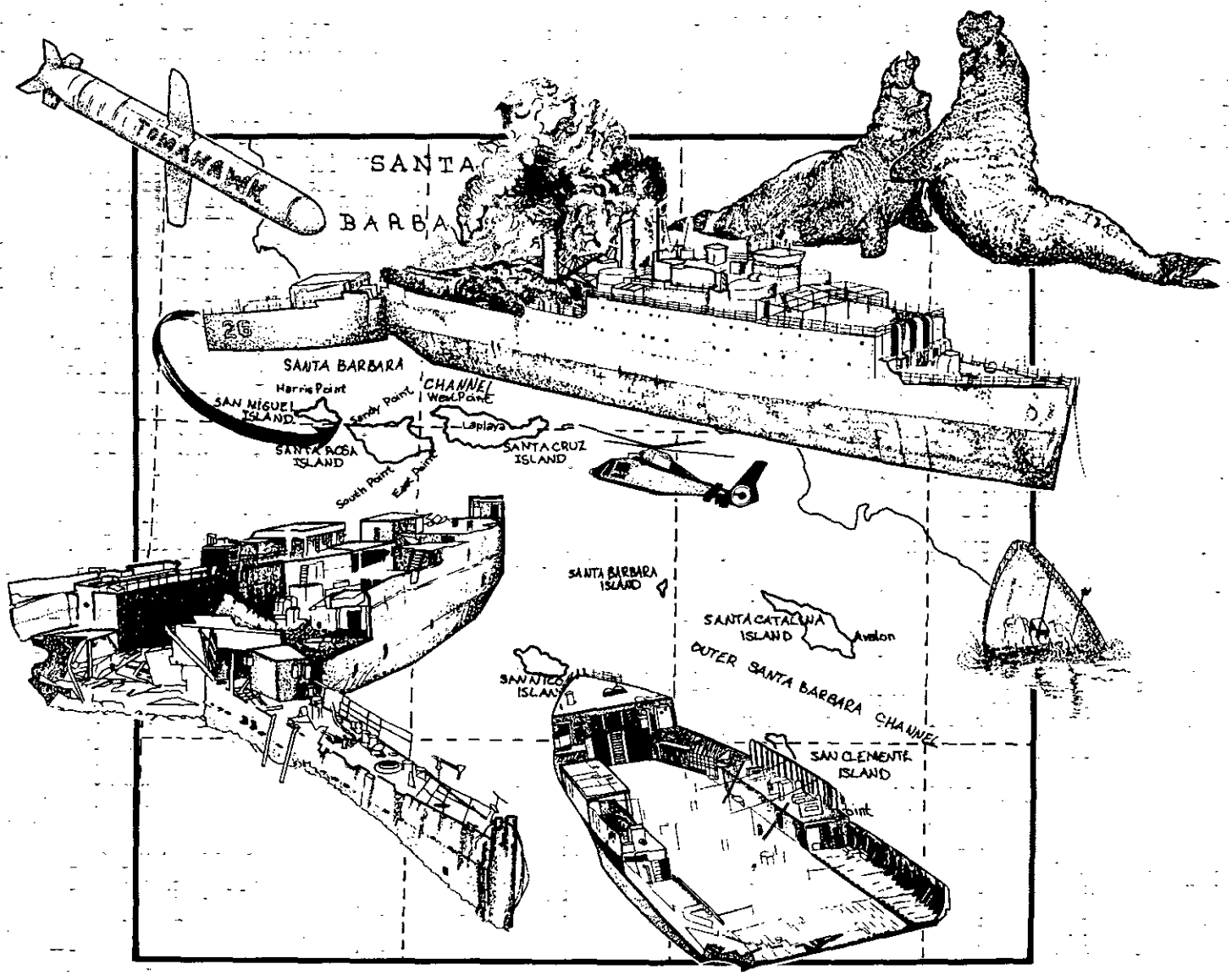
ex-USS TORTUGA (LSD 26)
SALVAGE REPORT



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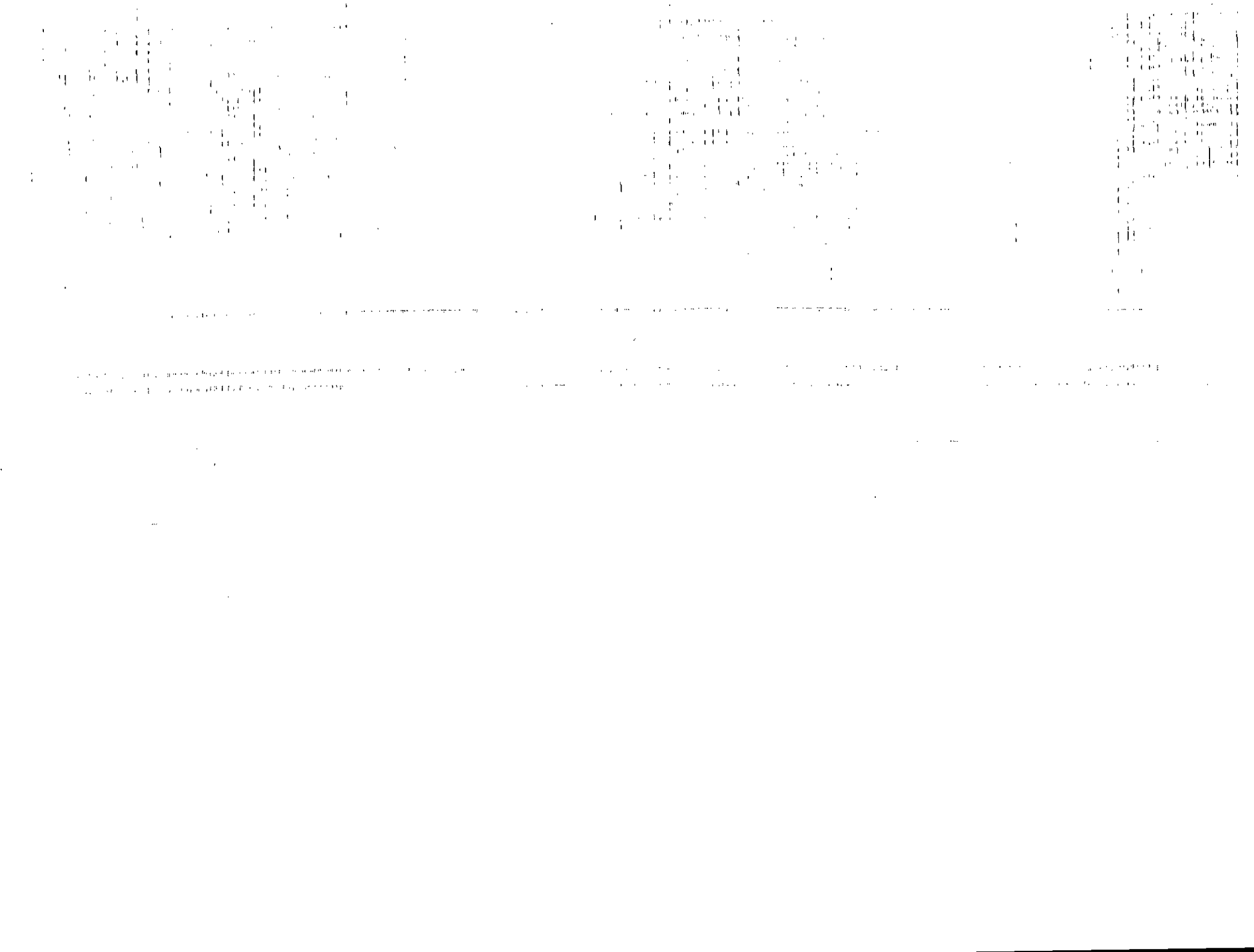

EX-USS TORTUGA (LSD 26) SALVAGE REPORT

PUBLISHED BY DIRECTION OF COMMANDER, NAVAL SEA SYSTEMS COMMAND

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14 SEPTEMBER 1989

SUPERVISOR OF SALVAGE
U.S. NAVY

14 September 1989

FOREWORD

The June - August 1989 removal and scuttling of the ex-USS TORTUGA (LSD 26) from San Miguel Island was a unique off-shore salvage operation for several reasons: the entire hull was fully flooded and open to the sea; complex salvage computer programming was utilized on-scene for the first time; and the effect of on-board hazardous substances at times dictated the salvors' actions.

Despite significant weather and asbestos related impact, the salvage operation was ultimately successful, under budget and completed ahead of schedule. Because a comprehensive salvage plan was developed beforehand and followed, the salvors, both military and civilian, knew what to do and did it.

The salvage engineers' tasks were greatly facilitated through use of the SUPSALV-developed computer programs. Nonetheless, the software had major limitations and required significant reprogramming changes specific to the TORTUGA situation. It therefore fell well short of what our salvors require. This is being corrected.

C. A. Bartholomew
Captain, US Navy

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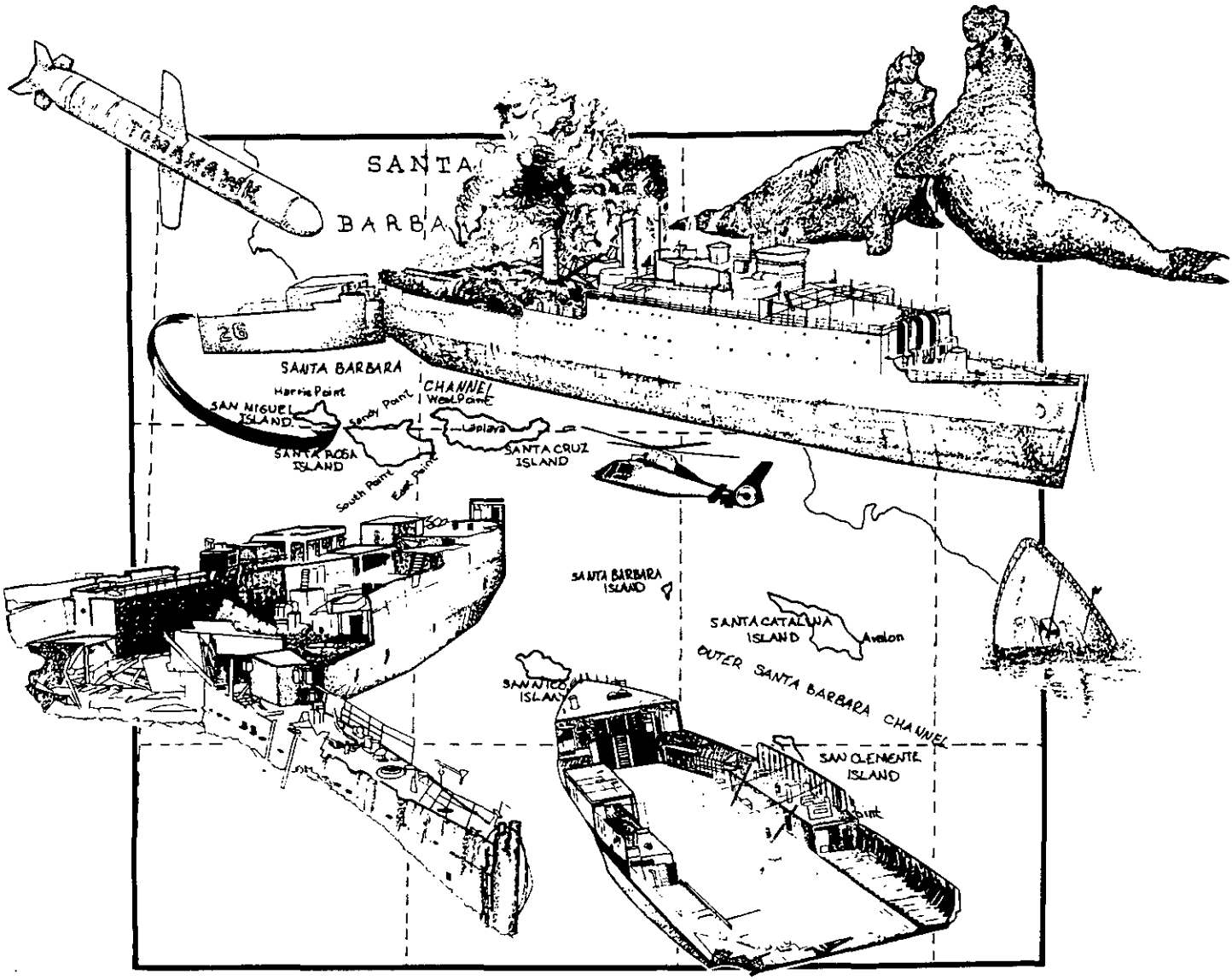
INTRODUCTION AND BACKGROUND SUMMARY



Chapter 1

INTRODUCTION AND BACKGROUND SUMMARY

The ex-USS TORTUGA (LSD 26) (Figure 1-1) went aground on 15 December 1987 at Cardwell Point, on the southeast corner of San Miguel Island (Figure 1-2), off the coast of Southern California. The ship, carrying neither personnel nor cargo, was being towed from Port Hueneme to an area west of St. Nicholas Island where it was to be used for an operational Tomahawk missile exercise. The grounding occurred during a storm with winds blowing east-southeast to 50 knots and seas in excess of 20 feet. Impact of the grounding caused a 100-foot section of the stern to break off and fall free from the 355-foot fore section, which had been holed in numerous places and was impaled on a large boulder.

TORTUGA was a CASA GRANDE-class dock landing ship which had been decommissioned in the early 1970's. The vessel had a light ship displacement of 4,790 long tons (LT), a length between perpendiculars (LBP) of 458 feet, and a maximum breadth of 72 feet. TORTUGA had seen extensive duty in Korea and Vietnam, and had been used previously as a target ship.

1-1 SALVAGE TASKING

Commander, Naval Air Systems Command Ltr Ser Air-4221/1188/0444 of 23 May 88, First Endorsement on COMPACMISTESTCEN Ltr 5090 Ser 00-3/6230-2/A-317 of 06 April 88 to CNO (OP-045) (Figures B-2 and B-3), directed that the ex-TORTUGA be removed per alternative (e) of the basic letter. Concurrently, Commander, Naval Air Systems Command Ltr Ser AIR 4221/1223/0443 of 23 May (Figure B-4) directed COMPACMISTESTCEN to take the lead for prompt execution of the removal effort.

The specified missions were to:

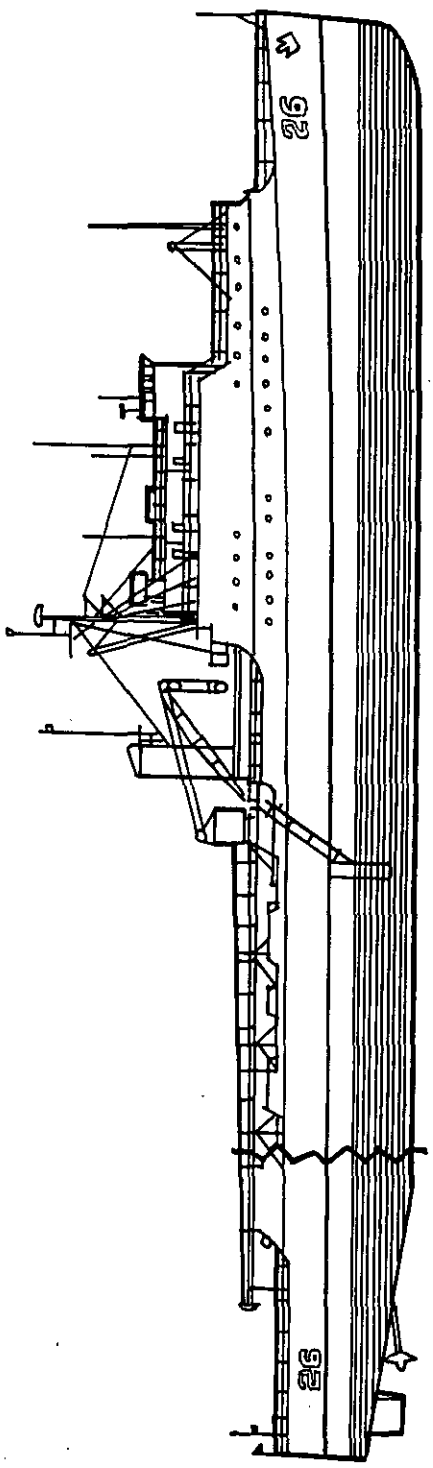
a. Minimize the environmental impact
b. Remove the wreck from the island
c. Scuttle the wreck at sea beyond the 1,000-fathom curve
d. Dispose in a safe and proper manner of all hazardous materials.

After receiving tasking from PMTC to conduct the salvage, SUPSALV, by COMNAVSEASYSCOM message 131656Z May 88 (Figure A-1) requested Commander-in-Chief, U.S. Pacific Fleet (CINCPACFLT) provide support. The operation officially commenced on 27 June 1988 and successfully concluded on 23 August 1988. The scope of this wreck-removal operation was the largest undertaken by the U.S. Navy in over a decade.

1-2 SCOPE OF SUPSALV MISSION

For two months SUPSALV managed an operation which included the removal of nearly 2,000 tons of scrap and debris, and involved the efforts of up to 20 U.S. Navy operating personnel and 15 contractor personnel, plus vessel crews, at any one time.

Figure 1-3 summarizes the statistics of the effort and Figure 1-4 gives a chronology of major events in the operation.



The ex-**USS TORTUGA** (LSD-26), a
decommissioned CASA GRANDE-class dock landing ship.
Built at Boston Naval Yard, January 1945.
Light ship displacement — 4,790 LT
Length overall — 475.4 feet

FIGURE 1-1. ex-USS TORTUGA (LSD 26).

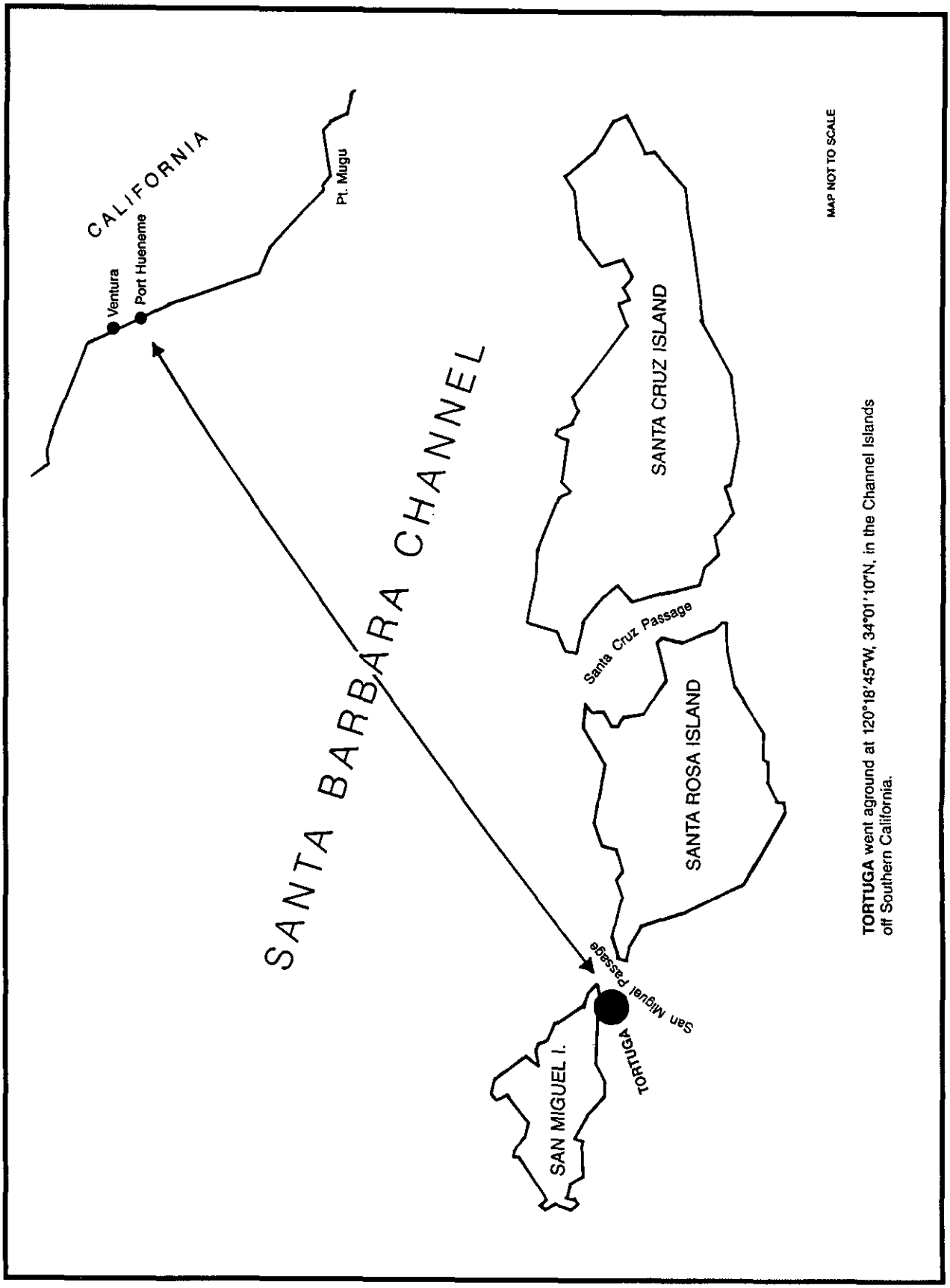


FIGURE 1-2. San Miguel Island.

- 4 primary surface vessels

  3 Contract

- 1,917 short tons of scrap removed from TORTUGA in 5 bargeloads

  600 tons of debris from well deck
  1,317 tons cut from superstructure

- 38 of TORTUGA's 41 compartments below the well deck were sealed and dewatered by blowing air into each tank.

- Divers were utilized to seal all tanks. Very little underwater diving time was required.

- First extensive Navy use of complex ship salvage computer programs in real time.

FIGURE 1-3. Summary Statistics of TORTUGA Wreck Removal.

1-3 PURPOSE OF REPORT

This report discusses the command, management, salvage engineering, and technical efforts of this wreck-removal operation. Many situational constraints guided the mission. For example, the operation was strongly infuenced by environmental factors including winds up to 70 knots, unpredictable ground swells to six feet and heavy concentrations of kelp. Other operational factors included:

a. The hull was almost totally open to the sea

b. Coordination of command and authority among multiple organizations including Naval Sea Systems Command (NAVSEA), Pacific Missile Test Center (PMTC), National Oceanic and Atmospheric Administration (NOAA), the National Park Service, various Fleet operating forces and contractor personnel

c. Moderate level of public and media interest which required constant care and attention to ensure the proper flow of information and personnel access to the area and facilities.

The stranding of the ex-USS TORTUGA (LSD 26) provided the Navy diving and salvage community with valuable lessons and experience.

1-4 SUPSALV AUTHORITY

SUPSALV supports the Fleet from his staff role (Code 00C) to the Commander, Naval Sea Systems Command (NAVSEA) in Washington, D.C. SUPSALV has several distinct responsibilities such as providing technical support to the Fleet in the areas of salvage, diving, underwater ship husbandry, oil and hazardous materials spill response and ocean

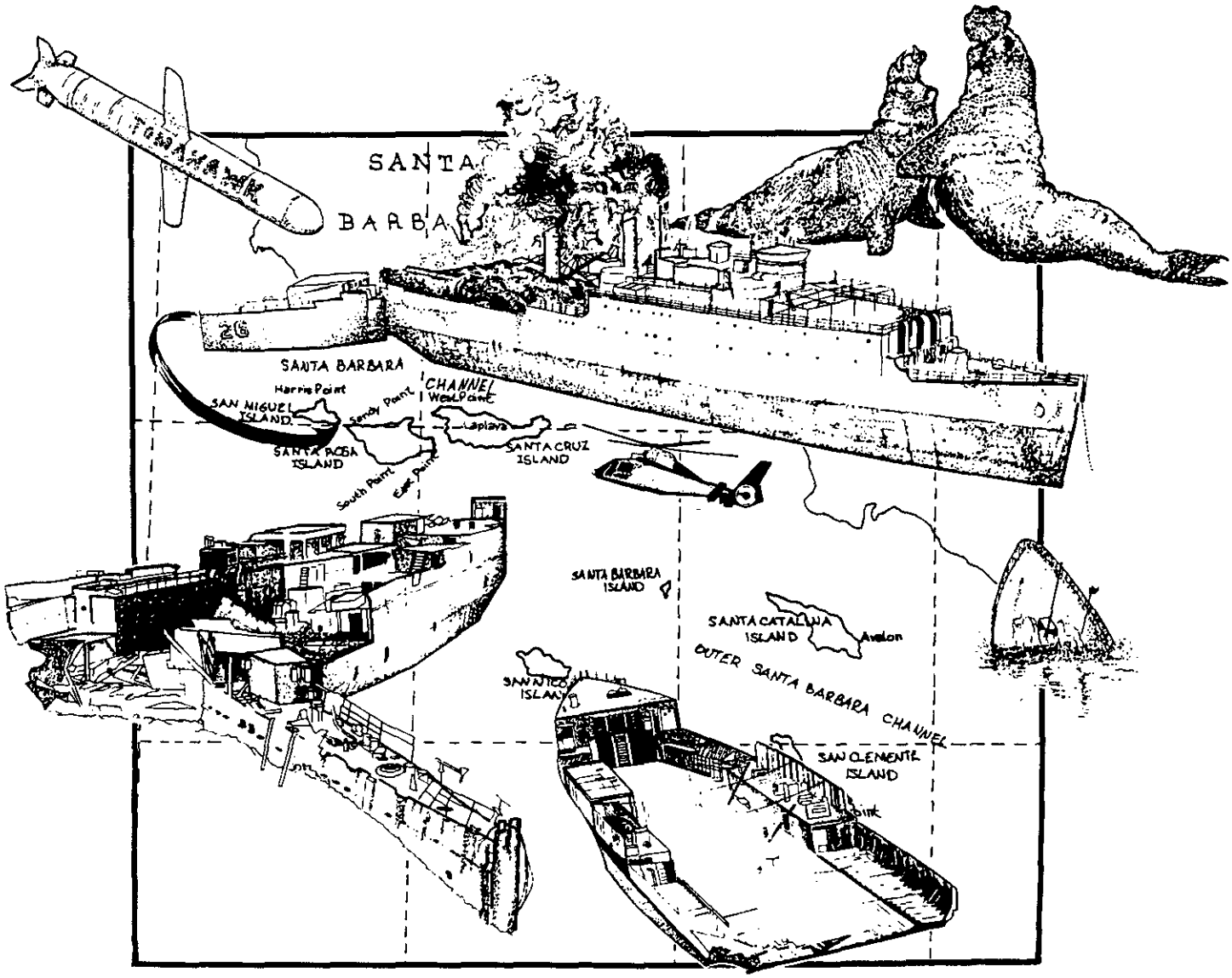
15 Dec 1987	•	TORTUGA grounding at San Miguel Island
2/3 Feb 1988	•	Wreck-site salvage survey and environmental assessment
6/9 Jun 1988	•	Mobilization of contractor vessels commences
26 Jun 1988	•	Contract vessels arrive at Port Hueneme
27 Jun 1988	•	Operations at wreck site commence
6 Jul 1988	•	Fleet divers arrive at San Miguel Island
10 Jul 1988	•	First bargeload of scrap steel departs from San Miguel Island
20 Jul 1988	•	Fleet divers depart from work site
16 Aug 1988	•	Tests of patched/plumbed tanks completed
17 Aug 1988	•	Fifth and final bargeload of scrap steel departs from San Miguel Island
18/19 Aug 1988	•	Rigging for pull on bow of TORTUGA
19 Aug 1988	•	NAVAJO commences loading of salvage gear
20 Aug 1988	•	TORTUGA fore section removed from strand by contract salvage vessel and towed to scuttle site
20 Aug 1988	•	NAVAJO released and demobilized
21 Aug 1988	•	Scuttling of TORTUGA fore section at sea
21/22 Aug 1988	•	Contract vessels released from job
23 Aug 1988	•	Mission concludes; all remaining assets and Navy Command van demobilized

FIGURE 1-4. Major Events During Operation.

engineering. In addition, SUPSALV has operational responsibilities and the capability to augment Fleet diving and salvage units. SUPSALV maintains contracts with commercial salvors worldwide to provide emergency salvage services to the Fleet, other government agencies, foreign governments through the U.S. Department of State and, under certain circumstances, to the private sector.

Chapter 2

COMMAND AND ORGANIZATION



Chapter 2

COMMAND AND ORGANIZATION

The command organization and resulting authority over day-to-day efforts are depicted in Figure 2-1.

2-1 ESTABLISHING COMMAND

NAVSEA has responsibilities within the Department of Defense for all salvage operations. When TORTUGA went aground, PMTC was the custodian of the vessel, using it as a target in support of the Naval Air Systems Command (NAVAIR) Managed Cruise Missile Project. PMTC submitted a recommendation to NAVAIR which was forwarded on to the Chief of Naval Operations (CNO). Six alternatives were considered for responding to the TORTUGA stranding, ranging from nothing, to breaking and flattening the wreckage in place, to complete removal. Ultimately, CNO directed NAVAIR to fund the complete removal of TORTUGA, and tasked NAVSEA with carrying out the operation. At this point, SUPSALV took charge and assumed responsibility for coordinating the various agencies, Fleet operating forces, and outside commercial contractors.

2-2 ORGANIZATION OF SALVAGE TEAM

SUPSALV was tasked with the specific responsibility for the wreck removal, including taking whatever measures were necessary to ensure that the environment was safeguarded, the primary motivation for removing the ship in the first place. The Navy's West Coast salvage contractor was directed to survey the wreck, provide a proposal for removing it and, ultimately, to complete the wreck removal.

2-3 SUPPORTING FORCES

A number of Navy commands and contractors supported the effort.

2-3.1 SHIPS. Several Navy salvage ships were requested from CINCPACFLT by SUPSALV. Ultimately, only the USNS NAVAJO (T-ATF 169) was mobilized for this operation.

2-3.2 OTHER NAVY UNITS. Other participating Navy units included Combat Support Squadron FIVE, Mobile Diving & Salvage Unit ONE, and the San Diego based Consolidated Divers Unit (CDU). Within the SUPSALV organization, a staff civilian operations specialist was assigned as project manager and stationed at the command post in Port Hueneme. The home office in Washington supported the operation with contracting, financial, and administrative functions. Several Navy industrial activities dispatched diving & salvage-qualified Engineering Duty officers for training purposes. SUPSALV was either personally on scene or represented by a salvage qualified Engineering Duty (ED) Officer throughout the operation.

2-3.3 CONTRACTORS. The Navy's ability to deploy experienced NAVSEA contractor personnel is essential to the success of most salvage and wreck-removal operations because of individual expertise and contractor ability to provide specialized equipment and platforms, either directly or by subcontract. Prime contractors are under multi-year delivery order contracts to provide specified services and equipment to SUPSALV and are required

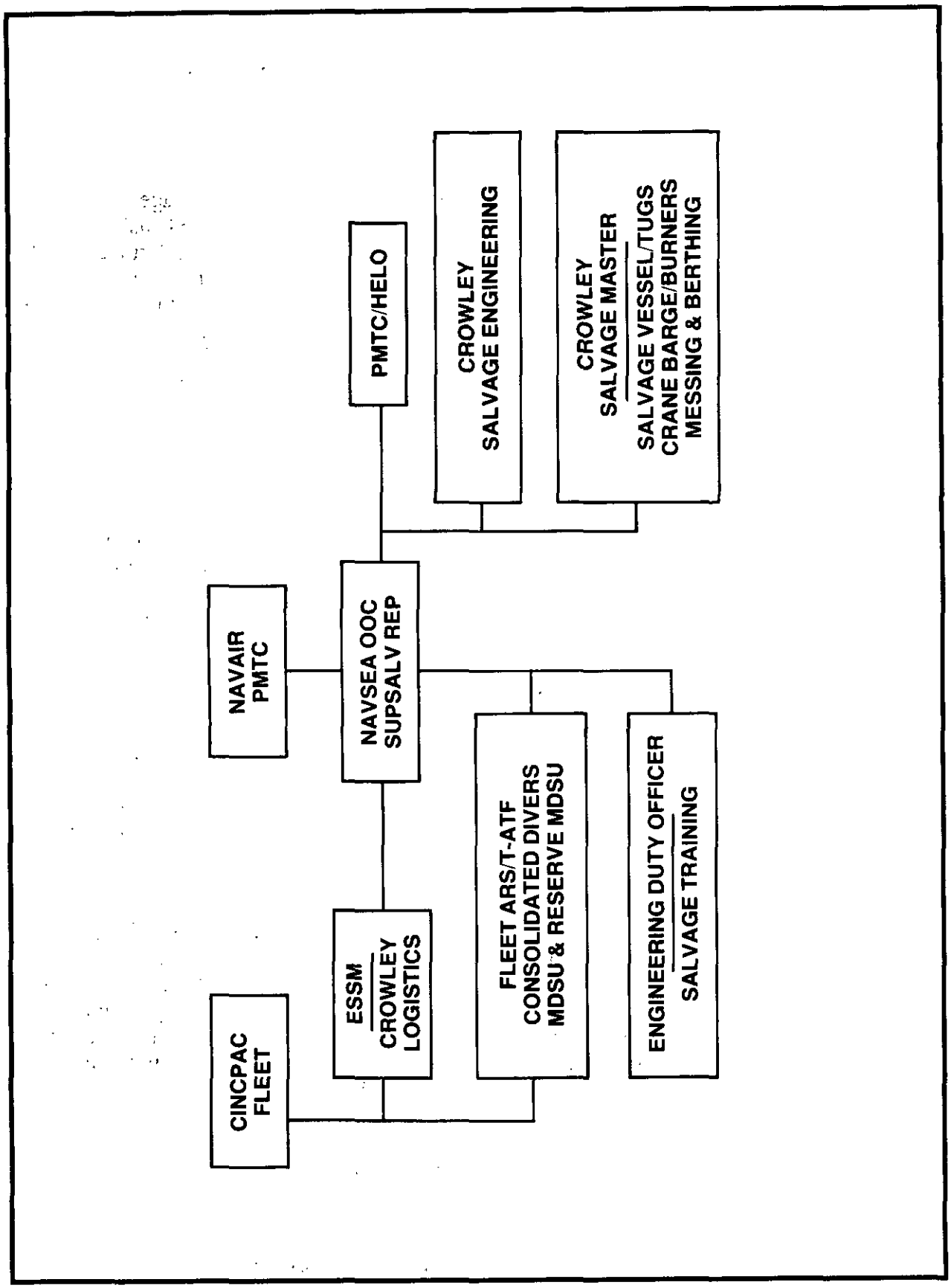


FIGURE 2-1. Command Organization.

to perform within the scope of their respective delivery orders without direct supervision by SUPSALV personnel. SUPSALV exercises control of contractor efforts by working with contractor project managers (e.g., salvage master). The principal contractors for this operation were:

Crowley Maritime Salvage, Seattle, WA. Crowley Maritime Salvage is NAVSEA's West Coast Zone salvage contractor. The on-scene salvage master, salvage consultant, and most of the platforms, equipment, and personnel used in support of this operation were provided directly or by subcontract by Crowley.

Tracor Marine, Port Everglades, FL. Tracor Marine, as SUPSALV's Emergency Ship Salvage Material (ESSM) base operator, mobilized support equipment from ESSM bases in Williamsburg, Virginia, and Stockton, California, as directed by the SUPSALV Project Manager.

Various other contractors were hired by subcontract in support of this operation:

- An environmental consulting firm identified environmental concerns involved in the salvage operation and developed a cost/time estimate for an Environmental Impact Report based on leaving TORTUGA in its grounded location.

- A salvage engineering consultant assisted in the initial salvage survey and provided salvage engineering for the contractor's proposal for removal of TORTUGA.

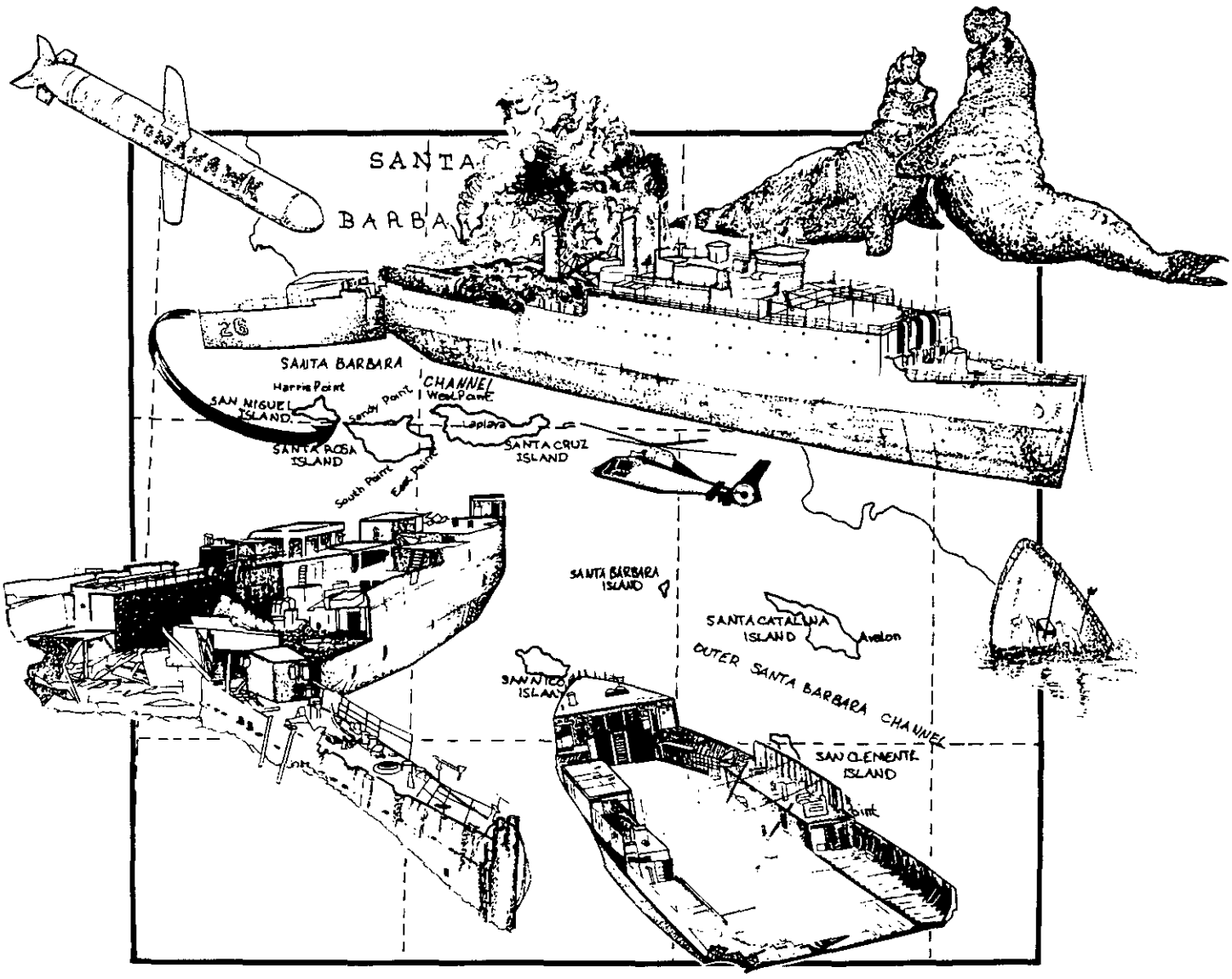
- A weather analyst provided current weather reports, 24-hour forecasts, 48-hour outlooks, and 72-hour extended outlooks for the work site throughout the salvage operation.

- A building fabrication company was used in making up specific patches and stand pipes.

- Professional topside burners, in the business of scrapping out ships, were subcontracted to remove the superstructure on TORTUGA.

Chapter 3

PLANNING, LOGISTICS AND MANAGEMENT



Chapter 3

PLANNING, LOGISTICS AND MANAGEMENT

3-1 OPERATIONS PLAN

3-1.1 SURVEY RESULTS. On 2 and 3 February 1988, the salvage contractor and a salvage engineer (Figure 3-1) conducted a survey for the purpose of developing an estimate for removing TORTUGA. The fore section, measuring 355 feet and weighing approximately 4,390 long tons, was hard aground by approximately three feet.

All fuel and ballast tanks and engineering spaces below the third deck (well deck), with no observed exceptions, were open to the sea. Mechanical systems within these spaces were disrupted. The ship appeared to be impaled by rocks in several locations along the starboard side amidships, and the hull appeared as though it may have sustained a fracture across the bottom at Frame 41. It was estimated that any plan to remove the fore section intact would have to include careful and selective topside weight removal in order to prevent further weakening of the hull girder and possible breaking of the ship at this frame. The detached 100-foot stern section, weighing approximately 400 long tons, appeared to be readily removable by breaking, refloating or a combination of the two.

3-1.2 PROJECTED WEATHER AND TIDE CONDITIONS. The Navy and the salvage contractor had worked extensively in the area near Pt. Conception and the east side of San Miguel Island, and were very familiar with typical weather patterns on nearby waters which form Southern California's main north/south shipping channel. Accordingly, weather at the work site was anticipated to be generally the same as the surrounding region. Reference to U.S. Coast Guard Pilot provided very little information on weather at San Miguel Island. Tide conditions were provided by the U.S. Tide Tables.

3-1.3 SALVAGE PROPOSAL: REFLOATING VS. BREAKING IN PLACE. Consideration was given to two options for removing the fore section of TORTUGA: refloating followed by scuttling at sea, and breaking in place. Refloating was considered to be the faster approach, but still required the removal of nearly the entire superstructure of the ship. In addition, a significant amount of tank-patching and plumbing would be required to recover adequate buoyancy. Finally, there was concern that, due to the suspected crack in the hull at Frame 41, the fore section might fail in seaway if, in fact, it could be refloated intact.

Removal by breaking in place and crane-lifting scrap was estimated to require 25% more time to accomplish than refloating. In addition, the position of TORTUGA in a surf zone, where it was subjected without warning to large ground swells, held greater personal risks for divers who would become involved in extensive underwater cutting. Accordingly, refloating was selected for removal of the stranded fore section.

3-1.4 ENVIRONMENTAL CONSIDERATIONS. A separate survey of the strand site was conducted in February 1988 to assess potential environmental impacts related to the removal of TORTUGA. San Miguel Island, which is owned by the U.S. Navy but falls under the jurisdiction of the National Park Service, supports a diverse population of marine mammals and marine-associated birds, some of which are rare or endangered species. Pinnepeds using the island for breeding and pupping are the California sea lion, the Northern sea elephant, the Harbor seal, the Stellar sea lion and the Northern fur seal. In addition, the Guadalupe fur seal, once thought to be extinct, uses the island occasionally, as does the California sea otter. Sighted during the survey were more than 100 adult

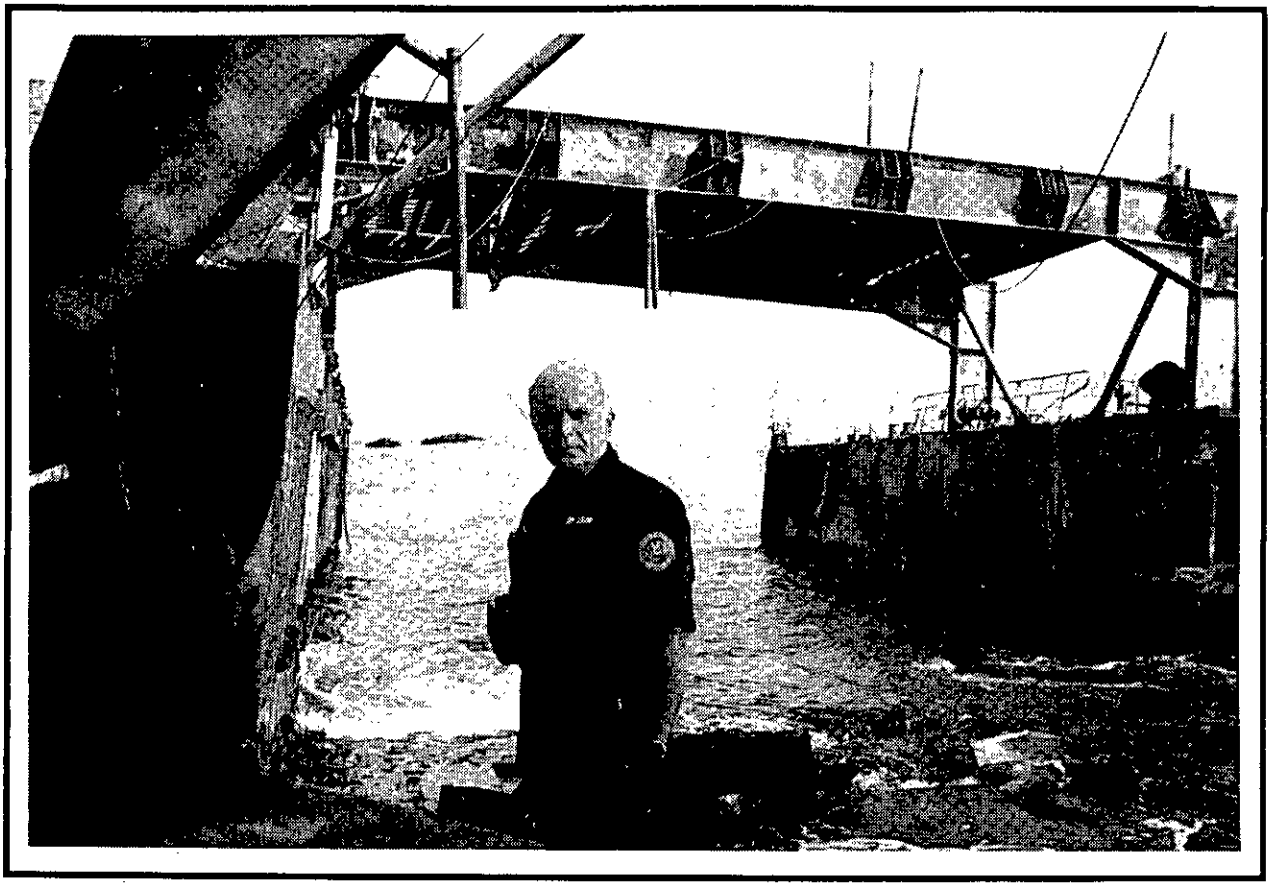


FIGURE 3-1. "Not much to smile about as Jim Bladh surveys TORTUGA."

Northern sea elephants and 50 pups on the beach immediately adjacent to TORTUGA. Additional colonies of Northern sea elephants were located nearby around the point. One California sea lion was sighted offshore between the ship and the island, and what was believed to be a Stellar sea lion was sighted on the ocean side of the ship. One dead Northern sea elephant was observed in a flooded tank in the stern of the ship. Among pelagic bird species nesting or breeding on the island are the rare Ashy Storm-petrel and the Cassin's Auklets.

The survey also included the rocky high intertidal zone east of the beach, where several intertidal organisms native to the California coastline were observed, including the California mussel, giant green sea anemone, green abalone and black abalone. Other marine organisms occupying the high tide zone were kitons, tube worms, hermit crabs, sea snails, shore crabs, eels and wooly sculpins.

Hazardous substances identified during the inspection of the ship included large quantities of asbestos insulation, six large lead acid batteries, residues of petroleum products in holding tanks throughout the ship and several drums with undetermined contents. In addition, large piles of debris in the ship's cargo hold contained scrap steel, missile parts, unidentified gas cylinders, forklifts and electrical equipment.

Environmental impacts associated with the wreck removal were analyzed and addressed prior to commencement of the operation. These impacts included disturbance of and interference with the marine mammal population and other marine life due to the presence

and activity of equipment, as well as the possible release of hazardous substances which could affect marine mammals, intertidal organisms and salvage workers.

Among significant mitigative measures was conducting the wreck removal during the non-breeding months of the resident sea elephants. Timeframes related to breeding and pupping restricted the wreck removal to a short window several months after the survey. Care was taken in the proper containment and removal of hazardous substances, particularly the asbestos, and these considerations are discussed in Chapter 5 of this report. To ensure protection for snails and other marine life, anchor positions were checked by divers before anchors were dropped into place. Once an anchor position was found to be free of snail life, the position was marked with a buoy for use in subsequent anchor placements.

3-1.5 WRECK REMOVAL PLAN. The plan for removing the fore section of TORTUGA consisted of a combination of breaking and refloating. The breaking phase would entail cutting the structure and outfit down to the well deck forward of Frame 31 and aft of Frame 62, removing approximately 1,300 tons of steel. The structure up to the main deck between those two frames would be retained to offset the effect of the suspected fracture near Frame 41. Loads of scrap, totaling 300 to 400 tons each, would be hauled by barge to Long Beach. Figure 3-2 shows the initial weight removal plan.

As burners cut off the superstructure, welders and divers would complete patching of tank tops and internal bulkheads between ballast tanks and engineering spaces below the well deck. After completion of repairs, these spaces would be plumbed to receive compressed air during the refloating phase. Low-pressure air compressors would be used to dewater the tanks, forcing air in through the top and water out through the bottom. It was believed that such an air bubble could be maintained to within at least five feet of the tank bottoms, providing sufficient buoyancy to allow salvage vessels to pull the fore section free from its strand. Once TORTUGA was afloat, a 2400-HP tug would be made up to tow it 20 miles to sea for scuttling at a predesignated site. There, the air compressors would be removed and the tanks vented, allowing the wreck to sink.

The original plan called for the prime salvage contractor (Crowley) to perform the topside wreck removal, and to assist a team of Navy divers who would be responsible for patching and refloating the remaining hull. It was believed that TORTUGA provided a unique opportunity for Fleet salvage personnel to participate in a major wreck clearance operation, and at the same time provide a potential cost savings to the project.

3-2 LOGISTICS

3-2.1 MOBILIZATION. Mobilization of contractor personnel and equipment commenced on 6 June 1988, when outfitting of the flatdeck barge ATB-99 began at Terminal 105, Seattle, WA. The salvage proposal provided by the contractor prior to commencement of the operation had recommended use of a crane barge moored perpendicular to the wreck to remove scrap from TORTUGA, and a scrap barge to transport cut steel from the wreck to the mainland. However, in pricing the project, it was determined that both of these barge activities could be performed by a single flatdeck barge, the ATB-99, outfitted with a crane on deck. This arrangement not only was less expensive, but also provided more open deck space for transportation of steel. Outfitting of the flatdeck ATB-99 included:

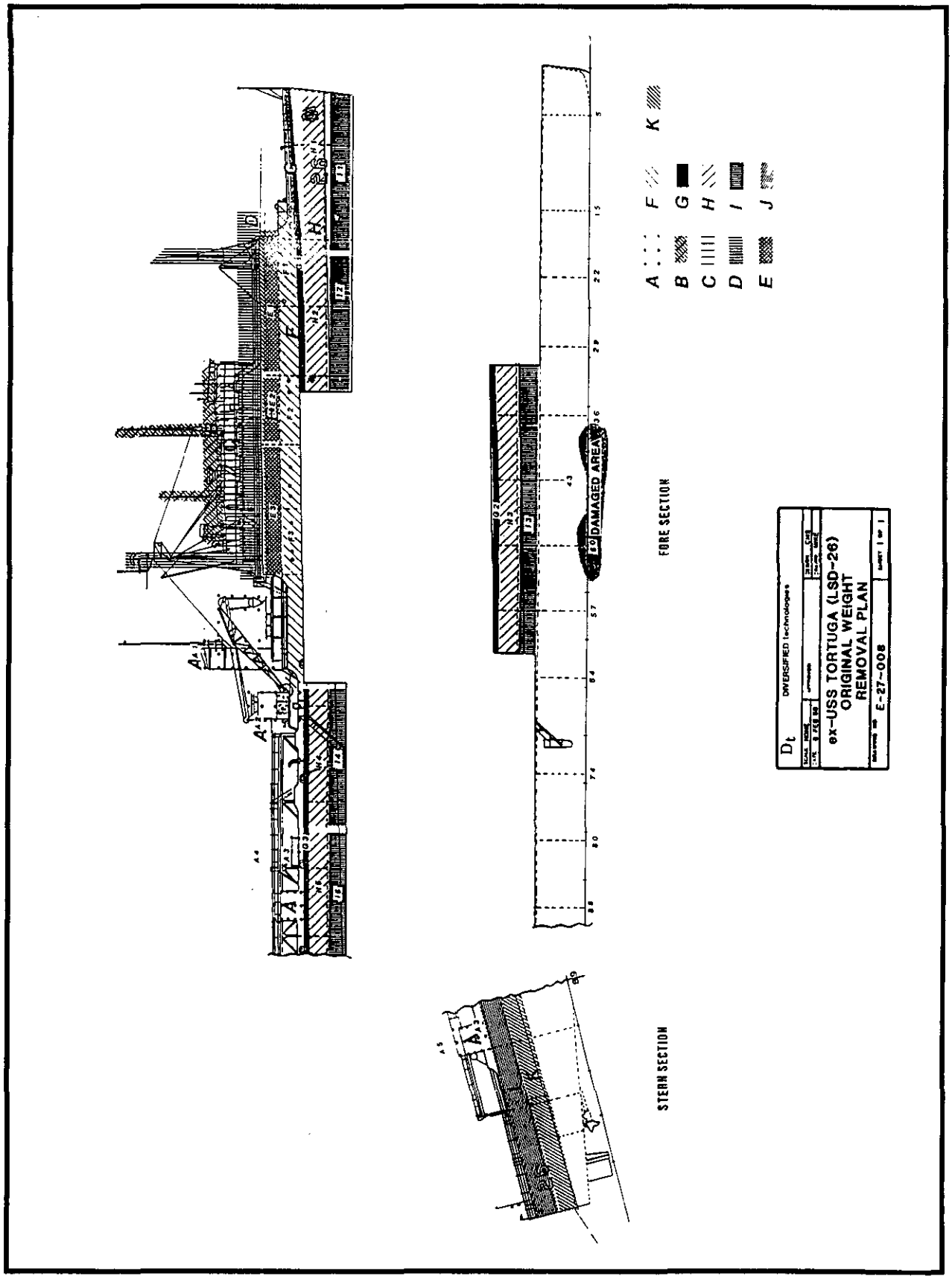


FIGURE 3-2. Original Weight Removal Plan.

- Two Skagit RB-90 deck winches, each spooling approximately 3,000 feet of 1-1/4-inch wire
- Four Berger fairleads, one at each corner of the barge
- Four 8,000-pound offshore anchors for the mooring arrangement
- A 4600 Manitowoc crane
- A rigging van containing lube oils, grease, and various parts of the rigging needed for the operation of the crane
- Wood wear decking composed of 5-inch x 14-inch planks over 80% of the main deck
- Installation of deck-edge stanchions to allow for high scrap loads
- Uke tires along both sides of the barge for fendering.

Outfitted as above, the ATB-99 is hereinafter referred to as a crane barge. The contractor's salvage vessel and crane barge were deployed out of Seattle on 20 June at 1000 and arrived at Port Hueneme on 26 June at 0850. The 2400-HP assist tugs were deployed out of Long Beach.

The following items were mobilized from SUPSALV's Emergency Ship Salvage Material (ESSM) pools in Stockton, California, and Williamsburg, Virginia:

- Four 100-psi, 125-CFM air compressors
- Two 400-amp diesel welding machines
- A Zodiak inflatable workboat and outboard motor
- One hydraulic power unit
- Two hose reels
- Four 27-cu.ft. equipment boxes
- One underwater welding box
- A 55-gallon drum of hydraulic oil
- 800 feet of Samson double braid nylon line
- One light kit and two lighting power plants
- One box of underwater cutting gear
- Two 6-inch fire pumps
- Two 20-foot berthing vans.

Oxygen and propane were provided by Amerigas through an existing Navy contract.

As many as 20 Fleet divers were brought on the scene, beginning 6 July 1988, under the operational control of the Commanding Officer of CDU. A Fly-Away Diving System (FADS) was mobilized along with additional equipment necessary to support Navy diving operations.

3-2.2 PRIMARY ASSETS. Figure 3-2 lists the major assets and commands participating in the operation. Appendix B describes the vessels and equipment employed in detail. Principal platforms included:

Navy Platforms. Originally, several U.S. Navy salvage and towing vessels had been requested by SUPSALV. Eventually only USNS NAVAJO (T-ATF 169) was mobilized with, but it did not actually participate in the operation. Two hours prior to getting underway from San Diego, NAVAJO received word that TORTUGA had been pulled free of its strand by the ARCTIC SALVOR.

Major Commercial Platforms. The salvage contractor provided the following platforms:

ARCTIC SALVOR. The salvage vessel ARCTIC SALVOR (Figure 3-3) is equipped with four Skagit DTW-150 SxS double-drum winches, each providing 300,000 pounds of line pull at bare drum. The vessel's total line pull for freeing grounded vessels is greater than that of any other salvage vessel in the United States.

Crane Barge, ATB-99. The ATB-99 (Figure 3-4) is a flatdeck cargo barge measuring 273 x 68 x 18 feet and providing a capacity of 6,000 short tons. With a Manitowoc 4600 crane secured to the deck, the ATB-99 was utilized not only for lifting scrap from TORTUGA, but also for transporting loads of scrap steel from the salvage site to the mainland for disposal.

Salvage Vessel	Tugboats	Crane Barge	Fleet Tug
ARCTIC SALVOR	SPARTAN SATURN	ATB-99	USNS NAVAJO (T-ATF 169)

Navy Commands Providing TAD Personnel

U.S. NAVY SUPERVISOR OF SALVAGE (SUPSALV)

PACIFIC MISSILE TEST CENTER (PMTC)

COMBAT SUPPORT SQUADRON FIVE

MOBILE DIVING & SALVAGE UNIT (MDSU) ONE

CONSOLIDATED DIVERS UNIT (CDU)

FIGURE 3-3. Major Deployed Assets.

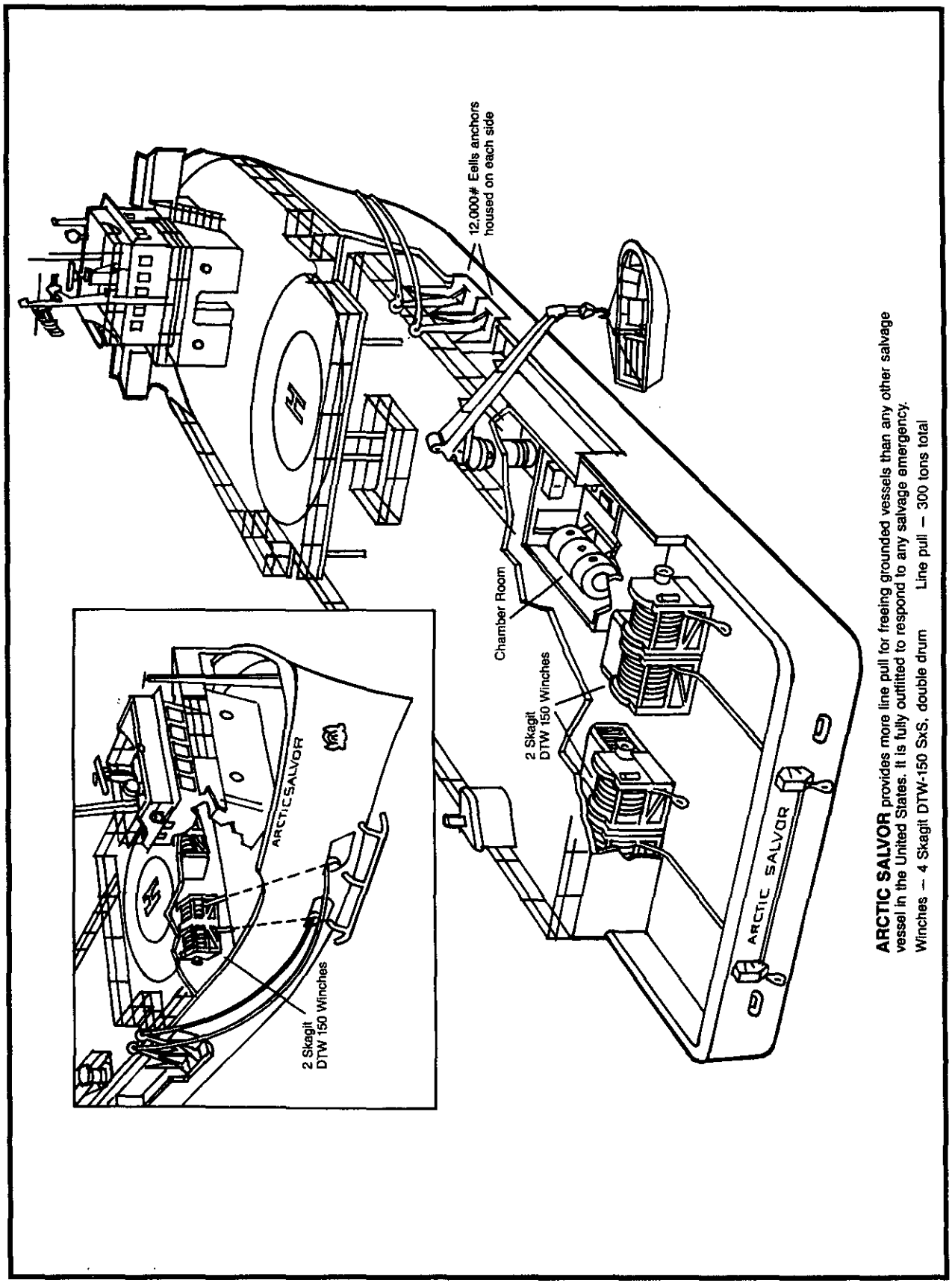


FIGURE 3-4. ARCTIC SALVOR.

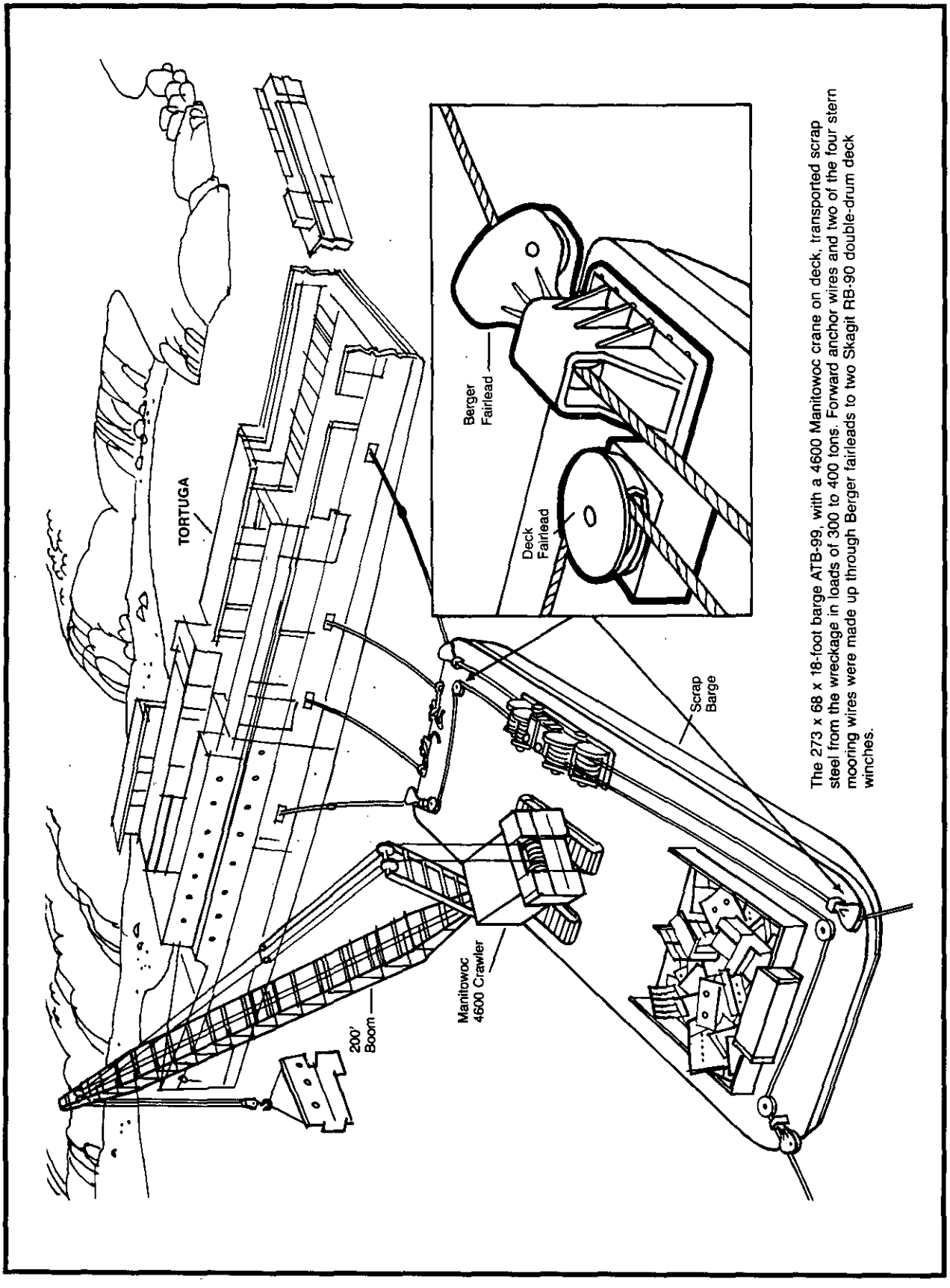


FIGURE 3-5. ATB-99.

Spartan-class Tugboat. The contractor's two Spartan-class tugboats (Figure 3-6) are rated at 2400 shaft horsepower. Each is equipped with a Skagit RB-90 double-drum towing winch, with 1,400 feet of 1-3/4-inch wire rope on each drum. Both tugs were used for the necessary towing, which included transportation of five bargeloads of scrap steel from the salvage site to Long Beach and the towing of the refloated fore section of TORGUGA to sea for scuttling.

3-2.3 SHOREBASED SUPPORT. Few major salvage operations have been successful in the absence of shorebased effort providing communications and logistic support of the work at sea. This situation was true with the TORTUGA operation. To the extent that there was a smooth flow of communications between offshore and shoreside personnel, problems could be discussed and solutions developed. This communication was particularly helpful in planning lead times needed to obtain special equipment.

3-3 MANAGEMENT

3-3.1 NAVY SHOREBASED COMMAND POST. The Navy command post was an ESSM based office van installed at Port Hueneme, California. This provided office space for the SUPSALV project manager and the salvage contractor's logistics manager. The command van contained the following equipment:

- One cellular telephone
- Two landline telephones
- Office equipment
- One microcomputer
- One reprographic machine.

Along with shorebased support coordinated through the Navy command post, the salvage contractor had additional shoreside support through its facilities at Pier 1, Long Beach, where the company maintains a complete staff including purchasing, marine operations, and marine engineering personnel. These individuals were available to assist the salvage team as needed.

3-3.2 NAVY ON-SCENE REPRESENTATIVE. A diving and salvage- trained Engineering Duty officer from Philadelphia Naval Shipyard was assigned to the scene and billeted aboard the ARCTIC SALVOR as the Navy's representative throughout the wreck-removal operation. The on-scene representative reported daily to the project manager at the command post in Port Hueneme on the progress of the operation. This officer also coordinated efforts between Fleet and contractor personnel.

3-3.3 PUBLIC AFFAIRS. In view of the environmental concerns associated with the removal of TORTUGA, public affairs was a sensitive activity during this operation. Because of the remoteness of the site, interaction with press and other media was not a daily occurrence. The project manager provided the PMTC public affairs office with necessary information, and periodic on-site visits by various interested parties, such as representatives of the National Park Service and NOAA, served to answer specific questions as to the progress of the operation.

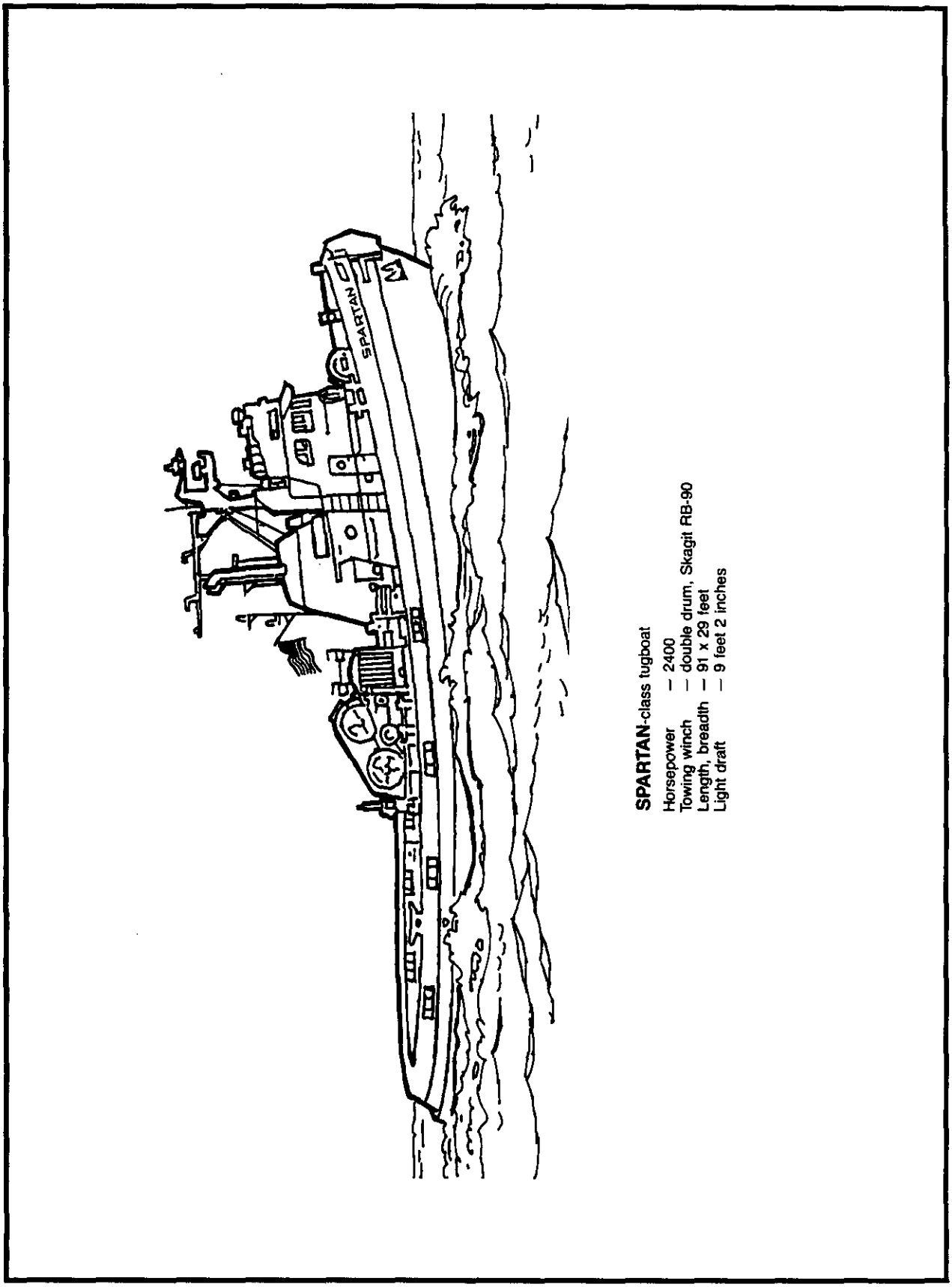
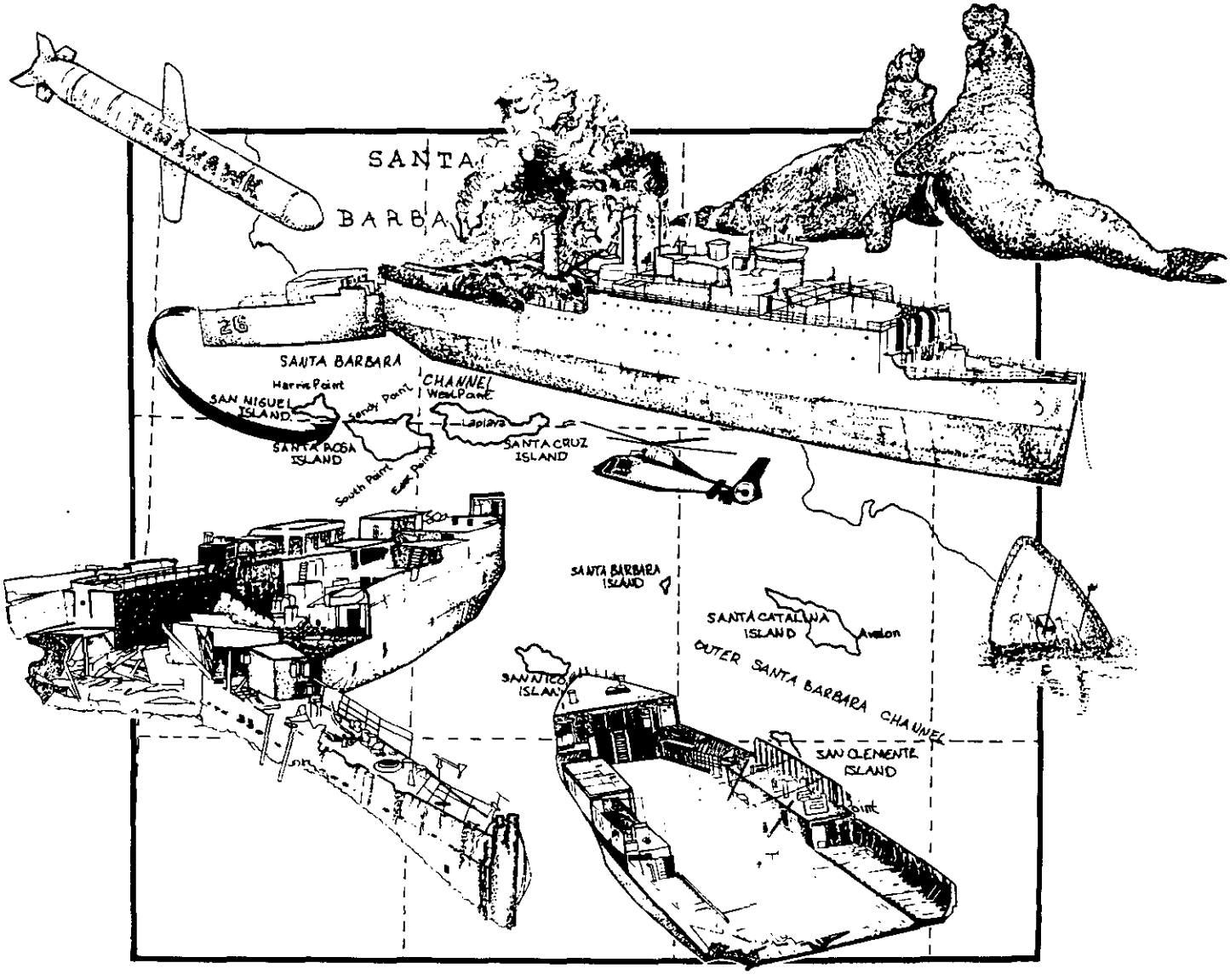


FIGURE 3-6. SPARTAN-class Tugboat.

3-3.4 FINANCIAL MANAGEMENT. Financial matters were coordinated by PMTC. Costs were tracked closely by the contractor and SUPSALV's project manager to stay within ceilings and to permit timely notification to PMTC as additional funds were needed. The total wreck-removal effort, including contractors, ESSM, and transportation costs, was completed both under budget and ahead of schedule.

Chapter 4

SALVAGE ENGINEERING CALCULATIONS



Chapter 4

SALVAGE ENGINEERING CALCULATIONS

The TORTUGA wreck removal operation provided the opportunity for the first real-time use of a new computer software developed by SUPSALV. This new system, entitled "Program of Ship's Salvage Engineering (POSSE)", is interactive, menu-driven, and uses inputs for weight, section modulus and hull shape to determine total displacement, bending stresses and damaged stability characteristics. The "Salvage Program Menu" is illustrated in Figure E-1. The program was used to make engineering assessments with regard to three major areas of concern: ground reaction, hull girder strength and transverse stability.

4-1 GROUND REACTION

While coming ashore, TORTUGA had sustained extensive hull damage. The resulting flooding had left the hulk with virtually no buoyancy. Therefore, the initial ground reaction (R_o) upon commencement of recovery operations was assumed equal to the entire weight of the ship and its contents, as illustrated in the following equation:

$$R_o = \Delta_F + S \qquad \text{Equation 1}$$

Since the actual weight of the fore section (Δ_F) was unknown, a light ship value of 4390 LT was assumed, where the weight of the detached stern section had been estimated at 400 LT. The weight of nearly 600 tons (over 500 LT) of scrap and debris which had been placed in the well deck prior to the stranding was neglected, because it was assumed that this material would have to be removed under any scenario. Otherwise, the ship was essentially empty of any cargo, except for the weight of sand which had washed into several spaces through the open bottom, represented by S.

The weight of the fore section Δ_F was subdivided as follows

$$\Delta_F = \Delta_t + \Delta_h \qquad \text{Equation 2}$$

$$\Delta = (1176 + 3214)\ \text{LT}$$

$$\Delta = 4390\ \text{LT}$$

Here, Δ_t is the weight of superstructure and topside decks removed from the fore section before refloating, and Δ_h is the weight of the remaining hull. The value for Δ_h of 3214 LT was arrived at by summarizing an itemized list of all structural weight remaining after removal of the superstructure, included as Figure E-2.

The following equation applied when pulling efforts began:

$$R = (\Delta_F + S) - (\Delta_t + B) \qquad \text{Equation 3}$$

$$= (\Delta_h + S) - B$$

The original ground reaction R_o was reduced by an amount equal to the sum of Δ_t and B. B is defined as the buoyancy made available in the fore section upon completion of salvage work below the well deck. Correcting the anticipated ground reaction R with a suitable static friction factor provided an estimate of the pulling force required to free the wreck

from its strand.

From equations 2 and 3 it is clear that as more steel was removed (i.e., as the value of Δ_t was increased), less buoyancy needed to be recovered, requiring less pulling force to free the wreck. This translated into fewer pulling assets required on station for the pull. The amount of success that would be achieved in recovering buoyancy from the ballast tanks and engineering spaces below the well deck was not known at the outset. Therefore, it was decided to drive the value of Δ_t as high as possible by removing all topside weight not actually required to keep the hull below the well deck intact or which would have some other bearing on the pulling and scuttling effort.

Figure 4-1 shows a plan view through the well deck of the fore section of TORTUGA, detailing the numerous spaces available for dewatering. A graph of the water level and corresponding static head necessary to achieve a given increase in buoyancy was prepared for each ballast tank and engineering space. Figure 4-2 shows a sample plot for wing tanks A-412-F and A-413-F. Based on a conversion of one foot of floodwater displaced (literally pushed out the bottom) for every 0.445 psig of air pressure introduced and retained in the space, the maximum static pressure achieved corresponded directly to a specific increase in buoyancy. Calculations for all tanks and engineering spaces were done in this manner. (A permeability factor of 0.85 was used for the six engineering spaces and 1.00 for all tanks). The water level within each space in the stranded condition prior to dewatering was established by interpolating between measured drafts for the fore section. Observed drafts were as follows:

Forward: 12.3' Aft (FR 88): 15.2'

These drafts are normalized to a nominal six-foot high tide, since the highest expected tide during the period of the wreck removal operation was slightly above this.

The logic used by the POSSE computer program include the weight of floodwater as part of the weight of the hulk itself. It then compensates for this by assuming that the buoyancy acting on the wreck includes an upward force attributed to this "displaced" floodwater. Since the weight of the wreck and the recovered buoyancy are opposing forces in ground reaction calculations, the "contribution" of this freely-communicating floodwater is cancelled out.

Figure 4-3 is the resulting printout from the "Stranded" subprogram. The final water level in each space as listed in Figure E-2 at a six-foot tide was summed to yield 2542 LT. A conservative estimate for the weight of sand in each space (as observed by the diving team) is also listed in Figure E-2. These values were summed to yield 385 LT. Thus, the total computed weight indicated by the printout in Figure 4-3 was arrived at as follows:

$$\text{Weight} = \Delta_h + H_2O + S \qquad \text{Equation 4}$$

$$= (3214 + 2542 + 385)\ \text{LT}$$

$$= 6141\ \text{LT}$$

The weight of the volume of water displaced by the grounded fore section during a nominal six-foot high tide was calculated by the program to be 6007 LT. As discussed previously, this value did not take into account that some of the "displaced" water (i.e., that water which remained in the hull after blowing down with compressed air) was actually still in the

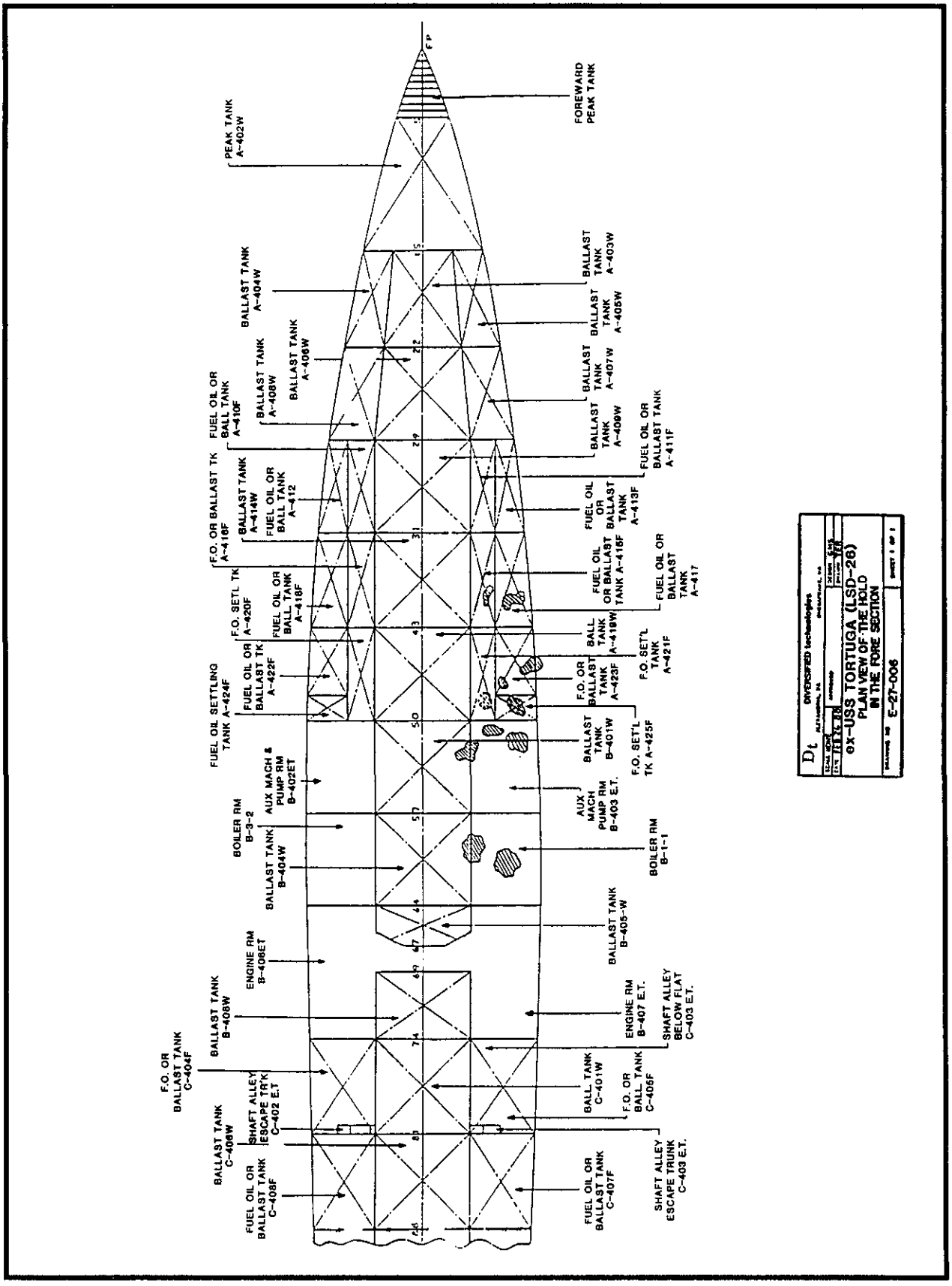


FIGURE 4-1. Plan View of Spaces Below the Well Deck in the Fore Section.

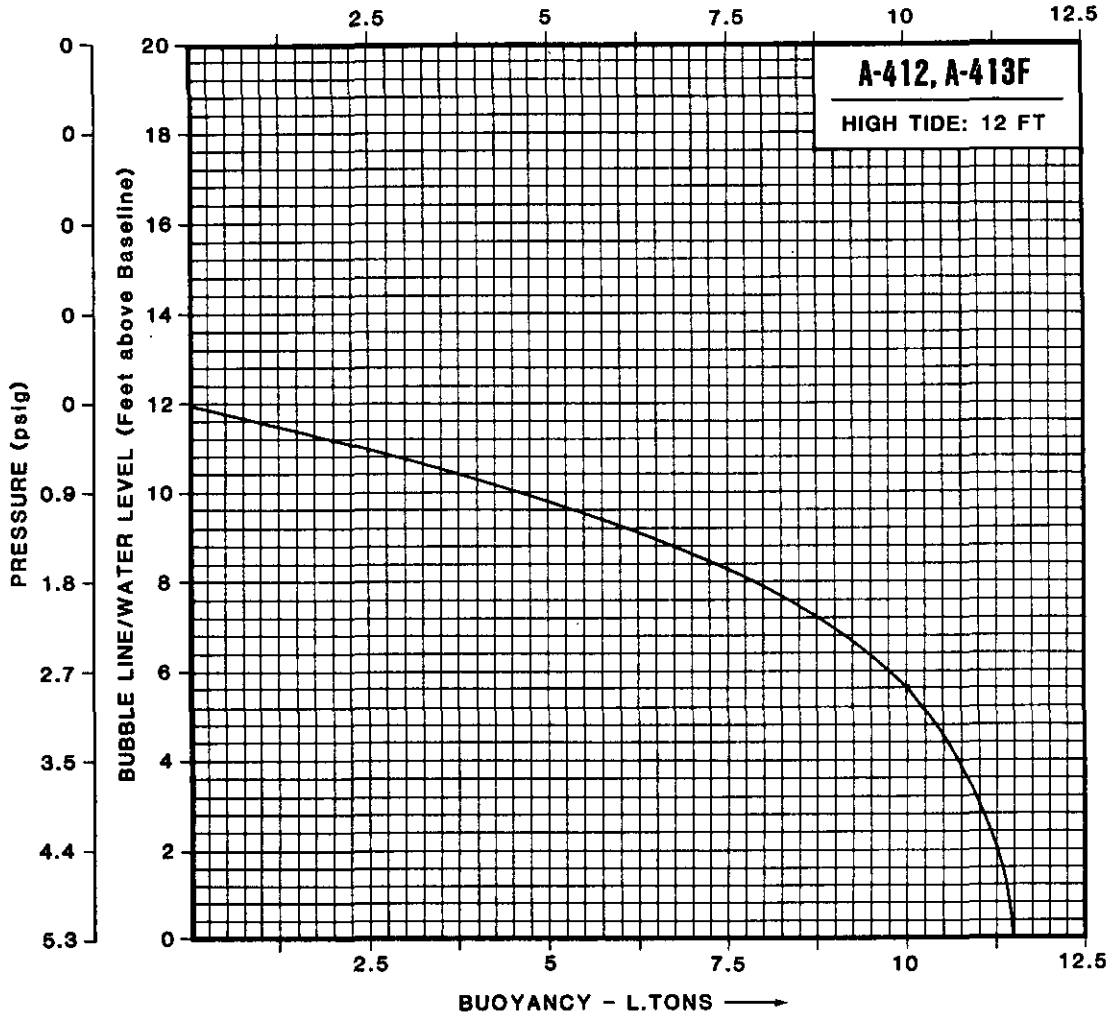
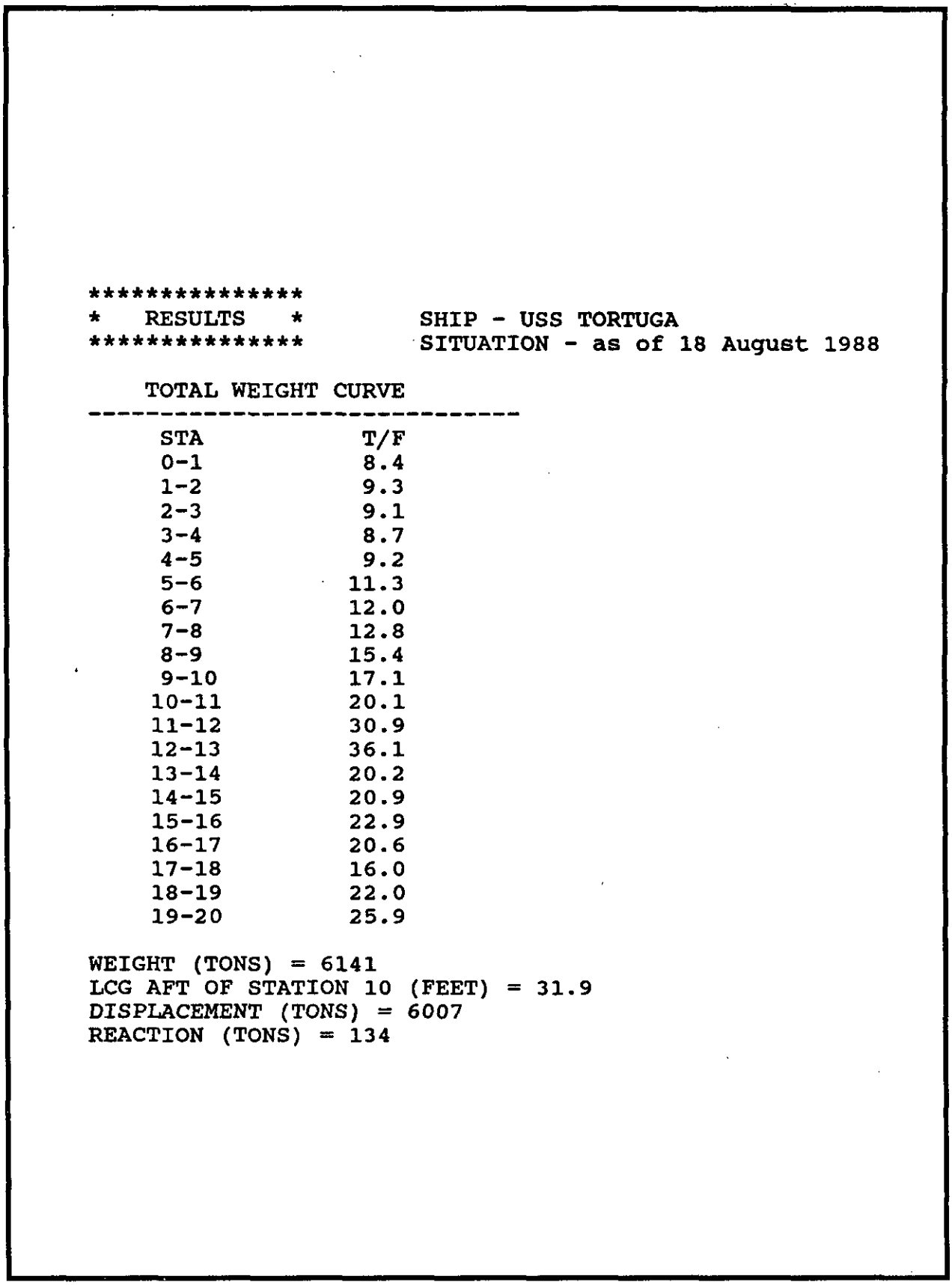


FIGURE 4-2. Sample Tank Capacity Curve.



```
***************
*   RESULTS   *          SHIP - USS TORTUGA
***************          SITUATION - as of 18 August 1988

    TOTAL WEIGHT CURVE
------------------------------
     STA            T/F
     0-1            8.4
     1-2            9.3
     2-3            9.1
     3-4            8.7
     4-5            9.2
     5-6           11.3
     6-7           12.0
     7-8           12.8
     8-9           15.4
     9-10          17.1
    10-11          20.1
    11-12          30.9
    12-13          36.1
    13-14          20.2
    14-15          20.9
    15-16          22.9
    16-17          20.6
    17-18          16.0
    18-19          22.0
    19-20          25.9

WEIGHT (TONS) = 6141
LCG AFT OF STATION 10 (FEET) = 31.9
DISPLACEMENT (TONS) = 6007
REACTION (TONS) = 134
```

FIGURE 4-3. Subprogram "STRANDED" Printout.

fore section; this water was included as added weight in equation 4. Thus, the effective buoyancy B acting on the fore section upon completion of assumed dewatering by air was

$B = (6007 - 2542)$ Equation 5

$= 3465$ LT

Finally, the ground reaction R was determined by subtracting the effective buoyancy B provided by equation 5 above from the weight of the hull (Δ_h) and its effective contents (S):

$R = (\Delta_h + S) - B$ Equation 6

$[(3214 + 385) - 3465]$ LT

$= 134$ LT

The friction factor for rock is rated between 0.8 to 1.5. Because of the large amount of sand believed to be between the hull and the rock bottom, a factor of 1.0 was used for all initial estimates. Measurements taken onboard ARCTIC SALVOR showed the total maximum bull rope tension between the two Skagit winches used during the extraction to be approximately 160 LT. This indicated a friction factor of about 1.2 for the ground reaction of 134 LT calculated in equation 6, although clearly 134 LT is only a salvage estimate as well and in actuality it was most likely greater.

4-2 HULL GIRDER STRENGTH

Due to extensive damage, it was suspected that the strength of the hull had been significantly reduced. Maximum stresses were computed to compare with the yield stress of the remaining structure. Figures 4-4 and 4-5 show the weight distribution for the entire fore section before and after the topside weight removal phase. The weight distribution of Figure 4-5 was used to generate the weight curve in Figure 4-6 which, when combined with the buoyancy curve generated from Bonjean areas, yielded the load curve. Second integration of this load curve, in turn, yielded the bending moments (M) which were computed for eleven evenly-distributed stations 35.2 feet apart. Figure 4-7 shows the summary of moments for both a stillwater condition and worst-case conditions of hog and sag. The worst-case scenarios are based upon a standard L/20 wave, where it is assumed that the fore section is supported amidships or at both ends on the crests of a 352-foot long, 17.6-foot high wave. As can be seen in Figure 4-7, the maximum bending moment predictably occurs in the midships area.

The section modulus (Z) for each station was computed using measurements taken manually onboard the fore section at each 35.2-foot station and entered in the "Ship Cross Section Properties" subprogram. As an example, Figure E-3 shows the input required to compute the section modulus for Station 8 (around Frame 70) and the results of that input. Figure 4-8 shows the composite section moduli for all eleven stations. These values increase toward the midships area due to the increase in the ship's cross section. The exception is Station 6, which had sustained significant damage to local bottom plating and longitudinals where a large boulder had penetrated the hull.

Bending stresses were computed based on the relationship

$\sigma = M / Z$ Equation 7

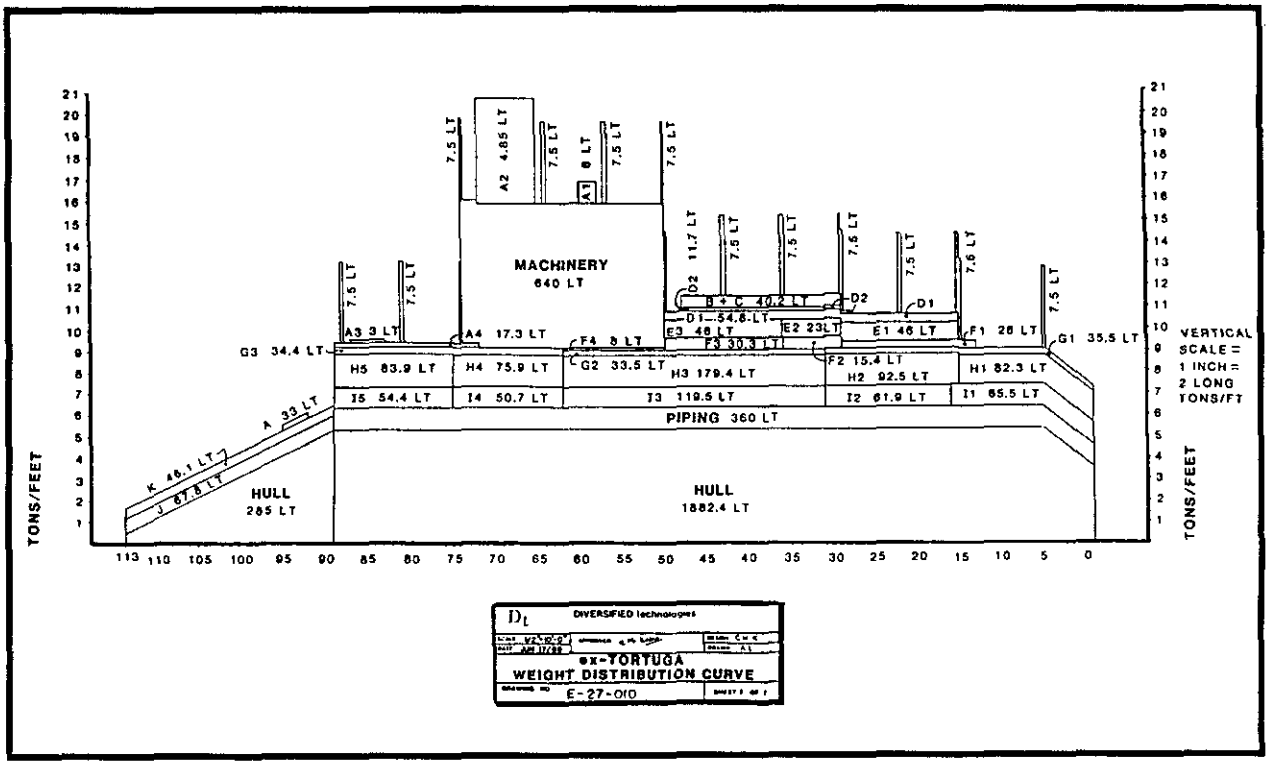


FIGURE 4-4. Weight Distribution Curve (Before Weight Removal).

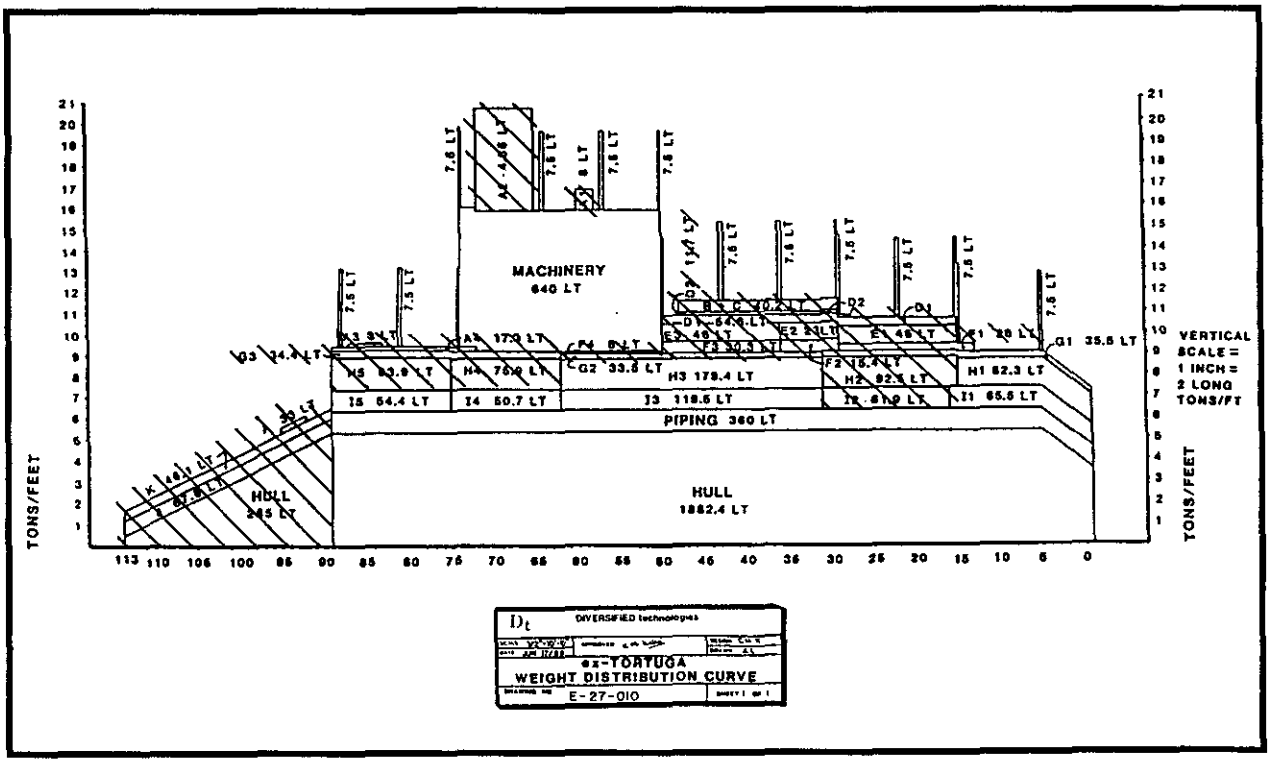


FIGURE 4-5. Weight Distribution Curve (After Weight Removal).

STATIONS	WEIGHT CURVE	BUOYANCY CURVE	LOAD CURVE
	(- - - - - - Long Tons per Foot - - - - - -)		
0 to 1	10.8	-2.4	8.3
1 to 2	7.3	-7.6	-0.3
2 to 3	11.6	-13.9	-2.3
3 to 4	13.6	-19.4	-5.8
4 to 5	16.7	-22.6	-5.9
5 to 6	26.0	-25.6	0.4
6 to 7	29.0	-25.2	3.8
7 to 8	22.5	-24.1	-1.6
8 to 9	18.6	-21.0	-2.3
9 to 10	22.8	-16.9	5.9

TOTAL WEIGHT CURVE = 6293 LONG TONS
TOTAL BUOYANCY CURVE = -6293 LONG TONS

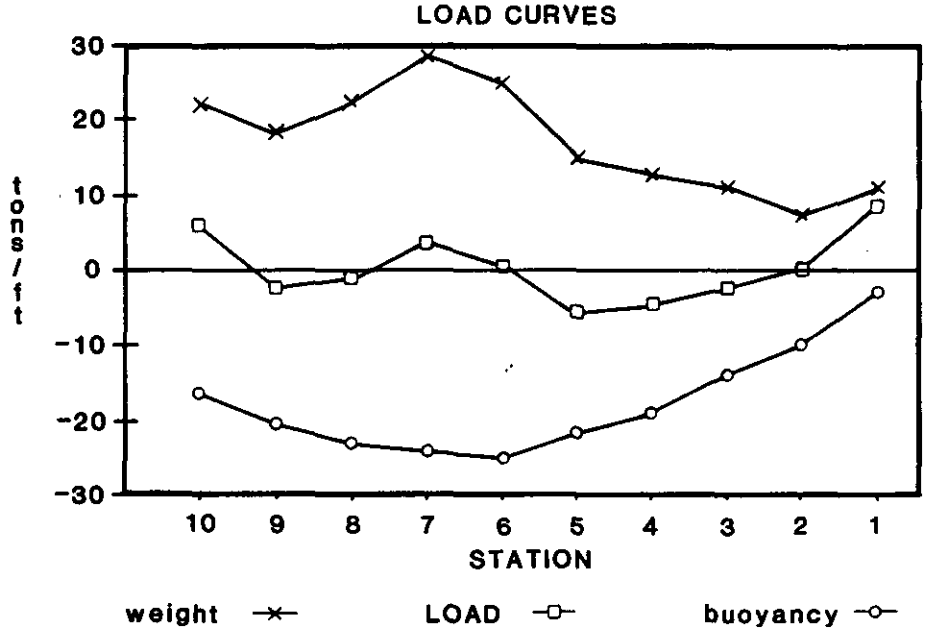


FIGURE 4-6. Weight, Buoyancy and Load Curve Values from "AFLOAT" Subprogram.

USS TORTUGA BENDING MOMENTS IN FOOT TONS

WAVE HEIGHT 17.6 FEET SITUATION as of 18 August 1988
WAVE LENGTH 352 FEET
WAVE CENTER 0 FM AMIDSHIPS

STATION	STILLWATER	HOG	SAG
0	0	0	0
1	4447	5592	3303
2	14629	23785	5478
3	24031	50834	-2755
4	27977	72897	-16912
5	25470	85056	-34064
6	16677	72802	-39383
7	16739	61982	-28429
8	11390	33203	-10354
9	7536	17688	-2569
10	-0	0	-0

Negative Bending Moments Indicate Tension in the Keel
PRESS C TO CONTINUE [FOR PRINT TYPE shft + prtsc keys] ?

FIGURE 4-7. Bending Moments.

SHIP SECTION MODULUS IN SQ. IN. - FEET

STATION	S.M. KEEL	S.M. DECK
0.0	0.0	0.0
1.0	1961.0	2790.0
2.0	4432.0	5128.0
3.0	6534.0	6526.0
4.0	8651.0	8032.0
5.0	10069.0	8650.0
6.0	5915.0	7161.0
7.0	10142.0	8261.0
8.0	9481.0	8231.0
9.0	8252.0	8189.0
10.0	6733.0	7563.0

FIGURE 4-8. Section Moduli.

Although the maximum bending moment occurred at Station 5, the reduced section modulus located at Station 6 produced the largest stresses: 12.3 and 10.2 tons per square inch (TSI) at the keel and well deck, respectively, in a hogging condition. Figure 4-9 lists composite bending stresses for all eleven stations.

Based on a yield stress of 15 TSI for mild steel, it was concluded that there was sufficient strength left in the hull for the fore section to float in any reasonable seaway without breaking up.

4-3 TRANSVERSE STABILITY

Stability of the hull was a matter of concern due to the free surface effect of the numerous partially flooded spaces, as well as the possibility of partial loss of the air bubble during extraction or from excessive heeling during the trip to the scuttling point.

The height of the center of gravity above the keel (KG) for the fore section with the superstructure and upper decks removed was estimated to be 15.8 feet. To remain conservative, the weight of sand was neglected in computing KG, since it was not known how much sand would be lost (washed out through the open bottom) during extraction or in transit to the scuttling site. In order to further anticipate a less-than-optimum situation, it was also assumed for calculative purposes that the air bubble would be "spilled" or otherwise lost from A-421/423/425-F and B-403-ET on the starboard side. With these conditions, the height of the center of gravity of all floodwater remaining after blowing down with compressed air was estimated at 4.1 feet, which reduced the overall KG of the fore section to 10.6 feet.

The assumption of a partially lost air bubble noted above, as well as the existing conditions of asymmetrical flooding and weight removal, would contribute to a net shift in the CG of the fore section of 1.8 feet to starboard. Finally, a free surface/free communication correction of 0.85 feet was computed, yielding an effective KG of about 11.5 feet. Figure 4-10 contains these results as provided by the "Estimating Ship Weight and Free Surface" subprogram.

Finally, righting arms were calculated by the "Cross Curves of Stability" subprogram by dividing the submerged volume of the hull for a given heeling angle into the moment of inertia of that volume about a longitudinal vertical plane passing through the CG. The results (Figure 4-11) predicted a starboard list, with maximum righting arms occurring at an angle of heel of 30°. These results indicated that stability would not be a problem during extraction or scuttling, even with an asymmetrical partial loss of buoyancy.

The determinations of ground reaction, hull girder strength and ship stability were iterative in nature and were continually refined as the salvage operation progressed. The numerical values documented in this chapter reflect the final, most accurate values calculated.

USS TORTUGA BENDING STRESSES IN TSI

STATION	STILLWATER		HOG		SAG	
	TOP	KEEL	TOP	KEEL	TOP	KEEL
0	0.00	0.00	0.00	0.00	0.00	0.00
1	1.59	2.27	2.00	2.85	1.18	1.68
2	2.85	3.30	4.64	5.37	1.07	1.24
3	3.68	3.68	7.79	7.78	-0.42	-0.42
4	3.48	3.23	9.08	8.43	-2.11	-1.95
5	2.94	2.53	9.83	8.45	-3.94	-3.38
6	2.33	2.82	10.17	12.31	-5.50	-6.66
7	2.03	1.65	7.50	6.11	-3.44	-2.80
8	1.38	1.20	4.03	3.50	-1.26	-1.09
9	0.92	0.91	2.16	2.14	-0.31	-0.31
10	-0.00	-0.00	0.00	0.00	-0.00	-0.00

FIGURE 4-9. Composite Bending Stresses for Eleven Stations

****
* WEIGHT SUMMARY *
********** SITUATION - Lost bubble stbd/no sand

Item	Weight (Tons)	Center of Gravity in FEET		
		FM FP	FM KEEL	FM C.L.[P-,S+]
INITIAL DISP	3439.00	181.0	15.8	0.0
CARGO	0.00	0.0	0.0	0.0
FLOODING	2744.67	238.4	4.1	4.1
TOTAL	6183.67	206.5	10.6	1.8

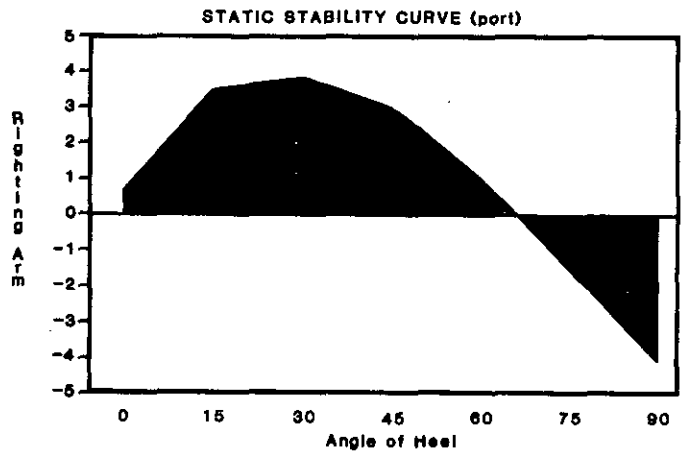
FLOODING EFFECTS

Total Free Surface Correction (FEET) = 0.69
Total Free Commun. Correction (FEET) = 0.16
Overall Corrections For F.S. AND F.C. (FEET) = 0.85

FIGURE 4-10. Effects of Asymmetrical Flooding from "ESTIMATING SHIP WEIGHT AND FREE SURFACE" Subprogram.

RIGHTING ARMS (virtual KG = 15.4'; TCG = 0.8' stbd; Mean Draft = 14.9')

Heel to Port		Heel to Starboard	
Degrees	Righting Arm	Degrees	Righting Arm
0	0.80	0	-0.80
15	3.66	15	2.11
30	4.00	30	2.61
45	3.30	45	2.17
60	1.29	60	0.49
75	-1.37	75	-1.79
90	-4.34	90	-4.34



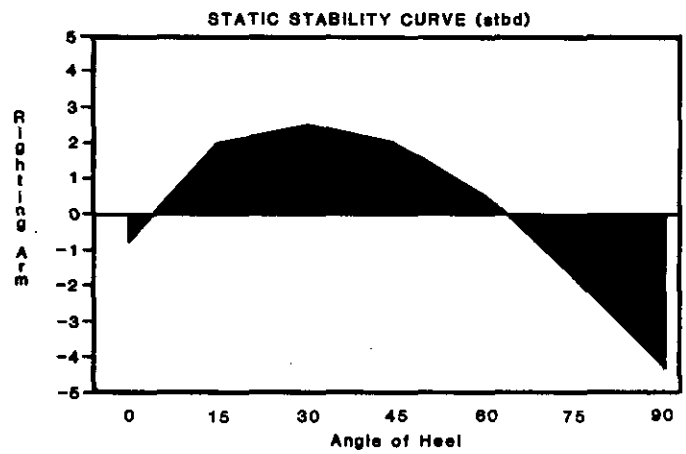
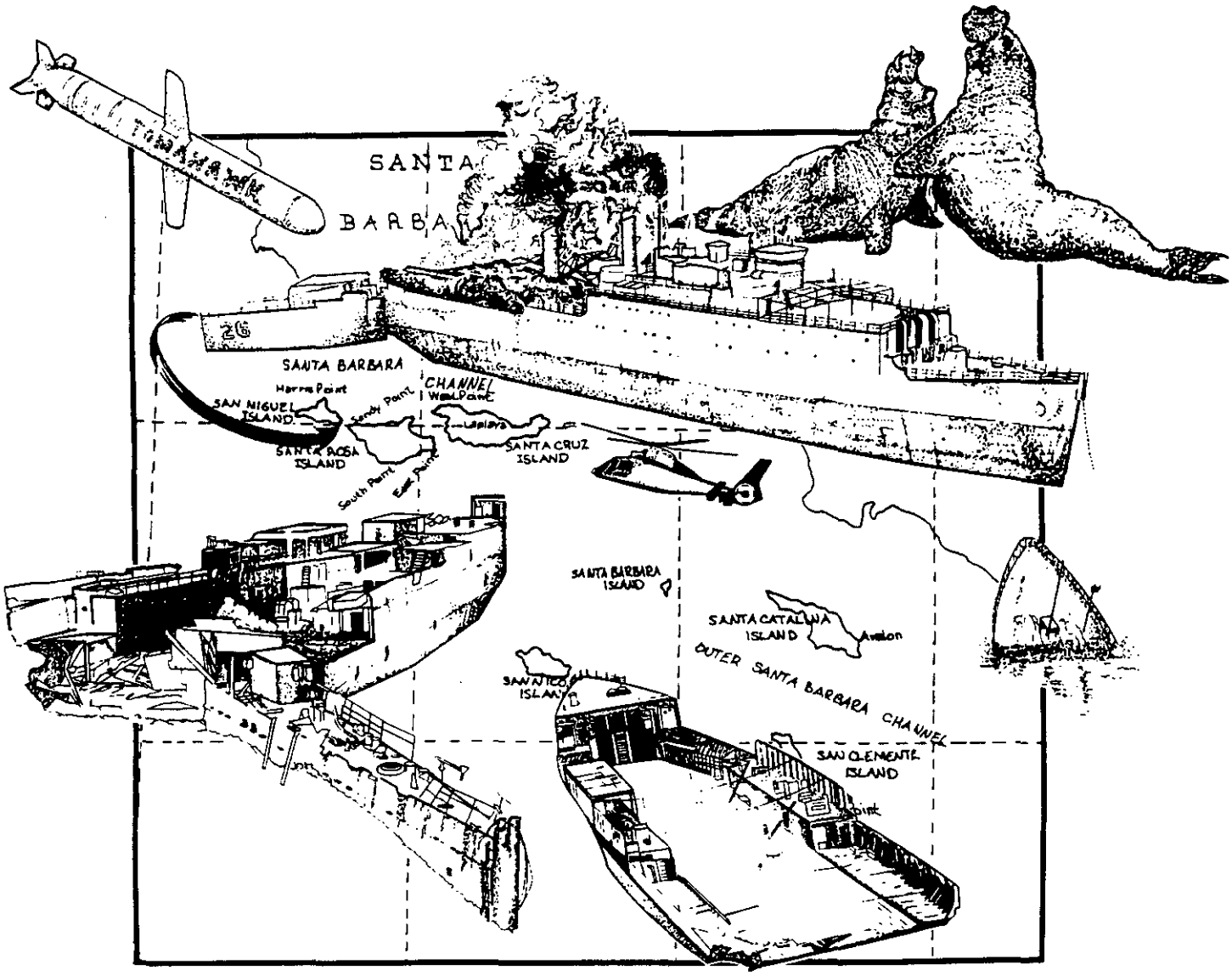


FIGURE 4-11. Righting Arms.

Chapter 5

WRECK REMOVAL OPERATIONS



Chapter 5

WRECK REMOVAL OPERATIONS

5-1 PROBLEMS ENCOUNTERED

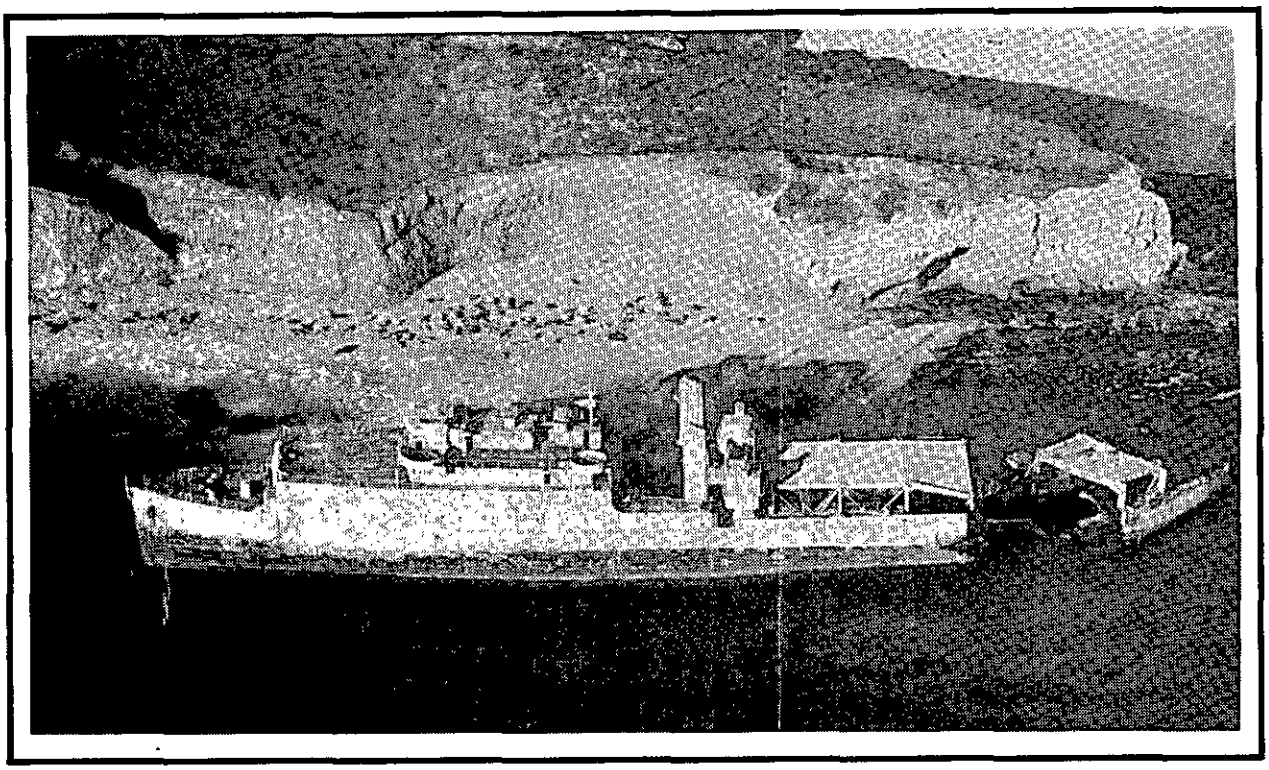
5-1.1 ACTUAL RECOVERY CONDITIONS VS. SURVEY FINDINGS.

Actual Condition of TORTUGA. At the conclusion of the survey, it was believed that TORTUGA was impaled in several places on a jagged rock bottom; however, once the operation got underway, the vessel was discovered to be significantly impaled only by one large boulder in the starboard auxiliary machinery room, and was otherwise resting on a sand-covered rock ledge. The numerous holes in the bottom shell plating may have been caused for the most part by this single boulder. Survey results had also suggested that the hull plating was cracked extensively around Frame 41, but no evidence of actual hull cracking that would have threatened the structural integrity of the hull girder was found during the removal effort; i.e., all hull damage was local in nature. Figures 5-1 through 5-5 show actual conditions of the stranded TORTUGA.

Impact of Weather Conditions. Wind and swell conditions (Figures 5-6 and 5-7) were a major factor throughout the TORTUGA operation. The south side of the island experiences wind conditions unlike those on the rest of the island, with the result that actual wind velocities at the work site were significantly higher than those projected for the area by the U.S. Weather Bureau. As a typical daily pattern, winds would lessen around 0100 or 0200 and stay in the 25- to 30-knot range until 1200 or 1400, at which time they would steadily increase until late in the afternoon when they would hit their maximum sustained velocity of 60 to 70 knots. These unexpectedly high winds were thought to be caused by a venturi effect created between Cardwell Point on San Miguel Island and Sandy Point on Santa Rosa Island, about three miles to the southeast. Winds of these velocities, compounded by consistently high southerly swells created conditions alongside TORTUGA which were often too rough to get personnel on or off the wreck by boat. As a result, a daily helicopter operation was adopted shortly after the start of the operation for personnel transportation.

Effect of Kelp on Anchoring. Contrary to what the contractor had observed in the salvage survey, the kelp line extended much farther out from the island, up to 2,700 feet. Upon arrival of the ATB-99 at the work site, the anchoring system was placed approximately 1,500 feet out from TORTUGA, but the kelp was so thick that the anchors would not hold. The contractor aborted this first attempt at anchoring when heavy southerly swells came up rapidly on the first day at the scene and carried the barge stern into TORTUGA. A corner of the ATB-99 was damaged. The barge was returned to Long Beach, where repairs were completed, the anchor wires were replaced with 3,500-foot wires, and the original 8,000-pound offshore anchors were replaced with 15,000-pound anchors. On the second attempt at the site, the anchors found sand bottom, and no further problem with dragging anchors was experienced. However, kelp continued to be a problem for the operation each time the anchor lines were pulled in for the barge's departure with a load of scrap steel. Six to eight hours were required each time to get the two anchors up, clear the kelp from the wires and anchors and get the barge ready to sail.

Communication with Shorebased Facilities. Communication between work-site operations and shoreside support was maintained by cellular telephone and by VHF radio. Telephone communication was often interrupted or broken, apparently because the distance between



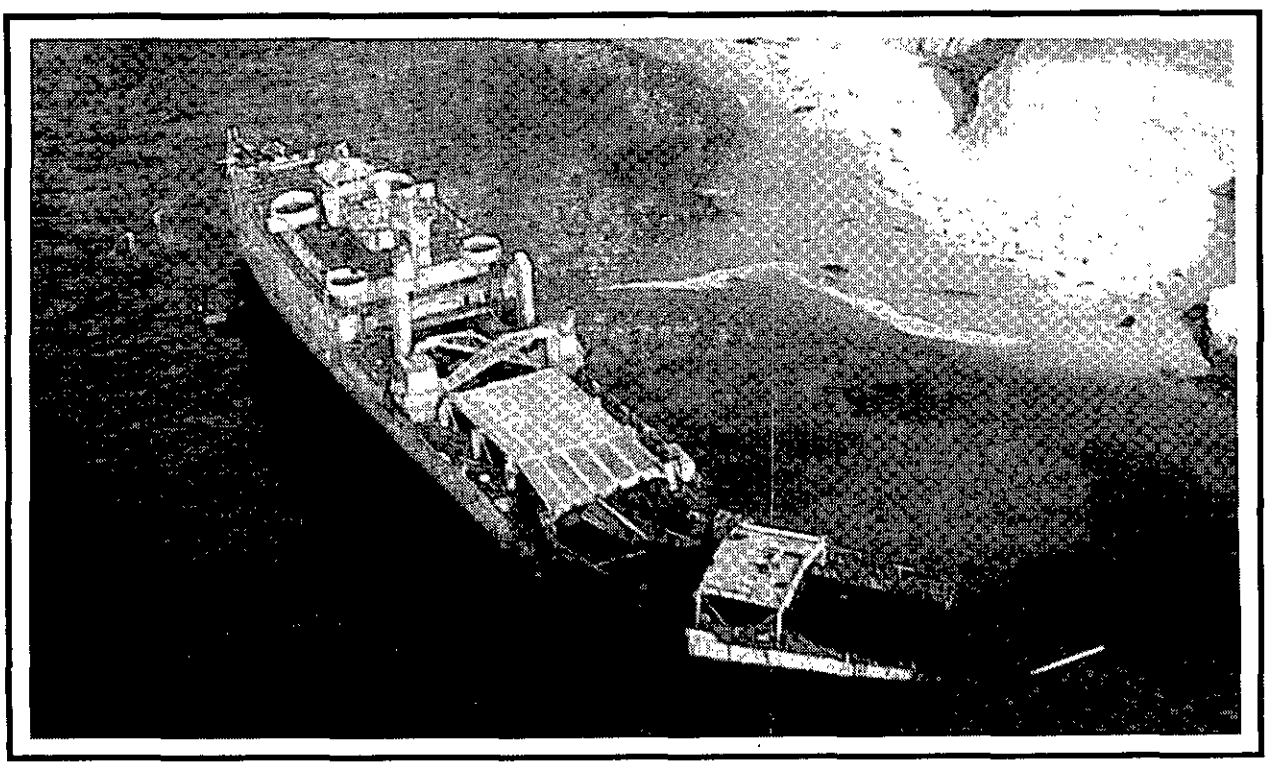


FIGURE 5-1. Two Views of TORTUGA as Originally Stranded on San Miguel Island.

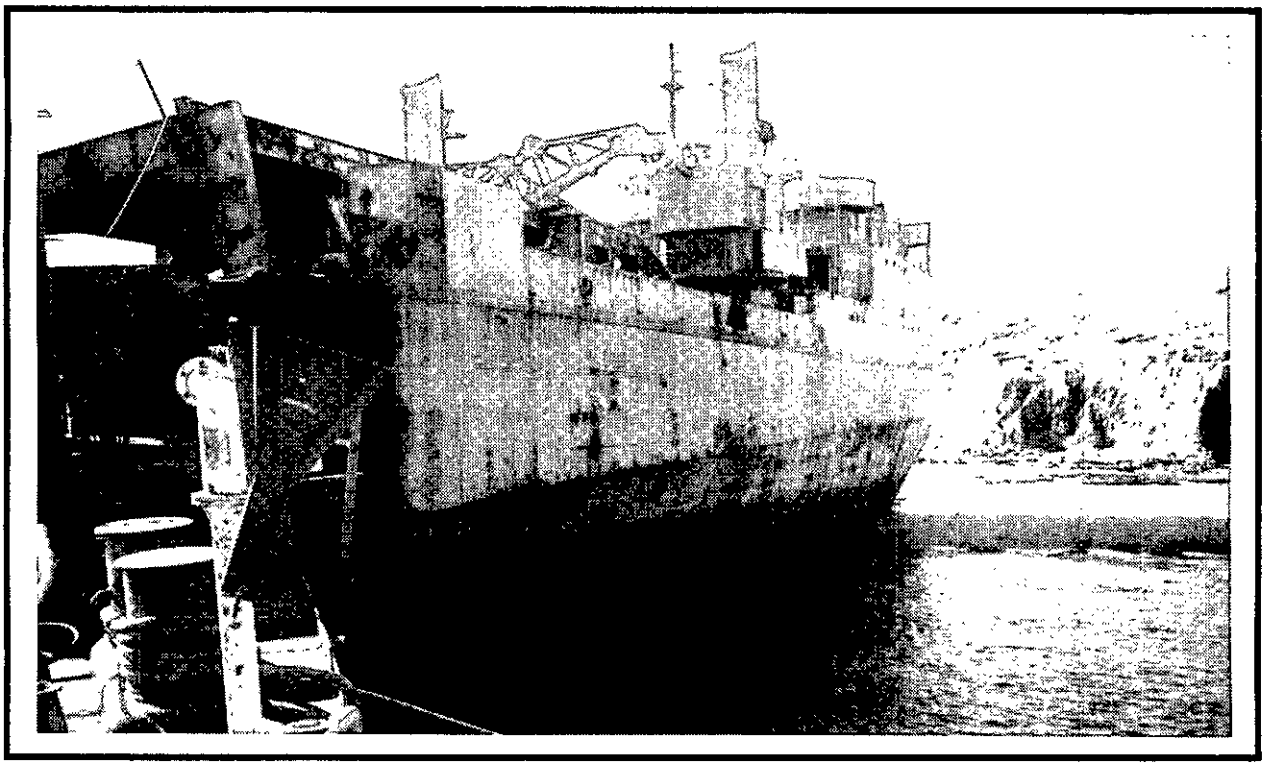


FIGURE 5-2. Starboard Side of TORTUGA on San Miguel Island.

FIGURE 5-3. View Look at the Broken Stern.

FIGURE 5-4. Starboard Side Amidships Stranding Point.

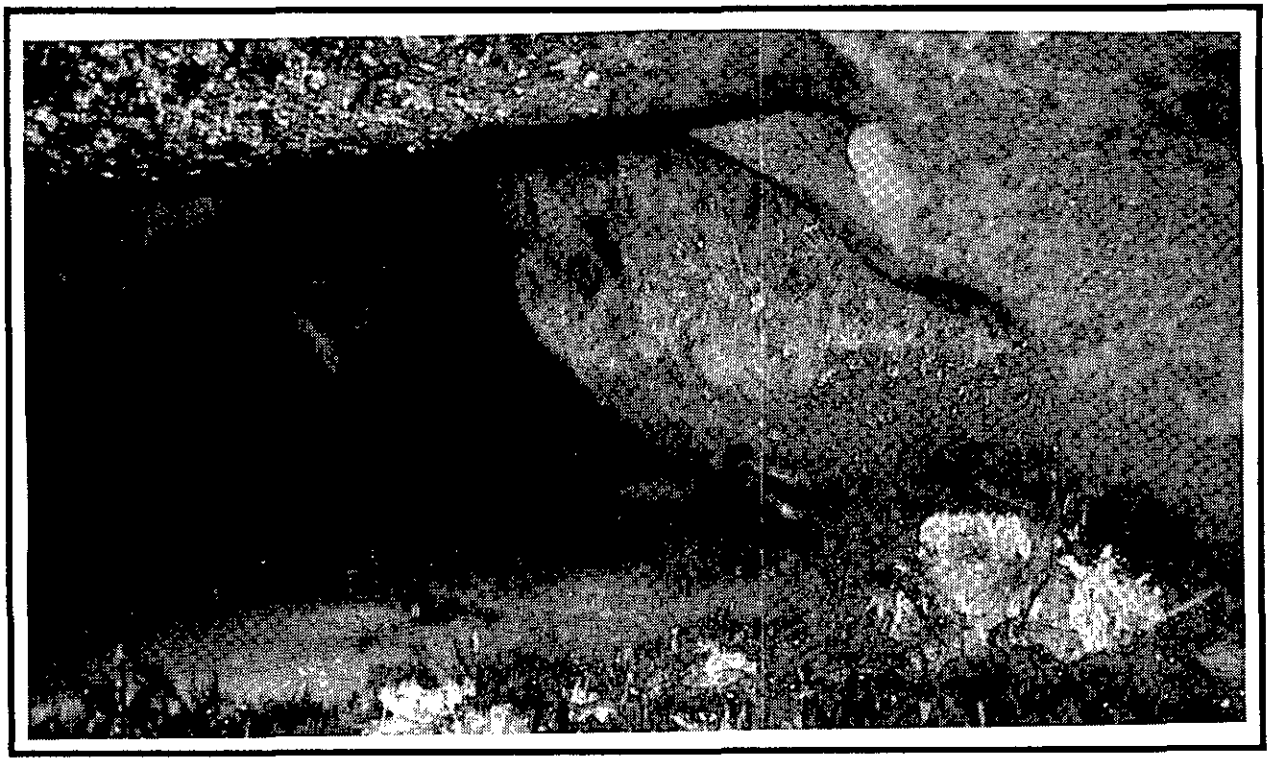


FIGURE 5-5. Rock Impaled into Starboard Engine Room.

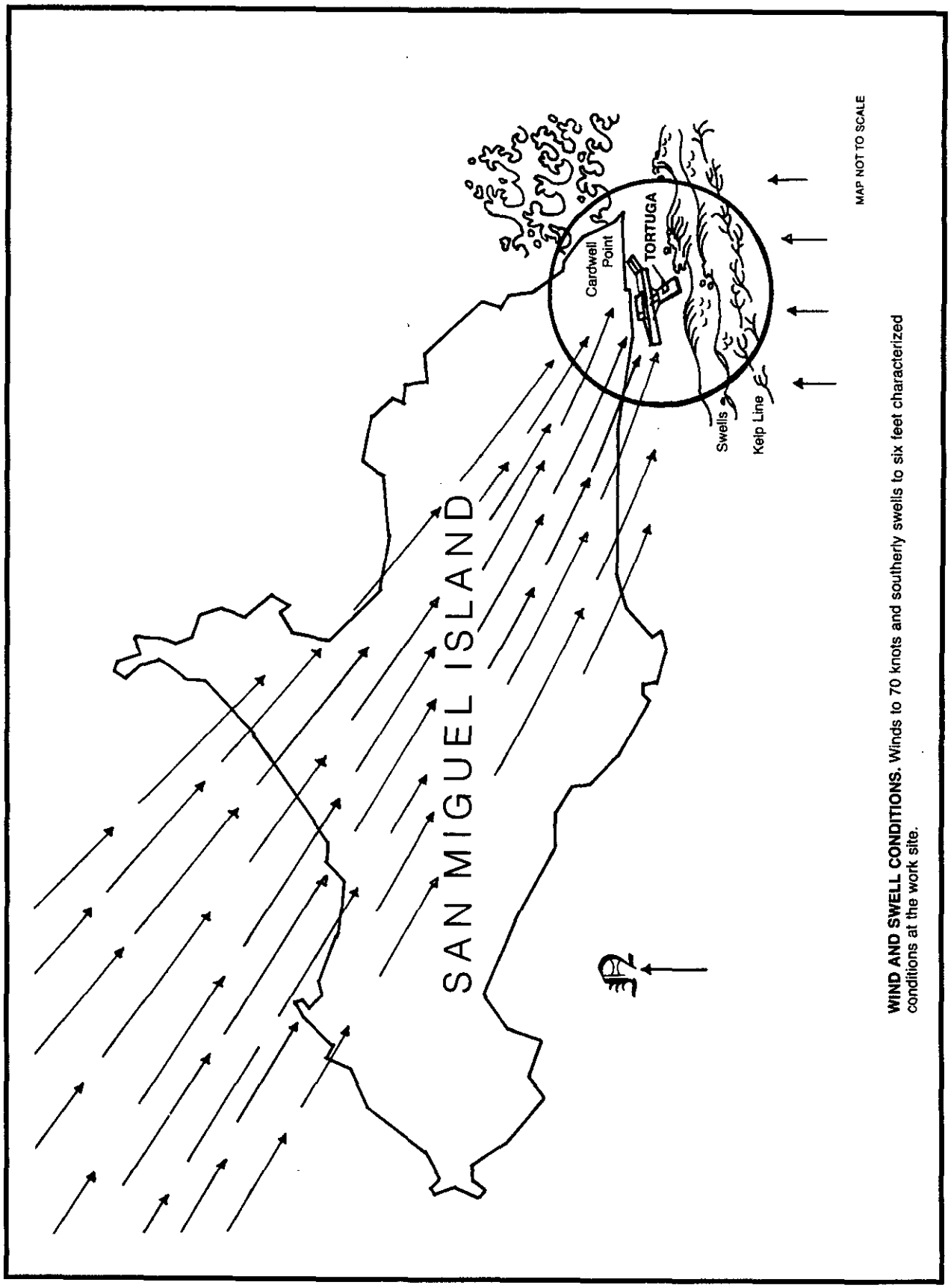


FIGURE 5-6. Wind and Swell Conditions.

FIGURE 5-7. Swell Action at Wreck Site.

the command center and the work site (over 50 miles) was at or near the maximum range of the cellular phone capability. Communication by VHF radio was affected by atmospheric conditions, so that on occasion transmission was impossible despite the efforts of the marine radio operator at Santa Barbara.

5-1.2 AIRBORNE CONTAMINANTS. In keeping with standard practice when TORTUGA was built, asbestos was used for lagging of various piping, in ceiling tiles, and in bulkhead insulation. In addition, airborne contaminants included dust, smoke from small fires and burning operations, and paint and metal fumes from burning through World War II-vintage paint containing lead and chromate.

The arrival of Navy divers at the scene focused additional attention early-on in the project on the need for greater personnel protective measures, particularly as they applied to the asbestos hazard. Occupational safety specialists from SIMA, San Diego, and from the salvage contractor's own safety office performed independent surveys and provided recommendations on how to improve the safety of personnel working on the wreck. As a result, each person visiting or working aboard TORTUGA was issued a half-mask respirator with combination filter cartridges designed for protection against asbestos, dust, and metal fumes. Burners working directly with the asbestos-insulated pipes were fully suited in Tyvek impervious coveralls, boot covers, hoods, full-face respirators, and gloves, with all joints taped. A change room was established so that contaminated clothing was not worn off the vessel. Used coveralls were taken to the ARCTIC SALVOR, soaked overnight in a strong detergent solution, then washed and reissued to workers. A decontamination area was also established on the stern of the salvage vessel, providing a place for wash-down as workers returned to the SALVOR, thus ensuring that no contaminants were tracked into the

berthing spaces.

Wherever asbestos was encountered, the vessel was hosed down thoroughly several times each day. Hard-to-reach places were wet down with buckets of soapy water. The practice of keeping asbestos wet greatly reduces the release of particles into the air. Small incisions were made in pipe lagging where cuts were planned and a pressurized water sprayer was used to soak the asbestos, which was then removed and placed in a plastic bag for disposal. Open ends of asbestos were well sealed with plastic visqueen. Once cut, sections of asbestos-wrapped pipe were placed in plastic with the ends and seams taped. All asbestos-contaminated materials were placed in two designated compartments, one each on the port and starboard sides. At the conclusion of the burning phase, these compartments were sealed shut and the plastic-wrapped asbestos inside was allowed to sink with TORTUGA when it was scuttled.

These procedures evolved gradually and sporadically as the scope of the problem became more defined. The U.S. Navy Ship Salvage Safety Manual, S0400-AA-SAF-010, dated 22 NOV 88, had not yet been issued to provide guidance. For these reasons, the complexities of setting up a U.S. Navy diving station became too hard and the tasks of recovering lost buoyancy was turned over to the contractor.

5-1.3 FIRE. Frequent small fires erupted on the vessel as insulation, wires, paint or debris ignited during the burning phase, although at no time was a fire allowed to get out of control. A fire hose was kept charged and available to turn on any flame or hot area. Burning areas were watered down regularly.

5-1.4 INJURIES. Salvage operations of the type required by TORTUGA offer many possibilities for injury. Burning and welding operations, utilizing high-pressure oxygen and propane, create the potential for flash burns and fire aboard the vessel. Other dangers arise from falling pieces of scrap, weighing from one to eight tons each, from holes and debris in walkways, and from crane operations. An important aspect of the management of the project was having a contractor Emergency Medical Technician (EMT) and a Navy corpsman on the scene to respond immediately to injuries, although the corpsman departed when Fleet diver participation was terminated several weeks into the operation. Only three injuries, all minor in degree of severity, occurred during the removal of TORTUGA; nevertheless, prevention of injuries was a constant concern and required continuous vigilance.

5-2 TOPSIDE WEIGHT REMOVAL IN THE FORE SECTION

5-2.1 MOORING THE SCRAP BARGE TO THE WRECK. The scrap barge was brought out from Long Beach and moored into place at the wreck site each time a bargeload of scrap had accumulated within TORTUGA's well deck (Figures 5-8 and 5-9). For environmental reasons, the placement of the two anchors was marked by buoys so that they could be dropped in the same place each time. Mooring of the barge ATB-99 to the wreckage was accomplished with four lines, two off the stern directly to TORTUGA, and two which led from a Skagit RB-90 deck winch through Berger fairleads to the wreck (Figure 5-10). Distance between the two vessels varied from 25 to 100 feet, depending upon swell and surf conditions.

In general, the high winds off the island had little effect on the barge. When those winds calmed, however, a long slow southerly swell would develop which would, if it reached five or more feet, put the barge in danger of grounding out on the bottom. Water depth next

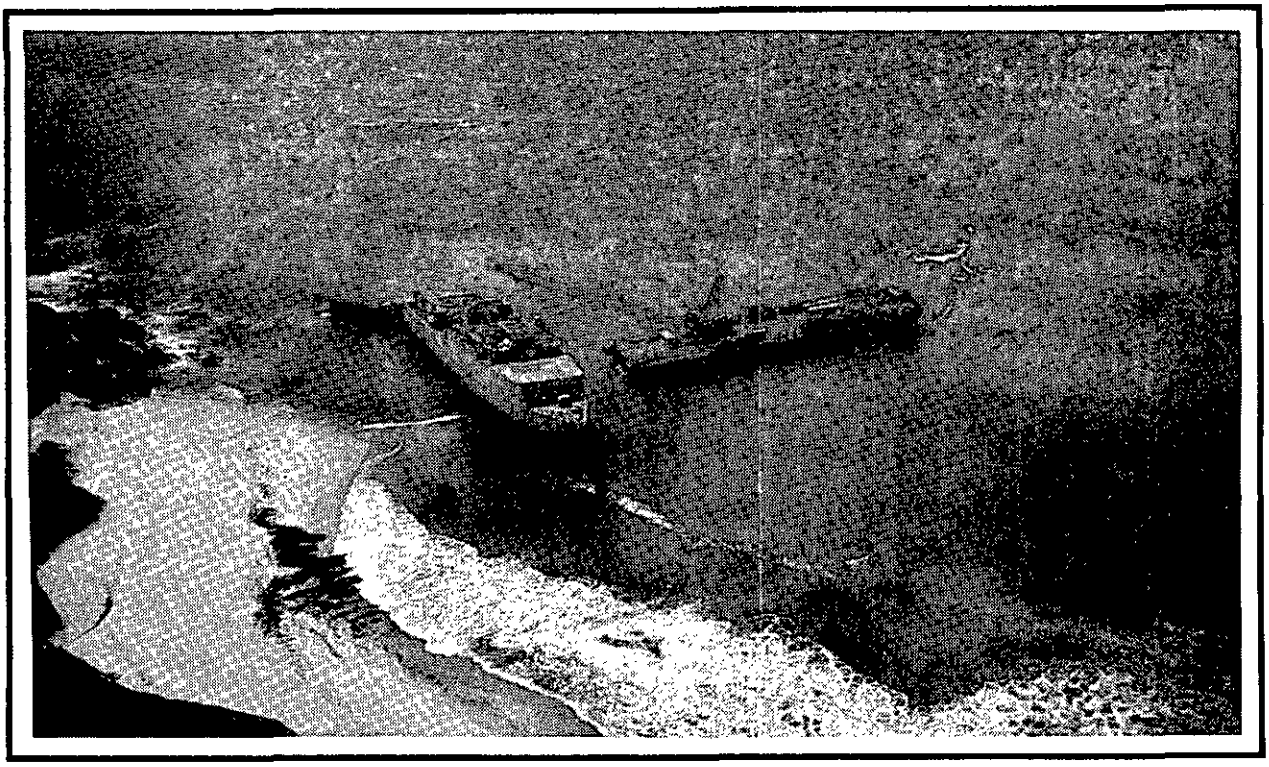


FIGURE 5-8. Position of Scrap Barge and Crane for Offloading.

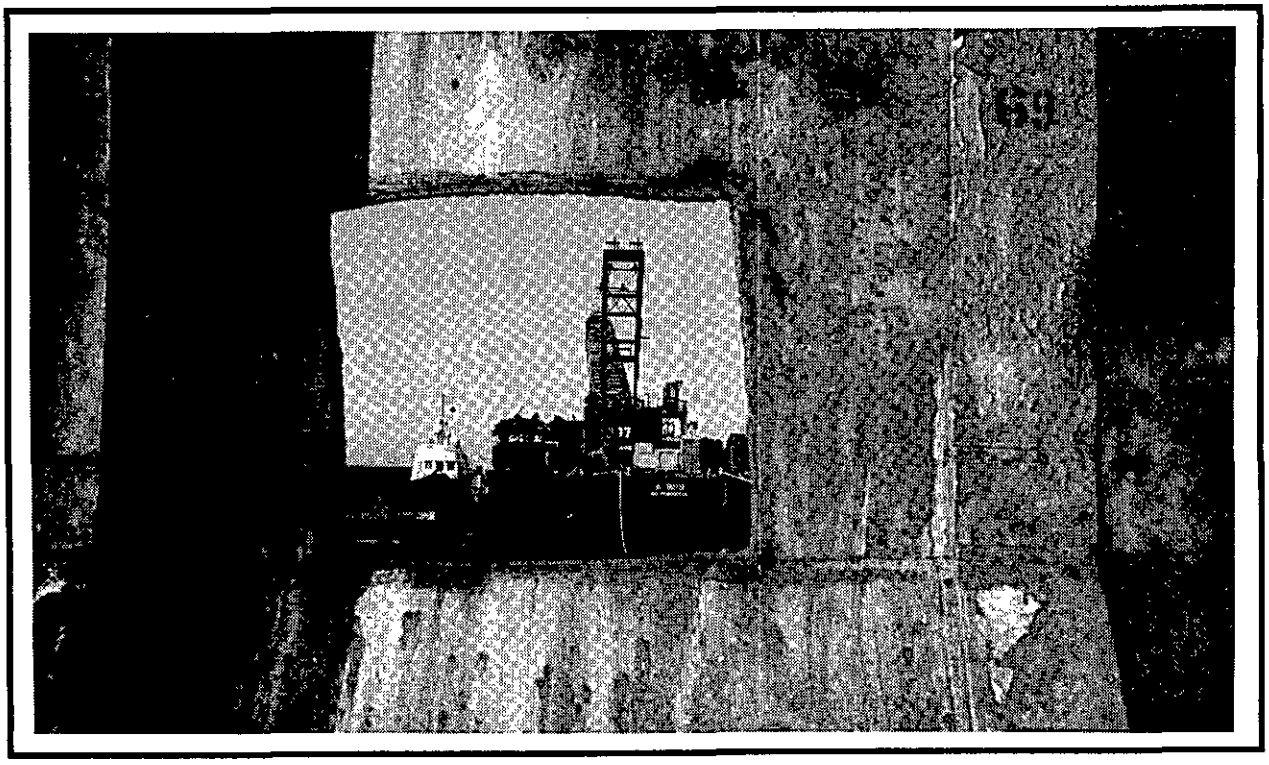
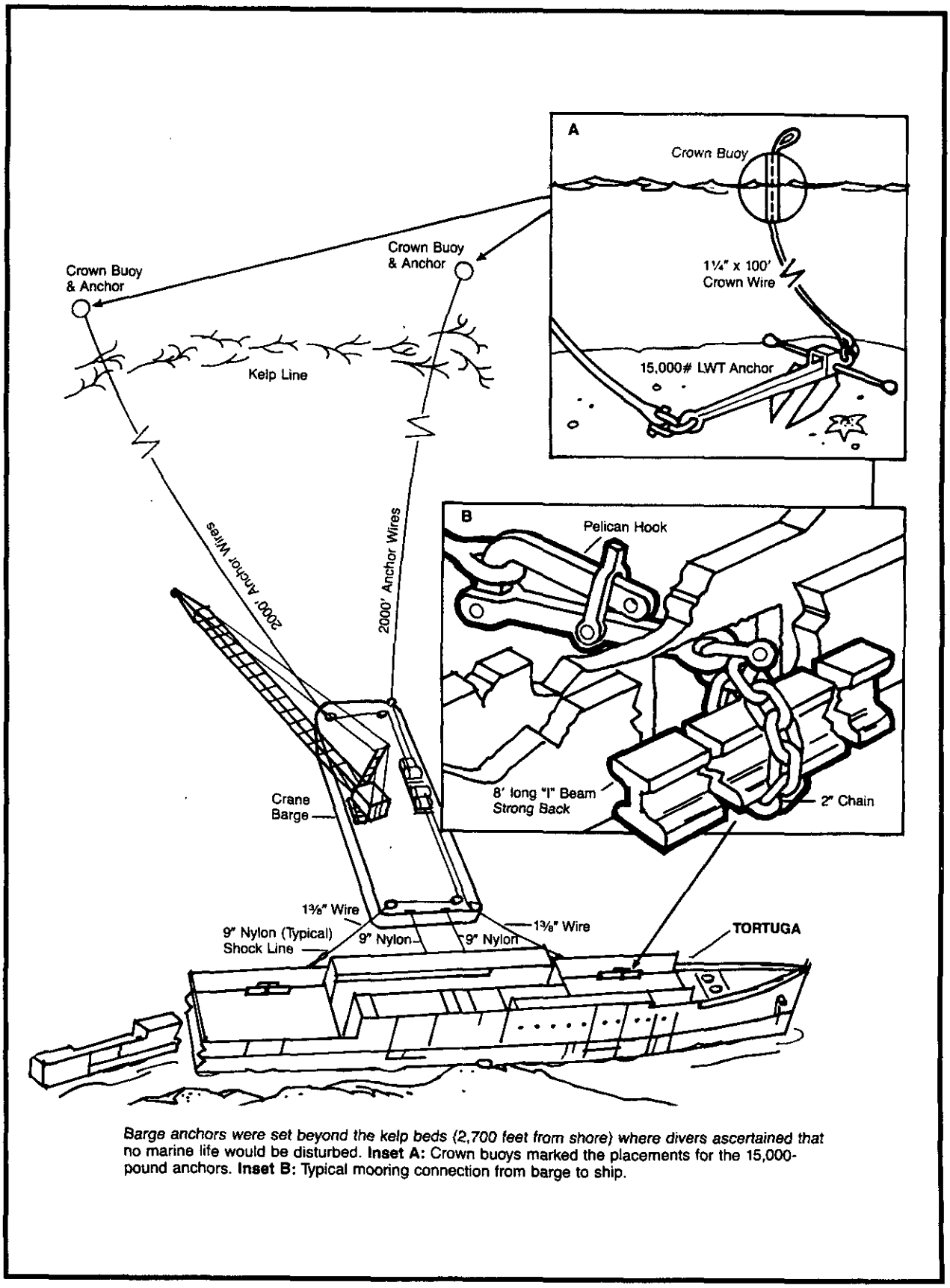


FIGURE 5-9. Scrap Barge as Viewed Through Mooring Point.



Barge anchors were set beyond the kelp beds (2,700 feet from shore) where divers ascertained that no marine life would be disturbed. **Inset A:** Crown buoys marked the placements for the 15,000-pound anchors. **Inset B:** Typical mooring connection from barge to ship.

FIGURE 5-10. Crane Barge Moored at Wreck Site.

to the wreckage was approximately nine feet, and the draft of the barge was three feet. During periods of high southerly swells, crane operations were sometimes suspended and the barge moved to deeper water until the swells abated. At these times, the burning and patching phases aboard TORTUGA continued without interruption.

5-2.2 OXY-PROPANE CUTTING. The salvage contractor's experience in breaking ships had indicated that it is more time/cost effective to undertake cutting of steel superstructure in small pieces rather than in larger, hard-to-handle sections. Average pieces cut from TORTUGA's superstructure averaged one ton or less in weight. The heaviest single pieces were the 26-ton, pedestal- mounted B & A cranes. Burning of the heaviest pieces was accomplished when the barge was at the site so that the pieces could be lifted directly aboard the barge and not handled twice by crane.

The original plan proposed by the contractor had recommended removing the raised fo'c'sle along with the rest of the superstructure. In the actual cutting operation, this part of the vessel was left intact to provide points for attachment of pulling lines. Removal of the fo'c'sle would have required considerable time and effort to burn the thick steel, and proper pulling points would then have had to have been welded to the bow. Figure 5-11 shows the revised weight-removal plan with the bow left in place. Steel was removed from the superstructure down to the well deck except as indicated, providing a weight reduction of nearly 1,200 LT, as discussed in Chapter 4.

In general, cutting of the superstructure progressed from top to bottom, from bow to stern, and from port to starboard. The salvage foreman used spray paint to indicate the sequence of cuts, spraying cut lines just ahead of the burning activity. Two factors directed the selection of cuts: 1) what access would be provided by the intended cut, and 2) what portions of the structure had to be retained in place to accommodate the succeeding two to three cuts. In addition, consideration had to be given to the approximate weight of the scrap piece and to the direction it would fall. Figure 5-12 shows burners at work removing top side weight.

Several problems arose in the cutting phase and had to be solved. First, throughout the interior of the ship, the decking was covered with tile or concrete which had to be chipped away with an air hammer to create a path along which burners could cut the steel deck underneath. Similarly, fiberglass insulation on the bulkhead had to be scraped off in swaths to give the burners clear access to the steel bulkhead. Second, TORTUGA was ribbed throughout with angle-iron framework which not only had to be cut on the bias so as to fall away correctly, but also created problems in that even a pencil's width skipped by the torch was sufficient to hang up the piece in place. Third, as a mothballed ship, TORTUGA had few vents that had not been sealed shut, so holes had to be cut to let air and light in, and smoke out, of the vessel. Another problem was the wireways containing huge bundles of hundreds of wires. Cutting through the wires was slow and difficult because of the high danger of fire, which could have swept down the wireway out of control. Ultimately, the crew used wire cutters and hydraulic cable cutters in the removal of the wire bundles. Finally, a significant consideration was the large number of people working aboard the ship. Areas where burners would be working were roped off, but because cut scrap was dropped as many as four decks to the well deck, constant attention was required to ensure that personnel below in the well deck were clear of falling pieces. Figure 5-13 shows partially removed top side weight.

5-2.3 ON-SITE LOGISTIC RESUPPLY. Restocking of oxygen and propane occurred every 10 to 14 days, usually in coordination with the dispatch of the crane barge from Long

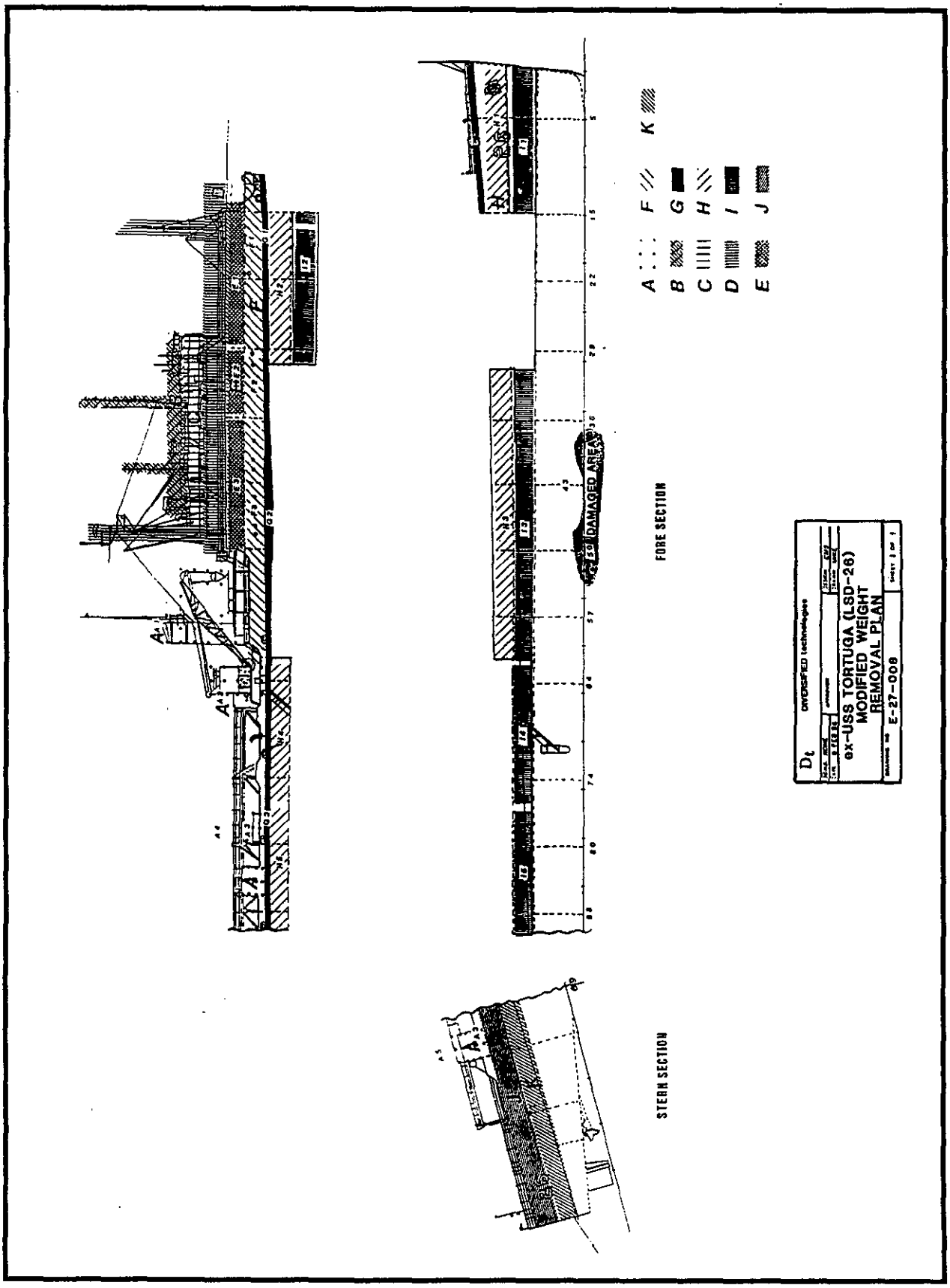


FIGURE 5-11. Modified Weight Removal Plan.

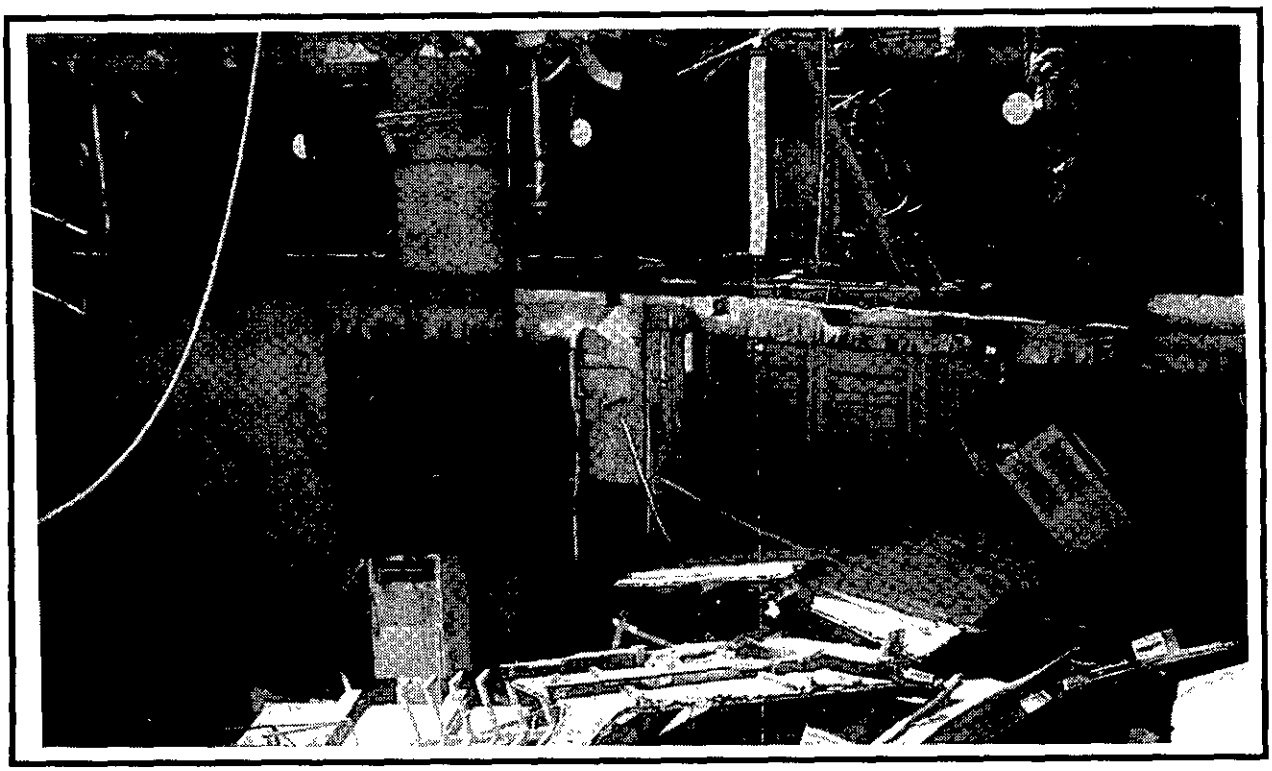


FIGURE 5-12. Burners at Work Removing Top Side Weight.

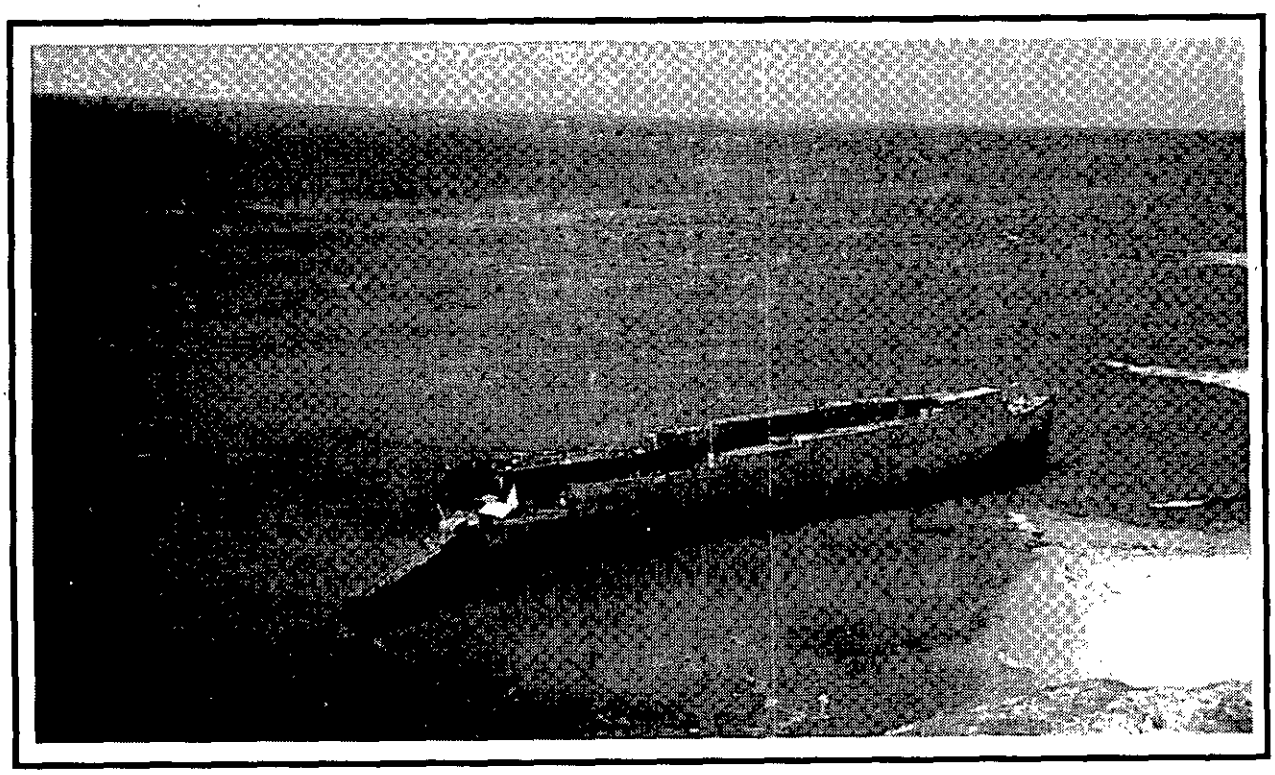


FIGURE 5-13. Top Side Weight Partially Removed.

Beach. On occasion a chartered utility vessel was utilized for this resupply. Full cylinders were staged at Port Hueneme for transport to the work site, and empty cylinders were placed aboard the vessel for return to shore. Food, clean laundry, and medical supplies were also transported to the site aboard either the crane barge or the utility vessel. Garbage collected from the various vessels on the project and accumulated in skip boxes aboard the ARCTIC SALVOR was craned aboard the utility vessel for shoreside disposal.

Occasionally, personnel were also transported between Port Hueneme and the salvage vessel aboard the utility boat, though the primary means of personnel transportation was by helicopter. The original plan for the operation did not call for daily helicopter service; however, as weather problems increased, resulting in such high swells that workers could not land at the site by boat, a daily helicopter operation was established. Arriving at San Miguel Island late in the afternoon, the helicopter would remove the workers to the ARCTIC SALVOR, then remain on board overnight to transport workers back to the wreck the following morning. Generally, the distance between the salvage vessel and the work site was between one half and three fourths of a mile, depending upon wind velocity and direction. When sea conditions permitted, transportation between the ARCTIC SALVOR and TORTUGA was also accomplished via rubber Zodiaks. Although the daily helicopter charges were substantial, helo usage to keep the job working resulted in major cost and schedule savings to the salvage operation.

5-2.4 SCRAP LIFTS AND TRANSPORT TO DISPOSAL SITE ASHORE. A front-bucket payloader was utilized in the well deck of TORTUGA with the primary purpose of clearing the deck of scrap items, including lockers, chain, discarded equipment, and other small pieces which had been placed aboard the vessel to be scuttled with the target. These items were placed in skip bins for removal from TORTUGA. Once the scrap was removed from the well deck, steel cut from the superstructure was allowed to free-fall into the well deck area. The payloader was utilized for controlling large cuts by way of a line rigged through a running block and attached to the steel piece.

When 300 to 400 tons of cut steel had accumulated in the well deck, the ATB-99 was brought to the job site from Long Beach, and moored into position to crane-lift the scrap aboard the barge for transport to Long Beach (Figures 5-14 and 5-15). The crane barge ATB-99 was outfitted with six-foot stanchions down each side as a containment fence for the scrap steel. Larger pieces of steel were positioned against the stanchions to add to the containment so that scrap could safely be piled higher. In addition to the ship's pedestal-mounted cranes, the heaviest units lifted were the grating sections of the helicopter deck and the two stacks, weighing eight to 10 tons each.

To enable the scrap steel to be lifted by crane, holes were burned into two corners, then long-link lashing chain was run through the holes and made up to a shackle pin and wire pendant which connected to the crane hook. Several lighter pieces could be picked at once, and heavier or odd-shaped pieces often required four points rather than just two for the pick. Small pieces of scrap from the living spaces, such as bunks, desks, and sinks, were piled by hand into 20 x 20-foot cargo nets, then the four corners of the net were picked up for the crane lift.

Loading of the barge usually required one and a half to two days. Because of weather conditions, the assist tug remained in attendance with the barge throughout the loading periods. Communication between the crane operator on the barge and salvage foreman aboard TORTUGA was accomplished by means of radio and hand signals.

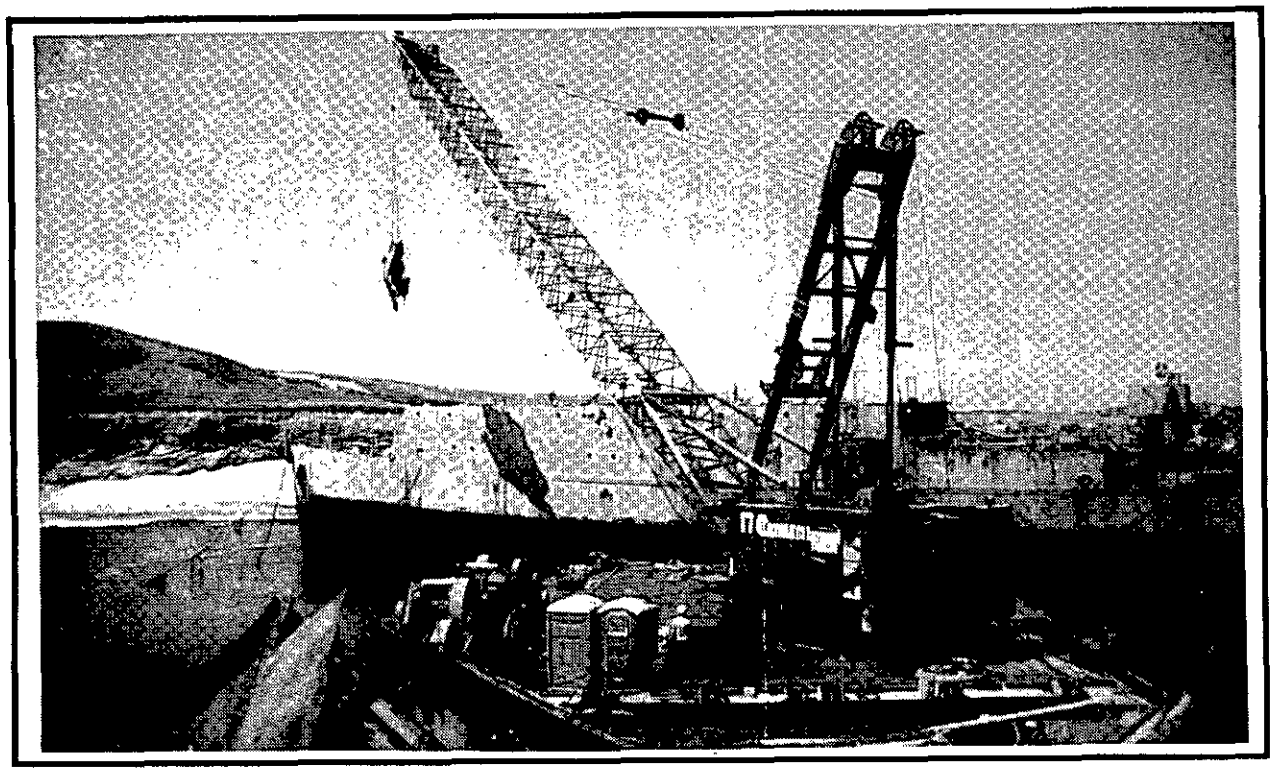


FIGURE 5-14. Offloading Scrap.

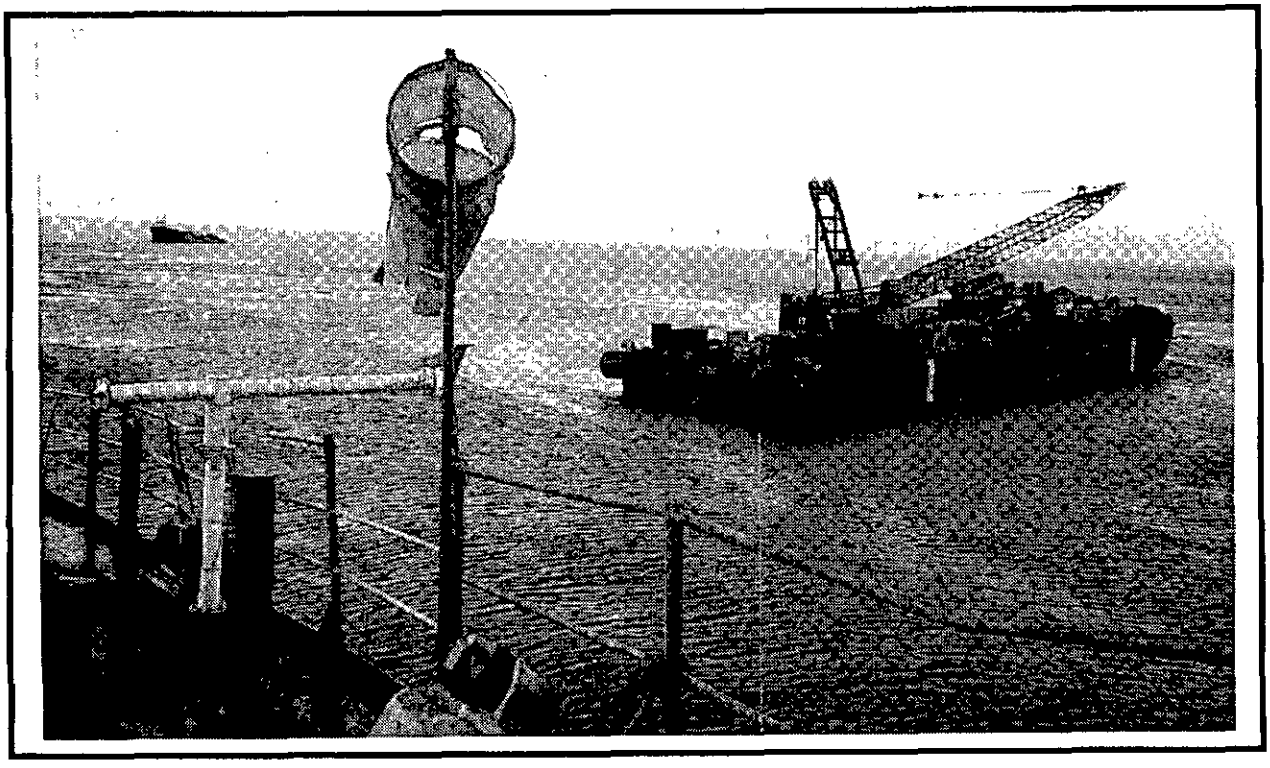


FIGURE 5-15. Scrap Barge Departing with Debris for Offload.

5-2.5 ROTATION OF BURNING CREWS. Each burning crew consisted of eight men, including a working foreman, and nearly all burners committed to the job returned for subsequent two-week shifts. Generally, the changeout of burners was timed on two-week intervals to coincide with the arrival of the chartered utility vessel. If situations arose that necessitated the departure of a crew member at other times, transportation was arranged via helicopter. Occasionally, crew members wished to stay on the job for a second shift without relief.

5-3 BUOYANCY RECOVERY IN THE FORE SECTION

5-3.1 TANK SURVEYS. Every ship tank was surveyed for leaks and to assess the extent of damage. Initial dry surveys were completed by Fleet personnel. Subsequently, the salvage contractor used two of its own salvage divers to perform the remaining underwater surveys and ballast tank repairs. Figures 5-16 through 5-19 depict reviewing of the salvage plan and tank repairs.

5-3.2 PATCHING OF SPACES BELOW THE WELL DECK. After the removal of approximately 1,300 tons (1,176 LT) of steel from the superstructure and approximately 600 tons of debris from the well deck, TORTUGA was within the range of the pulling capacity of the ARCTIC SALVOR if sufficient buoyancy could be generated by tank reclaimation. Nearly all of the 41 compartments below the well deck were found to be open to the sea. It was evident that it was neither practical nor economically feasible to patch the tanks entirely, so the only way to gain buoyancy was to patch the tank tops and blow in compressed air to displace the water.

In the engineering spaces, electrical wireways had to be cut away and patching put over the bulkheads in their place. Hydraulic lines, fuel lines, air lines, and other piping into the various tanks were cut out of the decks and bulkheads, and the resulting holes were covered with flat plates welded into place. In the ballast tanks, most of the valving and piping were ruptured and had to be burned off on either side with a patch affixed wherever the pipe had penetrated the bulkhead or the deck. Extensive patching and welding were performed to the tank tops and to the internal bulkheads segregating the tanks to render them capable of holding an air bubble.

Patching material generally consisted of steel plates or patches obtained from scrap and from supplies aboard the ARCTIC SALVOR. Temporary patching also was performed with plywood and heavy gasket material secured with strongbacks or a series of J-bolts to make the patch airtight. Some bulkhead fractures were simply welded closed without need of a patch.

Approximately two weeks were required for the patching process. For the most part, patching was completed before plumbing, though often additional leaks would be discovered when air was introduced for compartment testing, and more patching would be required.

5-3.3 PLUMBING OF SPACES BELOW THE WELL DECK. Plumbing (Figure 5-20) was completed on 38 of the 41 spaces below the well deck. Each ballast tank or engineering space was fitted with an air hose with a one-inch Chicago fitting. A low-pressure air gauge was installed in each tank to register pressure, and a shut-off valve provided the capability to add, hold, or release compressed air inside the tank.

Tanks were plumbed one at a time. When each was completed, four to six pounds of air was blown in to dewater the compartment. The valve was shut off so the tank could be

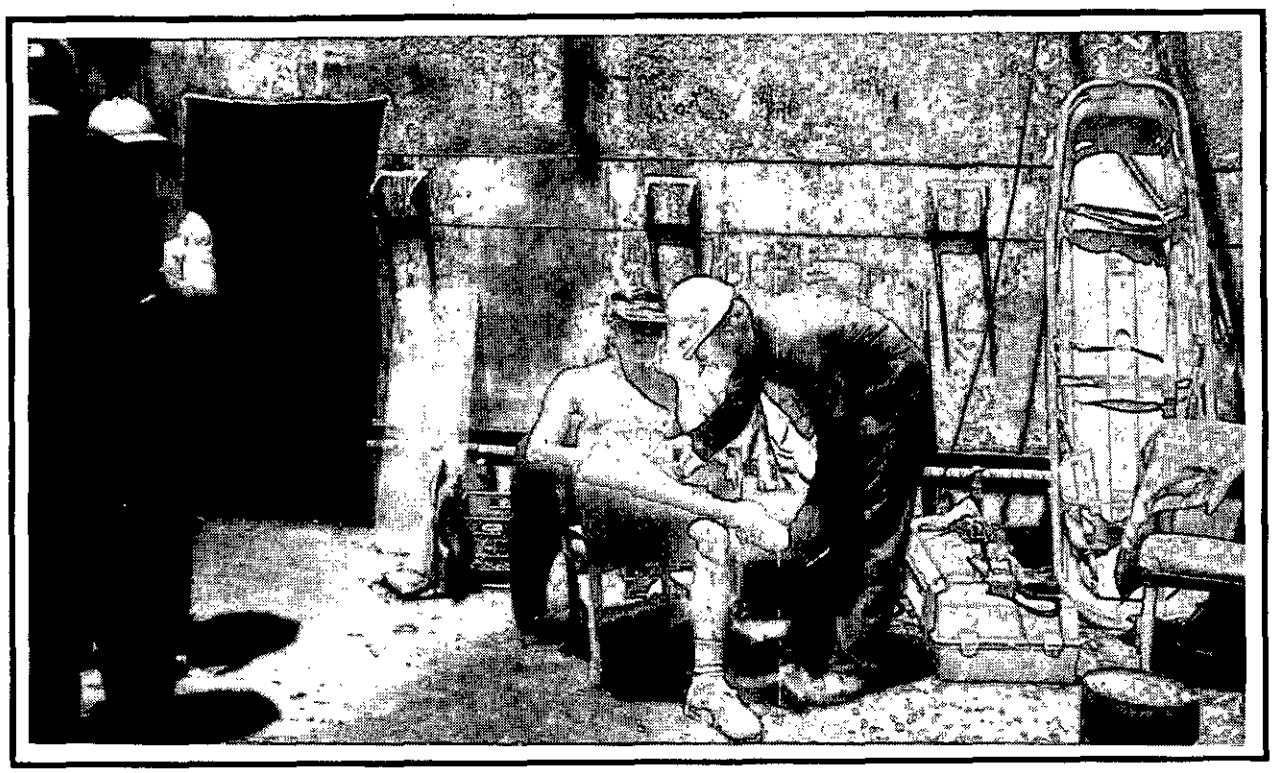


FIGURE 5-16. LCDR Jack Strandquist Reviewing the Salvage Plan.

FIGURE 5-17. Welding Close Tank Tops.

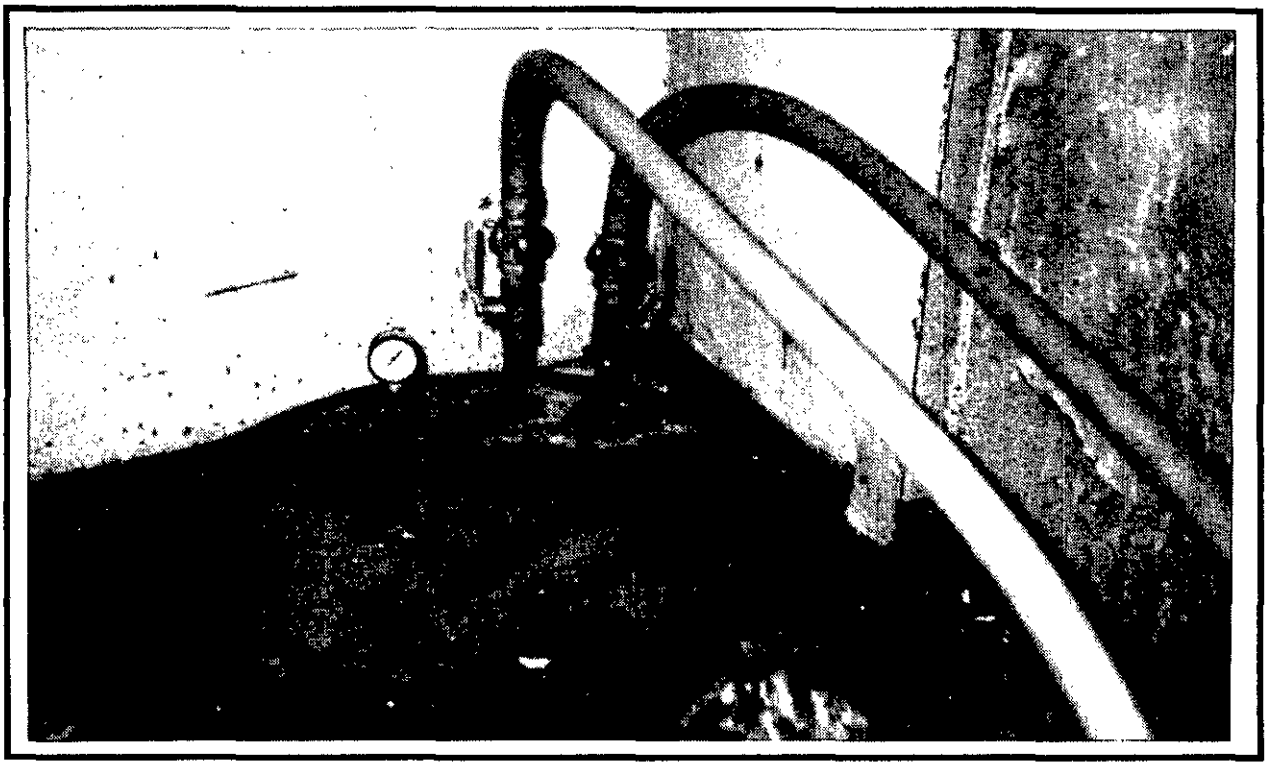


FIGURE 5-18. Tank Top Sealed with Hose Connections to the Manifold.

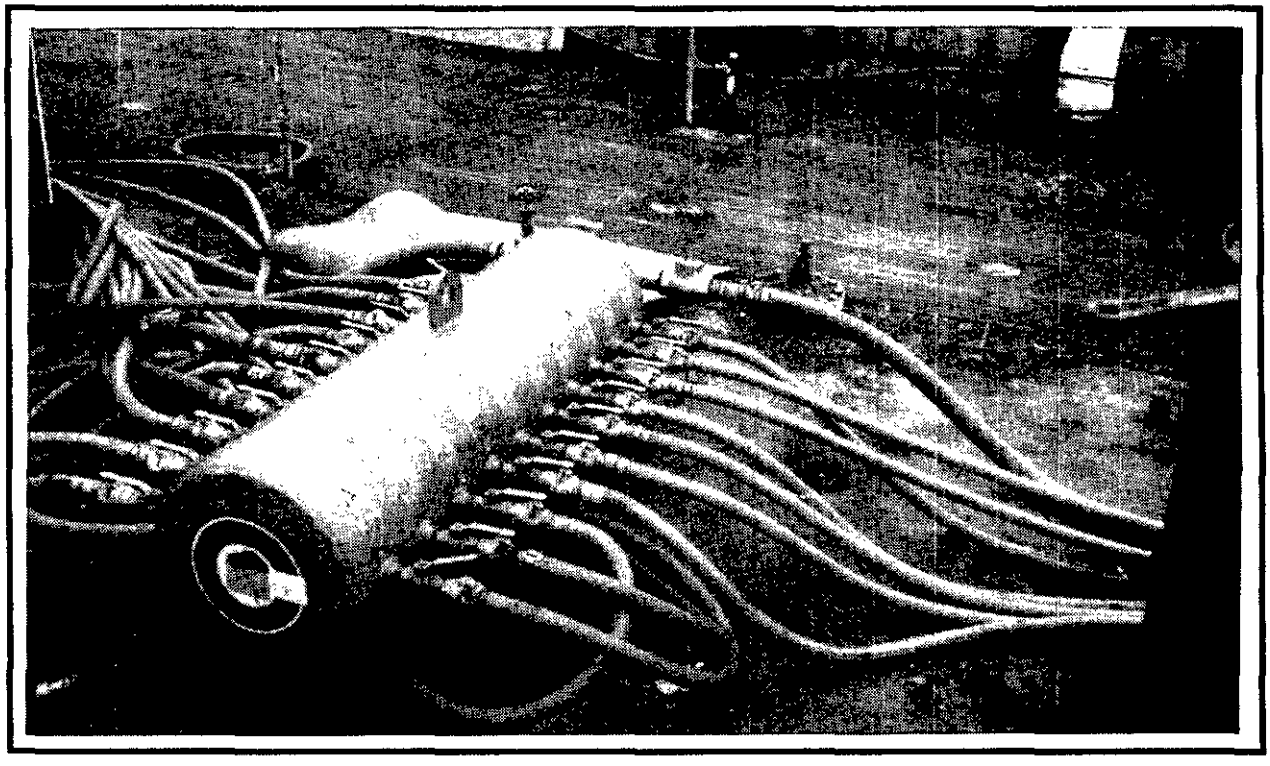


FIGURE 5-19. Primary Manifold to all Tank Tops.

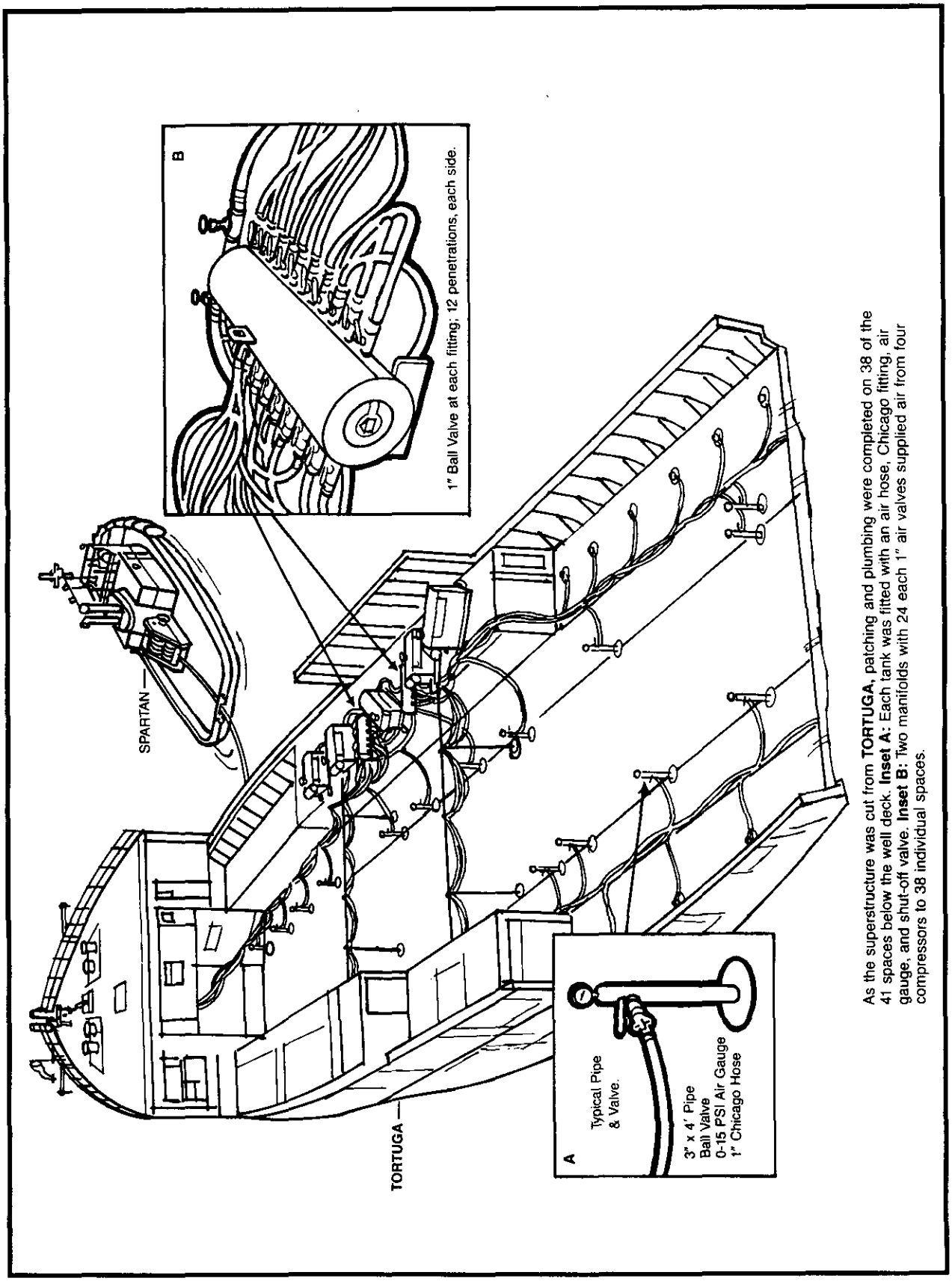


FIGURE 5-20. Plumbing of Spaces Below the Well Deck.

checked for further leaks and timed to determine how long it would hold air. Any leaks or fractures found were then patched or welded. Finally, all of the 38 plumbed spaces were pressurized and checked for their ability to maintain an air bubble.

Four 125-CFM air compressors from the ESSM system were placed on the wreck and hooked up to two manifold systems. Each manifold supplied 20 hoses, so the entire air arrangement supported 40 hoses strategically placed on the ship to supply air to each of the patched/plumbed tanks. Dewatering the vessel to the maximum attainable level of buoyancy took five to six hours.

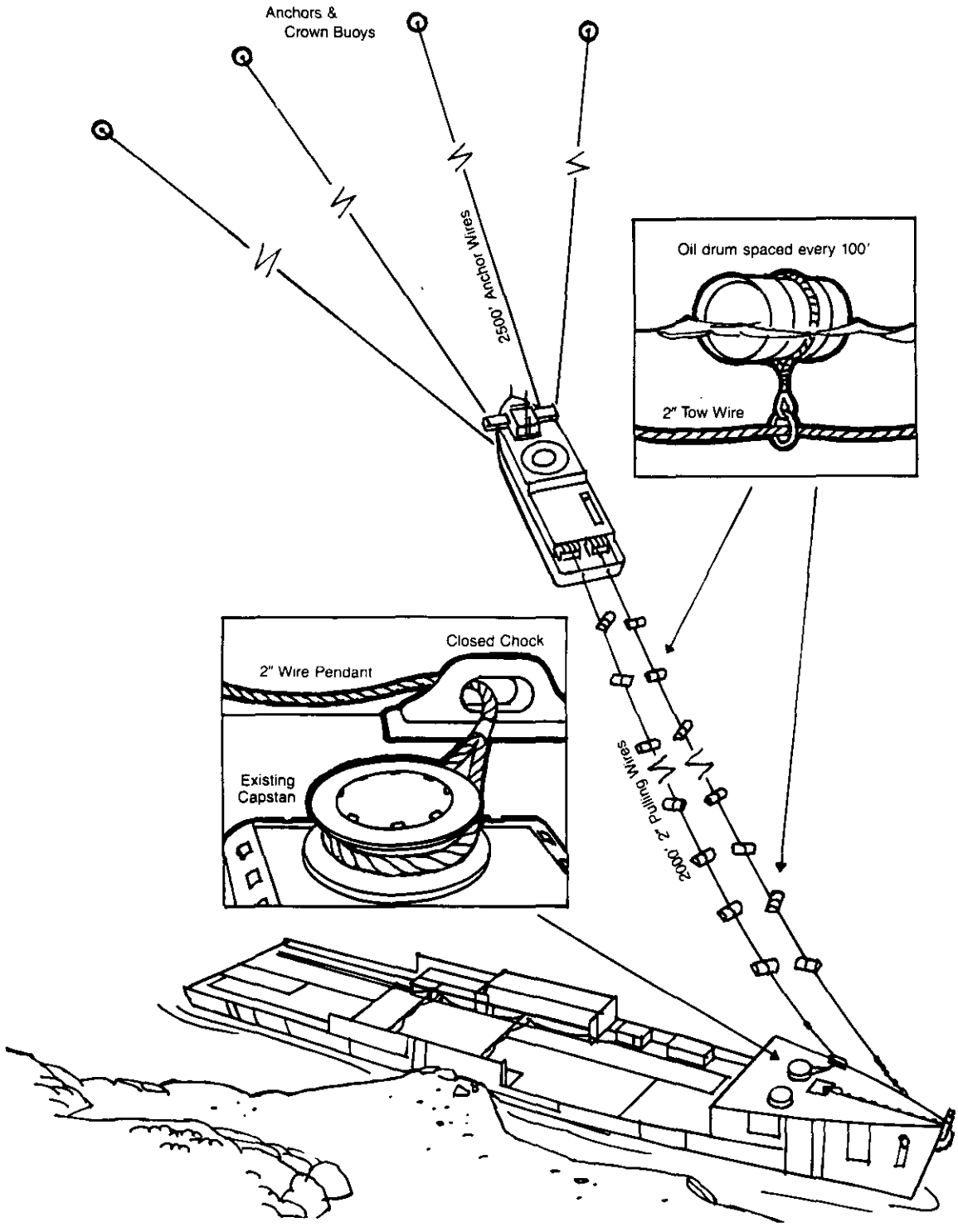
5-4 REMOVING THE FORE SECTION

5-4.1 RIGGING FOR THE INITIAL PULL ATTEMPT. (Figure 5-21) TORTUGA was aground broadside to the beach. Freeing a vessel from this condition can best be accomplished by pulling from one end rather than from the middle or along the side. A lever action is created, and greater results can be achieved for a given pulling force. In this case, the bow was the initial choice because of easier hawser attachment and potential interface from the stern section if an aft pull were selected. In addition, when the vessel was first dewatered for test, it was found to be afloat at the bow but not at the stern. Pulling the bow enabled the salvors to swing the wreck to a position nearly perpendicular to the beach so that the sea itself could assist in the refloating as swells rolled down the length of the ship and helped lift the stern.

The finalized salvage plan called for use of USNS NAVAJO (T-ATF 169) with two legs of beach gear plus the ARCTIC SALVOR with four legs. The pull was scheduled for the high tide on 25 August 1989. Placement of the ARCTIC SALVOR with a potential for 300 tons of pull was critical. Some 4,000 feet of 2-inch pulling wire was spooled on the two aft Skagit winches, each of which can pull 150 tons at bare drum. As a general safety practice, a reasonable amount of wire should be left on the drum, so the ARCTIC SALVOR was positioned approximately 2,000 feet from the wreck to control the amount of pull generated with the after-facing winch wires. Theoretically, the four 12,000 pound Eells anchors forward would begin to drag before the maximum pull available on the two winches aft was obtained.

The position of the salvage vessel determined the placement of the four forward anchors, 2,500 feet ahead of the ARCTIC SALVOR and 4,500 feet from TORTUGA. The forward anchors, were thus largely free of the kelp beds. Anchor areas were marked with small buoys and divers confirmed that snail beds would not be disrupted by the anchors. Rigging of the ARCTIC SALVOR's anchors began on 18 August and setting began on 19 August. The salvage vessel dropped one of the four anchors itself, then backed down into position, allowing one of the SPARTAN-class tugs to place the other three anchors at the marked locations.

As a common practice in refloating and wreck-removal operations, wires from the salvage vessel to the stranded vessel are flown by a helicopter in order to complete the hook-up as quickly and efficiently as possible. In the refloating of TORTUGA, however, time was not a critical factor, and sea and swell conditions were such that a helicopter was not necessary, so the two wires were pulled ashore utilizing the ARCTIC SALVOR's 300-HP workboat. Barrels were placed at 100-foot intervals to provide buoyancy to the wires. Already attached to the raised fo'c'sle deck of TORTUGA were pendants with wires hanging almost to the waterline. Salvage personnel aboard the workboat made connections between the pendant wires and the paid-out wires (Figure 5-22). Though a whole day had been allowed for this



RIGGING FOR THE PULL. The salvage vessel was positioned 2,000 feet from **TORTUGA**, with four 12,000-pound Eells anchors set 2,500 feet forward. Wires from the **ARCTIC SALVOR's** after winches were pulled to the wreck by a small workboat, aided by buoyancy provided by the attachment of barrels at 100-foot intervals.

FIGURE 5-21. Rigging for the Pull.

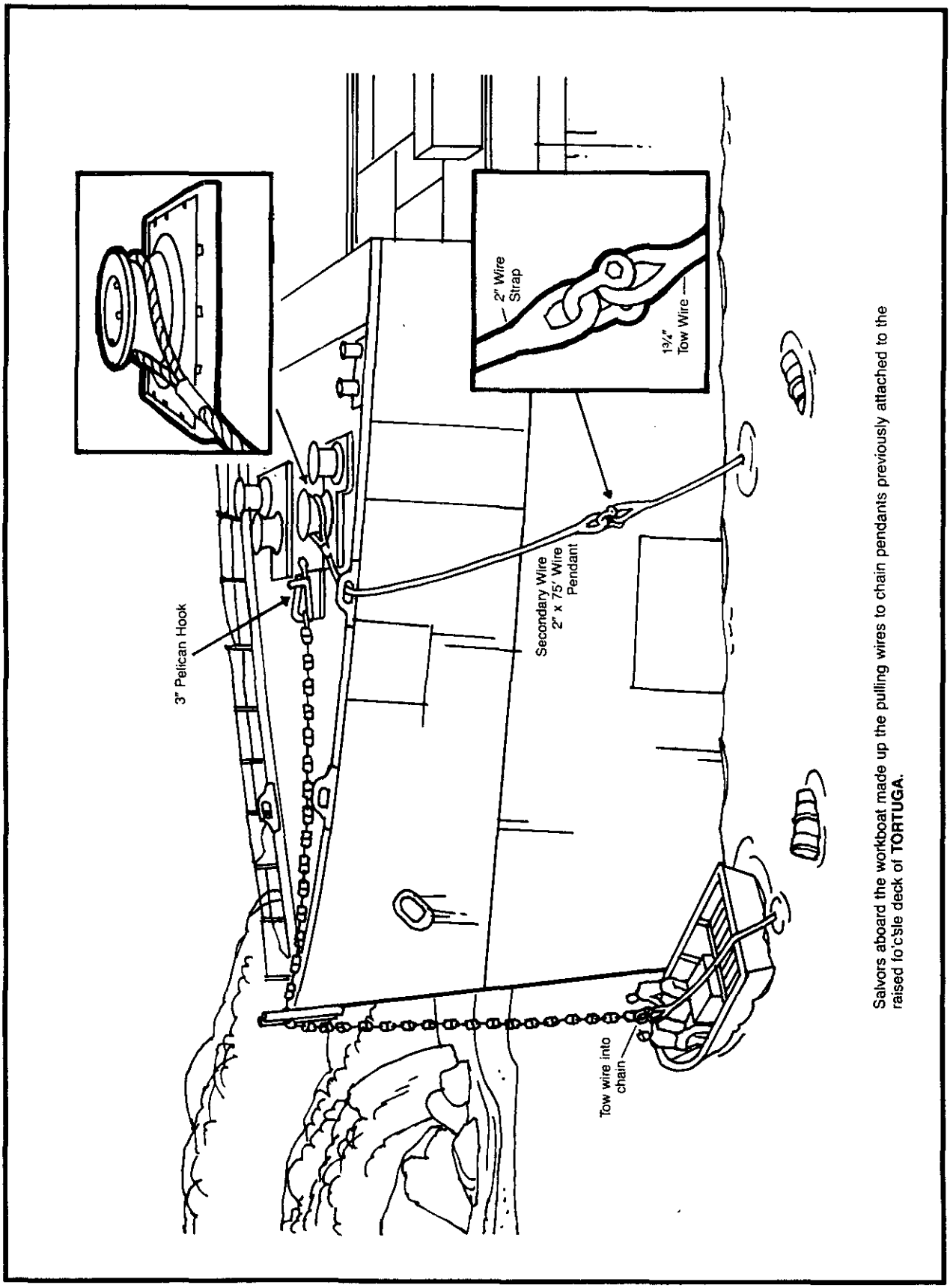


FIGURE 5-22. Connections Between Pendant Wires and Paid-Out Wires.

hook-up of wires, it was actually accomplished by this method in less than four hours.

Hook-up of the salvage vessel to TORTUGA was accomplished on 19 August so that the pull could occur at high tide the following day. The decision was made to attempt a pull using ARCTIC SALVOR alone (Figure 5-23). If unsuccessful, NAVAJO would be positioned later with the potential for another 150-200 tons.

5-4.2 BREAKING THE STRAND. At 1215 on 20 August, wires to the wreck were tightened and TORTUGA soon began to move. By 1330 the bow of TORTUGA had swung out from the beach and was afloat in 20 to 25 feet of water with the stern still aground. At 1406 the vessel was completely free of strand and floating. Power for the pull was supplied entirely by the salvage vessel's two after winches. All four forward anchors held in place throughout the pull. Maximum pulling force was estimated to be approximately 180 tons or 160 LT.

5-4.3 TOWING TO SEA AND SCUTTLING. A 2400-HP SPARTAN-class tug was at the scene when TORTUGA was freed from strand and immediately secured a towing line to the refloated vessel (Figures 5-24 and 5-25). Aboard TORTUGA were four salvage personnel, who cut the two wires connecting the wreck to the salvage vessel. The towing phase of the operation got underway at once (Figure 5-26) while the ARCTIC SALVOR remained at the site long enough to pull in wires, pick up the four anchors and remove kelp.

The at-sea dump site for TORTUGA was approximately 20 miles from San Miguel Island. It had been hoped that the tow and subsequent sinking of the wreck at the dump site could be accomplished the same day, 20 August, before dark. Daylight was needed for this final phase of the salvage operation to ensure safe removal of the four people aboard the wreck and to provide adequate light for photographic documentation. However, timing was such that the vessels arrived at the site at 2200, well after dark, and simply circled the area at slow speed until daylight, 21 August. The well-being of the personnel aboard TORTUGA had been attended to with supplies of food, blankets, lights, life jackets, and survival suits.

In scuttling operations of this type, the possibility always exists that air compressor equipment will have to be left with the sinking wreckage. In this instance, the Navy had access to an H-46 helicopter which had enough lift capacity to remove the compressors from TORTUGA.

On the morning of 21 August, the helicopter arrived at 0814 and began lifting the compressors off the wreckage, completing the equipment lift-off at 0850 (Figures 5-27 and 5-28). A rubber Zodiak was dispatched from the ARCTIC SALVOR to come alongside the wreck. Two persons left TORTUGA at this time and two remained aboard, one positioned at the bow and the other at the stern. At 0910, lines from the tug to TORTUGA were released. Moving rapidly toward the middle of the vessel, the two remaining salvage personnel opened the valves to let the air bleed off from the tanks. As soon as all valves were open, the final two salvors boarded the Zodiak and pulled away from the wreck. At 0925 the ex-USS TORTUGA (LSD 26) disappeared below the surface of the Pacific Ocean forever.

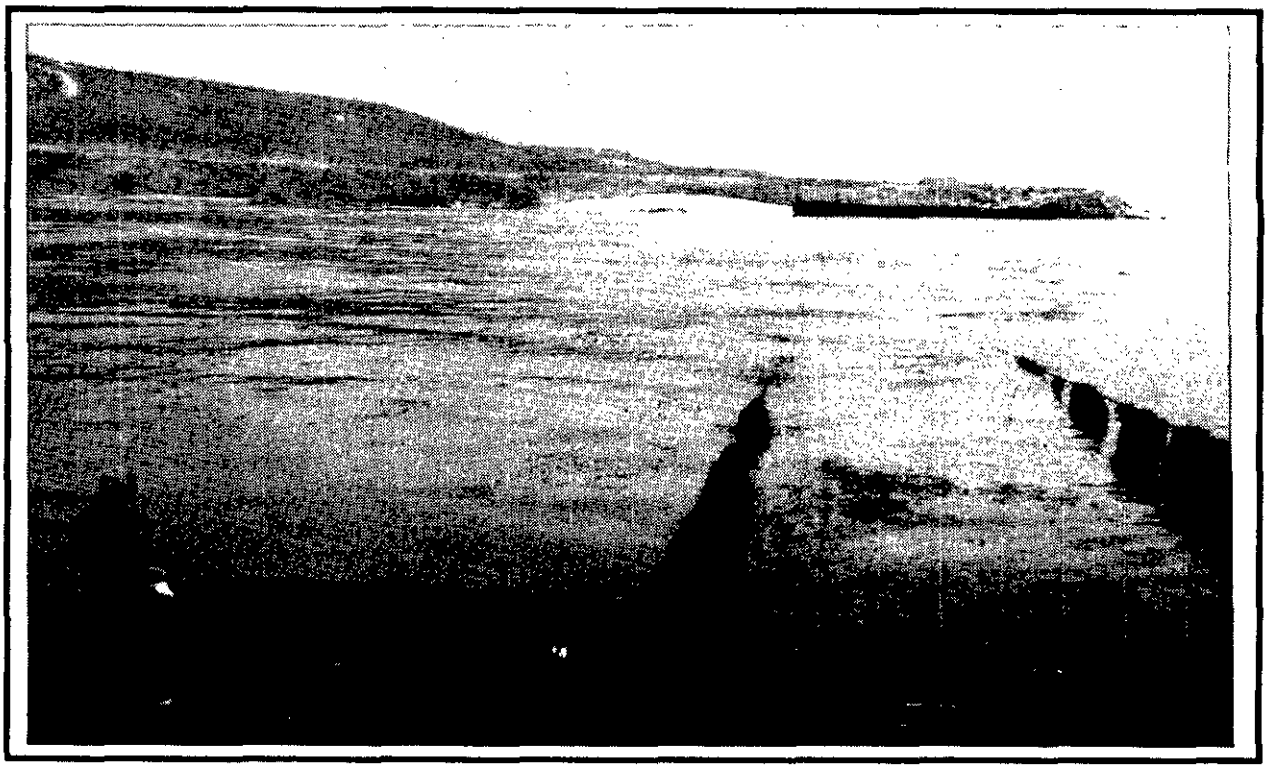


FIGURE 5-23. ARCTIC SALVOR in Harness Making Initial Pull.

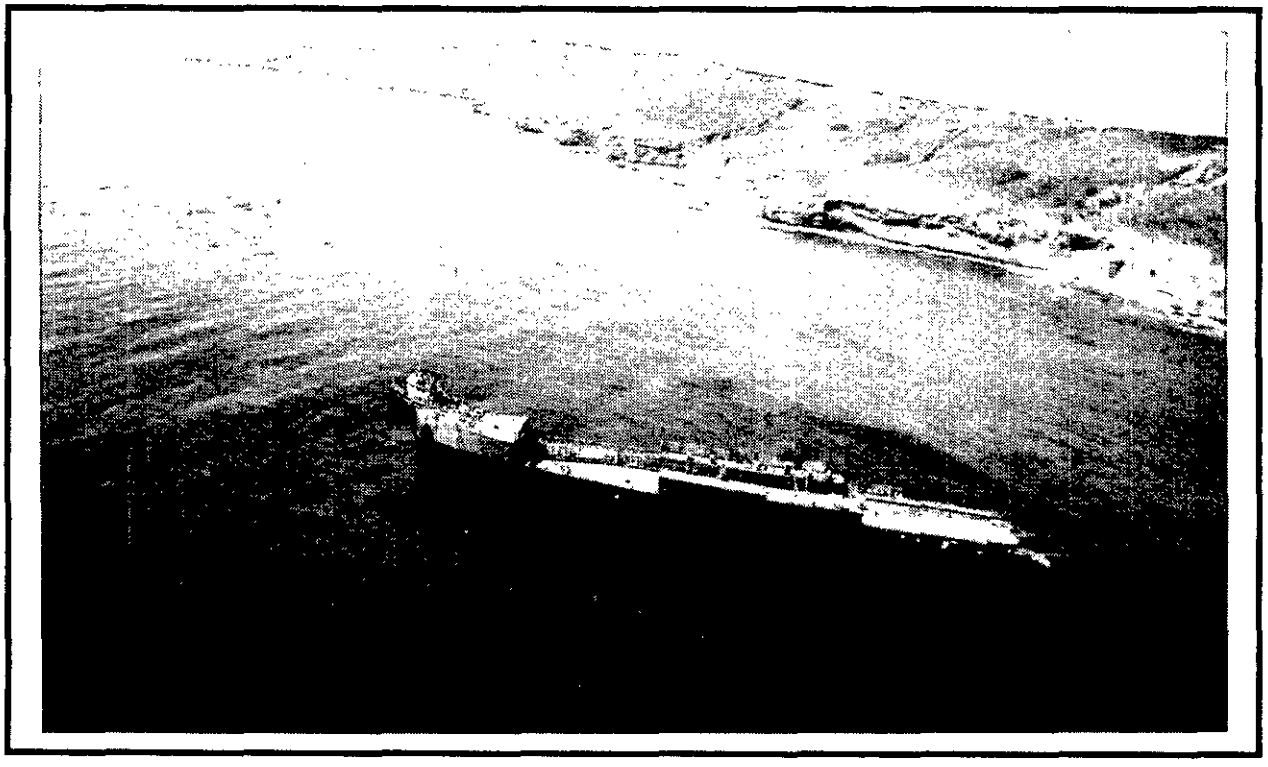


FIGURE 5-24. Tug Securing Towing Bridle for Tow to Disposal Area.

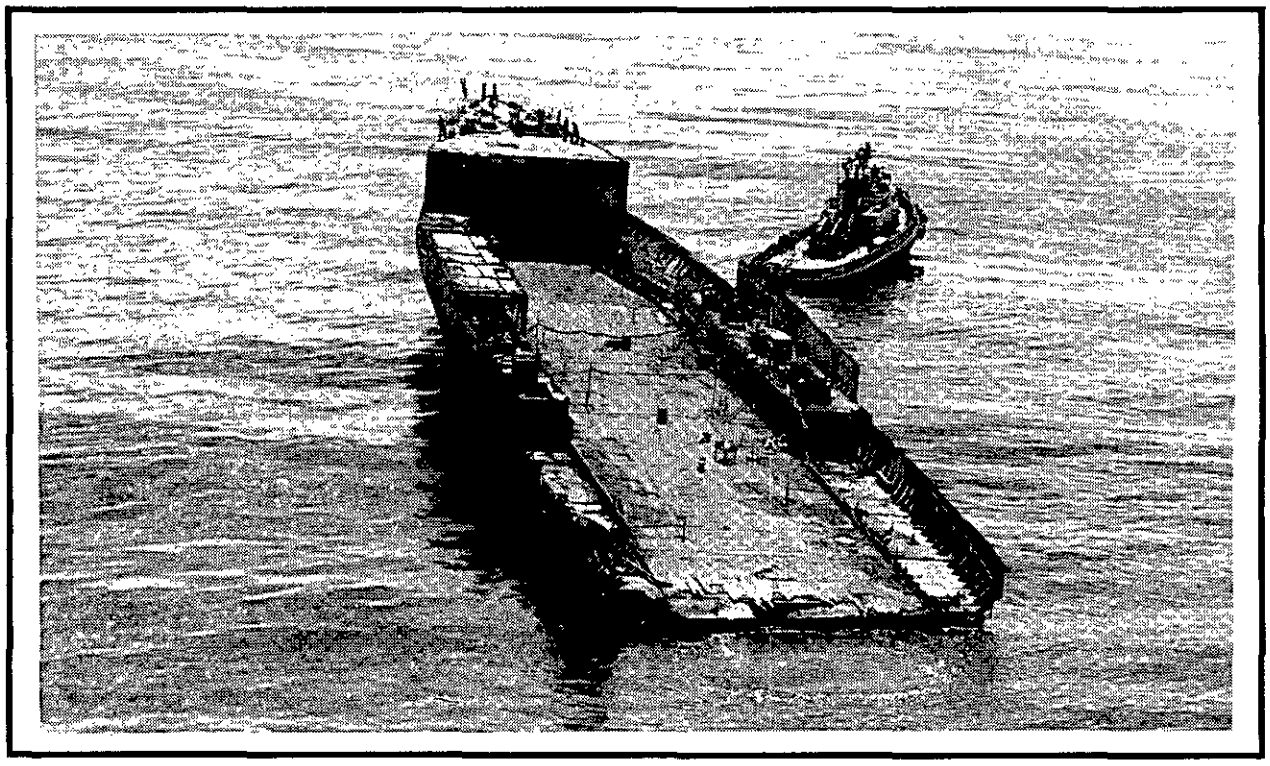


FIGURE 5-25. TORTUGA Ready for Tow to Disposal Site.
(Note Compressors and Manifolding)

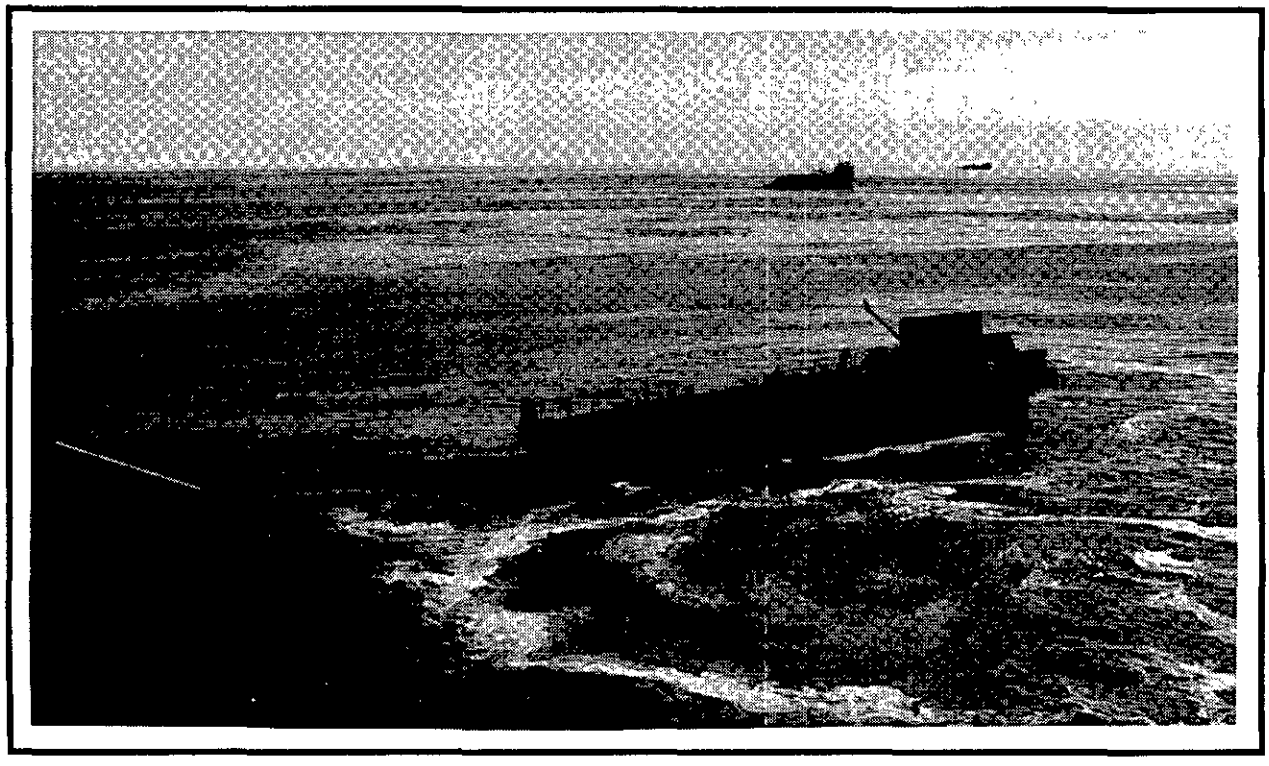


FIGURE 5-26. TORTUGA Hulk Under Tow. Remainder of Stern Section in Foreground.

FIGURE 5-27. Compressor Being Air Lifted Off TORTUGA Prior to Scuttling.

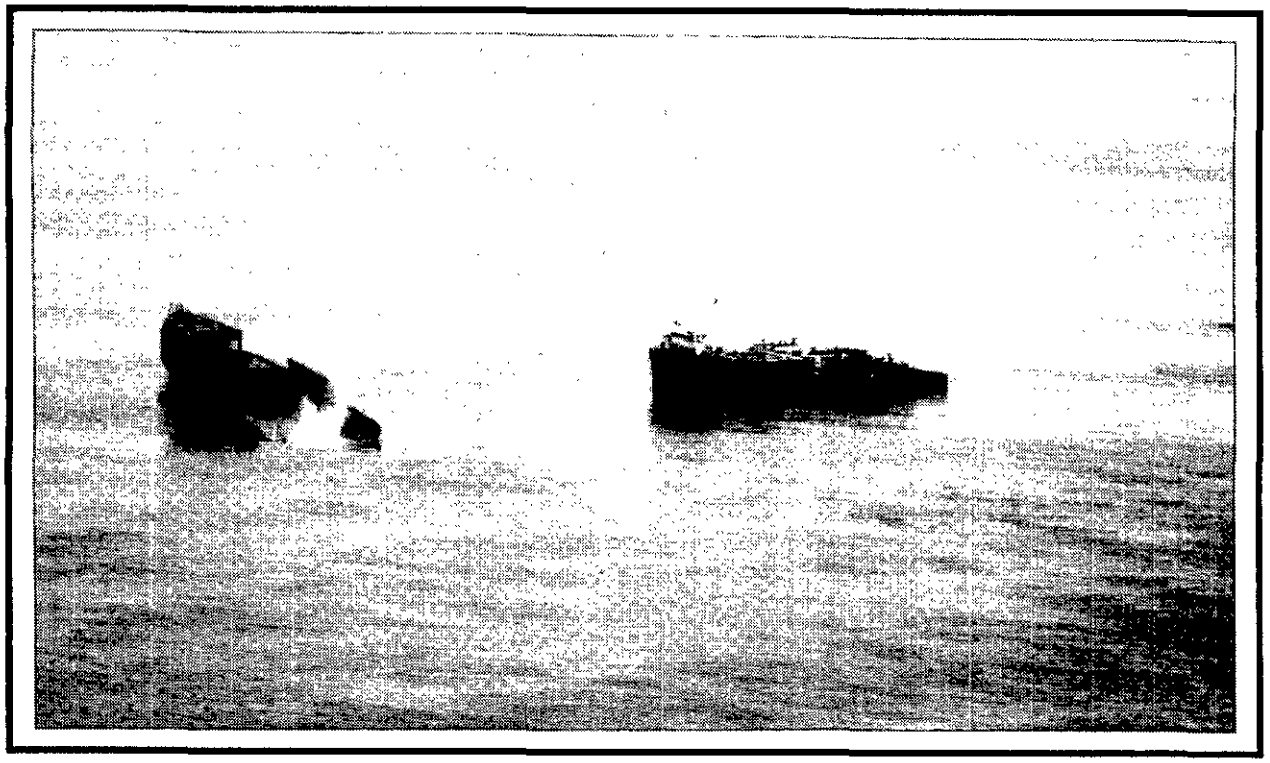


FIGURE 5-28. TORTUGA Just Prior to Sinking. Note That Compressors and Manifold Have Been Removed.

APPENDIX A
NAVAL MESSAGES

UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
U U N C L A S S I F I E D U
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU

ADMINISTRATIVE MESSAGE

PRIORITY

P 131656Z MAY 88 ZYB

FM COMNAVSEASYSCOM WASHINGTON DC

TO CINCPACFLT PEARL HARBOR HI

INFO CNO WASHINGTON DC
CINCLANFLT NORFOLK VA
COMTHIRDFLT
COMSERVRON FIVE
MOBDIVSALU ONE
CDU SAN DIEGO CA
NAVCIVENGRLAB PORT HUENEME CA
COMNAVAIRSYSCOM WASHINGTON DC
COMNAVSURFPAC SAN DIEGO
COMNAVSURFGRU MIDPAC
COMSURFRON ONE
USS BOLSTER
COMPACTMISTESTCEN PT MUGU CA
NAS PT MUGU CA

UNCLAS //N04740//

SUBJ: SALVAGE ASSISTANCE REQUEST FOR EX-TORTUGA (LSD 26)

A. MEETING CINCPACFLT CDR TETTELBACH/COMNAVSURFGRU MIDPAC RADM

REIMANN/COMSERVRON FIVE CDR WELLS/NAVSEA CAPT BARTHOLOMEW ET AL OF 16 FEB 88

1. THIS MSG REQUESTS FLEET ASSISTANCE IN THE SALVAGE OF EX-TORTUGA (LSD 26), STRANDED ON SAN MIGUEL ISLAND, CA.

2. ANTICIPATE ORIG WILL BE TASKED TO SALVAGE AND DISPOSE OF EX-TORTUGA 4300 LT AGROUND ON LEE SIDE OF SAN MIGUEL ISLAND APPROX 60 NM WEST OF PT MUGU LAT 34-01-10 N LONG 120-18-45 W. HULK IS RESTING ON ROCK BOTTOM WITH 43 W.T. COMPTS OPEN TO THE SEA. 400 LT STERN SECTION HAS BROKEN LOOSE AND SUNK ADJACENT TO WRECK. SOME BUCKLING/CRACKING IS EVIDENT AMIDSHIPS.

3. SALVAGE PLAN REQUIRES RECLAMATION OF ALL BELOW DECKS W.T. COMPTS WITH COMPRESSED AIR DOWN TO NOMINAL 5 FT WL, REMOVAL OF 500-1500 TONS OF TOPSIDE WT, AND EXTRACTION. FOAM-IN SALVAGE AND EXPLOSIVE DEMO OPTIONS ALSO BEING EXPLORED. WE ESTIMATE A 60-90 DAY EFFORT COMMENCING O/A 6 JUL 88.

00C2D(1)...ORIG FOR COMNAVSEASYSCOM WASH(5) /13/
00(1) 09(1) 05(1) 09B3341(1)

412(1)...INFO FOR COMNAVAIRSYSCOM WASH(4) 04740/ 1/0630
FC(1) 07E1(1) 09F(1)

RTD:021-000/COPIES:0009

040002/134 1 OF 2 MATA1405 134/17:49Z 131656Z MAY 88
CSN:RXIB00102 COMNAVSEASYSCO

UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
U U N C L A S S I F I E D U
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FIGURE A-1. 131656Z MAY 88 (sheet 1 of 2).

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U UNCLASSIFIED U
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4. AS DISCUSSED REF A THIS SALVOPS REPRESENTS EXCELLENT OPPORTUNITY FOR NEEDED TRAINING IN ACTUAL SALVAGE. SALVAGE AND LOGISTICS PLANNING IS COMPLEX, DIVING (MAX DEPTH 20 FSW) AND SHIP WRECKING EXTENSIVE, AND WORK CONDITIONS SPARTAN. WE ENVISION TURNING THE COMPT RECLAMATION AND HULK EXTRACTION PHASES OVER TO THE FLEET WHILE CROWLEY MARINE, OUR WEST COAST SALVAGE CONTRACTOR, PERFORMS TOPSIDE WEIGHT REMOVAL AND LOGISTIC SUPPORT. ESSM STOCKTON WILL PROVIDE MOST PORTABLE SALVAGE EQUIPMENT. PRELIMINARY SALVAGE PLAN HAS BEEN DEVELOPED BUT EXTENSIVE REFINEMENT REQ'D.

5. REQ ADVISE AVAILABILITY OF SALVAGE SHIPS AND/OR MOBILE DIVING/SALVAGE TEAMS TO SUPPORT OP. DESIRED-ASSETS INCLUDE ONE SALVAGE SHIP WITH SUFFICIENT PERSONNEL AND EQUIPMENT TO MAN DIVE STATION ONBD TORTUGA ON AROUND-THE-CLOCK BASIS FOR DURATION, PLUS ADD'L ARS/T-ATF SHIP DURING EXTRACTION AND DEEP WATER SCUTTLING PHASE. A SECOND DIVING TEAM MAY BE REQ'D AS WEIGHT REMOVAL NEARS COMPLETION. ORIG WILL FUND ALL OUT OF POCKET COSTS IAW NAVSEAINST 4740.8. EXTENT OF FLEET COMMITMENT REQ'D SOONEST TO ENABLE US TO CONTRACT FOR REMAINDER OF COMMERCIAL ASSETS. DETAILED PLANNING GROUP SCHEDULED TO MEET AT PMTC 1300 26 MAY 88.

6. POC FOR EX-TORTUGA SALVOPS IS MR. JIM BLADH, (202) 697-7403 OR A/V 227-7403.

BT

04002/134 2 OF 2 MATA1405 134/17:49Z 131656Z MAY 88
CSN:RXIB00102 COMNAVSEASYSCO

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FIGURE A-1. 131656Z MAY 88 (sheet 2 of 2).

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U U N C L A S S I F I E D U
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU

PRIORITY

P 190046Z MAY 88

FM CINCPACFLT PEARL HARBOR HI

TO COMNAVSURFPAC SAN DIEGO CA

INFO CNO WASHINGTON DC
COMNAVSEASYSCOM WASHINGTON DC
COMTHIRDFLT
COMSERVRON FIVE
MOBDIVSALU ONE
CDU SAN DIEGO CA
NAVCIVENGRLAB PORT HUENEME CA
CINCLANFLT NORFOLK VA
COMNAVAIRSYSCOM WASHINGTON DC
COMNAVSURFGRU MIDPAC
COMSURFRON ONE
USS BOLSTER
COMPACMISTESTCEN PT MUGU CA
NAS PT MUGU CA

UNCLAS //N04740//

SUBJ: SALVAGE ASSISTANCE REQUEST FOR EX-TORTUGA (LSD-26)

A. COMNAVSEASYSCOM WASHINGTON DC 131656Z MAY 88

1. TAKE PARA S OF REF A FOR ACTION. COORDINATE WITH THIRDFLT TO DETERMINE AVAILABILITY OF AFLOAT UNITS.

2. THE SALVAGE AND DISPOSAL OF THE EX-TORTUGA REPRESENTS AN EXCELLENT OPPORTUNITY TO PROVIDE EXTENSIVE TRAINING OF OUR SALVAGE FORCES. EVERY EFFORT SHOULD BE MADE TO MAXIMIZE THE EXPOSURE OF PERSONNEL TO INCREASE THE FLEET EXPERIENCE LEVEL IN THE CONDUCT OF A MAJOR SALVAGE PROJECT.

BT

412(1)...INFO FOR COMNAVAIRSYSCOM WASH(4) /05/
FC(1) 07E1 09F(1)

00C2D(1)...INFO FOR COMNAVSEASYSCOM WASH(5) /04/
00(1) 09(1) 05(1) 09B3341(1)

RTD:00C-000/COPIES:011

074178/140 1 OF 1 MATA0462 140/02:13Z 190046Z MAY 88
CSN:AUIA00196 CINCPACFLT PEA

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U U N C L A S S I F I E D U
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FIGURE A-2. 190046Z MAY 88.

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U U N C L A S S I F I E D U
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU

ADMINISTRATIVE MESSAGE

PRIORITY ROUTINE

P R 200543Z MAY 88 ZYB

TO COMNAVSEASYSCOM WASHINGTON DC
COMNAVAIRSYSCOM WASHINGTON DC
CINCPACFLT PEARL HARBOR HI

INFO CNO WASHINGTON DC
COMTHIRDFLT
MOBDIVSALU ONE
NAVCIVENGRLAB PORT HUENEME CA
COMNAVSURFGRU MIDPAC
USS BOLSTER
CINCLANTFLT NORFOLK VA
COMSERVRON FIVE
CDU SAN DIEGO CA
COMNAVSURFPAC SAN DIEGO CA
COMSURFRON ONE
NAS PT MUGU CA

UNCLAS //N04740//

SUBJ: MTG ON SALVAGE OF EX-TORTUGA (LSD 26)

A. COMNAVSEASYSCOM WASHINGTON DC 131656Z MAY 88

1. REF A, PARA 5 CITED DETAILED PLANNING GROUP FOR SUBJECT SALVAGE TO BE HELD AT PACMISTESTCEN ON 26 MAY 1988.

2. MTG WILL CONVENE AT 1300 IN TARGETS DIRECTORATE CONFERENCE ROOM, BLDG. 333, PACMISTESTCEN, PT MUGU, CA. ATTENDEES ARE REQUESTED TO FORWARDED CLEARANCES TO PACMISTESTCEN, CODE 6600. ATTENDEES SHOULD CHECK-IN FOR BADGING AT SECURITY BUILDING (BLDG. 3) OUTSIDE MAIN ROAD GATE NOT LATER THAN 30 MINUTES PRIOR TO MTG. RECEIPT OF CLNC REQUIRED PRIOR TO BADGING.

BT

412(1)...ACT FOR COMNAVAIRSYSCOM WASH(4) /05/
FC(1) 07E1(1) 09F(1)

00C2D(1)...ACT FOR COMNAVSEASYSCOM WASH(5) /04/
00(1) 09(1) 05(1) 09B3341(1)

RTD:000-000/COPIES:011

090319/142 1 OF 1 MATA0629 142/03:24Z 200543Z MAY 88
CSN:AUIB00583 COMPACMISTESTC

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U U N C L A S S I F I E D U
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FIGURE A-3. 200543Z MAY 88.

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U U N C L A S S I F I E D U
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PRIORITY

P 241817Z MAY 88

FM COMNAVSEASYSCOM WASHINGTON DC

TO COMPACMISTESTCEN PT MUGU CA

UNCLAS//N05521//

SUBJ: VISIT REQUEST

A. OPNAVINST 5510.6

1. IAW REF A FOL INFO PROVIDED FOR NAVSEA VISITORS:
A. CHARLES A. BARTHOLOMEW, CAPT, SSN 556-54-3439, DIRECTOR OF OCEAN ENGINEERING, NAVSEA 00C, U.S. CITIZEN, CLEARED TOP SECRET.
B. JAMES C. BLADH, SSN 555-16-9654, GS-13, OPERATIONS SPECIALIST, NAVSEA 00C, U.S. CITIZEN, CLEARED SECRET.
C. BENJAMIN F. STRICKLAND, SSN 417-32-2966, SALVAGE MASTER, CROWLEY MARITIME SALVAGE, U.S. CITIZEN, NAVSEA CONTRACTOR.
D. FRANK J. IGAZ, SSN 536-58-2638, SALVAGE MASTER, CROWLEY MARITIME SALVAGE, U.S. CITIZEN, NAVSEA CONTRACTOR.

2. REQUEST CLEARANCE FOR PERIOD 24 MAY 88 - 31 DEC 88.

3. PURPOSE IS TO ASSIST IN OPERATIONAL PLANNING FOR EX-USS TORTUGA SALVOPS.

4. POC IS CAPT MARSDEN, (805) 989-8157.

5. REPLY ONLY IF NEG.

BT

00C(1)...ORIG FOR COMNAVSEASYSCOM WASH(2) /13/
90B3341(1)

RTD:000-000/COPIES:0002

105402/145 1 OF 1 MATA2220 145/20:07Z 2418172 MAY 88
CSN:RXIA00096 COMNAVSEASYSCO

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U U N C L A S S I F I E D U
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FIGURE A-4. 241817Z MAY 88.

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PRIORITY

P 030404Z JUN 88

FM COMTHIRDFLT

TO CINCPACFLT PEARL HARBOR HI
COMNAVSURFPAC SAN DIEGO CA

INFO CNO WASHINGTON DC
CINCLANFLT NORFOLK VA
COMNAVSEASYSCOM WASHINGTON DC
COMNAVAIRSYSCOM WASHINGTON DC
COMNAVSURFGRU MIDPAC
COMSERVRON FIVE
COMSURFRON ONE
MOBDIVSALU ONE
CDU SAN DIEGO CA
COMPACMISTESTCEN PT MUGU CA
NAVCIVENGRLAB PORT HUENEME CA
NAS PT MUGU CA
UNCLAS //N04740//

SUBJ: SALVAGE ASSISTANCE REQUEST FOR EX-TORTUGA (LSD-56)

A. CINCPACFLT PEARL HARBOR HI 190046Z MAY 88

1. ORIG TAKES REF A AS A MATTER UNDER COMTHIRDFLT COG.

BT

412(1)...INFO FOR COMNAVAIRSYSCOM WASH(4) 04740/ 1/0630
FC(1) 0731(1) 09F(1)

OOC(1)...INFO FOR COMNAVSEASYSCOM WASH(4) 15709/ 3/1671
PMS395(1) 00(1) 09B362(1)

RTD:00C-000/COPIES:0008

162957/155 1 OF 1 MATA1665 155/10:34Z 030404Z JUN 88
CSN:AUIB01769 COMTHIRDFLT

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FIGURE A-5. 030404Z JUN 88.

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ADMINISTRATIVE MESSAGE

PRIORITY

P 291805Z JUN 88 ZYB

FM CDU SAN DIEGO CA

TO COMNAVSURFLANT NORFOLK VA

INFO CINCPACLT PEARL HARBOR HI
COMNAVSEASYSCOM WASHINGTON DC
COMLOGGRU TWO
MOBDIVSALU TWO
COMNAVSURFPAC SAN DIEGO
NAVSURFPAC READSUPPGRU SAN DIEGO CA
COMSUPPRON EIGHT

UNCLASS //N04740//

SUBJ: SALVAGE SUPPORT REQUEST

A. PHONCON MDSU2 - LCDR STEADLEY/CDU - LT BERNSOHN OF 28 JUN 88

1. COMNAVSURFLANT FOR CODE N37.

2. NAVSEA FOR OOC.

3. AS DISCUSSED REF A, REQ AUTHORIZATION FOR SHIPMENT OF ONE (1) ROPER CART DIVER SUPPORT SYSTEM FROM MDSU TWO TO ORIG. UNIT NEEDED TO SUPPORT DIVE OPS DURING EX-TORTUGA SALVAGE OPERATION.

4. COMNAVSURFPAC N41 CONCURS.

5. APPROXIMATE TIME FRAME EXPECTED FOR USE: 11 JUL 88 - 10 SEP 88.

6. REQUIRED DELIVERY DATE: 08 JUL 88.

7. SHIPPING AND ACCOUNTING DATA TO BE FORWARDED VIA SEPCOR.

8. CDU POC REGARDING SHIPMENT LT BERNSOHN A - 958-2958/9
B - 619-235-2958/9

9. YOUR ASSISTANCE APPRECIATED.

BT

OOC(1)...INFO FOR COMNAVSEASYSCOM WASH D.C. 15709/ 3/1671
PMS395(1) 00(1) 09B362(1)

RTD:000-000/COPIES:005

319796/182 1 OF 1 MATA0742 182/04:44Z 291805Z JUN 88
CSN:AUIB00822 CDU SAN DIEGO

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U U N C L A S S I F I E D U
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FIGURE A-6. 291805Z JUN 88.

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ADMINISTRATIVE MESSAGE

ROUTINE

R 200001Z JUL 88 ZYB

FM COMPACMISTESTCEN PT MUGU CA

TO COMNAVAIRSYSCOM WASHINGTON DC CINCPACFLT PEARL HARBOR HI

UNCLAS //N04650//

SUBJ: EX-TORTUGA SALVOPS FUNDING REQUIREMENTS

A. COMNAVAIRSYSCOM LTR SER AIR-4221/1223/0443 OF 23 MAY 88
B. DIRECTOR, CRUISE MISSILES PROJECT (PDA-14) PROJECT DIRECTIVE

SERIAL N000198PD43F01 REV 002 DATED 12 MAY 88

C. PMTC DOCUMENT N6312688WX5A101 OF 17 JUN 88
D. SUPERVISOR OF SALVAGE MEMO OF 17 JUL 88 (NOTAL)

1. NAVAIR FOR AIR-42; NAVSEA FOR SEA-00C.

2. BY REF A COMNAVAIR DIRECTED PMTC TO REMOVE EX-TORTUGA FROM SAN MIGUEL ISLAND. REFS B AND C PROVIDED $1,025,000 AND $450,000 RESPECTIVELY TO BEGIN SALVAGE OPERATION.

3. INABILITY OF THE FLEET TO PROVIDE ON SCENE SALVAGE SHIP FOR DURATION ESSENTIALLY ELIMINATED MAJOR COST SAVINGS POTENTIAL FOR FLEET PARTICIPATION. IN ADDITION, THE PROJECT HAS BEEN CONTINUALLY HAMPERED BY LARGE SOUTHERLY SWELLS AND NORTH WEST WINDS UP TO 60 KTS WHICH DELAYED OPS 7 TO 10 DAYS AFTER THE MOBILIZATION HAD BEEN INITIATED.

4. THE SALVAGE EFFORT HAS PROGRESSED FAVORABLY; SEVERAL HUNDRED TONS OF STEEL AND OTHER MATERIAL HAVE BEEN REMOVED. A CONTINGENT OF NAVY DIVERS HAS BEEN INSPECTING THE HULL AND TANKS IN PREPARATION FOR EVENTUAL FLOATING AND REMOVAL. ENVIRONMENTAL DIFFICULTIES HAVE BEEN ADDRESSED. THE HEAD OF SIMI

715(1)...ACT FOR COMNAVAIRSYSCOM WASH(3) 04650/ 1/0584
FC(1) 07E1(1)

00C(1)...INFO FOR COMNAVSEASYSCOM WASH(5) 15710/ 3/0348
PMS395(1) 00(1) 054(1) 09B362(1)

RTD:000-000/COPIES:0008

437006/203 1 OF 2 MATA1286 203/07:46Z 200001Z JUL 88
CSN:AUIB01511 COMPACMISTESTC

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FIGURE A-7. 200001Z JUL 88 (sheet 1 of 2).

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SAN DIEGO ASBESTOS RIP OUT TEAM IS ON BOARD TORTUGA TO IDENTIFY THE ASBESTOS PROBLEMS WHICH ARE TIME CONSUMING AND COSTLY, BUT ARE REQUIRED TO PROTECT THE SALVAGE PERSONNEL.

5. BY REF D THE SUPERVISOR OF SALVAGE NOTIFIES US THAT AT THE PRESENT LEVEL OF EFFORT, AVAILABLE FUNDING WILL BE EXPENDED APPROX 4 AUG 88 AND THAT ADDITIONAL $1,000,000 WILL BE REQUIRED TO COMPLETE TORTUGA SALVOPS. THE CURRENT PROJECTION FOR COMPLETION IS 1 SEP, PREDICATED ON BEING ABLE TO FLOAT THE HULK OUT DURING THE 27/28 AUG HIGH TIDE. INABILITY TO REFLOAT HULK AT THAT TIME WILL RESULT IN DELAY UNTIL NEXT HIGHEST TIDE 26/27 SEP, NECESSITATING ADDITIONAL $500K TO COMPLETE REMOVAL.

6. PMTC HAS NO ADDITIONAL FUNDS AVAILABLE EXPCET AT EXPENSE OF INCREASINGLY NEGATIVE AOR. REQUEST ASSIST TO IDENTIFY AND PROVIDE THE ADDITIONAL REQUIRED FUNDING NLT 27 JUL 88 TO SEA 00C TO PRESERVE THE CONTINUITY OF THE CONTRACTUAL EFFORT.

7. COMMANDER, PMTC SENDS.

BT

437006/203 2 OF 2 MATA1286 203/07:46Z 200001Z JUL 88
CSN:AUIB01511 COMPACMISTESTC

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FIGURE A-7. 200001Z JUL 88 (sheet 2 of 2).

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U U N C L A S S I F I E D U
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ROUTINE

R 170243Z AUG 88

FM COMPACMISTESTCEN PT MUGU CA

TO COMNAVAIRSYSCOM WASHINGTON DC

INFO CNO WASHINGTON DC
CINCPACFLT PEARL HARBOR HI
COMNAVSEASYSCOM WASHINGTON DC
CMP NAVAIRSYSCOMHQ WASHINGTON DC

UNCLAS //N04650//

SUBJ: EX-TORTUGA SALVOPS SITREP

A. MY 200001Z JUL 88 (NOTAL)
B. SALVOPS SITUATION CONFERENCE AMONG PACMISTESTCEN, NAVSEASYSCOM,

NOAA AND NPS OF 12 AUG 88 (NOTAL)

1. NAVAIRSYSCOM FOR AIR-42; NAVSEASYSCOM FOR SEA-00C; CNO FOR OP-45.

2. FUNDING PROVIDED IRT REF A PERMITTED SALVOPS TO PROCEED ON SKED. FIRST EXTRACTION EFFORT IS TARGETED FOR 25 AUG 88.

3. BY 20 AUG APPROX 1400 TONS OF STEEL AND DEBRIS WILL HAVE BEEN REMOVED, REQUIRED PATCHING COMPLETED AND TANK TOPS SEALED. AT THIS POINT THE CONTRACTED SALVAGE VESSEL ARCTIC SALVOR WILL BE IN HARNESS RESTRAINING TORTUGA AND WILL TEST BLOW ALL TANKS. IF TORTUGA BECOMES LIVELY AT THAT TIME IT WILL BE PULLED OFF AND TOWED TO DISPOSAL SITE.

4. THE USNS NAVAJO (T-ATF 169) IS PRESENTLY LOADING BEACH GEAR AND WILL BE ON SCENE 21 AUG TO ASSIST WITH THE 25 AUG EXTRACTION EFFORT IF REQUIRED.

5. AS AGREED REF B, THE BADLY DAMAGED STERN SECTION OF TORTUGA (ABOUT 400 TONS) NOW SEPARATED FROM THE MAIN HULK AND PARTIALLY COLLAPSED, WILL REMAIN IN PLACE UNTIL AT LEAST THE MID-OCTOBER SEASONAL SUBSIDENCE OF SWELL. DIVING OPS ARE UNSAFE AT PRESENT DUE TO SURGE/SWELL CONDITIONS.

DLVR:CMP NAVAIRSYSCOMHQ WASHINGTON DC(14)...INFO

715(1)...ACT FOR COMNAVAIRSYSCOM WASH(3) 04650/ 1/0584
FC(1) 07E1(1)

00C(1)...INFO FOR COMNAVSEASYSCOM WASH(5) 15710/ 3/0348
PMS395(1) 00(1) 05R(1) 09B362(1)

RTD:000-000/COPIES:0022

600156/231 1 OF 2 MATA2029 231/15:49Z 170243Z AUG 88
CSN:AUIB02516 COMPACMISTESTC

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U U N C L A S S I F I E D U
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FIGURE A-8. 170243Z AUG 88 (sheet 1 of 2).

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U U N C L A S S I F I E D U
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6. ADDITIONAL FUNDING REQUIREMENTS IF ANY TO COMPLETE THE FINAL PHASE WILL DEPEND ON: (A) THE SUCCESS OF THE 25 AUG EXTRACTION EFFORT; (B) COOPERATING WEATHER; AND (C) FLEET PARTICIPATION. SEA-00C WILL ADVISE ALCON ON AVAILABILITY OF FLEET SUPPORT TO ASSIST IN STERN SECTION REMOVAL.

600156/231 2 OF 2 MATA2029 231/015:49Z 170243Z AUG 88
CSN:AUIB02516 COMPACMISTESTC

UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
U U N C L A S S I F I E D U
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU

FIGURE A-8. 170243Z AUG 88 (sheet 2 of 2).

APPENDIX B
RELEVANT CORRESPONDENCE

19TH DISTRICT, CALIFORNIA

2332 RAYBURN BUILDING
WASHINGTON, DC 20515
202-225-3601

CONFERENCE SECRETARY

CONGRESSIONAL OBSERVER
GENEVA ARMS CONTROL TALKS

CONGRESSIONAL TASK FORCE ON
AFGHANISTAN—CO-CHAIRMAN

POW/MIA TASK FORCE
CHAIRMAN

Congress of the United States
House of Representatives
Washington, DC 20515

FOREIGN AFFAIRS
SUBCOMMITTEES:
WESTERN HEMISPHERE AFFAIRS
VICE CHAIRMAN
ASIAN AND PACIFIC AFFAIRS

COMMITTEE ON
INTERIOR AND INSULAR
AFFAIRS
SUBCOMMITTEES:
INSULAR AND INTERNATIONAL AFFAIRS
VICE CHAIRMAN

NATIONAL PARKS AND PUBLIC LANDS
VICE CHAIRMAN—PARKS

6 April 1988

Richard C. Gentz
Rear-Admiral, USN
Commander
Pacific Missile Test Center
Point Mugu, California 93042

Dear Admiral Gentz:

The accidental grounding of the Navy target hulk, the Ex-Tortuga, is of great concern to me. I have discussed this event at length with the local U.S. Park Service. Obviously the hulk is intruding on San Miguel Island (SMI) and the Channel Island National Park (CINP) and leaving it to slowly break-up and disintegrate is not in the spirit and best interests of the Park.

I have been a strong supporter of the close working relationship that you, the Navy, and the CINP have established over the past many years. I take great pride in being the author of legislation to establish the CINP. That legislation insured that the strong and mutually beneficial Navy-Park Service relationship would continue.

In the past little was known of the negative environmental impacts of accidents such as this, but we have learned much since and should act accordingly.

I supported establishment of the Channel Islands National Marine Sanctuary and its six nautical mile buffer. Leaving the hulk on SMI is counter to the purpose of the Sanctuary.

I urge you as Steward having custody of SMI to remove the hulk in an expeditous manner. To leave it will continue to cause environmental damage for many years to an area that has been set aside as a National Park for all to enjoy, especially in the future.

I am told that a combination plan utilizing fleet salvage personnel and salvage contractor has been proposed at an estimated cost of approx. $1.3 million. This would lighten the hulk by removing upper sections and floating it off to be disposed of in deep water. I understand that

SUITE 101
5740 RALSTON
VENTURA, 93003
642-2200/658-4344

STUDIO 121 EL PASEO
814 STATE STREET
SANTA BARBARA, 93101
963-1708

104 E. BOONE ST. #E
SANTA MARIA, 93454
922-2131

FIGURE B-1. House of Representatives Letter (sheet 1 of 2).

the salvage company is optimistic as to success of this approach. Even in the event of failure to float, the remainder of the hulk would be a lesser problem and could be dealt with later or left in place, depending on how the envirnomental impact assessment at that time directs.

I look forward to a continuing close working relationship between the Navy and other federal and state agencies that share the same geography, so that the Navy can perform its missions and the environment be protected.

Thank you for your consideration of this matter. I look forward to your response. In the interim, if I can be of any assistance, please do not hesitate to let me know.

Sincerely,

ROBERT J. LAGOMARSINO
Member of Congress

RJL:aal
page 2

FIGURE B-1. House of Representatives Letter (sheet 2 of 2).

DEPARTMENT OF THE NAVY

HEADQUARTERS
PACIFIC MISSILE TEST CENTER
POINT MUGU, CALIFORNIA 93042-5000

IN REPLY REFER TO

5090
Ser 00-3/6230-2/A-

6 APR 1988

From: Commander, Pacific Missile Test Center
To: Chief of Naval Operations (OP-045)
Via: Commander, Naval Air Systems Command (AIR-04)

Subj: DRAFT ENVIRONMENTAL ASSESSMENT FOR GROUNDING OF TORTUGA

Ref: (a) OPNAVINST 5090.1

Encl: (1) Draft Environmental Assessment And Supporting Documents

1. The target hulk ex-TORTUGA (LSD-26) was lost-at-sea during a Naval exercise on 15 December 1987. It ran aground off Cardwell Point, near the eastern end of San Miguel Island, California.

2. Enclosure (1) was prepared by Channel Islands National Park (CINP) under contract to the Pacific Missile Test Center (PACMISTESTCEN). It addresses the environmental impacts associated with the stranding of the hulk. Included is a full range of alternatives, from total removal to leaving the hulk in place.

3. San Miguel Island is assigned to the PACMISTESTCEN, but is managed by CINP under a two-party agreement. The hulk lies within several areas of jurisdiction. In addition to CINP and the PACMISTESTCEN, the area falls within San Miguel Island State Ecological Reserve (California Department of Fish and Game), Channel Islands National Marine Sanctuary (National Oceanic and Atmospheric Administration (NOAA) and the California Channel Islands International Biosphere Reserve. The immediate area of the stranding also lies within a Naval danger zone which restricts non-military vessels during operations.

4. Several scoping sessions were held, as recommended by reference (a), with cognizant state and federal regulatory agencies. Enclosure (1) was prepared following this scoping process. Five alternatives are presented:

a. No action. Leave the hulk and allow it to disintegrate in place.

b. Remove loose debris and hazardous materials (batteries, etc.) and reduce hazards from projecting structural members. Asbestos will not be removed because it is not deemed a personal hazard in this wet environment.

c. Alternative b. and weaken the superstructure to accelerate hulk erosion.

d. Remove the structure and outfit down to the well deck (3rd deck) fore and aft of frames 31 and 62, respectively; completely remove stern section; and leave hulk to erode.

e. Alternative d. and seal, float, and sink the remaining hulk in deep water.

FIGURE B-2. COMPACMISTESTCEN Ltr 5090 Ser 00-3/6230-2/A-317 (sheet 1 of 2).

5090
Ser 00-3/6230-2/A-
6 APR 1988

5. I am recommending alternative b. for our course of action. Cost of removal of the hulk is estimated at $2.1 million if refloated by commercial salvage, or $1.3 million if performed in combination of commercial and Navy salvage. Costs for cutting up and removing the hulk are estimated at $2.7 million. Costs will be higher than $2.7 million if refloating is attempted but proves unsuccessful requiring total salvage. There are no adverse impacts to endangered species or marine mammals which may override economic considerations.

6. The cognizant state and federal agencies are against the limited action alternative and will support only the alternative e. I anticipate that there will be a sizable response from environmental organizations and local public against my intended course of action.

7. I request you review enclosure (1) with limited action as the preferred alternative and advise us if another alternative is preferred. A rapid response is required if another alternative is selected as the hulk is exposed and could be subject to further break up which will increase future salvage costs.

R. C. GENTZ

FIGURE B-2. COMPACMISTESTCEN Ltr 5090 Ser 00-1/6230-2/A-317 (sheet 2 of 2).

DEPARTMENT OF THE NAVY
NAVAL AIR SYSTEMS COMMAND
NAVAL AIR SYSTEMS COMMAND HEADQUARTERS
WASHINGTON, DC 20361-4220

IN REPLY REFER TO
5090
Ser AIR-4221/1188/0444
23 May 88

FIRST ENDORSEMENT on COMPACMISTESTCEN ltr 5090 Ser 00-3/5230-2/
A-317 of 6 Apr 88

From: Commander, Naval Air Systems Command
To: Chief of Naval Operations (OP-045)

Subj: DRAFT ENVIRONMENTAL ASSESSMENT FOR GROUNDING OF TORTUGA

Ref: (b) Ex-Tortuga mtg at NAVAIRHQ on 8 Apr 88

1. Forwarded in accordance with reference (a).

2. I have reviewed the recommendation of the Commander, Pacific Missile Test Center as well as the political, legal and environmental ramifications of the recommendation.

3. During reference (b) the Draft Environmental Assessment was discussed. The general consensus was that there is a high probability that ultimately the Navy will have to remove the vessel and that delays beyond 1988 would likely increase costs of salvage. Since reference (b), we have been informed that to leave the ex-Tortuga in place, even after partial cleanup, will require an Environmental Impact Statement (EIS) with attendant public hearings. After completion of a costly EIS process, we may well be directed to remove the ship.

4. Considering the above, and keeping with the proactive environmental stance taken by the Naval Air Systems Command, I am directing that the ex-Tortuga be removed per alternative (e) of the basic letter. Recommend that the environmental assessment review be concluded with a Finding of No Significant Impact based on removal action.

J. B. WILKINSON

Copy to:
COMPACMISTESTCEN
ASSTSECNAV SL

FIGURE B-3. NAVAIR Ltr Ser AIR-4221/1188/0444.

DEPARTMENT OF THE NAVY
NAVAL AIR SYSTEMS COMMAND
NAVAL AIR SYSTEMS COMMAND HEADQUARTERS
WASHINGTON, DC 20361 -4220

IN REPLY REFER TO
4740
Ser AIR-4221/1223/0443
23 May 88

From: Commander, Naval Air Systems Command
To: Commander, Pacific Missile Test Center

Subj: SALVAGE OF THE EX-TORTUGA

Ref: (a) COMPACMISTESTCEN ltr 5090 Ser 00-3/6230-2/A-317 of 6 Apr 88

1. I have reviewed your recommendation concerning the ex-Tortuga, obtained comments from the Headquarters staff, as well as from specialists in Chief of Naval Operations, Office of the Secretary of the Navy and Office of Counsel, Naval Air Systems Command. It appears that to leave the vessel in place will generate a lengthy and costly conflict with local, state and federal agencies at the end of which the Navy may well be directed to remove the hulk.

2. In keeping with my proactive environmental protection policy and to minimize long-term costs, I have determined that alternative "e" of reference (a) shall be implemented. The Program Director for Cruise Missile Programs will help Commander, Pacific Missile Test Center (COMPACMISTESTCEN) fund this ex-Tortuga cleanup. COMPACMISTESTCEN shall take the lead for prompt execution of the removal effort.

3. Every effort should be made to expedite this task for completion prior to the 1988 fall/winter storm season, as well as minimizing costs by use of Navy help in salvage operations where practical.

J. B. WILKINSON

FIGURE B-4. NAVAIR Ltr Ser AIR-4221/1223/0443.

DEPARTMENT OF THE NAVY

HEADQUARTERS
PACIFIC MISSILE TEST CENTER
POINT MUGU, CALIFORNIA 93042-5000

IN REPLY REFER TO
7000
Ser 0222A-596

16 JUN 1988

From: Commander, Pacific Missile Test Center
To: Commander, Naval Sea Systems Command

Subj: EXEMPTION TO SECNAV WASHINGTON DC 202208Z MAY 88

Encl: (1) PACMISTESTCEN Order for Work and Service/Direct Citation--Navcompt Form 2276A, Document Number N6312688WX5A101

1. I have determined that the requirement of enclosure (1), salvage of the EX-USS TORTUGA is exempt from deferment as provided in SECNAV Washington DC 202208Z as performance is essential for safety and environmental protection.

2. Address questions regarding this funding to Mr. Peter Marvin, Code 5040, AUTOVON 360-3236 or telephone (805) 982-3236 or Mrs. Linda Kimbrough, Code 0222, AUTOVON 351-8995 or telephone (805) 989-8995.

S. L. VERNALLIS

FIGURE B-5. COMPACMISTESTCEN Ltr Ser 0222A-596.

SUPERVISOR OF SALVAGE
U.S. NAVY

MEMORANDUM FOR FILE

6 July 1988

From: Supervisor of Salvage Representative
To: Crowley Maritime Salvage

Subj: DISPOSAL AUTHORIZATION OF ex-TORTUGA SCRAP MATERIAL

1. The ex-TORTUGA (LSD 26) currently stranded on San Miguel Island is being removed by the U.S. Navy Supervisor of Salvage under NAVSEA Contract N00024-86-D-4267 D/O 0016.1.

2. Crowley Maritime Salvage is authorized to dispose of all scrap material in connection with this removal effort. It is understood that Crowley intends to subcontract disposal of the scrap material to others. As compensation to the subcontractor for such disposal, Crowley is authorized on behalf of the Government to transfer title to the scrap to said subcontractor and to grant to said subcontractor the right to retain all compensation received from the sale thereof. In the event that Crowley receives from the subcontractor any funds realized from the disposal action, such funds will be credited against the above contract.

JAMES C. BLADH
Supervisor of Salvage Representative
U.S. Navy

FIGURE B-6. SUPSALV Representative Memorandum.

DEPARTMENT OF THE NAVY
NAVAL SEA SYSTEMS COMMAND
WASHINGTON, DC 20362-5101

IN REPLY REFER TO

4740
OPR: 00C
Ser: 00C/2320

23 DEC 1988

From: Commander, Naval Sea Systems Command
To: Commander, Pacific Missile Test Center

Subj: EX-TORTUGA STERN SECTION

Ref: (a) PHONCON PMTC CAPT Marsden/NAVSEA CAPT Bartholomew of 22 Dec 88
(b) COMNAVSEASYSCOM ltr 4740 Ser 00CB/2309 of 30 Nov 88

1. As discussed in reference (a) and in amplification of reference (b), we have examined the feasibility and cost of a third option for complete removal of the remaining stern section of the EX-TORTUGA (LSD 26) from San Miguel Island; namely, cutting the stern into small sections (nominally five tons each), dragging the pieces into deeper water and then winching them onto a barge for subsequent disposal.

2. This option is unattractive from both a risk and cost perspective. The likelihood of dragging 80 large pieces of cut steel considerable distances along a seafloor littered with rocks and through dense kelp forests without their getting hung up or entangled is very remote. Therefore, this option has a greater risk of success or conversely of cost overrun than the other options. Our estimated cost for this option is $700K, which is roughly equivalent to the cost of the airlift option if you factor in the H-46 helo costs. This option is not recommended and is considered the least desirable of the three. A more detailed cost breakout can be provided by the Naval Sea Systems Command salvage contractor if required.

3. In summary, due to the high cost and potential further environmental damage considerations, we do not recommend complete removal of the EX-TORTUGA stern section be undertaken.

C. A. BARTHOLOMEW
Director of Ocean Engineering
Supervisor of Salvage and Diving, USN

FIGURE B-7. COMNAVSEA Ltr Ser 00C/2320.

APPENDIX C
ENVIRONMENTAL CONSIDERATIONS

DRAFT ENVIRONMENTAL ASSESSMENT FOR GROUNDING OF TORTUGA

(ENCLOSURE (1) TO FIGURE B-2)

DRAFT

ENVIRONMENTAL ASSESSMENT of ex-Tortuga (LSD-26) on San Miguel Island, California

I. Need for the Proposal

The target vessel ex-Tortuga grounded on Cardwell Point, near the eastern end of San Miguel Island, California, on December 15, 1987, after having been blown there by a severe storm from the general area of a missile exercise west of San Nicholas Island. Storm winds reached at least fifty knots with of seas over 6 m (20'). Original plans called for sinking the hulk, but because of the inclement weather this was not possible before it went aground.

The ex-Tortuga (LSD-26) is a CASA GRANDE class Dock Landing Ship. Built at the Boston Naval Shipyard in January 1945, it had an overall length of 153.4 m (475.4'), LBP 146.4 m (454'), and a beam of 24.6 m (76.'), with displacements of 4,790 LT (light) and 9.375 LT (full load)(Crowley Marine 1988).

The vessel came to rest on a rock and sand shore approximately 1,500 m west of Cardwell Point on the south shore of the island, at 120 deg 18'45" W; 34 deg 01'10" N. It lies within the boundaries of Channel Islands National Park, Channel Islands National Marine Sanctuary, California Channel Islands International Biosphere Reserve, and San Miguel Island State Ecological Reserve. This wild and remote island is particularly renowned as the only place in the world where six species of pinnipeds share the same rookery area and haulout locations. The island is the home of several rare and unique plant and animal species and contains numerous archeological sites.

The immediate environment of the ex-Tortuga can be characterized as an area of alternating sand and rock reefs. Adjacent to the hulk and extending out for a distance of about 40 m. is a zone of scoured bedrock, scoured bare except for patches of surf grass (*Phyllospadix* sp.) and green algae (*Ulva* sp.) Beyond this zone, which exhibits fracturing and scouring from the grounding of the vessel, lies an extensive sandy area with large concentrations of a small gastropod mollusk, *Olivella biplicata*. About 120 m. directly offshore from the hulk rocky reefs appear, supporting understory kelps *Pterygophora californica* and *Cystoseira osmundacea*, and somewhat further offshore the giant kelp, *Macrocystis pyrifera*. The kelp forest habitat is typical of San Miguel Island, consisting of an assembledge of several hundred species characteristic of the central and northern California coast. It occurs in alternating bands of rock, 20- 40 m. wide, separated by sand channels 10 - 15 m. wide. Harvestable species such as rockfish, *Sebastes* sp., sea urchins, *Strongylocentrus francisanus*, red abalone, *Haliotis rufescens*, and market crabs, *Cancer* sp. are commonly taken in this area.

Observation of the wreck since the original grounding gives the impression that either the vessel has moved slightly shoreward since mid-December, or that the shoreline has been altered and moved seaward to meet the hulk. A section of the stern, approximately 50 m in length, partially broke from the main hull shortly after grounding.

Awash in the surf, the ex-Tortuga is dramatically affecting the local environment and is continuing to deteriorate since grounding. Wave energy that would have been normally absorbed by the sandy beach at the site is now reflected forcefully off the hull into the nearshore subtidal zone. This wave energy is scouring the bottom and has removed virtually all sand from the bottom and exposed bed rock in a zone 40 m from the seaward surface of the hull to a depth of 4.5 m (14'). The seaward side of the hull is resting entirely on bedrock. Local water currents are apparently altered by the hulk, and a sand spit, or tombolo, has developed amidships on the shoreward side of the vessel in the first two months, covering a rock outcrop in the intertidal zone. Large amounts of marine algae characteristic of disturbed sites are growing on the hull.

Examination of the hulk and the affected area during the field studies for the assessment by various individuals including the Channel Islands National Park archeologist indicates that no submerged cultural resources are present or affected by the hulk.

A significant and ongoing process is the breakup and deterioration of the vessel itself. Although generally clean, some hazardous materials occur on the vessel. These include asbestos in ceiling tiles, boiler insulation, and other ap-

plications; six large lead batteries; oil and gasoline residues of unspecified quantity; debris and scrap including various sized drums and cylinders with unknown contents (Crowley Marine 1988). Although the ex-Tortuga lies within a Danger Zone marked on Chart 18727, private vessels, both commercial and pleasure, regularly cruise and anchor in waters near the hulk.

II. Alternatives

The environmental effects of five alternative courses of action, ranging from no action to complete removal of the vessel, are presented in this assessment. These alternative were developed by technical representatives of the U. S. Navy, National Park Service, National Marine Sanctuaries Program, National Marine Fisheries Service, and California Department of Fish and Game after reviewing a preliminary salvage proposal prepared by Crowley Maritime Salvage (Crowley 1988) and an inspection of the hulk and its environment on 23-24 FEB 88. The five alternatives are listed briefly below:

- No Action. Leave the hulk and allow it to disintegrate in place.

- Remove loose debris and hazardous materials (asbestos and fluids) and reduce hazards from projecting structural members.

- Remove loose debris and hazardous materials (asbestos and fluids), reduce hazards from projecting structural members, and weaken the superstructure to accelerate hulk erosion.

- Remove the structure and outfit down to the well deck (3rd deck) fore and aft of frames 31 and 62, respectively, completely remove the stern section, and leave the hull to erode.

- Remove the hulk completely, by removing the structure and outfit down to the well deck (3rd deck) fore and aft of frames 31 and 62, respectively; completely remove the stern section; seal, float, and sink the remaining hulk in deep water.

1. **No Action.** If the ex-Tortuga remains in place, the Navy will be taking action which is contrary to the spirit and intent of Federal and State laws and regulations (16 USC 1, 16 USC 410ff, 33 USC 403ff, 15 CFR 935.7 a (2), 36 CFR 2.1, and State of California Fish and Game Code Title 14 Chap. 11 sec. 630 a). Presence of the hull alters local currents and changes sand dynamics and transport which will affect beach erosion and redeposition. Altered wave patterns have scoured the bottom, exposing bedrock along the length of the hull, and will prevent re-establishment of natural biological communities in a zone of at least 1,000 m^2. Alteration of the seabed as a result of the grounding outside the scoured area has already resulted in the establishment of species commonly associated with highly disturbed areas. Species diversity will probably remain lower than normal as long as the wave and current patterns are altered by the vessel's presence.

As the ex-Tortuga breaks up under stress from environmental forces over the next 100+ years, several thousand tons of debris will smother benthic communities and scour previously unaffected areas for many decades, as is apparent by the remains of nearby wrecks on Santa Rosa Island, such as the *Goldenhorn* which wrecked in 1892 and the M/V *Chickasaw* which went aground in 1962 (prior to establishment of Channel Islands National Park and Channel Islands National Marine Sanctuary). These vessels, with gross tonnages of 1,915 and 6,131 respectively, probably have had a lesser impact on their surrounding environments than the larger (9,375 ton) ex-Tortuga may achieve, although the environmental effects of these wrecks are unstudied and not well understood. The ex-Tortuga is more than 50% larger, in terms of gross tonnage, than the next largest vessel, the *Chickasaw*, which has wrecked on any of the islands in the Park or Sanctuary. Thus the possibility exists that these smaller wrecks may not accurately model the impacts of the ex-Tortuga.

Dispersal of steel plating sections, miscellaneous debris, and vessel subassemblies will occur over a wide area. Large hull fragments of the 87 m. *Goldenhorn*, was dispersed over an area 200 m.long 93 years after sinking, and the wreckage continues to spread. Movement of vessel fragments remains quite pronounced near the surf zone. Movement of steel plating from the ex-Tortuga shoreward may affect nearby pinniped haul-outs and adjacent abalone bearing rocky intertidal communities. In adjacent subtidal areas, it will alter or damage kelp forest, sea grass meadows, sand communities, and rocky reefs.

These alterations to the seabed and subsequent resource damage would counter the intent and spirit of National Marine Sanctuary regulations (15 CFR

935.7), the Refuse Act of 1899 (33 USC 403ff), National Park Service regulations (36 CFR 2.1), and State Ecological Reserve regulations Title 14, sec. 630 (a)(1) and (14). Federal courts have recently awarded up to $6.5 million for mitigation in other grounding cases (the *Wellwood*, at Key Largo National Marine Sanctuary in south Florida Florida) in national marine sanctuaries prosecuted under 15 CFR. (US vs *Wellwood*??)

The vessel's continued presence on the beach for the next 100+ years would also constitute a significant degradation of the scenic values of the area. A fundamental purpose of national parks is "to conserve the scenery...in such manner and by such means as will leave them unimpaired...."(16 USC 1). Furthermore, Channel Islands National Park was specifically established "To protect the nationally significant natural, scenic...values of the California Channel Islands...."(16 USC 410ff). Degrading the scenic values of this area is more than an aesthetic eyesore; it would impair one of the primary natural resources of Channel Islands National Park in direct contradiction to the intent of Congress and Federal law.

The beach on which the ex-Tortuga lies is designated as a hauling/breeding ground for the pinnipeds using San Miguel Island. A northern elephant seal, *Mirounga angustirostris*, was impaled on debris within the hulk of the ex-Tortuga during its first six weeks aground. This, and subsequent take of marine mammals which is likely if the vessel is left in place, and interference by debris from the deteriorating hulk with pinniped haulout areas would be contrary to the spirit and intent of the Marine Mammal Protection Act (16 USC 1372).

In summary, if this alternative were exercised, the Navy would act in oposition to National Marine Sanctuary regulations (15 CFR 935.7), the Refuse Act of 1899 (33 USC 403ff), National Park Service regulations (36 CFR 2.1), State Ecological Reserve regulations Title 14, sec. 630 (1) and (14), and probably the Marine Mammal Protection Act (16 USC 1372), and the Endangered Species Act (16 USC 668). The hulk would continue to diminish the scenic values of the National Park contrary to l6 USC 1 and 16 USC 410ff.

2) Remove loose debris and hazardous materials (asbestos and fluids) and reduce hazards from projecting structural members. If this alternative were exercised, the environmental impacts of the hulk would be somewhat reduced, but the Navy would be acting contrary to the spirit and intent of Federal and State Law. In addition, this alternative would expose the local environment of the ex-Tortuga to a series of short term effects. These include placement of anchors which would impact sand communities including remarkable concentrations of *Olivella* snails. If anchors and chains are draped across rock reefs, tremendous damage will occur. This impact could be minimized by prior under-

water inspection of prospective anchor locations during operations and by mapping rock and sand substrates prior to salvage operations. Debris and scrap will fall into the water during operations and would disturb the environment. Careful observations and recording of these events will allow the removal of this material by divers since the area is quite shallow. Salvage operators must take care to avoid dragging material across the seabed during the conduct of operations. An environmental monitor with the authority to modify or stop operations which would unnecessarily impact the area may be necessary. Vessel operators and supervisors must comply with applicable regulations regarding discharge of waste, litter, and effluent from the working area. Park, Sanctuary, and Ecological Reserve regulations (33 USC 407, 36 CFR 2.14 (a) (1) and (6), and California Title 14, sec 630, 14) generally forbid the discharge of these materials, requiring their removal along with the scrap from the vessel. This option would leave virtually the entire hulk in place to weather and deteriorate. This would have a long term negative effect upon the environment denying habitat to communities now present.

This alternatpive will remove known hazardous materials and potentially hazardous materials, primarily drums with unknown contents, from the environment. This action will reduce the environmental damage caused by the wreck. Impalement of pinnipeds will be less likely, although as the vessel deteriorates, additional hazards will be created, for man as well as animal species using the wreck.

If this alternative were exercised, the Navy would act contrary to the spirit and intent of National Marine Sanctuary regulations (15 CFR 935.7), the Refuse Act of 1899 (33 USC 403ff), National Park Service regulations (36 CFR 2.1), State Ecological Reserve regulations Title 14, sec. 630 (1) and (14), and probably the Marine Mammal Protection Act (16 USC 1372), and the Endangered Species Act (16 USC 668). The hulk would diminish the scenic values of the National Park contrary to l6 USC 1 and 16 USC 410ff. There will be no more compliance with the State and Federal regulations than with option 1) above.

To exercise this alternative, the Navy will need to secure a consistency determination from the California Coastal Commission, and obtain permits from the National Marine Sanctuaries Program for anchoring and seabottom disturbance in order to perform this work.

Salvage activity should occur during the late summer and early fall (late August through November) to avoid impacting pinniped breeding activities (Channel Islands General Management Plan, Vol 2, Table 4).

3. Remove loose debris and hazardous materials (asbestos and fluids), reduce hazards from projecting structural members, and weaken the superstructure to accelerate hulk erosion. If this alternative were exercised, the environmental impacts of the hulk would be somewhat reduced, but the Navy would be acting contrary to the spirit and intent of Federal and State Law. In addition, this alternative would expose the local environment of the ex-Tortuga to a series of short term effects. These include placement of anchors which would impact sand communities including remarkable concentrations of *Olivella* snails. If anchors and chains are draped across rock reefs, tremendous damage will occur. This impact could be minimized by prior underwater inspection of prospective anchor locations during operations and by mapping rock and sand substrates prior to salvage operations. Debris and scrap will fall into the water during operations and would disturb the environment. Careful observations and recording of these events will allow the removal of this material by divers since the area is quite shallow. Salvage operators must take care to avoid dragging material across the seabed during the conduct of operations. The Navy should establish an environmental monitor with the authority to modify or stop operations which would unnecessarily impact the area. Vessel operators and supervisors must comply with applicable regulations regarding discharge of waste, litter, and effluent from the working area. Park, Sanctuary, and Ecological Reserve regulations (33 USC 407, 36 CFR 2.14 (a) (1) and (6), and California Title 14, sec 630, 14) generally forbid the discharge of these materials, requiring their removal along with the scrap from the vessel. This alternative would leave the hulk in place to weather and deteriorate, although at an accelerated pace. This would have a long term negative effect upon the environment by altering habitat of communities present before the incident.

The primary effect of this alternative will be to reduce the length of time that the hulk will impact the scenic resources of Channel Islands National Park. The precise amount of time involved cannot be estimated precisely now. Alteration of wave and current patterns will occur for a shorter period of time than under options 1 and 2. Several thousand tons of debris will be released on the seabed and shore as the hulk breaks up, but this release will occur over a shorter period of time. We do not know if this change of timing would be beneficial or adverse. This alternative may render the U.S. Navy more vulnerable to damage suits from individuals injured as a result of unauthorized exploration of the hulk, since this action will make the hulk more dangerous for a period of time.

In addition, if this alternative were selected, the Navy would act contrary to the spirit and intent of National Marine Sanctuary regulations (15 CFR 935.7), the Refuse Act of 1899 (33 USC 403ff), National Park Service regulations (36 CFR 2.1), State Ecological Reserve regulations Title 14, sec. 630 (1) and (14), and probably the Marine Mammal Protection Act (16 USC 1372), and the Endangered Species Act (16 USC 668). The hulk would continue to diminish the scenic values of the National Park contrary to l6 USC 1 and 16 USC 410ff, although presumably for a shorter period of time.

To exercise this alternative, the Navy will need to secure a consistency determination from the California Coastal Commission, and a permit from the National Marine Sanctuaries Program for anchoring and seabottom disturbance in order to perform this work.

Salvage activity should occur during the late summer and early fall (mid-July through November) to avoid impacting pinniped breeding activities(Channel Islands General Management Plan, Vol 2, Table 4).

4. Remove the structure and outfit down to the well deck (3rd deck) fore and aft of frames 31 and 62, respectively, completely remove the stern section, and leave the hull to disintegrate. If this alternative were exercised, the environmental impacts of the hulk would be somewhat reduced, but the Navy would be acting contrary to the spirit and intent of Federal and State Law. In addition, this alternative would expose the local environment of the ex-Tortuga to a series of short term effects. These include placement of anchors which would impact sand communities including remarkable concentrations of *Olivella* snails. If anchors and chains are draped across rock reefs, tremendous damage will occur This impact could be minimized by prior underwater inspection of prospective anchor locations during operations and by mapping rock and sand substrates prior to salvage operations. Debris and scrap will fall into the water during operations and would disturb the environment. Careful observations and recording of these events will allow the removal of this material by divers since the area is quite shallow. Salvage operators must take care to avoid dragging material across the seabed during the conduct of operations. The Navy should establish an environmental monitor with the authority to modify or stop operations which would unnecessarily impact the area. Vessel operators and supervisors must comply with applicable regulations regarding discharge of waste, litter, and effluent from the working area. Park, Sanctuary, and Ecological Reserve regulations (33 USC 407, 36 CFR 2.14 (a) (1) and (6), and California Title 14, sec 630, 14) generally forbid the discharge of these materials, requiring their removal along with the scrap from the vessel. This option would leave the main hull section in place to weather and deteriorate. This would have a

long term negative effect upon the environment denying habitat to communities now present.

This action would remove a minimum of 1,100 tons of scrap metal from the environment. This action will reduce the visual impact of the hulk. The size of the area affected by the hulk's disintegration will be lessened, but the relatively intact hull will continue to alter wave and current patterns for a long period of time, resulting in lower species diversity in the affected area. The end result of this action will remain contrary to the sprit and intent of National Marine Sanctuary regulations (15 CFR 935.7), the Refuse Act of 1899 (33 USC 403ff), National Park Service regulations (36 CFR 2.1), State Ecological Reserve regulations Title 14, sec. 630 (1) and (14), and probably the Marine Mammal Protection Act (16 USC 1372), and the Endangered Species Act (16 USC 668). The hulk would continue to diminish the scenic values of the National Park contrary to l6 USC 1 and 16 USC 410ff, but to a lesser extent than under the options discussed previously. The breakup of the hull will alter the habitat of the nearshore environment through the dispersal of corroding steel plate and vessel fragments.

To exercise this alternative, the Navy will need to secure a consistency determination from the California Coastal Commission, and a permit from the National Marine Sanctuaries Program for anchoring and seabottom disturbance in order to perform this work.

Salvage activity should occur during the late summer and early fall (mid-July through November) to avoid impacting pinniped breeding activities(Channel Islands General Management Plan, Vol 2, Table 4).

5. Complete Removal. Selection of this alternative would comply completely with the spirit and intent of Federal and State Law regarding the area surrounding San Miguel Island. However, this alternative would expose the local environment of the ex-Tortuga to a series of short term effects. These include placement of anchors which would impact sand communities including remarkable concentrations of *Olivella* snails. If anchors and chains are draped across rock reefs, tremendous damage will occur. This impact could be minimized by prior underwater inspection of prospective anchor locations during operations and by mapping rock and sand substrates prior to salvage operations. Debris and scrap will fall into the water during operations and would disturb the environment. Careful observations and recording of these events will allow the removal of this material by divers since the area is quite shallow. Salvage operators must take care to avoid dragging material across the seabed during the conduct of operations. The Navy should establish an environmental monitor with the authority to modify or stop operations which would unnecessarily im-

pact the area. Vessel operators and supervisors must comply with applicable regulations regarding discharge of waste, litter, and effluent from the working area. Park, Sanctuary, and Ecological Reserve regulations (33 USC 407, 36 CFR 2.14 (a) (1) and (6), and California Title 14, sec 630, 14) generally forbid the discharge of these materials, requiring their removal along with the scrap from the vessel.

On the other hand the vessel will no longer affect the area presently impacted and there will be no long term impacts. The Navy will fully comply with applicable Federal and State laws. There will be a potential for additional scraping, fracturing, and disturbance of the seabed as the lightened hull is floated to deeper water. This effect can be minimized by timing the floating operation to utilize an extreme high tide.

To exercise this alternative, the Navy will need to secure a consistency determination from the California Coastal Commission, as well as permits from the National Marine Sanctuaries Program for anchoring and seabottom disturbance in order to perform this work.

Salvage activity should occur during the late summer and early fall (mid-July through November) to avoid impacting pinniped breeding activities(Channel Islands General Management Plan, Vol 2, Table 4).

All the proposed actions contemplate that salvage activities will be conducted from barges and work platforms anchored near the ex- Tortuga and that no use of the land mass of San Miguel Island will occur. Reconnaissance of the immediate vicinity of the island reveals the presence of fragile, easily impacted plant communities and numerous prehistoric archeological sites which would be profoundly affected by any activity on the land near Cardwell Point.

REPORT ON DISPOSITION OF TORTUGA

DISPOSITION OF THE EX-TORTUGA (LSD-26)

CURRENT STATUS: AGROUND AT CARDWELL POINT, SAN MIGUEL ISLAND

ACTION REQUIRED: EXECUTE PREFERRED COURSE OF ACTION

PURPOSE OF THIS MEETING: PROVIDE INFORMATION AND INITIATE DISCUSSION TOWARDS RESOLUTION

CAPTAIN JIM LEWIS - PMTC TARGETS
MR. RON DOW - PMTC ENVIRONMENTAL AFFAIRS
MR. JOE DIVITTORIO - PMTC ENVIRONMENTAL AFFAIRS

ADMINISTRATIVE HISTORY OF SAN MIGUEL ISLAND

1934 - SAN MIGUEL ISLAND IS WITHDRAWN FROM PUBLIC DOMAIN LAND FOR NAVY USE

1963 - A TWO PARTY AGREEMENT REACHED BETWEEN SECRETARY OF INTERIOR AND SECRETARY OF THE NAVY COVERING INVENTORY OF NATURAL RESOURCES ON SAN MIGUEL ISLAND

1976 - NATIONAL PARK SERVICE ASSUMES MANAGEMENT OF SAN MIGUEL ISLAND

1979 - CHANNEL ISLAND NATIONAL PARK (CINP) FORMED

1980 - CHANNEL ISLAND SANCTUARY ESTABLISHED

1985 - CINP AND PMTC LOCAL AGREEMENT ON DAY TO DAY MANAGEMENT

AGENCIES INVOLVED

NAVAL AIR SYSTEMS COMMAND

PACIFIC MISSILE TEST CENTER - TARGET OPERATOR AND SEA TEST RANGE AUTHORITY

PROGRAM DIRECTOR AIR FOR CRUISE MISSILES (PDA-14) - "TARGET SHOOTER/USER" (TOMAHAWK)

NAVAL SEA COMMAND

HULK POOL PROGRAM MANAGER (PMS-300) NOT INVOLVED

SUPERVISOR OF SALVAGE (SEA-00C) - SALVAGE OR REMOVAL LEAD

U.S. DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

MARINE AND ESTUARINE MANAGEMENT DIVISION
(MARINE SANCTUARY ADMINISTRATOR)
NATIONAL MARINE FISHERIES SERVICE
(ENFORCES FEDERAL MARINE AND FISHERIES LAWS)

NATIONAL PARK SERVICE

CHANNEL ISLANDS NATIONAL PARK
(ADMINISTRATOR OF CINP)

CALIFORNIA DEPARTMENT OF FISH AND GAME
(ENFORCES STATE MARINE FISHERIES LAWS; ADMINISTRATOR OF SAN MIGUEL ISLAND ECOLOGICAL RESERVE)

ACTION TO DATE

GROUNDING - 15 DECEMBER 1987 SINKEX

16 DECEMBER AGROUND DURING SEVERE STORM

AGENCY LIAISON (16 DEC 1987 - 1 JAN 1988)

INITIAL CONTACTS AND NOTIFICATION
- NOAA
- NPS
- CALIFORNIA FISH AND GAME
- NAVSEA - 00C

PRESS RELEASE AND COVERAGE

SALVAGE ASSESSMENT (3-5 FEB)

NAVSEA-00C
CROWLEY MARITIME

INTERAGENCY MEETING AND SITE VISIT (18 FEB)

PMTC
NAVSEA
NOAA
NPS
CAL. FISH AND GAME

ON SITE SUB TIDAL ENVIRONMENTAL ASSESSMENT (23-25 FEB)

PMTC
NOAA
NPS

ON SITE SHORE ENVIRONMENTAL ASSESSMENT (3-6 MARCH)

PMTC
NPS
CAL FISH AND GAME

INTERAGENCY MEETING AND ASSESSMENT REVIEW (28 MARCH)

PMTC PERSPECTIVE

ALTERNATIVES

1. NO ACTION. LEAVE THE HULK AND ALLOW IT TO DISINTEGRATE IN PLACE.

2. REMOVE LOOSE DEBRIS AND HAZARDOUS MATERIALS AND REDUCE HAZARDS FROM PROJECTING STRUCTURAL MEMBERS.

3. REMOVE LOOSE DEBRIS AND HAZARDOUS MATERIALS, REDUCE HAZARDS FROM PROJECTING STRUCTURAL MEMBERS, AND WEAKEN THE SUPERSTRUCTURE TO ACCELERATE HULK EROSION.

4. REMOVE THE STRUCTURE AND OUTFIT DOWN TO THE WELL DECK (3RD DECK) FORE AND AFT OF FRAMES 31 AND 62, RESPECTIVELY, COMPLETELY REMOVE THE STERN SECTION, AND LEAVE THE HULL TO ERODE.

5. REMOVE THE HULK COMPLETELY, AS PROPOSED BY CROWLEY MARINE (1988).

SALVAGE COSTS

CUT AND REMOVE (IN PLACE).....$2.7 MILLION

REFLOATING (COMMERCIAL).....$2.1 MILLION

REFLOATING (WITH FLEET ASSISTANCE).....$1.3 MILLION

REFLOATING (ATTEMPT FAILED) AND CUT & REMOVE.....$2.7 MILLION

ENVIRONMENTAL IMPACTS

CURRENT CONDITIONS

BUILDUP OF SAND BAR

SCOURING OF SEA FLOOR

LOSS OF BIOLOGICAL DIVERSITY

SAND TRANSPORT ALTERATIONS

SAND DEPOSITION OVER RICH KELP BED

LONG-TERM (LEFT IN PLACE)

LOSS OF BIOLOGICAL DIVERSITY

COVERING OF SEA FLOOR WITH METAL DEBRIS

HEAVY METAL UPTAKE BY MARINE ORGANISMS

VISUAL IMPACTS

SALVAGE

ALL IMPACTS ARE SHORT-TERM

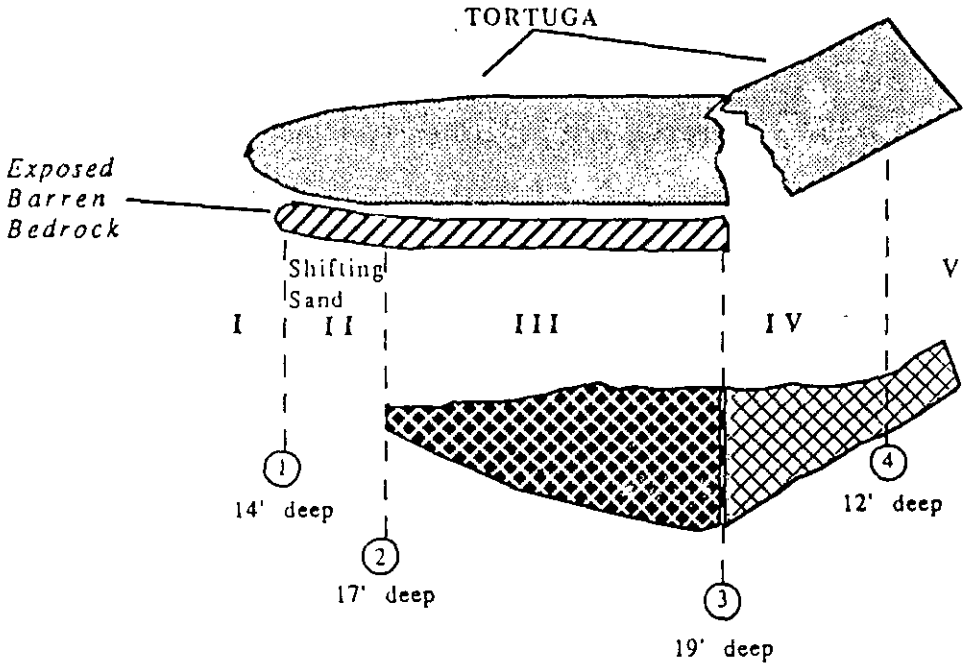
SHORT-TERM DAMAGE TO SEA FLOOR

SHORT-TERM DISTURBANCE TO HARBOR SEAL HAUL-OUT

QUICK RETURN TO PREVIOUS CONDITION

TORTUGA - LSD-26 Casa Grande Class

Length:	153.4m (475.4')
Beam:	24.6m (76')
Draft:	5.5m (18')



	Impacted Rock Reef
	Fragmented Rocky Area
	Exposed Barren Bedrock

Buoy
1 - 52.5m from hull, 14' deep
2 - 58.3m from hull, 17' deep
3 - 72.0m from hull, 19' deep
4 - 60.0m from hull, 12' deep

Scale: 12m

ALTERNATIVE CONSIDERATIONS

TIME CRITICAL DECISION

- DETERIORATING HULL INTEGRITY
- PINNIPED ROOKERY AND HAULOUT WINDOW
- SALVAGE WINDOW
- POLITICAL WINDOW

COST CONSIDERATIONS

- 2.1 M FOR RE-FLOAT AND REMOVE
  (800K REDUCTION POSSIBLE THROUGH NAVY ASSIST)
- 2.7 M FOR BREAK UP AND BARGE AWAY
  (200K-300K REDUCTION POSSIBLE WITH NAVY ASSIST)

COMMUNITY RELATIONS CONSIDERATIONS

- INTER AGENCY
- LOCAL COMMUNITY
- LOCAL AND STATE GOVERNMENTS

LEGAL BASIS

- PREVIOUS AGREEMENTS
- PREVIOUS PRECEDENT

COMMANDER, PACIFIC MISSILE TEST CENTER POSITION

NEITHER SITE VISITS, PMTC ENVIRONMENTAL STAFF INPUTS NOR THE ENVIRONMENTAL ASSESSMENT ADEQUATELY JUSTIFY THE EXPENSE OF REMOVAL OF THE EX-TORTUGA.

DECISION IMPACTS

LEAVE IN PLACE OR REMOVE?

PUBLIC RELATIONS

CONGRESSIONAL REACTION

WORKING RELATIONS

LEGAL IMPLICATIONS

RANGE EXEMPTION STATUS

INTERESTED AGENCIES/PUBLICS

CONGRESSIONAL OFFICES

CONGRESSMAN LAGOMARSINO

STATE SENATOR HART

FEDERAL AGENCIES

U.S. FISH & WILDLIFE SERVICE

U.S. ARMY CORPS OF ENGINEERS

STATE AGENCIES

STATE CLEARING HOUSE

COASTAL CONSERVANCY

CALIFORNIA DEPARTMENT OF FISH & GAME AREA BIOLOGIST

SOUTH CENTRAL COASTAL ZONE

CALIFORNIA DEPARTMENT OF FISH & GAME - ENVIRONMENTAL IMPACTS

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

COASTAL COMMISSION

LOCAL GOVERNMENT

TOM ROGERS, SUPERVISOR 2ND DISTRICT, SANTA BARBARA, CA

WILLIAM WALLACE, SUPERVISOR 3RD DISTRICT, SANTA BARBARA, CA

PLANNING DIRECTOR, COUNTY OF SANTA BARBARA

CITY OF SANTA BARBARA PLANNING DEPARTMENT

VENTURA COUNTY BOARD OF SUPERVISORS

INTERESTED GROUPS

THE NATURE CONSERVANCY

LEAGUE OF WOMEN VOTERS

CONEJO VALLEY AUDUBON SOCIETY

ENVIRONMENTAL COALITION OF VENTURA CO.

SIERRA CLUB (LOCAL CHAPTER)

ENVIRONMENTAL DEFENSE CENTER - SANTA BARBARA CO.

COMMUNITY ENVIRONMENTAL COUNCIL

SCENIC SHORELINE PRESERVATION COMMITTEE

INFORMATION SOURCES

SANTA BARBARA PUBLIC LIBRARY

CITY OF OXNARD LIBRARY

E. P. FOSTER LIBRARY

"APPLICABLE" STATUTES/REGULATIONS

1. STATUTE: CHANNEL ISLAND NATIONAL MARINE SANCTUARY

   PROTECT AND PRESERVE ECOSYSTEM
   NAVY WAIVER FOR ESSENTIAL/ROUTINE OPERATIONS

   TORTUGA SALVAGE MAY NOT BE COVERED

2. STATUTE: NATIONAL PARK SYSTEM

   REGULATES USE OF PARK AREAS

   TORTUGA IS IN CINP

3. STATUTE: RIVER AND HARBOR ACT OF A899

   REGULATE NAVIGATION OF NAVIGABLE WATERS

   TORTUGA POTENTIALLY IN VIOLATION

4. STATUTE: MARINE MAMMAL PROTECTION ACT OF 1972

   PRESERVE AND PROTECT MARINE MAMMALS

   TORTUGA IMPACT APPEARS MINIMAL

5. STATUTE: FISH AND WILDLIFE COORDINATION ACT

   COORDINATE WATER RESOURCE DEVELOPMENT CONSISTENT WITH WILDLIFE CONSERVATION

   TORTUGA DOES NOT APPLY OR MINIMAL IMPACT

6. STATUTE: CALIFORNIA FISH AND GAME CODE

   PRESERVE ECOLOGICAL RESERVE AREAS

   TORTUGA POTENTIALLY IN VIOLATION

BRIEF OVERVIEW OF STATUTES/REGULATIONS

RE: TORTUGA

1. STATUTE: CHANNEL ISLANDS NATIONAL MARINE SANCTUARY
16 USC 1431 et seq.
15 CFR 935

ENFORCEMENT AGENCY: Commerce

PURPOSE: To protect and preserve the ecosystem, including marine birds and mammals and national resources of the waters surrounding north Channel Islands, Santa Barbara Island.

SUMMARY: a. In accordance with 15 CFR 935.7(b), DoD activities currently carried out within the sanctuary are deemed essential for the National Defense and, therefore, are not subject to the prohibitions of 15 CFR 935.7(a) nor the permit procedures of 15 CFR 935.9.

b. However, "additional" activities (i.e., those beyond the scope of current DoD activities) having significant impact on the sanctuary shall be determined in consultation between assist administrator of NOAA and DoD.

c. Any action/decision taken re the TORTUGA (e.g., removal, partial salvage operations, etc.) would probably fall within the scope of the aforementioned "additional activity", thereby, necessitating NOAA/DoD coordination.

2. STATUTE: National Park System 16 USC 1, 16 USC 410 ff
(Channel Island National Park)
36 CFR 2.A and 2.14

ENFORCEMENT AGENCY: Interior

PURPOSE: Promote and regulate the use of the federal areas known as National Parks, Monuments and Reservations.

SUMMARY: a. TORTUGA is resting within the Channel Island National Park. 36 CFR 2.1 prohibits activities within a designated National Park which lead to disturbance of wildlife or fish from their natural state.

b. 36 CFR 2.14 prohibits polluting of park waters.

c. 16 USC 410 ff-4 requires all Federal Agencies, prior to licensing of any activity or expenditure of funds in a designated park area, to advise the Secretary of the Interior and provide him/her reasonable opportunity to comment on the intended activity.

d. TORTUGA potentially violation.

3. STATUTE: River and Harbor Act of 1899
33 USC 401 et seq.

ENFORCEMENT AGENCY: Army

PURPOSE: To prescribe regulations for the safe and efficient use, administration and navigation of navigable waters of U.S.

SUMMARY: a. 33 USC 403 prohibits the creation of any obstruction not affirmatively authorized by Congress to the navigable capacity of any U.S. waters.

b. 33 USC 407 prohibits discharge from any ship of any solid refuse matter into navigable waters.

c. TORTUGA potentially in violation.

4. STATUTE: Marine Mammal Protection Act 1972
16 USC 1361 et seq.

ENFORCEMENT AGENCY: Commerce

PURPOSE: To preserve and protect all species of marine mammals.

SUMMARY: a. 16 USC 1372 prohibits certain fishing practices, the taking, selling, buying or possessing of specified endangered mammals.

b. TORTUGA impact appears minimal to non-existent.

5. STATUTE: Fish and Wildlife Coordination Act
16 USC 661, et seq. and 668

ENFORCEMENT AGENCY: Interior

PURPOSE: Develop coordinated water resource development programs consistent with wildlife conservation.

SUMMARY: a. 16 USC 662 requires licensing by Fish and Wildlife Service prior to impounding, diverting, channel deepening, or altering the navigation/drainage of any U.S. waters.

b. Requirements of Section 662 N/A if impoundment of water less than 10 acres of surface area.

c. 16 USC 668 prohibits anyone from knowingly selling, buying, taking, possessing or transferring bald and golden eagles or their nests.

d. TORTUGA situation appears either outside the scope of 16 USC 662 or minimal impact.

6. STATUTE: California Fish and Game Code.

California Administrative Code 630 Title 14, Chapter 11, Section 630 (a) (1) (14).

PURPOSE: Preservation of ecological reserve areas.

SUMMARY: a. Title 14, Chapter 11 of subject California Regulations prohibits disturbing of geological formations, birds, nests, plants, mammals or animal life within an ecological reserve.

b. Deposit of any refuse/debris within ecological reserve is prohibited.

c. TORTUGA potentially in violation.

7. Questions or requests for additional information can be directed to Robert F. Catania, Command Counsel, PACMISTESTCEN, AUTOVON 351-7735, or commercial (805) 989-7735 or Dan Blalock, NAVAIRCOM, AUTOVON 222-3625 or commercial (202) 692-3625.

APPENDIX D
MAJOR MOBILIZED ASSETS

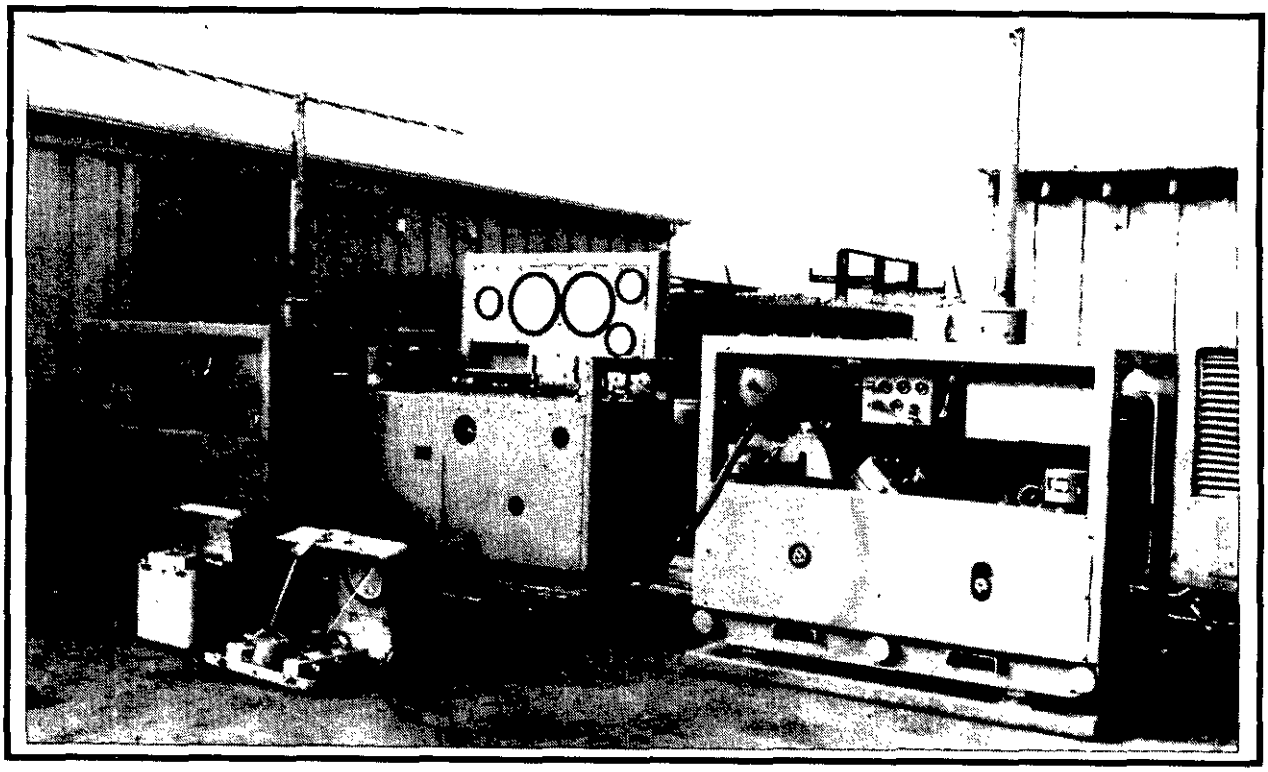


FIGURE D-1. Fly-Away Diving System (FADS).

Description:	Two each 5120 Quincy compressors diesel driven 250 psi 97.6 SCFM One each Divers Air Control Filter Console
Assets:	Certified to 190' for 40 min on air for two divers and one standby diver
Primary Assignment:	Support diving operations for the refloating of ex-TORTUGA stranded on San Miguel Island
Owner:	Consolidated Diving Unit, San Diego, CA.

Four 100-psi, 125-CFM air compressors

Two 400-amp diesel welding machines

A Zodiak inflatable workboat and outboard motor

One hydraulic power unit

Two hose reels

Four 27-cu.ft. equipment boxes

One underwater welding box

A 55-gallon drum of hydraulic oil

800 feet of 6" Samson double braid nylon line

One light kit and two lighting power plants

One box of underwater cutting gear

Two 6-inch fire pumps

Two 20-foot berthing vans

FIGURE D-2. Mobilized ESSM Materials.

The above items were mobilized from SUPSALV's Emergency Ship Salvage Material (ESSM) pools in Stockton, California and Williamsburg, Virginia.

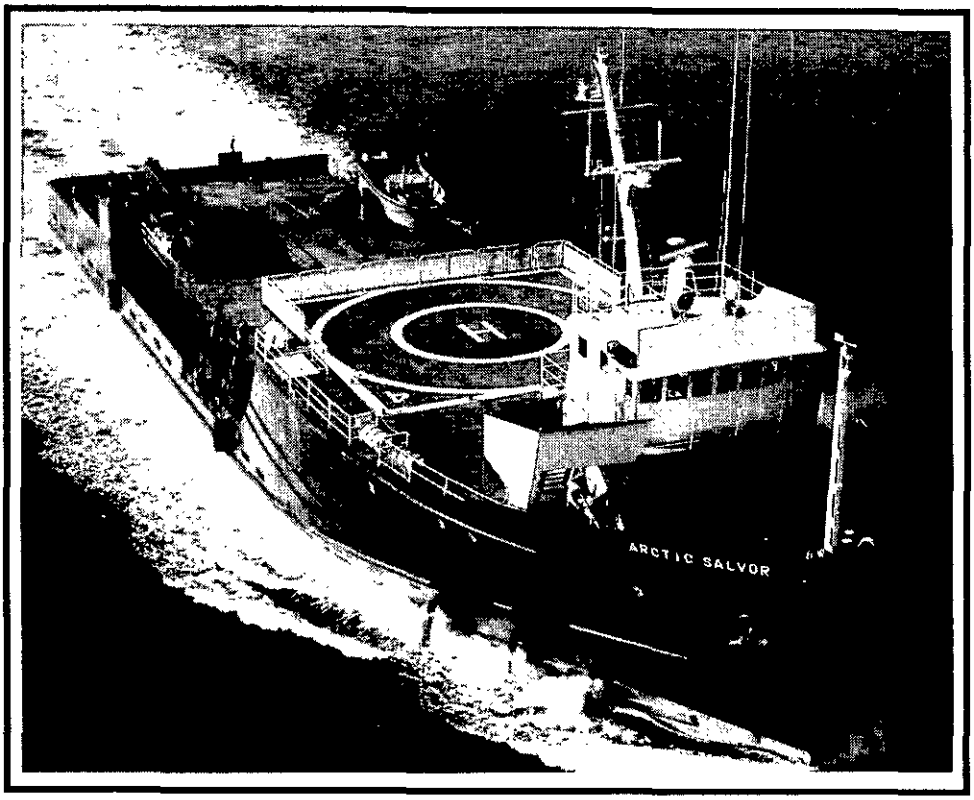


FIGURE D-3. ARCTIC SALVOR.

Description:	The largest salvage vessel on the U.S. West Coast
Assets:	4 Skagit DTW-150 SxS double-drum winches Helicopter pad 35-ton crane 21-foot workboat 16-foot skiff Decompression chamber 2 Diving compressors 4 Welding machines 2 Firefighting monitors Salvage crew accommodations 200-HP Bow thruster Loran navigation system Satellite Navigator
Primary Assignment:	Provide pulling power to remove the fore section of TORTUGA from strand; provide personnel transportation and berthing
Overall Dimensions:	213' x 53' x 14'6"
Owner:	Crowley Maritime Salvage

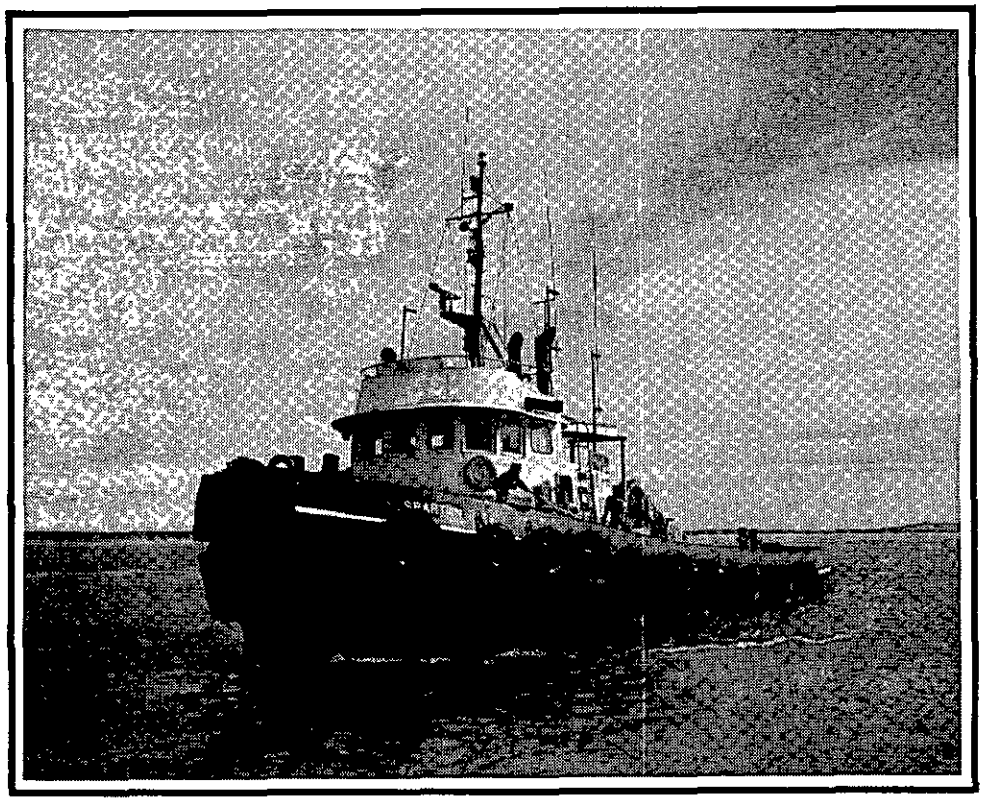


FIGURE D-4. SPARTAN.

Description:	2400-HP tugboat
Assets:	Skagit RB-90 double-drum towing winch Twin-screw with 4-blade propellers Loran navigation system
Primary Assignment:	Tow crane barge between Long Beach and work site, transporting five bargeloads of scrap steel; attend crane barge while moored at work site; tow refloated TORTUGA for section to sea for scuttling
Overall Dimensions:	91' x 29' x 13'3"
Owner:	Crowley Maritime Corporation

APPENDIX E
SAMPLE "POSSE" COMPUTER PRINTOUTS

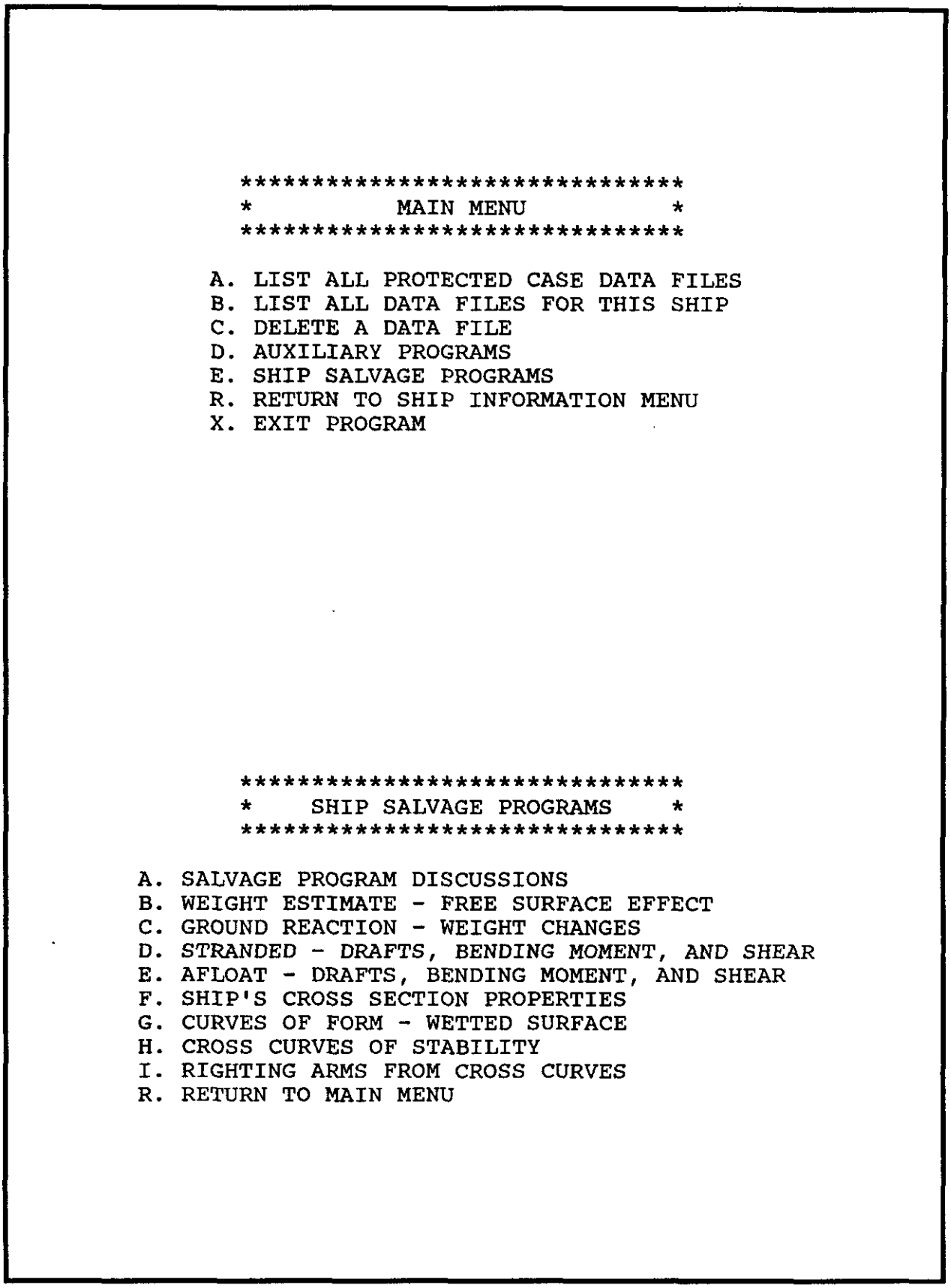


FIGURE E-1. Option Menus.

DISCRETE WEIGHTS - TONS
(DISTANCES IN FEET)

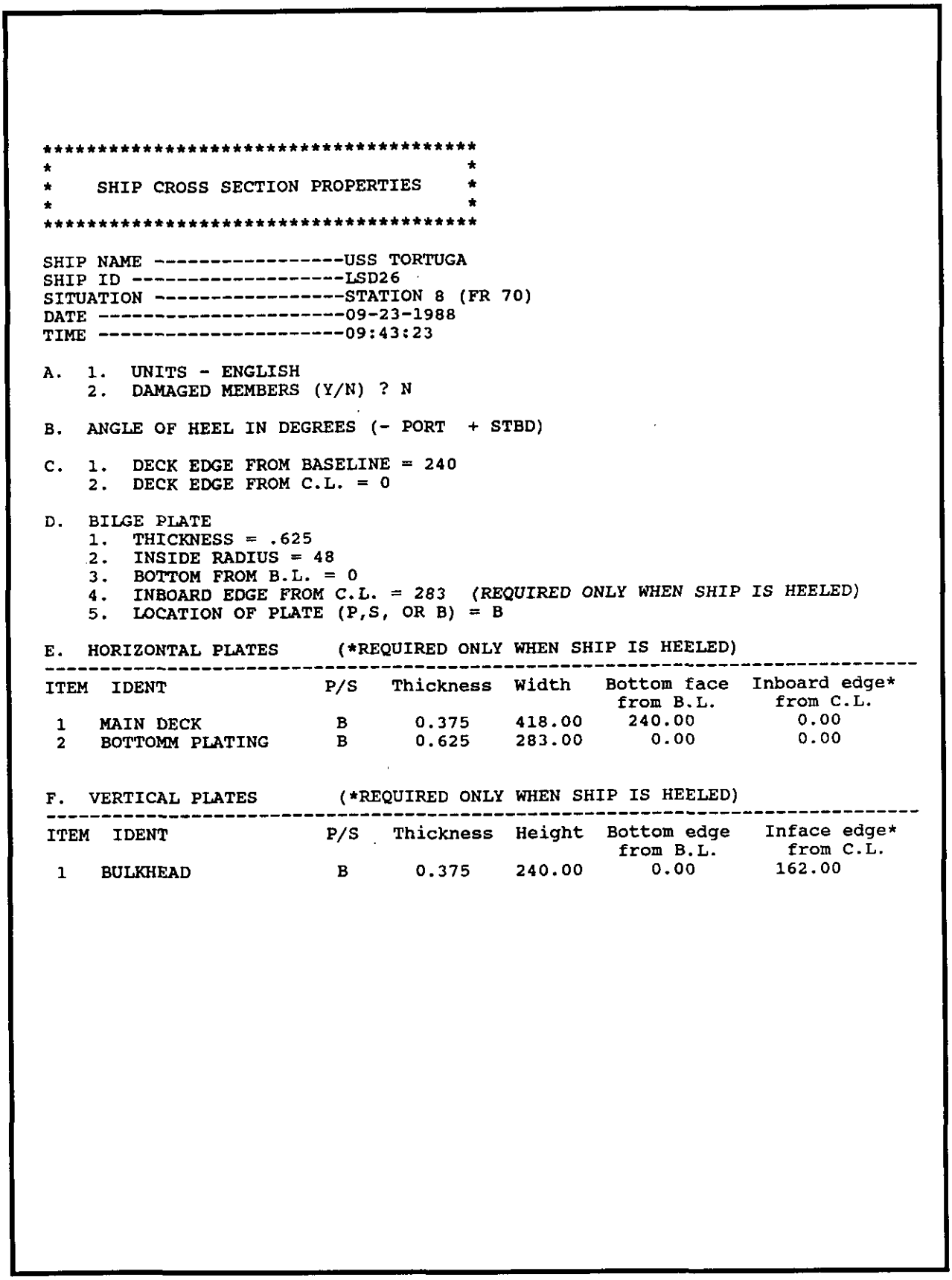
ITEM	IDENT	WEIGHT	FROM	TO
1	Piping	360.00	0.00	352.00
2	Hull - FR 0 to 5	80.40	0.00	20.00
3	Hull - FR 5 to 88	1802.00	20.00	352.00
4	BULKHEAD - FR 5	3.75	20.00	20.10
5	BULKHEAD - FR 15	7.50	60.00	60.10
6	BULKHEAD - FR 22	7.50	88.00	88.10
7	BULKHEAD - FR 29	7.50	116.00	116.10
8	BULKHEAD - FR 36	7.50	144.00	144.10
9	BULKHEAD - FR 43	7.50	172.00	172.10
10	BULKHEAD - FR 50	7.50	200.00	200.10
11	BULKHEAD - FR 57	7.50	228.00	228.10
12	BULKHEAD - FR 64	7.50	256.00	256.10
13	BULKHEAD - FR 74	7.50	296.00	296.10
14	BULKHEAD - FR 81	7.50	324.00	324.10
15	BULKHEAD - FR 88	7.50	351.90	352.00
16	Machinery	640.00	200.00	296.00
17	A-401-W WL 12.4	14.46	0.00	20.00
18	A-402-W WL 0	0.00	20.00	60.00
19	A-403-W WL 2 S 19T	51.87	66.00	88.00
20	A-404-W WL 0	0.00	60.00	88.00
21	A-405-W WL 0	0.00	60.00	88.00
22	A-406-W WL 3 S 24T	85.24	88.00	116.00
23	A-407-W WL 2	12.75	88.00	116.00
24	A-408-W WL 3	18.72	88.00	116.00
25	A-409-W WL 3 S 39T	106.20	116.00	144.00
26	A-410-F WL 3	19.20	116.00	144.00
27	A-411-F WL 6 S 7T	45.31	116.00	144.00
28	A-412-F WL 0	0.00	116.00	144.00
29	A-413-F WL 0	0.00	116.00	144.00
30	A-414-W WL 3 S 48T	115.20	144.00	172.00
31	A-415-F WL 6 S 7T	45.33	144.00	172.00
32	A-416-F WL 3 S 6T	25.13	144.00	172.00
33	A-417-F WL 3	16.60	144.00	172.00
34	A-418-F WL 2 S 5T	16.38	144.00	172.00
35	A-419-W WL 7 S 39T	195.80	172.00	200.00
36	A-420-F WL 3 S 7T	26.20	172.00	200.00
37	A-421-F WL 10	64.00	172.00	200.00

FIGURE E-2. Structural and Discrete Weights (sheet 1 of 2).

DISCRETE WEIGHTS - TONS
(DISTANCES IN FEET)

ITEM	IDENT	WEIGHT	FROM	TO
38	A-422-F WL 0	0.00	172.00	192.00
39	A-423-F WL 10	42.95	172.00	192.00
40	A-424-F WL 0	0.00	192.00	200.00
41	A-425-F WL 10	17.31	192.00	200.00
42	B-401-W WL 8 S 26T	205.20	200.00	228.00
43	B-402-ET WL 6	72.35	200.00	228.00
44	B-403-ET WL 10 S 40T	157.35	200.00	228.00
45	B-404-W WL 7 S 35T	192.00	200.00	228.00
46	B-1-1 WL 7 S 40T	126.33	228.00	256.00
47	B-3-2 WL 4	50.00	228.00	256.00
48	B-409-W WL 2 S 3T	20.50	256.00	268.00
49	Vestible WL 6	43.60	268.00	276.00
50	B-406-ET WL 7	111.70	256.00	296.00
51	B-407-ET WL 6 S 40T	137.01	256.00	296.00
52	B-408-W WL 2	32.00	276.00	296.00
53	C-401-W WL 5	112.00	296.00	324.00
54	C-404-F WL 0	0.00	296.00	324.00
55	C-405-F WL 2	24.50	296.00	324.00
56	C-406-W WL 15.1	338.24	324.00	352.00
57	C-407-F WL 6	53.78	324.00	352.00
58	C-408-F WL 15.1 PA S	83.53	324.00	352.00
59	PF SA (COMPL)	67.00	296.00	324.00
60	SF SA (PARTIAL)	57.30	296.00	324.00
61	SA SA (COMPL)	52.00	324.00	352.00
62	FO'C'SLE	161.00	0.00	60.00
63	FR 15-18 P FDNS	1.23	60.00	72.00
64	FR 15-36 S OUTER W/W	8.53	60.00	144.00
65	FR 15-37 P OUTER W/W	8.91	60.00	148.00
66	FR 19-23 P W/W & 2DK	4.32	76.00	92.00
67	FR 31-33 P 2ND DK	1.45	124.00	132.00
68	FR 37-50 P TO MN DK	45.88	148.00	200.00
69	FR 37-42 P INNER W/W	2.17	148.00	168.00
70	FR 50-63 P W/W & 2DK	13.12	200.00	252.00
71	FR 36-63 S W/W & 2DK	37.76	144.00	252.00
72	FR 36-60 S OUTER W/W	6.94	144.00	240.00
73	FR 50-60 S MACHY	7.70	200.00	240.00
74	FR 64-88 OUTER W/W	18.68	256.00	352.00

FIGURE E-2. Structural and Discrete Weights (sheet 2 of 2).



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****************************************
*                                      *
*    SHIP CROSS SECTION PROPERTIES     *
*                                      *
****************************************

SHIP NAME ----------------USS TORTUGA
SHIP ID ------------------LSD26
SITUATION ----------------STATION 8 (FR 70)
DATE ---------------------09-23-1988
TIME ---------------------09:43:23

A.  1.  UNITS - ENGLISH
    2.  DAMAGED MEMBERS (Y/N) ? N

B.  ANGLE OF HEEL IN DEGREES (- PORT  + STBD)

C.  1.  DECK EDGE FROM BASELINE = 240
    2.  DECK EDGE FROM C.L. = 0

D.  BILGE PLATE
    1.  THICKNESS = .625
    2.  INSIDE RADIUS = 48
    3.  BOTTOM FROM B.L. = 0
    4.  INBOARD EDGE FROM C.L. = 283  (REQUIRED ONLY WHEN SHIP IS HEELED)
    5.  LOCATION OF PLATE (P,S, OR B) = B

E.  HORIZONTAL PLATES     (*REQUIRED ONLY WHEN SHIP IS HEELED)
-------------------------------------------------------------------------------
ITEM  IDENT              P/S   Thickness  Width   Bottom face   Inboard edge*
                                                  from B.L.      from C.L.
 1    MAIN DECK           B       0.375   418.00    240.00          0.00
 2    BOTTOMM PLATING     B       0.625   283.00      0.00          0.00

F.  VERTICAL PLATES       (*REQUIRED ONLY WHEN SHIP IS HEELED)
-------------------------------------------------------------------------------
ITEM  IDENT              P/S   Thickness  Height  Bottom edge   Inface edge*
                                                  from B.L.      from C.L.
 1    BULKHEAD            B       0.375   240.00      0.00        162.00
```

FIGURE E-3. Section Modulus for Station 8 (sheet 1 of 2).

G. OBLIQUE PLATES

ITEM	IDENT	P/S	THICKNESS	LOWER OBD CNR FM CL	LOWER OBD CNR FM BL	UPPER OBD CNR FM CL	UPPER OBD CNR FM BL
1	SHELL PLATING	B	0.625	307.00	24.00	418.00	240.00

H. SHAPES (*REQUIRED ONLY WHEN SHIP IS HEELED)

ITEM	IDENT	P/S	Section area	Centroid from B.L.	Centroid* from C.L.
1	STRINGER #1	B	2.50	198.00	412.00
2	STRINGER #2	B	2.50	157.00	406.00
3	STRINGER #3	B	2.50	116.00	400.00
4	STRINGER #4	B	2.50	75.00	394.00
5	STRINGER #5	B	2.50	34.00	388.00

```
************
* RESULTS  *
************

SHIP---------- USS TORTUGA
SITUATION----- STATION 8 (FR 70)
ANGLE OF HEEL IN DEGREES (- PORT  + STBD) = 0

SHIP CROSS-SECTION PROPERTIES
-----------------------------

AREA (sq. inches) = 1270.68
AREA (sq. feet) = 8.82

I [NEUTRAL AXIS] (sq. in. - sq. ft.) = 88116.72
Y [DECK] (ft) =10.71
Y [KEEL] (ft) = 9.29

SECTION MODULUS - TOP (sq. inches - ft.) = 8230.708
SECITON MODULUS - BOTTOM (sq. inches - ft.) = 9480.878
```

FIGURE E-3. Section Modulus for Station 8 (sheet 2 of 2).