned a month and a half after the survey, the time thought to be optimum for the recovery effort. The team got underway at 0400 to be at the job site by 0500. The divers had to complete work by 1000 or 1100 because of the strong winds. Divers went down on the chain fall, which was to lift the fuselage.

Difficulties were many! There were a couple of mornings when heavy fog prevented diving because of zero visibility. The boat went aground once because of the poor visibility and communication problems between the Navy divers and the two Japanese fishermen who were guides.

When the salvage work began, the divers were unable to lift the plane intact, although several complete sections were raised. White air bags or salvage balloons, about 6 feet in diameter, brought up many broken-off pieces. The balloon has slightly more than one-ton capacity from a depth of 60 feet, when attached to underwater cargo nets which cradle the wreckage underneath.

After three days of diving, the engine and main fuselage were still on the bottom. Together, they weighed two and one-half to three tons; too much for lift bags.

A 3 a.m. start 20 August enabled the diving team to take advantage of calm early morning waters. The



SCPO Richard A. Booth, EOD, Ship Repair Facility, Yokosuka, Japan, brings in the salvage balloon with wreckage suspended underneath. (U.S. Air Force photo by JO2 Melissa Lefler.)

6-foot-high aluminum A-frame, designed by Kruk, was rigged between two boats.

MRCM(DV) Marvin Markham suggested, for future recovery efforts similar to this one, that lift bags should be attached to take the strain off the chain fall. If the wire straps are broken, the wreck could be found by lifting the balloons.

Once the chain fall had brought the fuselage and engine to the surface, the wreckage was towed into the Misawa Air Force Base beach, seven miles away. The boats, held together by the A-frame, traveled to shore no faster than 2 ½ to 3 ½ knots, awash of the stench of thousands of decaying barnacles.

When the divers returned to the site for a final underwater sweep where the wreckage had lodged, they found another wing. "When we pulled the fuselage out, it left a huge hole on the bottom. The remaining wing must have been uncovered then," Kruk related. So the last diving day, which began as a routine clean and check operation, became another day of salvage work.

Noting that the diving officer's primary on-site role is that of safety observer, Kruk stated, "When the wreck was on the surface the day before, I couldn't send anyone down to see what might be left; if the large piece had broken lose and fallen, it would have fallen fast. It just wasn't safe down there."

"Safety was paramount in this operation because the nearest decompression chamber was 600 miles away, in Yokosuka. "Salvage diving is a life-or-death situation," remarked EO2 Robert L. Duran, Jr., team leader. "Our lives depend on each other." Kruk agrees. "All the support a diver needs is on the surface. . . tools, rigging, lines, air. You have to have faith in the people up there taking care of you."

Any myths that salvage diving is an exciting, adventure-filled profession are abruptly dismissed by Kruk. "Salvage diving is dirty, dark, uncomfortable, exhausting and unpredictable," he stated matter-of-factly.

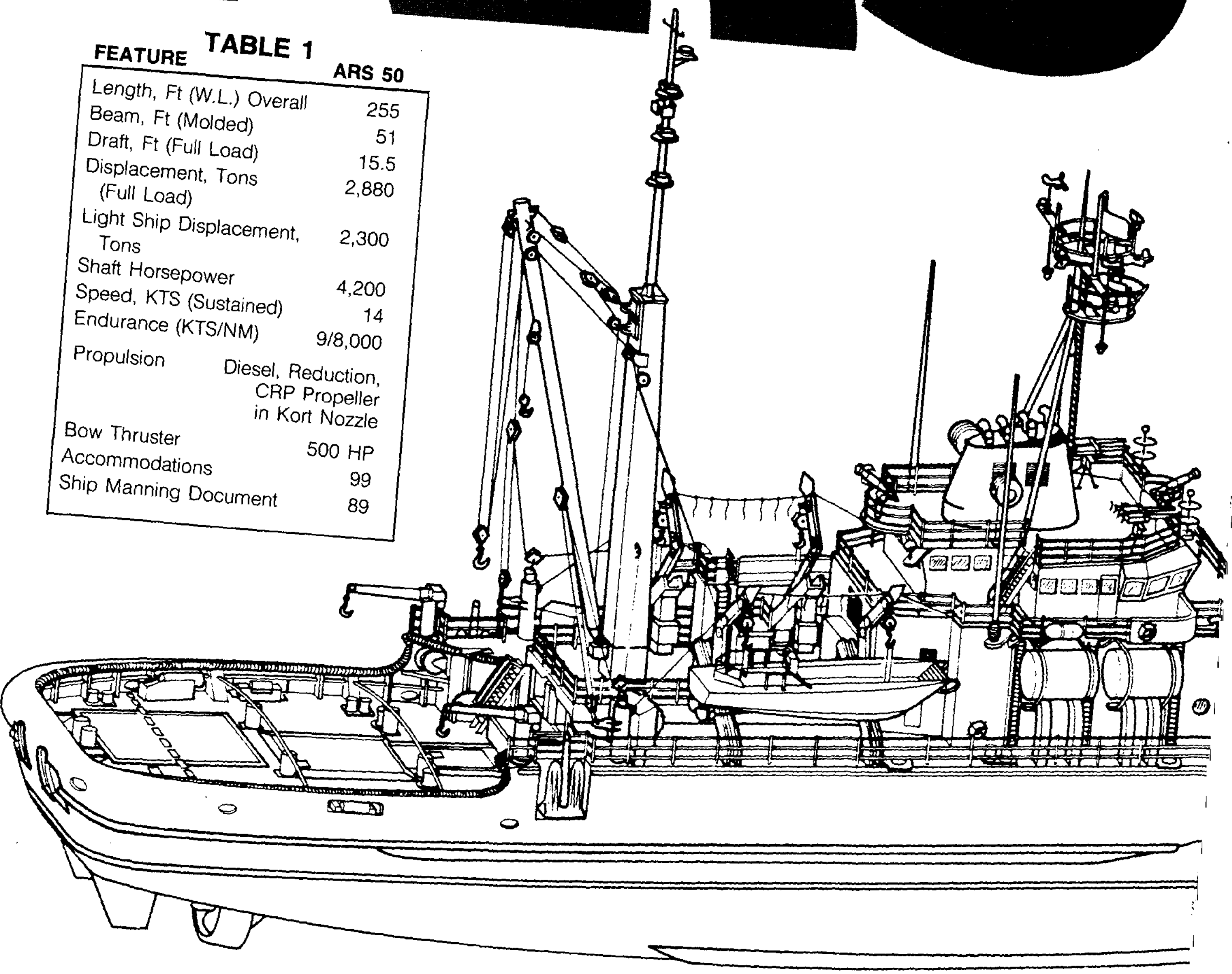
Members of the Diving Team

LT Edward M. Kruk
MRCM(DV) Marvin Markham
PO1 Timothy O'Rourke
EO2 Robert Duran
SCPO Richard A. Booth

ARS

TABLE 1

FEATURE	ARS 50
Length, Ft (W.L.) Overall	255
Beam, Ft (Molded)	51
Draft, Ft (Full Load)	15.5
Displacement, Tons (Full Load)	2,880
Light Ship Displacement, Tons	2,300
Shaft Horsepower	4,200
Speed, KTS (Sustained)	14
Endurance (KTS/NM)	9/8,000
Propulsion	Diesel, Reduction, CRP Propeller in Kort Nozzle
Bow Thruster	500 HP
Accommodations	99
Ship Manning Document	89



Under Con

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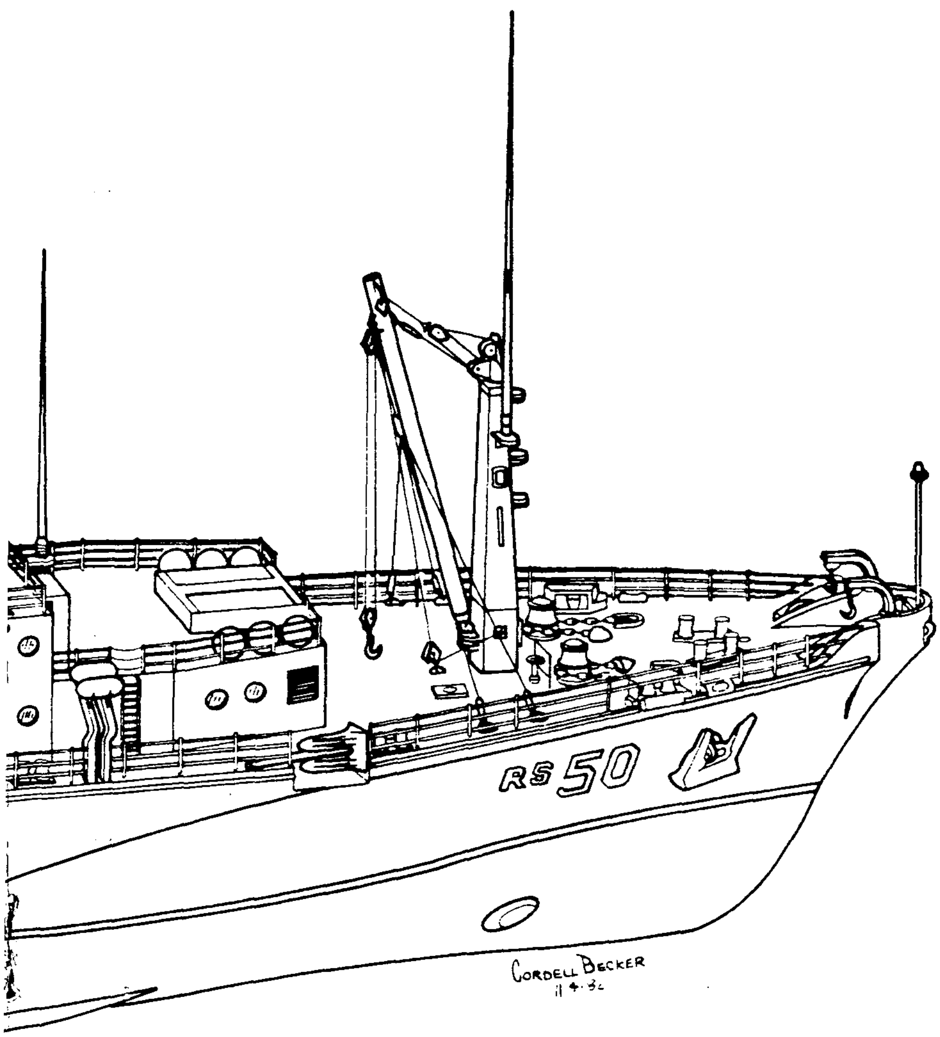
New Workhorse of the Fleet



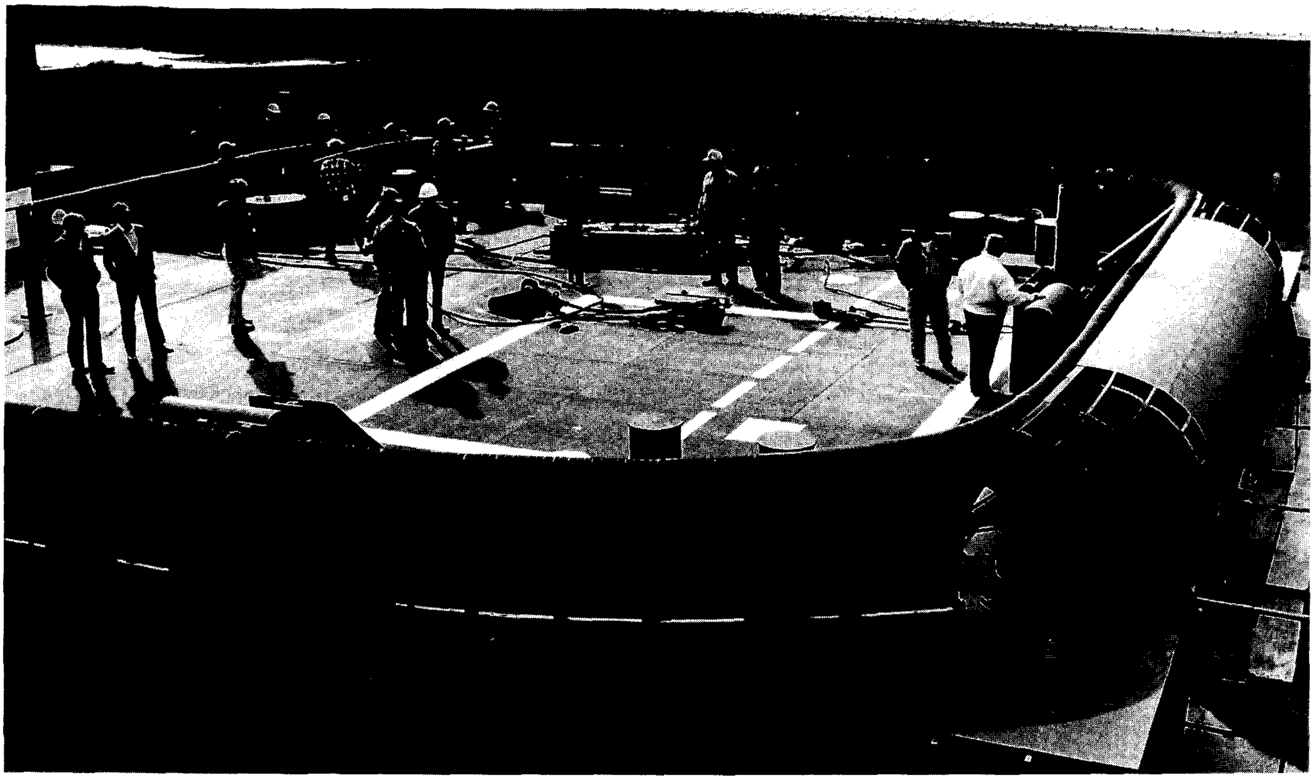
nstruction

By LCDR Ken Smith, Jr.
NAVSEA PMS 383A

A new class of salvage ships is currently under construction in Sturgeon Bay, Wisconsin. The first rescue and salvage ship designed since the ATS in 1964, the ARS-50, will incorporate many features to grapple with its missions: towing, debeaching, air diving, heavy lift and rescue and assistance. The class is currently envisioned to consist of five ships. Four are currently under contract to Peterson Builders, Inc. NAVSEA PMS-383 is serving as project office for this program.

The ship characteristics are listed in Table 1. The main propulsion plant will be combination diesel and diesel (CODAD) with either two or four Caterpillar D-399 engines driving two controllable, reversible pitch propellers in KORT nozzles through reduction gears. This will allow economical cruise at almost 12 knots on two engines and a maximum estimated bollard pull of 131,000 pounds. The ship will develop an estimated towing pull of 90,000 pounds at 8 knots and 65,000 pounds at 10 knots. Fitted with a bow thruster, the ship will be maneuverable at low speeds and can be driven sideways to hold position better during salvage and rescue operations. The electric plant is also powered by CAT D-399 engines and consists of three 750 KW generators.

The towing system on the ship contains many of the best features found on tow ships throughout the world. The towing engine is a two-



Port looking inboard.

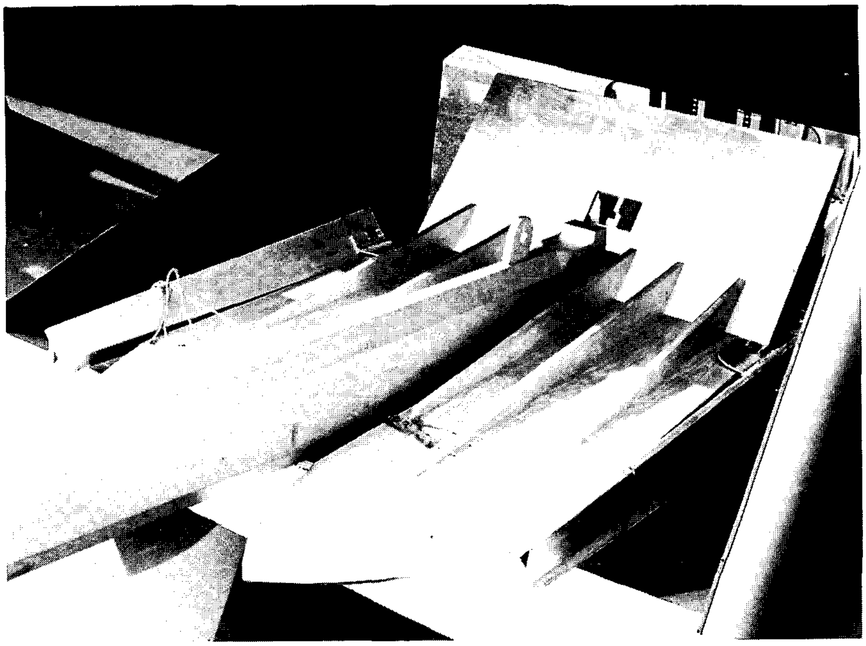
Looking aft: Checking tag line passing through tow rollers in vertical position.

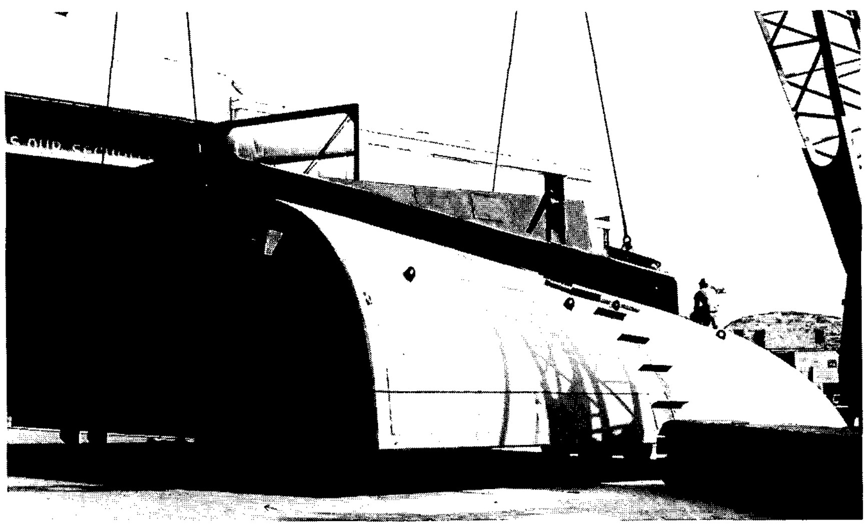
drum Almon Johnson Automatic Towing Machine with a traction winch for nylon or fiber hawsers. The fiber hawsers are tended and fed to the tow machine by power blocks directly from stowage bins, located between the shaft alleys. This minimizes the labor required to set up and break down tow gear. Norman pins, which are hydraulically controlled from the towing control room (COOP), and a lateral control winch pulling a saddle block riding on the tow wire, allow the tow operator to handle or capture the hawser with the fantail unmanned. The Norman pins tilt down when under a heavy strain to prevent the ship from getting into irons.

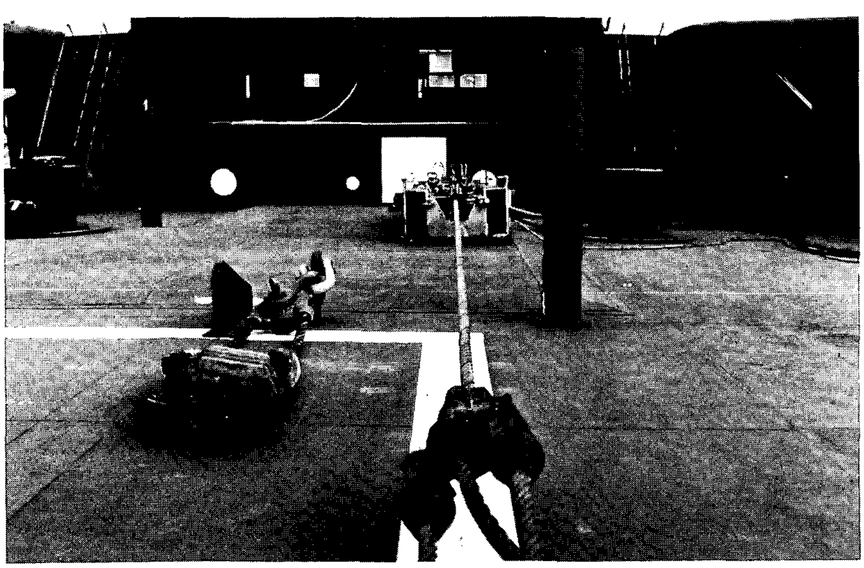
Debeaching and salvage operations are facilitated by fo'c'sle and fantail areas designed as working areas. Detailed mock-ups of the major components in these areas have been modified by the fleet at several reviews; and this process is continuing. The fantail is served by a compensating vang boom capable of lifting 80,000 pounds and plumbing the entire fantail area to well aft of the salvage hold and 27-feet outboard. The 10,000-pound whip on the boom is capable of lifting from a depth of 190 feet. The ship has two stern chutes and four billboards on the 01 level for launching Stato anchors.

The ship carries four beach gear hydraulic pullers and will have hydraulic systems to control the pullers either locally or from the bridge. The fo'c'sle boom, capable of handling 15,000 pounds, when in its normal location will lift the two forward hydraulic pullers from their stowage positions above and aft of the fo'c'sle to their positions for beach gear. The remaining pullers are stowed in the salvage hold. Working areas are increased to handle the wire purchase for pulling on the beach gear. There are two main and two auxiliary bow rollers and two stern rollers to facilitate both debeaching from the bow and heavy lift operations from either the bow or the stern.

Both booms are designed with self compensating vangs. The arrangement and installation of the topping lift and the vangs make it possible to handle the boom with only two winches and to slew the boom using only one winch.







(Top) Port looking aft to C.L. Stato anchor in port anchor pocket.

(Middle) Peterson Builders, Inc., Sturgeon Bay, Wisconsin, ARS-50 Rescue/Salvage Vessels, 30 September 1982. Two major sections of Module 201 for ARS-50 being joined together. (Courtesy of PBI.)

(Bottom) The ARS-50 has a 75-ton heavy lift over the stern rollers using hydraulic pullers. (Courtesy of Steven November.)

The controls for the two jib booms will each be in a small, portable control box on an umbilical and will be operated by a joy stick. One person will be able to grasp all the equipment necessary for controlling the booms, reducing the manning required. The forward boom can be rigged to a position forward of the king post to plumb the bow and can be positioned on each side to maximize lift over the side. Use of free-standing king posts eliminates the stay and use of vang posts raises the vang hardware off the deck in the way of these jib booms. This contributes to the clean working deck forward.

The ship is designed to support air diving to 190 feet. Fitted with a recompression chamber, two diving davits capable of handling either a dive platform or open diving bell, the ARS-50 can quickly rig for diving operations. The davits will be certified prior to delivery and will handle the ascent rates required for air diving through use of a variable speed winch. Primary air is supplied at up to 400 psig at 150 scfm by one of two RIX 2JS2B-300 medium pressure air compressors. Backup air is from high pressure banks charged from a RIX 2JS4B-150 high pressure air compressor providing up to 3000 psig at 90 scfm. A second identical compressor is installed for HP starting air, and provision is made for connection to the diver's air system in the event of an emergency. The two consoles on the fantail can each support three divers.

Questions or comments about the ship should be addressed to LCDR Ken Smith, Jr., USN, PMS-383, Naval Sea Systems Command, Washington, DC 20362.

Buoy-Mounted Transponder Navigation System

By LCDR Richard P. Fiske

A systematic open-ocean search for downed aircraft is one of the most common and toughest problems in Navy salvage today. The key to a good search is the local navigation system.

In a recent European aircraft search, the Mini-Ranger III System with buoy-mounted transponders was used to provide precision local navigation information. Although the Mini-Ranger system has been in use for years with shore-based transponders, this was one of the first Navy open-ocean searches using transponders mounted on buoys. This configuration is necessary in open-ocean areas which are too shallow for a bottom-mounted acoustic navigation system.

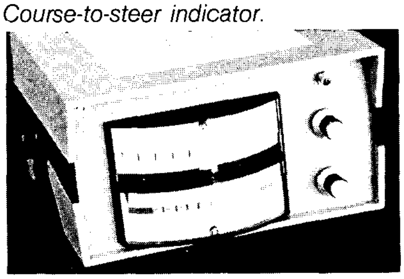
The buoy-mounted transponder system provides the capability to systematically plan a search and has demonstrated repeatable accuracy on the order of a few feet depending upon the area surveyed. It also provides hard copy documentation of searched areas and the capability to identify and cover holidays. Although there were a number of problems with this first search, these were initial-use difficulties and can easily be corrected. The concept is valid and valuable.

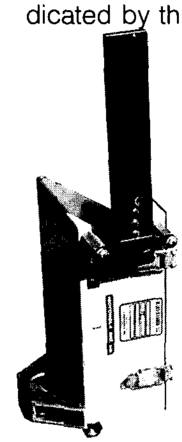
Mini-Ranger III

The Mini-Ranger III uses a shipboard master station and two fixed transponder stations. System components are illustrated at right. The ranges from the master station to the two transponder stations are determined electronically using known transponder locations. These locations are initially entered in the computer which performs the required trigonometry to convert the ranges to coordinates of the ship. A reference XY point is indicated by the computer on each

Buoy on station. Transponder is mounted on top of the mast above the radar reflector. The cable provides power to the transponder from the battery pack in the center of the buoy.

Course-to-steer indicator.





Buoy transponder.

System components. Left — track plotter. Right (top to bottom) — data cassette recorder, range console, computer and terminal.

plotting sheet and must be manually annotated. The X and Y axes are entered and can be oriented as desired. Any scale can be used. The ship's position is shown by pen position. Desired search tracks are entered from the keyboard. Planned and actual tracks are indicated on the computer-driven plot, creating a hard copy.

The system is usable when the angle of intersection between the two ship-transponder lines is between 30° and 150°, with 90° being optimum. (See Figure 1.)

Knowing side-scan sonar ranges and desired run overlap, planned tracks can be laid out and preprinted with a series of crosses when the plot is initialized. As each track is run, holidays can be identified and contact locations noted.

In one instance a unique bottom feature was located on a side-scan sonar run. Three days later the decision was made to investigate this contact with a tethered drone. The bottom feature was relocated on the first run within 30 feet of its predicted location. After two side-scan runs the navigation system was used to conn the ship over the feature. The drone was launched and reached bottom in the midst of the small patch of mounds and gullies found by side scan.

The master station and the two transponder stations are each in a box approximately 12″ x 8″ x 5″. Each transponder has a separate radio channel. Only two transponders are used at any one time. Several transponders on different buoys can be installed and available to cover different, overlapping areas without having to reposition any buoys.

Range is a function of both station height and antenna configuration. A variety of antennas are available. Those with narrower beams have longer ranges. The maximum range used in this search was 12 NM.

The transponders are powered by a series pair of 12-volt deep cycle, lead acid, car-type batteries. These batteries will power the transponders for about three days. A second pair in parallel can drive the transponder for six days.

Figure 1. The navigation system is accurate when the ship is positioned such that the angle between the two ship-transponder (buoy) lines is between 30° at 150°; with 90° being the optimum angle.

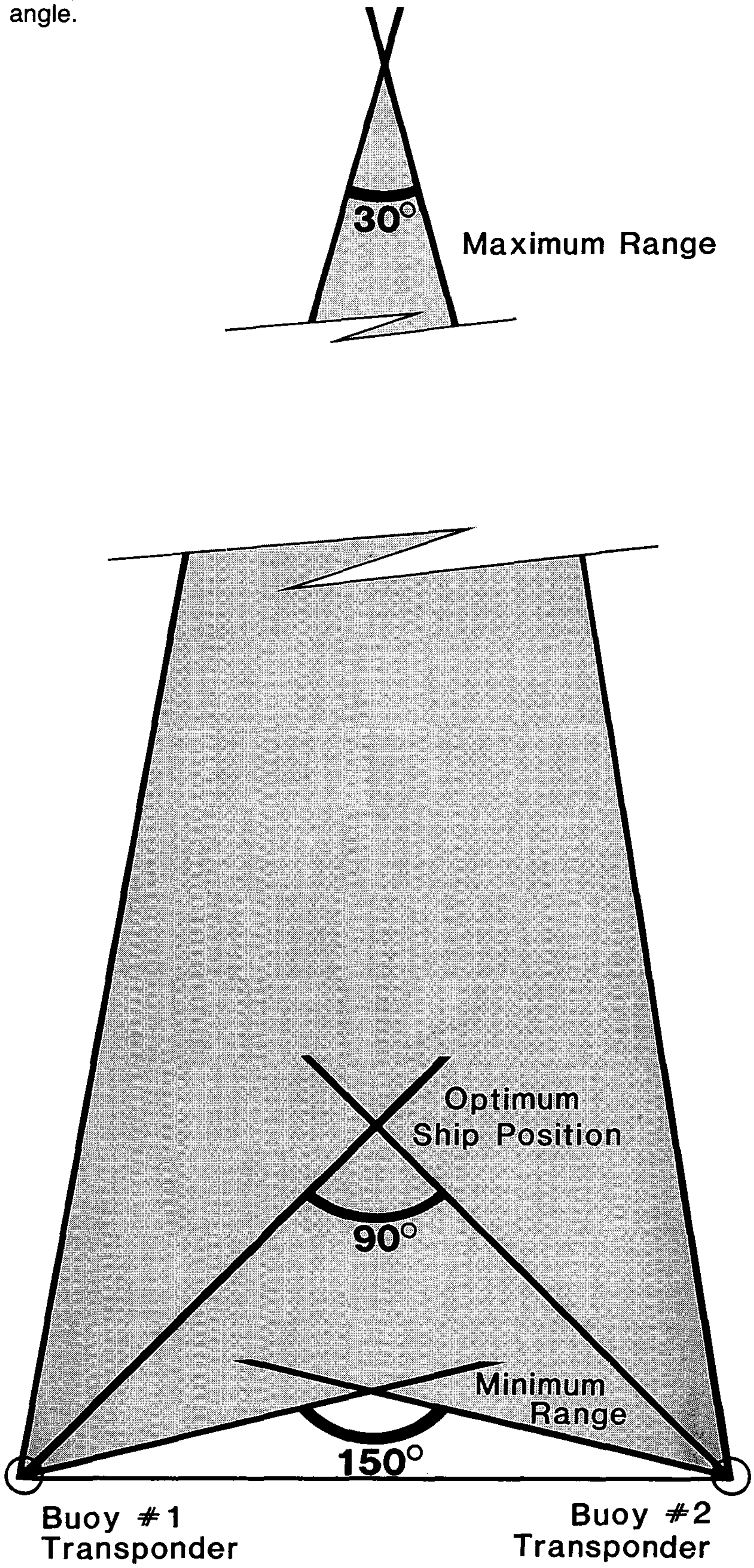
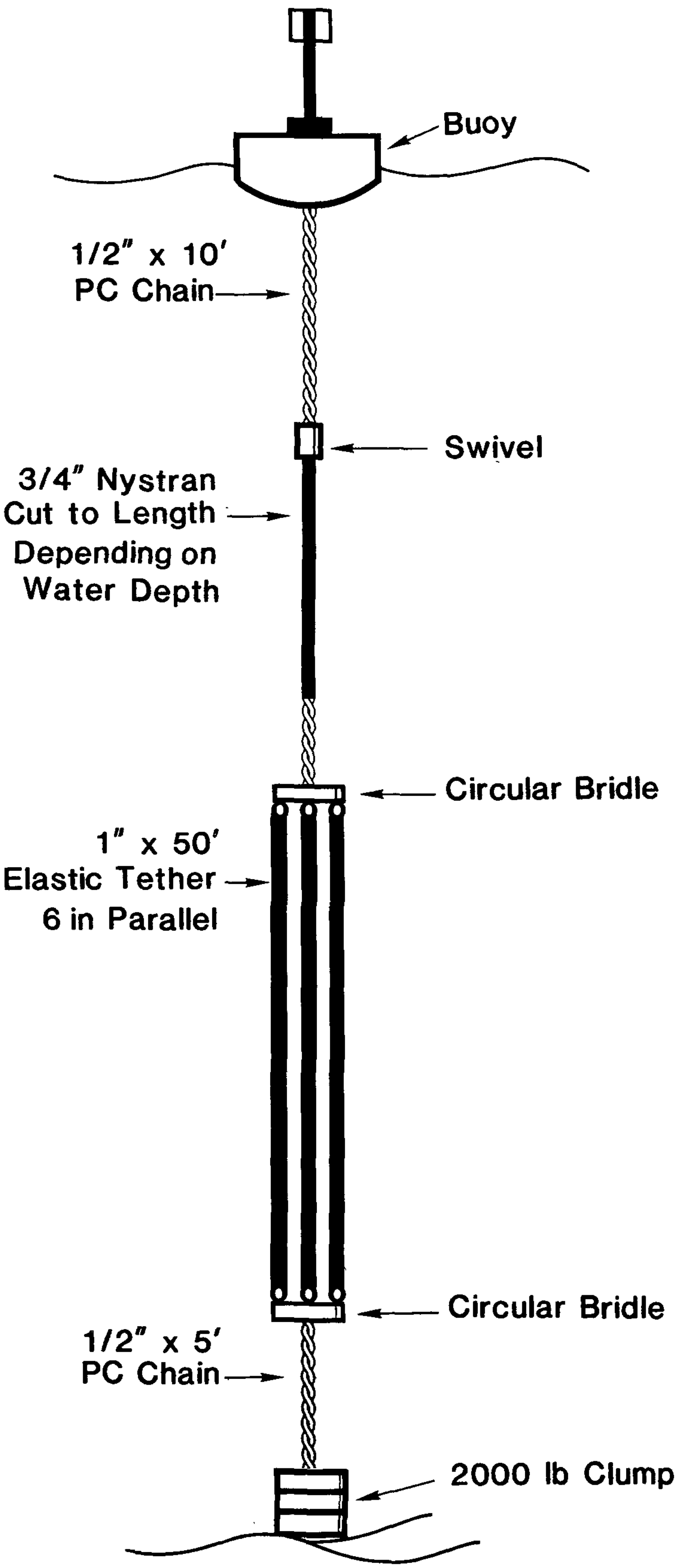


Figure 2. Buoy Mooring Configuration.



Interface between operator and the system is through a typewriter-like terminal. The computer can be directed to print out ship coordinates at various time intervals or on command.

The desired search track can display a course to steer on an indicator located near the helmsman. When the targets are aligned the ship is on the search track.

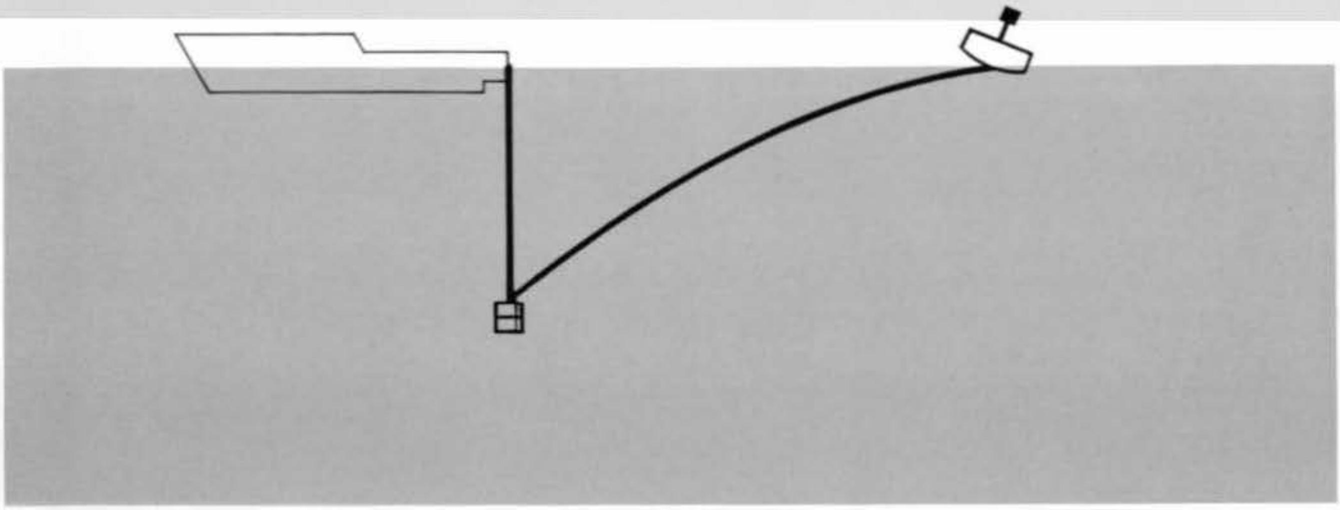
Buoys

Transponders for the Mini-Ranger III are normally shore mounted. When the search is out of the range of shore stations and in water too shallow for bottom mounted acoustic navigation systems, the obvious solution is to use a buoy. Three system requirements are that the buoys must be easily handled on deck, must have a small watch circle and must be able to support the transponder and power source. These requirements are met and the complexity of a three-point moor is avoided with the Buoy Technology MB-72 buoy system (Figure 2).

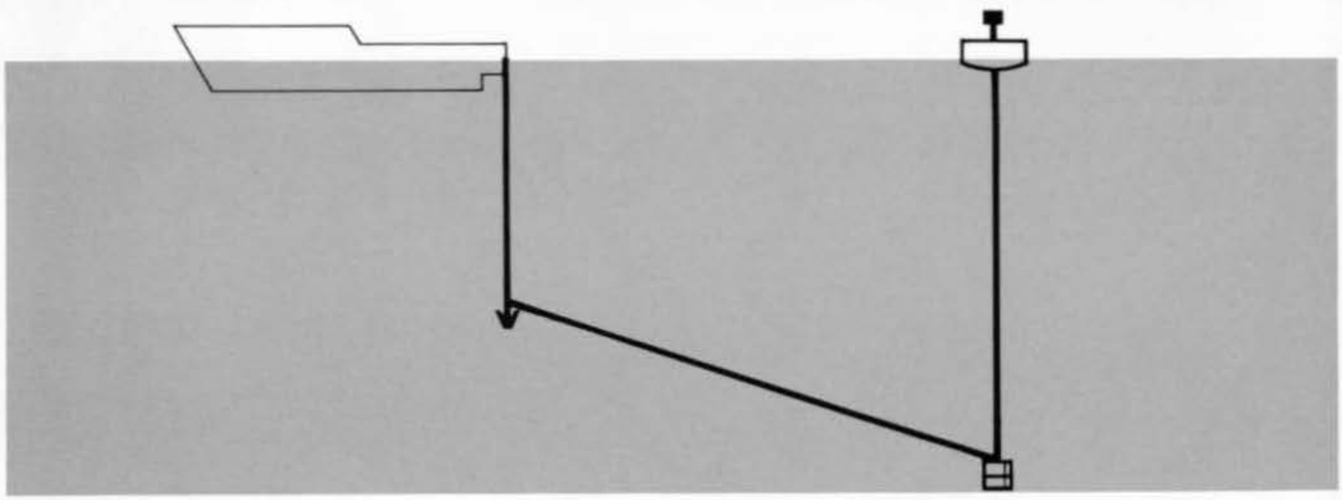
The buoy is kept in positon with a one point, tension leg moor. Tension is provided by six-1" x 50" elastic bands in parallel joined by 5 feet of 1/2-inch chain to a 2000-pound clump. Joining the upper end of the elastic tethers to the 10 feet of 1/2-inch chain from the buoy is a piece of 3/4-inch systran line cut to a length determined by water depth. In this application, the total unstretched mooring leg length was about 85 feet less than water depth. For 240 feet of water, the advertised watch circles is 5-10 percent of buoy depth.

Table I gives the characteristics of the buoy itself. A six-foot piece of 1.5-inch diameter pipe was mounted vertically on the buoy. The radar reflector, light and transponder mount were attached to a short pipe sleeve which could slide over the vertical pipe and were secured with two set bolts. This permitted adjusting the height and azmuth of the directional transponder antenna. A 12-inch diameter well in the body of the buoy held the batteries.

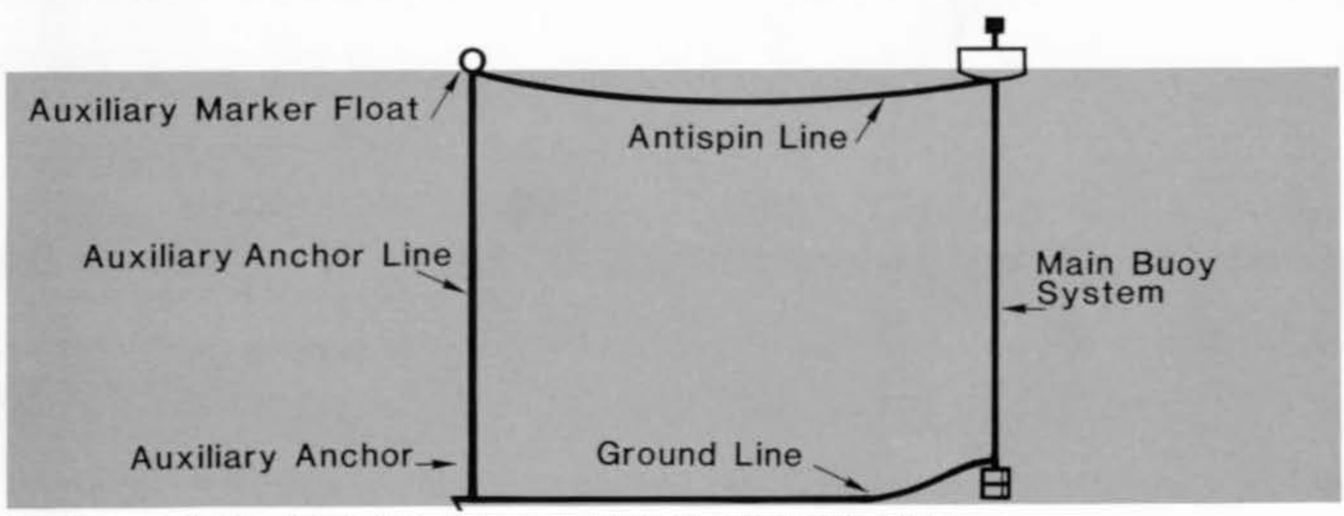
Figure 3. Buoy Launch Sequence.



Clump Anchor Lowered Using Ground Line



Auxiliary Marker Anchor Lowered



Buoy System in Position. Antispin Line can be Omitted if Omnidirectional Antenna Used.

TABLE 1 BUOY SPECIFICATIONS

	MB-72
DISPLACEMENT (LBS)	1100
DIAMETER (FT)	6
HULL HEIGHT (FT)	2.5
NOMINAL DRAFT (FT)	2
FREE FLOATING FREEBOARD (FT)	1.3
POUNDS PER INCH IMMERSION	150

Buoy Positioning

Since the location of the navigation buoys is critical to geographic accuracy, the buoys must be positioned as precisely as possible. This is best done using SAT NAV or LORAN "C." Even so, there will be some error. In the recent search the buoys were located at the southeast and southwest corners of a 10 NM square, the center of which was the highest probability area for the lost aircraft. The first navigational check was to determine Mini-Ranger's range to the first buoy as the second was launched. This defined the relative buoy range to be entered to the computer. After the buoys were launched, the antennas were aligned with the center of the search area.

Launch Sequence

Once the site was selected, the water depth determined and the moor made up, the launch was a simple process. The buoy was hoisted over the side. The clump was attached and slowly lowered using a ground line (Figure 3).

When the clump was on the bottom, a boat anchor was shackled in at the junction of the ground leg and crown buoy line. An antispin line was then used to join the crown buoy and transponder buoy to maintain constant antenna direction. This last step can be avoided if an omnidirectional antenna is used.

Buoys can be moved if required. If the water depth is roughly constant, then the crown buoy and boat anchor are recovered and the clump dragged to the new location. This proved satisfactory the one time it was used. After the move, a known bottom feature was located. That, in conjunction with the new buoy separation, enabled the new buoy grid position to be determined exactly. The same function can be performed by a temporary buoy or, less accurately, by an anchored ship. The buoy instructions say that once stretched, the elastic tether should not be reused. Therefore, a move requiring clump recovery should be avoided if possible.

Advantages

There are a number of advantages to the buoy-mounted transponder navigation system described here. The primary advantage is that the search is independent of shore-based transponder systems. Thus searches can be conducted out of sight of land or off potentially hostile shores. Search tracks can be laid out in a systematic fashion based on known equipment and sensor parameters. There is a precise, real time readout of ship location both in print-out form and on the plotter. Data can also be tape recorded for later retrieval. Contacts can be precisely located during search for later, closer investigation. Repeatability is a major advantage. The system is lightweight and highly portable. It is easily installed and can be serviced by Z-Boat, even in 6- to 8-foot seas, and will support a man accomplishing maintenance.

Finally, there is the psychological advantage of being able to lay out a systematic search and know that a searched area has, in fact, been searched. There is less tendency to break off the search to investigate an area where there is a feeling the search object may be located.

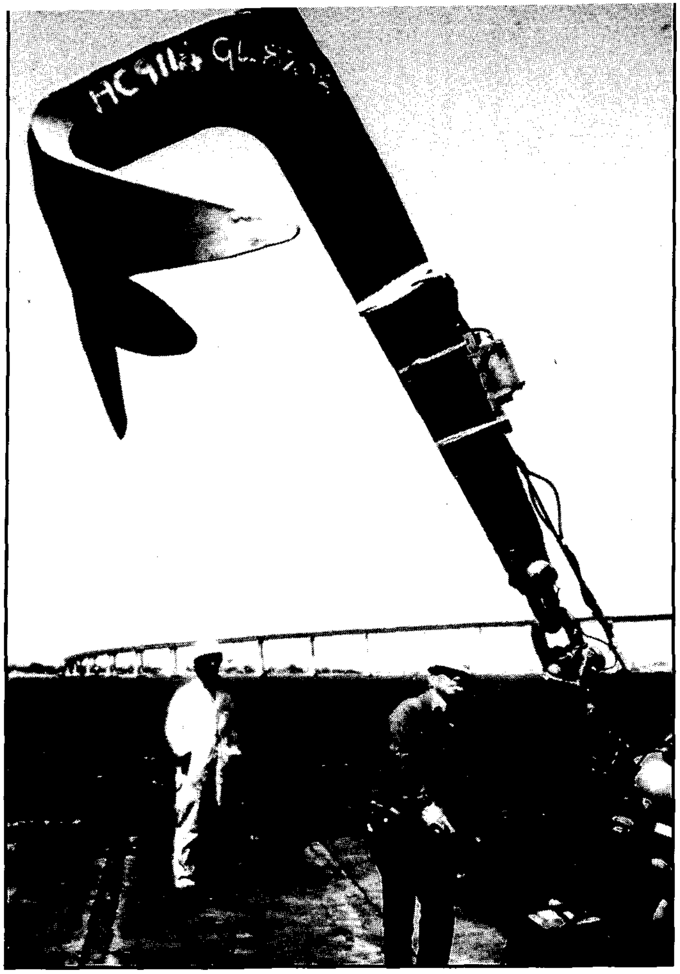
Lessons Learned

The problems associated with what is probably the first Navy open-ocean search using buoy-mounted transponders were nagging but minor. Long-lived batteries are a must. Too much time was spent breaking off the search to change batteries. Large capacity (Nicad or Lithium) batteries should be used, along with an array of solar cells to trickle charge the batteries during daylight. The battery's well lip needs to be raised so water will not splash into the well during heavy-weather battery changes.

The transponder stations need to be improved in several areas. First, the station case needs to be spray- and water-tight. A jury-rigged mast collapsed in heavy weather and dunked one station, ruining the transponder. Second, antenna height needs to be extended. At long range (greater than 9 miles) the signal became intermittent in heavy weather. A stayed aluminum angle iron mast improvised to extend antenna range collapsed due to whipping action in heavy weather. Finally, an omnidirectional antenna needs to be used to avoid having to aim the antenna from a lively buoy and so avoid losing signal during runs at the edges of the search area.

Conclusion

Search is the most time consuming aspect of aircraft salvage. Much of the lost time is due to imprecise local navigation, particularly offshore. The Mini-Ranger III System using tensioned single-point moors for transponder buoys works well for local navigation offshore. With correction of a few minor problems, the buoy-mounted transponder navigation system will become a valuable tool to systematically plan and execute a shallow-water offshore search.



A standard drag anchor is deployed for testing in sand at San Diego by the Naval Civil Engineering Laboratory, Port Hueneme, Cal. Clearly visible is an instrumentation package. The anchor was one of about 200 used by the Laboratory during at-sea tests. (Official U.S. Navy Photograph.)

ANCHOR RESEARCH

NAVAL CIVIL ENGINEERING LABORATORY

The Navy is developing an engineering data base to take the guesswork out of the selection and sizing of anchors.

The Naval Civil Engineering Laboratory (NCEL), Port Hueneme, California, under the sponsorship of the Naval Facilities Engineering Command (NAVFAC), has completed a comprehensive four-year program involving more than 200 at-sea tests of a wide variety of Navy and commerical anchors, ranging in size from 1000 to 20,000 pounds, in various seafloors common to worldwide Navy fleet moorings.

As a result of tests conducted by NCEL's Foundation Engineering Division, Ocean Engineering Department, the state-of-the-art in anchoring has been improved in three areas. First, the Navy now has a better understanding of what causes erratic anchor behavior and knows what should be avoided in specifying anchors and installation procedures for specific applications. Second, this new understanding allows Navy engineers to improve anchor behavior by modifying anchor configuration. And third, the data base resulting from the tests forms the basis upon which anchor-holding capacity prediction schemes can be developed.

NCEL's interest in anchor behavior dates back to 1947 when tests were performed to determine the effectiveness of available mooring anchors and their suitability for Navy fleet moorings. The unsatisfactory behavior of these anchors led the Laboratory to the development of the Stato family of mooring anchors which proved to be the forerunners of a new breed of high efficiency anchors.

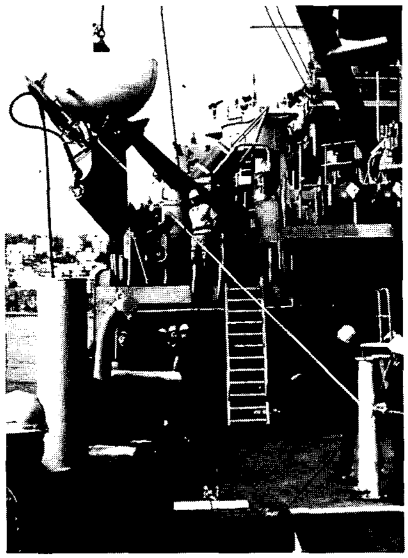
Renewed interest in the performance of Navy and commercial anchors was sparked when the Navy faced the possibility of spending millions of dollars for new high efficiency anchors to satisfy future fleet mooring requirements. The concern was that the selection of anchors to satisfy those requirements was more of an art than a science because of a limited data base for available anchors. There also was a fear that a large portion of the cost of new anchors would be spent on overdesigned moorings, or that perhaps they would prove inadequate, resulting in unsafe moorings.

With 384 permanent Navy fleet moorings installed worldwide and scheduled for upgrading, it was imperative that NCEL develop a data base that would enable engineers to select the correct anchor for use at a given site; an anchor which would satisfy the Navy's newly upgraded requirements calling for stronger and more reliable moorings.

The approach taken by the Laboratory has been to test full-sized anchors in environments typical of fleet moorings. The anchors tested were instrumented. Their response in terms of force at the anchor, drag distance, pitch and roll of the anchor and depth of embedment into the seafloor could be measured during each installation. With this technique, it was possible to observe in detail the anchor's behavior as it penetrated the seafloor. This data provided insight that permitted engineers to make simple and quick alterations to anchors. These alterations improved anchor performance, helped establish anchor holding efficiency (the ratio of anchor holding capacity to anchor weight) and isolated the holding effects of the anchor from those of the anchor chain.

To minimize costs, the Laboratory sought and received the cooperation of other government agencies and commercial anchor manufacturers. NAVFAC and the Naval Sea Systems Command (NAVSEA) provided funding and equipment support. The Washington State Army National Guard provided substantial work vessel support during tests in Puget Sound. Three major companies — Vrijhof Ankers, Bruce Anchors and Baldt Anchor and Chain — provided anchors for testing. The firms were given access to NCEL test results. In some instances, the data and Laboratory recommendations were used to modify anchor configuration to improve performance.

Of immediate importance to the Navy is the fact that the information developed thus far allows the Navy to effectively use anchors already in its inventory. In fact, the new data has saved the Navy approximately $500,000 in the rehabilitation of the mooring system at Apra Harbor, Guam. Anchor tests there determined that Navy anchors in stock could be used effectively. They are and the system is meeting requirements.



Four years ago, this 100 K Navy propellant embedded anchor was installed at Gaeta, Italy to provide bow mooring for the USS ALBANY, then the flagship of the U.S. Navy in the Mediterranean. The mooring is still in service. At that time, the installation demonstrated the greatest confidence in propellant embedded anchor technology developed by the Naval Civil Engineering Laboratory, Port Hueneme, Cal. (Official U.S. Navy Photograph.)

A recognized leader in anchor technology, the Laboratory in the late 1940's compiled data for the design of a new and improved class of anchors. As a result, NCEL's Stato anchors (weighing 200-15,000 pounds) are in use today throughout the Navy. Earlier years of research and development at the Laboratory also resulted in improvements in the Navy's Stockless anchors.

In the mid 1960's, when requirements called for a reliable salvage anchor for installation in coral and for a deep-water (to 20,000 feet) anchor for antisubmarine warfare application, NCEL initiated development of a series of propellant embedded anchors. They proved invaluable at sites where weight, cost and precision placement were critical and where seafloor conditions such as thin sediment or coral prohibit deployment of drag embedded anchors. Since 1970, approximately 170 propellant-embedded anchors have been installed worldwide, serving a broad range of Navy anchor and mooring applications and requirements.

The propellant embedded anchor system and associate technology gives the Navy a series of anchors with nominal holding capacities of 10 kips (kip is a unit of weight equal to 1000 pounds), 20 kips and 100 kips. The anchors can be installed in virtually any water depth and in mud, sand or coral seafloors. The laboratory is developing anchor flukes suitable for rock seafloors and a 300-kip propellant embedded anchor to support fuel supply systems during amphibious operations.

The Navy installation at Diego Garcia in the Indian Ocean is a prime example of the successful application of propellant embedded anchor technology. On three occasions the anchors were installed in the islands' harsh coralline environment to meet fleet needs. The first 18 anchors were for tanker moorings. The next 10 were for mooring buoys at the end of a fuel pier. Then 88 anchors were installed to moor ships of the Rapid Deployment Force stationed there.

NCEL's 35 years of research, development, testing and evaluation of anchors continue to play a vital role in improving the Navy and commercial sectors' capabilities to understand, design and install more demanding and complex moorings.

USNS CHAUVENET
ON THE ROCKS

By CAPT C. A. Bartholomew
Staff Material/Ship Maintenance Budget Officer
CINCPACFLT

On 8 May 1982 while in routine transit from Subic Bay, Republic of the Philippines, to survey grounds in Indonesia, USNS CHAUVENET (T-AGS-29) ran hard aground on Dauison Reef, Cagayan Islands, in the middle of the Sulu Sea (Lat 09° 47.0 N, Long 121° 13.5 E). Immediate flooding was reported in the auxiliary machinery room and reefer machinery space. Subsequent investigation revealed a 60-foot tear along the port side, opening two fuel tanks and three major WT compartments to the sea. In addition, the stem of the ship, upon impacting the coral reef, was damaged and the forward peak tank flooded. CHAUVENET was reported stable and in no immediate danger. Main propulsion and ship's power remained available, but most hotel services were lost.

The conditon of CHAUVENET upon BRUNSWICK's arrival was not encouraging. Including the added weight due to flooding, she was approximately 700-1400 long tons (LT) aground dependent upon the tides; she was lying at the edge of a near vertical reef which descended several hundred fathoms precluding effective use of conventional beach gear. She was in a very unstable condition due to inherent design conditions, the large ground reaction forward and a free surface which extended over one-third of her normal intact waterplane.

Figure 1 is CHAUVENET's inboard profile showing the location of the flooded compartments and the 60-foot tear along the port side.

CDR John Drucker, Commanding Officer, USS BRUNSWICK (ATS-3) took charge of the salvops with technical assistance provided by LCDR Kirk Boyd, the SEVENTH Fleet Salvage Officer and LCDR Mike Steding, the SRF Subic Docking Officer. During the course of the salvops, logistic support was provided by USS SAN JOSE (AFS-7), USNS NARRAGANSETT (T-ATF-167) and USS KISKA (AE-35). A basic salvage plan was immediately formulated to patch, pump and pull with subsequent refinement dependent upon detailed external and internal survey results.

BRUNSWICK's divers, lead by CWO (W3) Ron Roe and ENS Paul Currivan, organized an around-the-clock team to patch the torn hull using a series of form fitted external patches fabricated from sheet aluminum or steel, wood, canvas and rubber and secured with "J" bolts and strongbacks. All this was accomplished,using scuba, in only four days.

Using BRUNSWICK's four-point mooring buoys lashed together, two Ells anchors were floated into

Figure 1. Flooding Damage Sustained by the USNS CHAUVENET (Inboard Profile)

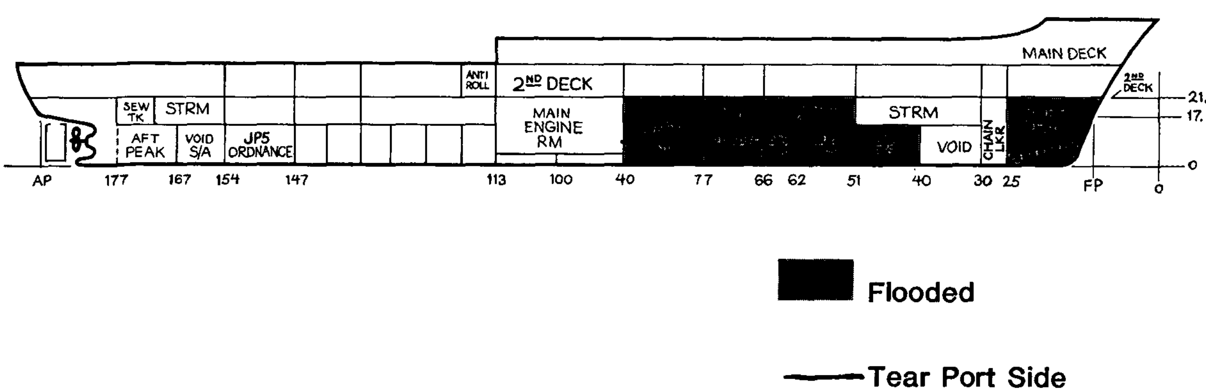
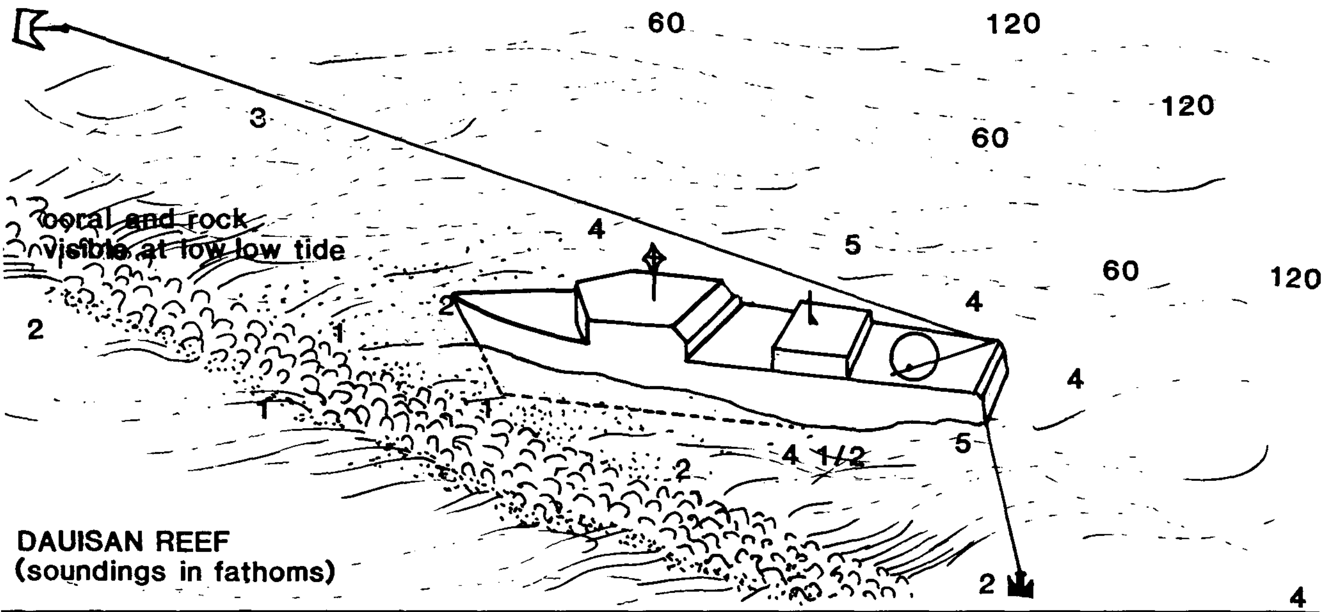


Figure 2. USNS CHAUVENET Aground on the Dauisan Reef with BRUNSWICK Ells Anchors in Position



position on the shallow reef and made fast to CHAUVENET's stern quarters. This feat was typical of the resolve and resourcefulness of the officers and men of the BRUNSWICK throughout the salvage effort. The anchors were rigged to the CHAUVENET such that heavy weather could not move the ship off the reef and into the abyss 200 feet off the starboard quarter. A schematic of the ship's relative position on the reef is sketched in Figure 2.

The stability of the ship during this period was tenuous, especially at the lower tides. CHAUVENET's list could actually be controlled by raising and lowering the ship's 10-ton workboats! Calculations indicated a 3-4 foot negative GM at low tide. Fortunately, as would be expected, the cradling effect of the ground reaction resisted serious listing and the ship remained essentially upright, since there were no large upsetting moments in play.

A sequential pumping plan was formulated for dewatering the gyro space, chill room space and auxiliary machinery room (AMR), in that order. Test pumping commenced on 18 May and by the next evening the water level in the AMR was about 6 feet above the deckplates. At this time CHAUVENET commenced an eratic, yet increasing, list to starboard with the outgoing tide. When the list reached 16°, the CHAUVENET's Master gave the order to abandon ship. The BRUNSWICK's pumping team, on watch onboard CHAUVENET, manned their workboat and safely evacuated approximately 30 members of CHAUVENET's crew. A party of four, including CHAUVENET's Master, LCDR Boyd, LCDR Steding and LT Bob Reish, BRUNSWICK's XO, remained onboard relaying onboard conditions to the salvage team back on BRUNSWICK. With all pumping long stopped, the ship abandoned and capsizing feared to be imminent, CHAUVENET finally settled with a 28-29° starboard list approximately four hours after low tide. Reboarding shortly thereafter on the afternoon of the 20th, the salvors found the flooded spaces filled with diesel oil, 4-8 tons of loose gear shifted to starboard, and the lower 10 feet of the bow area so deformed that an 8 foot change in trim by the bow was evident. In addition, flooding in the main engine room shorted out the main distribution switchboard, knocking out ship's propulsion and electric power. The emergency diesel was soon on the line, however and provided power throughout the remainder of the salvops.

The underlying cause of this setback turned out to be the unrepaired damage to the four WT bulkheads at frames 51, 62, 66 and 77. While the divers had successfully patched the ship's hull, no attempts had been made (nor was it realistic to do so from outside) to patch and render WT the deformed transverse bulkheads. Thus, there was essentially no fore and aft watertight integrity between frames 40 and 90. Once the water level in the AMR had been pumped below the first platform deck level, diesel oil from DO tanks 4-40-2 and 4-51-2 began moving aft. Being intact, DO tanks 4-40-1 and 4-51-1 remained full. The near capsizing is therefore explained as follows: As the tide receded, the ground reaction continued to increase, driving the ship into a less and less stable condition. But for the first time since stranding, CHAUVENET had now developed a large upsetting moment caused by the partial defueling of diesel oil tanks 4-40-2 and 4-51-2. This moment was estimated on scene to be approximately 350 ft-tons, which was apparently sufficient to force the ship over as the tide ebbed. Why the ship's list continued to increase after low tide when the ship's stability should have been improving is not clear. It may have been caused by shifting cargo or by a change in transverse components of the ground reaction caused by the compressive failure of the bow (which occurred sometime during this period), or by a combination of both.

Figure 3 shows the attitude of CHAUVENET after the attempt at pumping. The increased draft forward is most evident.

Figure 4 shows several views of CHAUVENET's bow taken the day after docking at SRF Subic Bay. Essentially, the bow was "accordioned" and rolled to port from the 10 foot waterline down and aft to frame 25.

The increased draft forward raised the water level in the AMR and chilled stores space to within a foot or so of the second deck overhead. Thus, in essence, CHAUVENET was now fully flooded from the forepeak to the main engine room forward WT bulkhead (FR 90). The aforementioned free fore and aft communication prevented space-by-space dewatering and control of free surface once dewatering below the first platform deck was attempted. This fore and aft free communication was a controlling factor in the final salvage plan.

On 24 May, CAPT Bart Bartholomew arrived on scene from CINCPACFLT Headquarters to provide technical assistance. On 25 May, a revised salvage plan was implemented. This salvage plan, including some subsequent minor refinements, is outlined as follows:

1. Manhandle all loose gear from starboard side to centerline.
2. Flood and fully press up all intact fuel and water tanks.
3. Plug all second deck drains, vents, etc., to prevent any unwanted flooding.
4. Remove topside weight (although consideration was given to toppling forward and aft masts, etc., the only major topside weights removed were the boats (40 tons), anchor chain (24 shots at 3525 lb/Shot), and three anchors (14 tons).
5. Rig 4-inch sub pump and 3-inch diesel pump in Main Engine Room (MER) as contingency against potential flooding in that critical space.
6. Rig two 35kw diesel generators as contingency for loss of ship's emergency diesel.
7. Rig LP air compressor and blow forward peak tank down to 10-foot WL.
8. Dewater chain locker (intact but previously flooded by salvors).
9. Rig firemain to press up AMR and chill space to overhead. This was to reduce the free surface in these two spaces since they could not be safely dewatered and the water level was so near the overhead. It was of questionable success, however, since water leaked back through the full patches as fast as it was pumped in. Maintenance of a head of just a few inches would have made a positive, though unquantifiable, contribution to stability. Because of the waterline proximity to the overhead, a free surface correction of only 1 foot was assumed throughout the extraction phase.
10. Extract the ship, taking steps in the following sequence, commencing at low tide:

a. Counterflood and press void FR 159-167 hold level and shaft alley FR 147-113.

b. Counterflood and press JP5 and ammo spaces FR 147-149 hold level.

c. USS BRUNSWICK in harness using 2 ¼ bullrope heading 160° relative from CHAUVENET.

d. Dewater first platform storeroom FR 30-51 and void FR 30-40 hold level using two 4-inch sub pumps. Strip as necessary. These spaces were intact but had been flooded by the salvors.

e. Dewater internal communications (IC)/Gyro space FR 51-66 using two 4-inch sub pumps. Strip as necessary. This space, initially flooded, had subsequently been rendered water tight. BRUNSWICK would be taking a strain during this phase and extraction was predicted.

f. If unsuccessful, counterflood and press sewage tank space FR 171-177.

g. If unsuccessful, have USNS NARRAGANSETT make up to BRUNSWICK's bow with 10-inch nylon to increase bollard pull from 50 tons to up to 100 tons.

h. If still unsuccessful, and as a last resort, counterflood and press storeroom FR 159-171 first platform level and continue pulling until well after high tide.

i. After extraction, and when well clear of reef, conduct visual under-

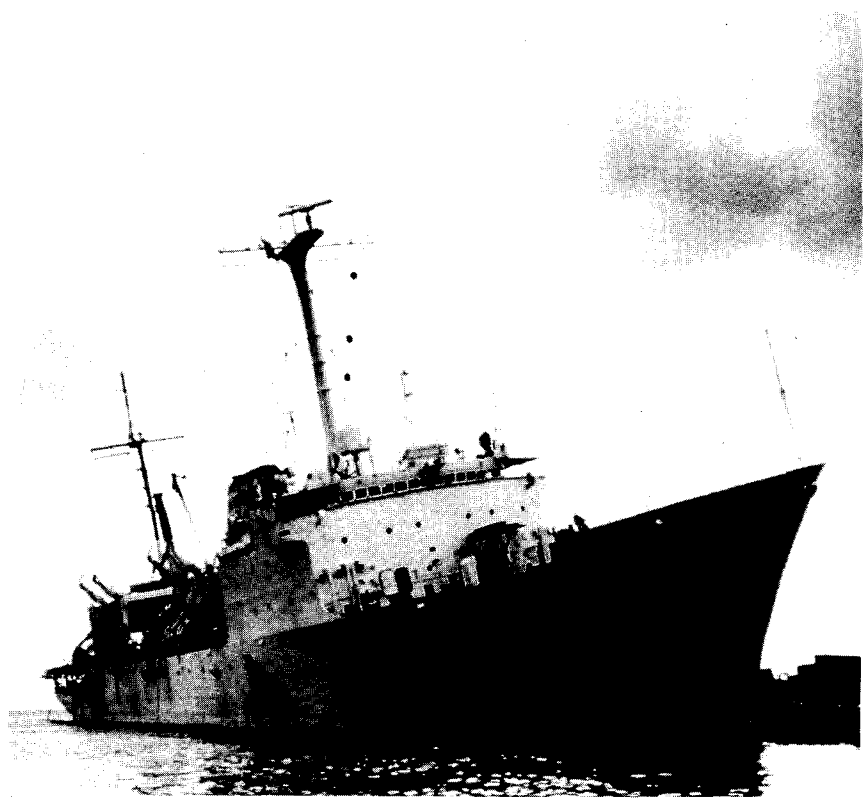
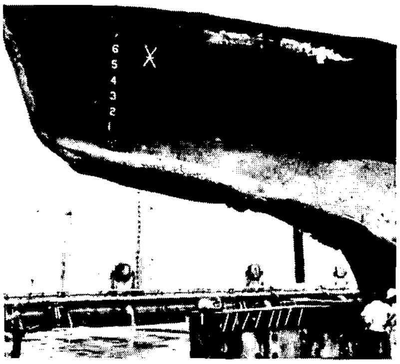
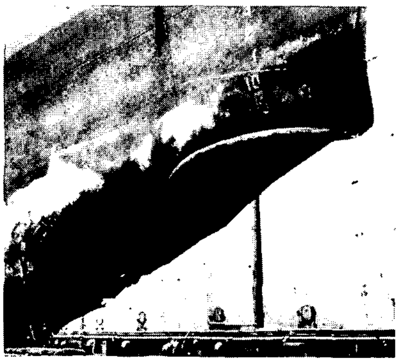


Figure 3. *USNS CHAUVENET after bow failure.*

Figure 4.

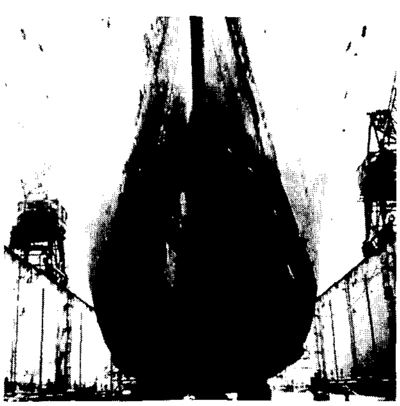


Port Side.



Starboard Side.

Port Side. Aft looking forward.



Head On.

water hull inspection to verify ship's status and make final changes, if any, to towing rigging.

j. Tow to SRF Subic. Subject to any last minute changes, it was planned to tow CHAUVENET stern first using the harness already rigged.

Figure 5 illustrates the status of liquid loading both before and after execution of the salvage plan.

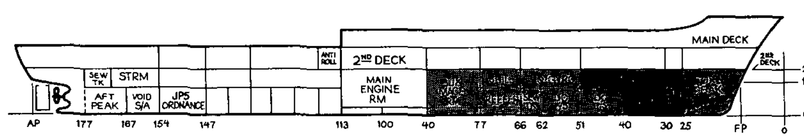
USNS CHAUVENET was predicted to displace 6024 LT when pulled free with a trim of 23 inches by the bow.

Deployment of the salvage team on board CHAUVENET the following morning was not completed until well after the 0637 (low tide) target time and counterflooding operations did not commence until 0842. The salvage plan was executed from that point exactly as planned.

Actual events are recorded on Figure 6. At 1417 (high tide) pumping of IC/Gyro was not completed, the CHAUVENET was still stranded. Counterflooding of the aft sewage tank compartment was then ordered even though the salvage plan called for the IC/Gyro space to be completely dewatered first. By varying the relative angle of pull, BRUNSWICK, with all engines almost redlined, managed to rotate the ship's heading about 10° back and forth. A cloud of white coral dust dirtied the water under the bow. Then, at 1437 aft motion was sensed and USNS CHAUVENET picked up sternway estimated to max at 5-6 knot! BRUNSWICK immediately guided the ship into open water. After a brief underwater inspection which verified that all external patches were still solidly in place, and that the twisted steel hanging from the bow did require a stern first tow, BRUNSWICK layed a track for Subic Bay. As BRUNSWICK in-

Figure 5. USNS CHAUVENET (T-AGS-29)

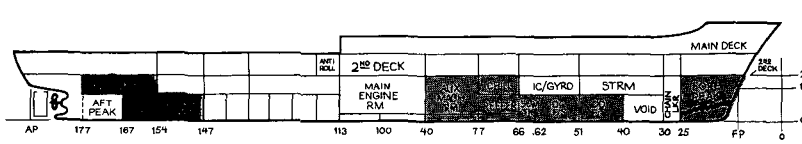
Condition Prior to Execution of Salvage Plan



Flooded and Open to the Sea

Flooded by Salvors

Afloat Condition with Contingency Flooding Aft



creased turns, CHAUVENET veered to starboard where she remained steady. The tow displayed no tendency to yaw at all, making the three-day return trip absolutely uneventful, a good change of pace from the preceding three weeks!

The successful salvage of USNS CHAUVENET clearly demonstrated the Navy's mission requirement for a fully capable salvage ship. Operating in a remote corner of the world with minimal logistic support, BRUNSWICK was able to lay a deep-water moor, rig heavy-ground tackle over a reef, manufacture and install u/w patches, position yellow gear, provide diving services and generate the necessary bollard pull for retraction. It is the requirement for this type of complete capability which has led to the Navy's decision to procure the ARS-50 class of salvage ships.

This article does not attempt to dwell upon the technical details of the operation. The precise salvage engineering aspects of the CHAUVENET salvops with a much greater emphasis upon stability considerations will be the subject of a NAVSEA report scheduled for distribution early in FY 83. All Navy divers and salvors are encouraged to make this report a must for their professional enlightment.

Figure 6.

Actual Running Calculations Performed During USNS Chauvenet Refloating Operations 29 May 1982

TIME	DISPLACEMENT (LONG TONS)	WEIGHT (LONG TONS)	GROUND REACTION (LONG TONS)	KM_T (FT)	KG (FT)	GM (FT)	GG_1 (FT)	GM (CORRECTED)** (FT)	COMMENTS
0842	5,250	6,277	1,027	25.03	20.02	5.01	3.92	0.09	**Commence counterflooding void & shaft alley**
1000	5,520	6,491	971	25.00	19.63	5.38	3.45	0.93	**Complete counterflooding void & shaft alley. Commence counterflooding JP5 & AMMO spaces**
1100	5,800	6,639	839	25.00	19.37	5.63	2.80	1.83	**Complete all counterflooding aft. Commence dewatering strm & void**
1300	5,880	6,324	444	25.03	19.56	5.47	1.48	2.99	**Complete dewatering strm & void. Commence dewatering IC/GYRO**
1430	5,910	6,024	114	24.97	19.68	5.29	0.38	3.91	**Continue dewatering IC/GYRO. Commence counterflooding sewage tank**
1437	6,100	6,024*	0	24.95	19.68	5.27	0.00	4.27	**Afloat**
30 MAY 82	6,150	6,091*	0	24.95	19.66	5.29	0.00	4.29	**Afloat, counterflooding & stripping complete**

***Calculated weight. Actual weight equals afloat displacement**

****In addition to incorporating the virtual rise in GM due to ground reaction (GG_1), the corrected GM was reduced by an additional 1.0 ft to account for the estimated free surface in the AMR and chill space.**

The OLD MASTER

It's winter time again and cold weather diving will become more a part of your lives for a while. One of the least thought about dangers of diving in cold weather is hypothermia, so I would like to draw your attention to it with an extraction from the Diving Manual.

Immersion hypothermia (significant loss of body heat) is a potential hazard whenever diving operations take place in cool to cold waters. Insulating garments or garments which supply heat to the diver, limiting the duration of cold water dives and rewarming the diver completely between dives can prevent hypothermia. Adequate thermal support for divers is a necessity for some operations. A diver who has become chilled must be brought out of the water and his heat losses restored before serious complications arise.

Immersion in cold water may be immediately painful and distracting, even before significant heat is lost. The hypothermic diver loses muscle strength and the ability to concentrate. He may be irrational or confused. Continued chilling can result in collapse or unconsciousness.

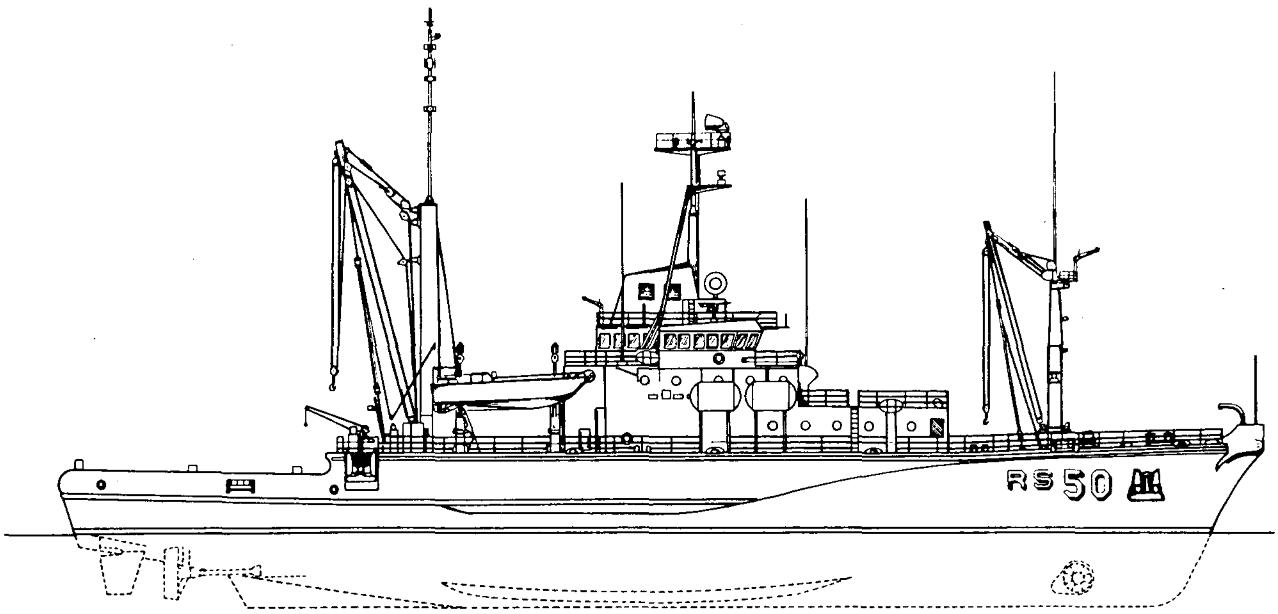
Diagnosis of hypothermia is easy, except when it is complicated by additional diving injuries. The skin is cold. The victim may shiver violently, or display muscle rigidity. Profound hypothermia (30 minutes) may depress the heartbeat and respiration to the extent that the victim appears dead.

The treatment of hypothermia is rewarming. In mild cases, when the diver is only chilled, treatment is still important if diving operations are to continue. Hypothermia severe enough to cause confusion or unconsciousness is a medical emergency. Rewarming should not be delayed by waiting for medical assistance. In profound hypothermia, even when it appears that breathing has stopped and there is no cardiac action, rewarming should be attempted.

The quickest and most efficient way to rewarm the diver is with hot water, either in a bath or directed under the diver's suit. Rapid rewarming, if necessary, is best accomplished using water from 104-111°F (40-44°C) which is as hot as a normal person can tolerate on the immersed hand or arm.

These temperatures may be too hot for the diver to tolerate initially, so gradual warming can be done until this level is achieved. If no hot water is available, the alternative is to dry the diver, provide warm clothes or blankets and put him in a warm room, or supply heat from another source.

A diver should be completely rewarmed before attempting a repetitive dive in cold water. Studies have shown that men suffering from heat loss invariably report feeling warm again very soon after they stop shivering, when rewarming is less than half complete. A simple indicator that rewarming has been carried on long enough is the onset of sweating. In repetitive diving with cold exposure, the operation should be planned so that the diver is rewarmed until he sweats, before he begins his next dive.



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