S0300-BN-RPT-0010/SUPSALV

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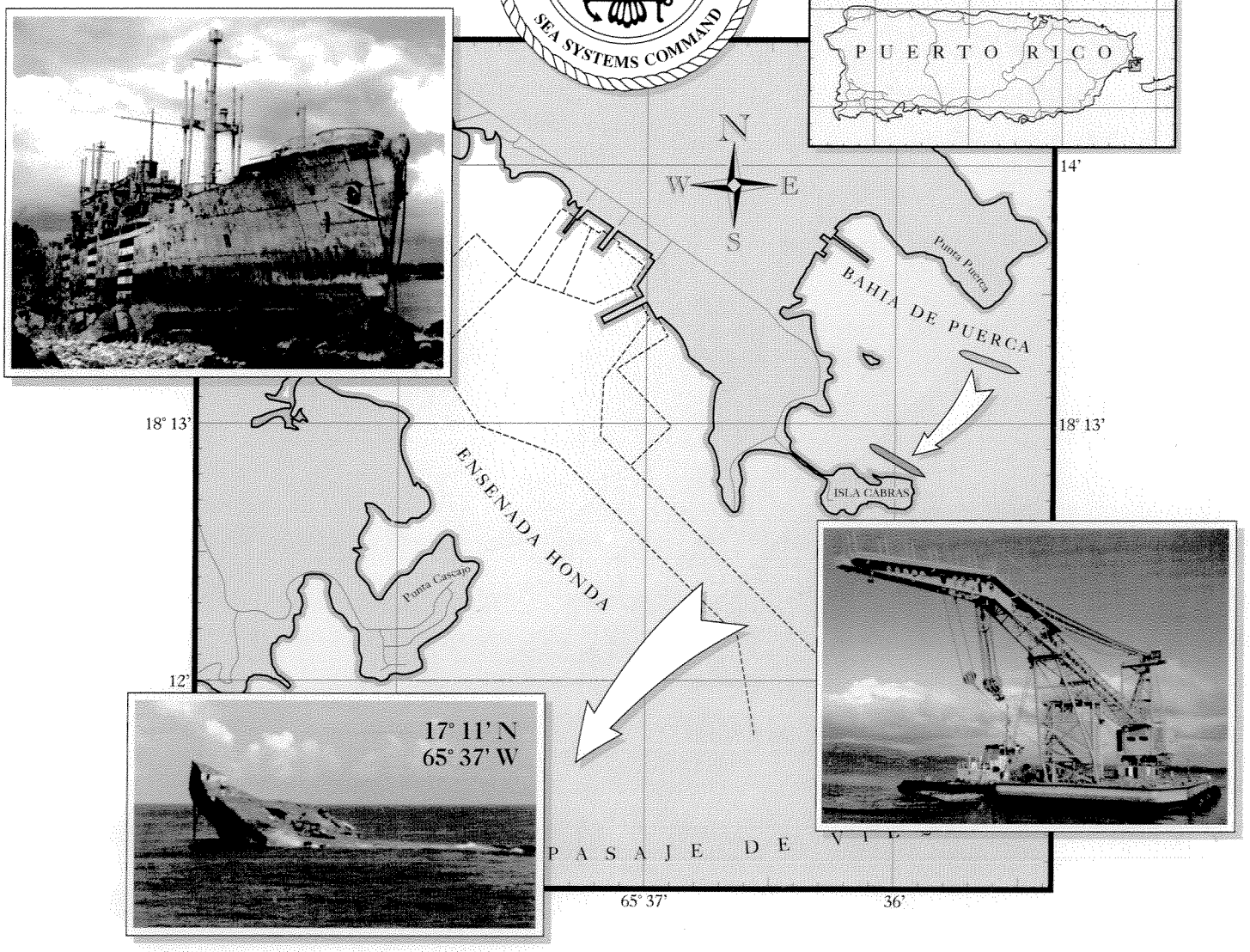
EX-USS BROOKINGS WRECK REMOVAL OPERATIONS



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1 JULY 1992

EXECUTIVE SUMMARY

The ex-USS BROOKINGS (APA 140) grounded herself on *Isla Cabras*, Puerto Rico as a result of Hurricane Hugo in September 1989. This 6,872-long-ton lightship displacement APA "target ship" posed a unique challenge for the U.S. Navy Supervisor of Salvage in that the operation had two main objectives: (1) remove the vessel from the strand and dispose of the hulk, and (2) minimize any environmental impact.

Between 26 December 1991 and 14 April 1992, the Supervisor of Salvage orchestrated a complex operation that balanced complex salvage engineering with serious environmental concerns. During the operation, over 2,000 long tons of steel, (over 50 percent of the ship's steel structure) was removed while maintaining enough residual strength to successfully debeach the remaining hulk and dispose of it at sea in an environmentally responsible manner. The following key events are notable:

- 26 DEC 91 – NAVSEA 00C contractor mobilization begins.
- 5 JAN 92 – Structural steel cutting begins.
- 7 FEB 92 – Weight removal begins.
- 28 MAR 92 – Ex-USS BROOKINGS removed from strand.
- 1 APR 92 – Ex-USS BROOKINGS scuttled.
- 14 APR 92 – Demobilization complete.

The coordination of multi-agency oversight responsibilities posed a unique challenge for the salvors, as consensus building for the salvage plan required coordination with and briefings for U.S. Environmental Protection Agency, U.S. Department of Interior Puerto Rican Fish and Wildlife Service, U.S. Army Corps of Engineers, Puerto Rico Department of Natural Resources, U.S. Maritime Administration, and various interested Navy commands and organizations.

The successful wreck removal techniques combined with a high regard for the environment are a tribute to the U.S. Navy salvors, environmentalists, and contract salvors involved.

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CHAPTER 1

INTRODUCTION AND BACKGROUND SUMMARY

On 18 September 1989, during Hurricane Hugo, the ex-USS BROOKINGS (APA 140) broke free from her moorings at the U.S. Naval Station, Roosevelt Roads, Puerto Rico and stranded on *Isla Cabras*, a small island within the naval station boundaries (Figure 1-1 illustrates the general and detailed operation area). The hurricane's extreme surge drove BROOKINGS hard aground, making retraction a difficult salvage problem. BROOKINGS damaged coral during the stranding and her position on the reef obstructed normal water flow, damaging the surrounding areas of the reef. Figure 1-2 (Page 1-2) provides two photographic views of the BROOKINGS stranding.

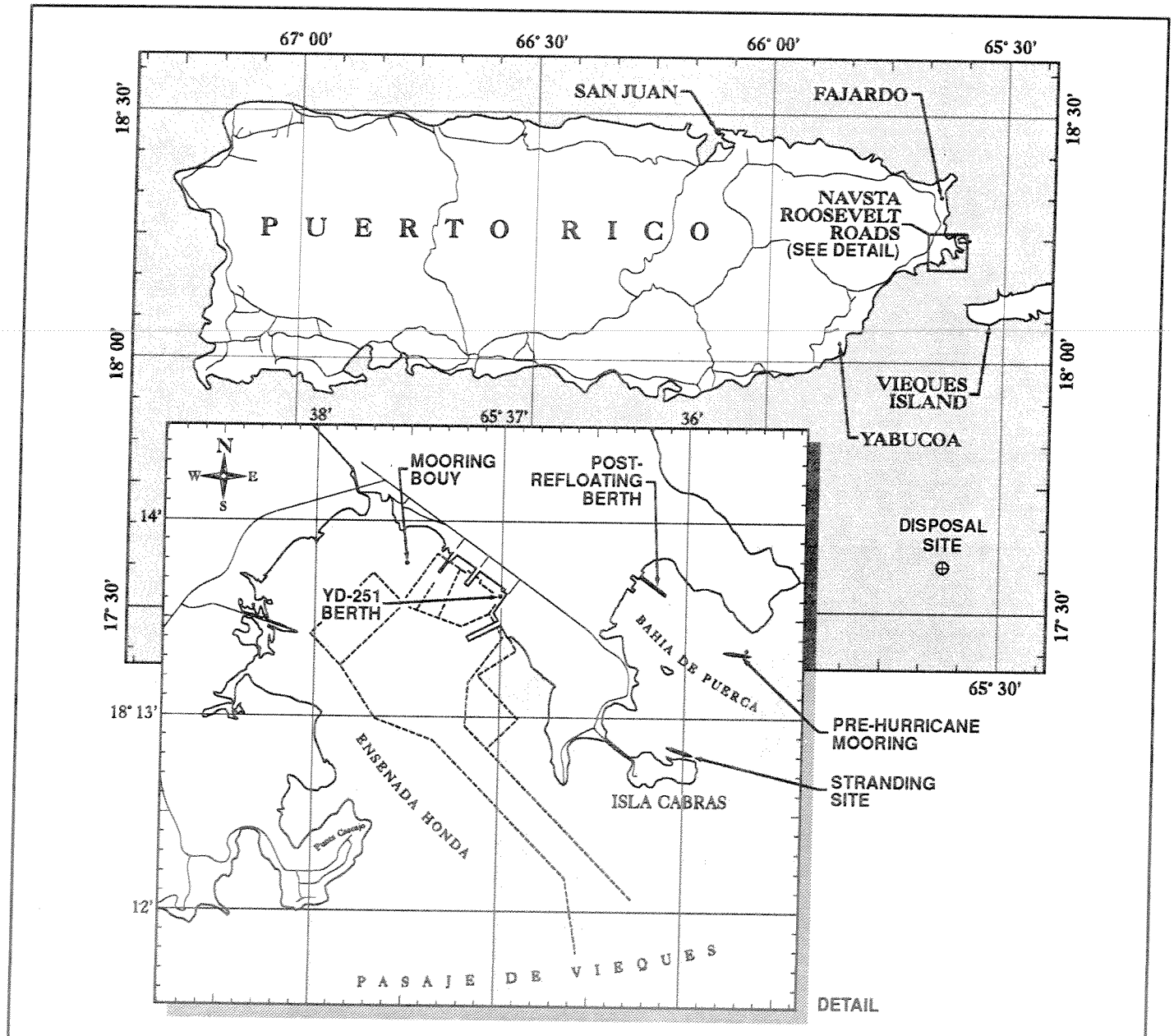


Figure 1-1. Operation Area.

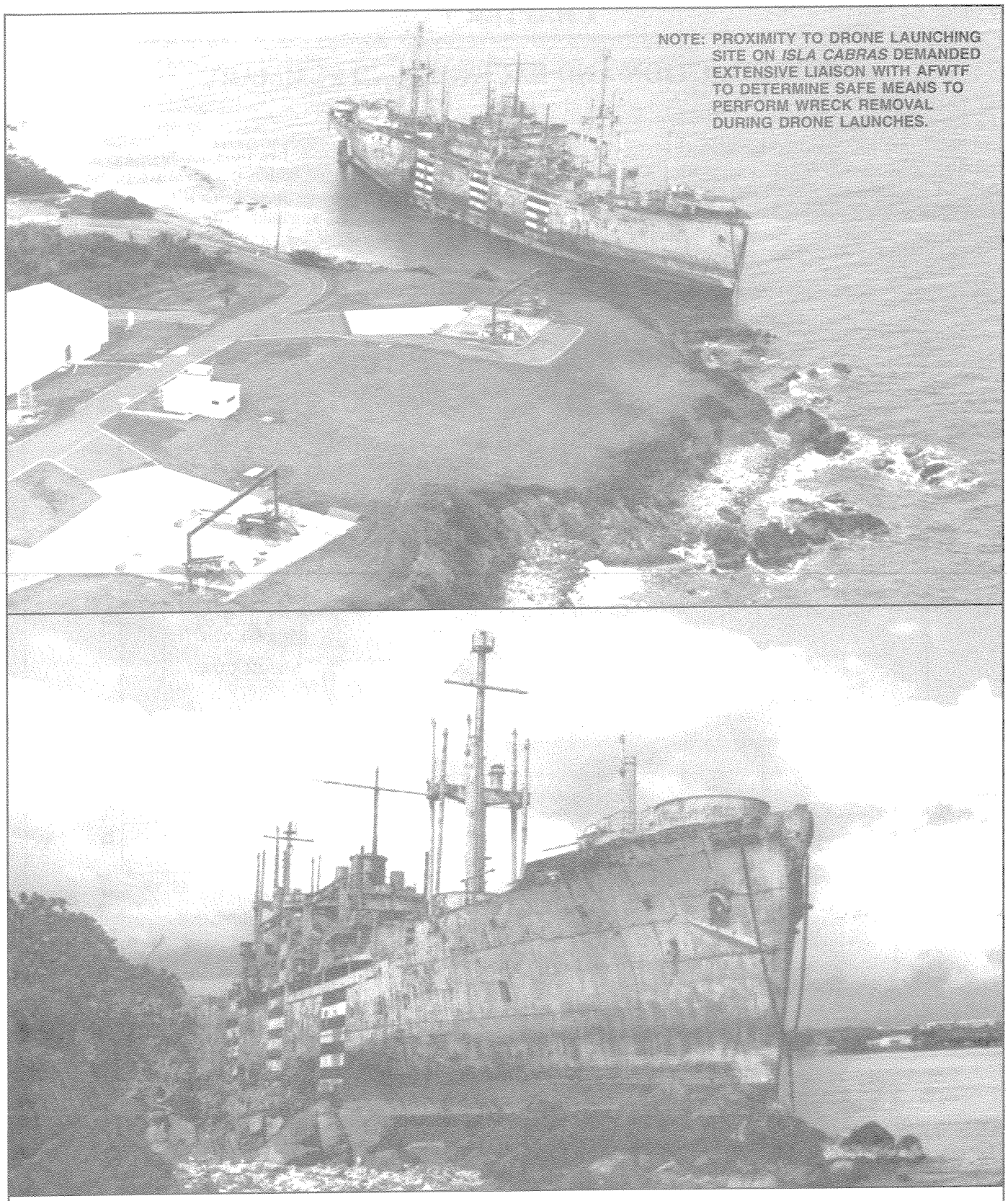


Figure 1-2. BROOKINGS Aground.

BROOKINGS was a VC2-S-AP5 Transport Attack Class, Troop Transport. The vessel had a lightship displacement of 6,872 long tons, a length of 455 feet, and a maximum breadth of 62 feet (BROOKINGS' characteristics are listed in Appendix B). Built by California Ship Building Corporation, Wilmington, California in 1944 and commissioned on 6 January 1945 (hull number 140 in a total of 111 built in her class), she saw limited service in WWII before being laid up in reserve in 1946. BROOKINGS last saw service during the Korean War. Her service as a target ship to support Atlantic Fleet Weapons Training Facility, Roosevelt Roads began in 1986.

1-1 SALVAGE TASKING AND MAJOR PLANNING MILESTONES

An after-storm survey by the USS PRESERVER (ARS 8) in January 1990 estimated BROOKINGS to be nearly 3,000 tons aground and predicted that effective removal/retraction would require Commander, Naval Sea Systems Command (00C) contractor support—specifically, cutting and removal of topside weight using floating cranes to remove scrap steel. Follow-on environmental surveys and an environmental impact analysis for the BROOKINGS removal and disposal were conducted in 1990 and 1991. On 9 September 1991, the Chief of Naval Operations (OP-43) tasked the Supervisor of Salvage (Naval Seas Systems Command Code 00C) *to initiate procedures to contract for removal and disposal of EX-BROOKINGS* (CNO 091947Z SEP 91, Exhibit A-1). CNO further directed funding for the wreck removal be supplied by the Program Executive Officer, Cruise Missile and Unmanned Aerial Vehicles (PEOCMPANDUAV), the custodian for ex-USS BROOKINGS.

On receipt of CNO tasking, the Supervisor of Salvage (SUPSALV) promulgated a message of intent (COMNAVSEASYSCOM 110030Z SEP 91, Exhibit A-2) which outlined a two-part approach to the BROOKINGS removal. Part 1 was to be a detailed salvage survey, followed by part 2, implementation of the salvage plan.

The detailed survey was conducted by Mr. James C. Bladh of the SUPSALV office and the East Coast Salvage Support Contractor, DONJON Marine Co., Inc., during the period 7 – 13 October 1991. During the survey, environmental factors including the local reef ecology and the potential hazards of contaminants such as asbestos and polychlorinated biphenyls (PCBs) were examined, along with the logistic and engineering of the wreck removal.

Upon completing the salvage survey, SUPSALV directed the contractor to prepare a detailed salvage plan which would have two main objectives:

- **Remove vessel from strand, and**
- **Minimize environmental impact.**

The subsequent salvage plan (Appendix C) was developed between 13 October and 8 November 1991 and offered two alternatives for the ultimate disposal of BROOKINGS. Both alternatives offered either a "scrap sale" of all steel from topside weight removal coupled with scuttling the remaining hulk. The plan called for weight removal by one of two methods. One alternative called for access to the BROOKINGS by building a "berm" across the intervening shallow water from landside; while the second alternative offered access to BROOKINGS from the seaward side using floating cranes and barges to effect "scrap steel" removal. Subsequent meetings with environmental oversight agencies plus the cost needed to restore *Isla Cabras* reef to original condition, made the floating crane/scrap barge option the preferred alternative.

Subsequent to the development of the salvage plan, meetings were held with various governmental agencies, specifically the United States Environmental Protection Agency, the United States Army Corp of Engineers, the Puerto Rico Department of Natural Resources, and the Puerto Rico Department of Fish and Game, and representatives from the United States Naval Station, Roosevelt Roads, Puerto Rico. During a 2 December meeting in San Juan among the concerned parties, a consensus was achieved to *partially break the wreck* and tow the remaining hulk to sea for disposal. On 4 December 1991, the Puerto Rico Department of Natural Resources formally endorsed the plan by letter (Exhibit A-3). On 6 December, the United States Department of Interior formally endorsed the plan (Exhibit A-4). On 3 March 1992, the United States Environmental Protection Agency formally approved open ocean scuttling of the BROOKINGS hulk (Exhibit A-5), and on 10 March, the Chief of Naval Operations gave final approval for open ocean disposal.

SUPSALV promulgated COMNAVSEASYSCOM 100030Z DEC 91 (Exhibit A-6) to alert all concerned of SUPSALV's intent to mobilize and commence salvage operations. The operation commenced on 26 December 1991 and concluded on 6 April 1992. Table 1-1 summarizes the statistics of the effort and Table 1-2 provides a chronology of major events in the operation.

Table 1-1. Summary Statistics of BROOKINGS Wreck Removal.

- 3 Contract Tugs
- 1 Navy Yard Crane
- 2 Contractor Crane/Barges
- 2 Contractor Scrap Barges
- 2,600 Long Tons of Scrap Removal
- Utilization of *POSSE* on first wreck removal operation
- Environmental concerns overcome by detailed environmental planning
- Wreck removal training for USN Salvage Officers

1-2 SCOPE OF SUPSALV MISSION

For three months, SUPSALV managed a salvage operation which included the removal of 2,600 long tons of scrap steel and debris, and involved the efforts of up to 20 United States Navy operating personnel and over 15 contractor personnel, plus vessel's crew.

Table 1-2. Major Events During Operation.

DATE	EVENT
18 SEP 1989	BROOKINGS grounded at Isla Cabras
7/13 OCT 1991	SUPSALV survey of ex-BROOKINGS
10 DEC 1991	SUPSALV promulgates salvage plan
27 DEC 1991	Mobilization of contractor personnel
5 JAN 1992	Structural steel cutting begins
7 FEB 1992	Weight removal begins
3 MAR 1992	U.S. EPA approves open ocean disposal
10 MAR 1992	CNO authorizes open ocean disposal
28 MAR 1992	ex-BROOKINGS removed from strand
1 APR 1992	ex-BROOKINGS scuttled
14 APR 1992	Demobilization complete

1-3 PURPOSE OF REPORT

This report will serve as a historical guide in conducting future wreck removal operations. This report discusses the command, structure, organization, salvage engineering, environmental concerns, and operational aspects of this wreck removal operation. A myriad of organizational relationships evolved, both internal to Navy and with external governmental agencies. These organizations had to be advised on major facets of planning, operations and environmental considerations. Further the salvage operation served as a "primer" and field exercise for both naval engineers and operators. It also proved the ability of the *Program of Ship Salvage Engineering* (*POSSE*) to support real-time engineering analysis for weight removal and for scrap barge loading.

1-4 SUPSALV AUTHORITY

SUPSALV supports Fleet salvors 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 engineering. When salvage requirements exceed the capability of Fleet salvors or when Fleet assets are committed to other operations, SUPSALV may exercise standing contracts with commercial salvors world-wide to provide emergency salvage services to the Department of Defense, other government agencies, foreign governments through the U.S. Department of State, and in certain circumstances, to the private sector.

CHAPTER 2

COMMAND AND ORGANIZATION

The command organization and resulting control over the day to day operations are depicted in Figure 2-1.

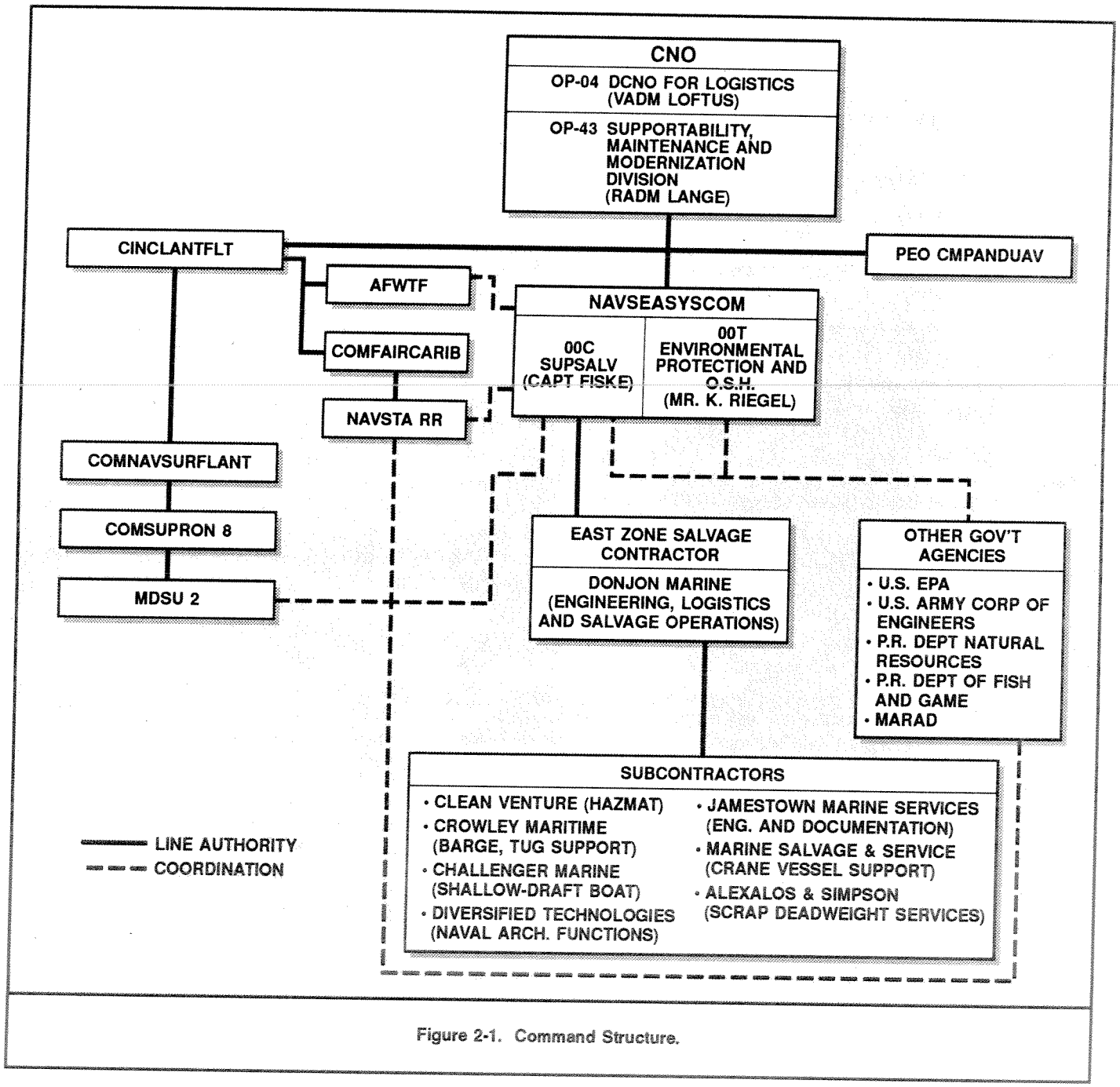


Figure 2-1. Command Structure.

2-1 ESTABLISHING COMMAND

Commander, Naval Sea Systems Command (00C) has responsibilities within the Department of Defense for all salvage operations not specifically allocated to Fleet Commanders. When BROOKINGS went aground, Commander Atlantic Fleet Weapons Test Facility was the custodian of the vessel, using it to support PEOCMPANDUAV programs. Subsequent removal decisions involved CINCLANTFLT, COMNAVAIRSYSCOM HQ, and ultimately the Chief of Naval Operations (CNO).

2-2 ORGANIZATION OF SALVAGE TEAM

CNO tasked SUPSALV with the specific responsibilities of wreck removal and appropriate environmental protection. Consequently, SUPSALV assumed on-scene coordination of Fleet salvage assets, U.S. Naval Station Roosevelt Roads, Atlantic Fleet Weapons Test Facility, and contractor personnel. The Navy's east coast salvage contractor was directed to survey the wreck, provide alternatives for removing it, and ultimately to complete the wreck removal.

2-3 SUPPORTING FORCES

2-3.1 Vessels. SUPSALV requested a Navy Salvage Ship from CINCLANTFLT to support removal of ex-USS BROOKINGS from her stand and to tow the hulk to the disposal site. USNS APACHE (T-ATF 171) was tasked with this support function and was loaded with beach gear and other salvage support equipment. A team of Navy salvors from MDSU-2 was selected to deploy the salvage equipment from USNS APACHE to support the removal. Weight removal during the last two weeks of March proceeded faster than expected such that the planned deployment of USNS APACHE and the MDSU-2 Detachment became too late to assist in the removal operations. APACHE's deployment was cancelled. Ultimately, sufficient weight was removed so that the BROOKINGS hulk was refloated and removed from her strand and towed to the scuttling site by the DONJON tug J. A. WITTE which was mobilized with the DONJON-owned floating crane OBS-2250, to remove scrap and handle scrap barges. During the early stages of the wreck removal, a 2,200-horsepower tug (EL MORRO) was chartered from Crowley Maritime Puerto Rico to handle scrap barges and the Navy derrick, YD-251.

2-3.2 Other Navy Units. Other participating Navy units included Combat Support Squadron Eight, Mobile Diving Unit Two, and U.S. Naval Station Roosevelt Roads. Within the SUPSALV organization, a staff civilian salvage operations specialist coordinated the planning and survey phases. During the wreck removal operation, two on-scene SUPSALV representatives, one U.S. Navy Engineering Duty Officer Lieutenant Commander and one civilian environmental specialist coordinated the salvage engineering and environmental issues, logistics of the wreck removal, and interplay between the numerous concerned Navy activities. Commander, Naval Sea Systems Command (00C) provided all contract support, field accounting, and administrative functions. Several Navy industrial activities dispatched engineering duty officers for training purposes. Fleet salvage units also provided TAD personnel for coordination and purposes and to receive training.

2-3.3 Contractors. The Navy's ability to deploy experienced contractor personnel is essential to the success of most wreck-removal operations due to specialized expertise and equipment. Prime contractors are under multi-year, delivery order contracts to provide specified services and equipment to SUPSALV. SUPSALV retains technical control of contractor efforts by working with contractor project managers (e.g., salvage masters). The principal contractor for this operation was:

DONJON Marine Co., Inc., Hillside, N.J. DONJON Marine is the SUPSALV East Coast Zone salvage contractor. The on-scene salvage master, salvage engineering consultant and most of the platforms, equipment and personnel used in support of this operation were provided directly or by subcontract by DONJON Marine. The following subcontractors were used.

Clean Ventures, Incorporated, Camden, N.J. Subcontracted by DONJON Marine for asbestos and PCB removal.

Crowley Maritime (Puerto Rico). Subcontracted by DONJON Marine to provide one 2,200-horsepower tug (EL MORRO), a 5,000-ton (DWT) scrap barge (SANTO DOMINGO), and a 3,000-ton (DWT) scrap barge (PS-201).

Challenger Marine, Fajardo, Puerto Rico. Subcontracted by DONJON Marine to provide a shallow-draft pusher boat (MR. RUDY) to handle crane and scrap barges alongside BROOKINGS.

Diversified Technologies, Alexandria, Virginia. Subcontracted by DONJON Marine to provide naval architect functions.

Jamestown Marine Services. Subcontracted by DONJON Marine to provide engineering support and documentation.

Marine Salvage & Service. Subcontracted by DONJON Marine to provide initial, self-propelled crane vessel support and labor force support for duration of wreck removal.

Alexalos & Simpson. Subcontracted by DONJON Marine to provide deadweight survey services for sale of scrap from BROOKINGS wreck.

CHAPTER 3

PLANNING, LOGISTICS, AND MANAGEMENT

3-1 PLANNING

Meetings were held at Naval Station Roosevelt Roads, Puerto Rico on 7 October 1992 to discuss the options available for the removal and disposal of the BROOKINGS, as well as the possible roles for Navy and commercial assets. Participants included Commander, Combat Support Squadron EIGHT (Commander Nibbs); Commanding Officer, NAVSTA Roosevelt Roads (Captain Roulstone); Public Works Officer, NAVSTA Roosevelt Roads (Commander Ybanez); Chief of Staff for Commander, Caribbean Theater (Captain Therrell); Supervisor of Salvage (Mr. Jim Bladh); and the NAVSEA Salvage Contractor, DONJON Marine Co., Inc. (Mr. J. Arnold Witte).

These discussions resulted in a decision to use both Navy and commercial assets to remove BROOKINGS. The operation would be under the control of SUPSALV, acting through a project manager (Mr. Jim Bladh), an on-scene representative/salvage engineer (Lieutenant Commander R. W. Hooper), and an environmental specialist (Mr. Paul Hankins). Combat Support Squadron EIGHT and DONJON Marine would share responsibility for survey and engineering, preparation of the vessel for removal, and removal of the vessel. Responsibility for towing the hulk to the at-sea disposal site and sinking it was assigned to Combat Support Squadron EIGHT. It was also understood that NAVSTA Roosevelt Roads would support the removal and disposal operations by providing access to the base and exchange facilities and by providing a staging area for the operation. More specific responsibilities would be worked out when on-site work began.

During the period 7 – 14 October 1991, BROOKINGS and the stranding site were surveyed by DONJON Marine and COMSUPPRON EIGHT personnel. Figure 3-1 (Page 3-2) shows BROOKINGS' position relative to shore and deep water as noted by the survey. DONJON Marine subsequently prepared a SALVAGE PLAN (TECHNICAL VOLUME) that examined BROOKINGS condition and alternatives for her removal. The plan (excerpts of which are reproduced as Appendix C) proposed removal by "partial breaking" to lighten the hulk to the point that it could float free of its strand at high tide. Concurrently, Commander, Combat Support Squadron EIGHT prepared a plan for the refloating, towing, and at-sea disposal of BROOKINGS, taking the DONJON plan as a point of departure.

On 20 November 1991, the project funding was received. On 17 December, the Chief of Naval Operations (CNO OP-43) approved the weight removal portion of SUPSALV contractor plan (CNO 172151Z DEC 91, Exhibit A-7). Approval of at-sea scuttling of the hulk was withheld pending EPA review of the proposal. With the basic plan in place, contractor mobilization began 26 December 1991.

3-1.1 Environmental Issues. An environmental survey of the stranding site was conducted by the Caribbean Office of the U.S. Department of the Interior Fish and Wildlife Service in December 1991 to assess potential environmental impact of the grounding, removal, and disposal of ex-USS BROOKINGS.

The survey report (see Exhibit A-5) presented several conclusions:

- BROOKINGS had caused severe damage to the coral reef in grounding and continued to impact the reef while grounded,
- Removal of BROOKINGS would allow the damaged portions of the reef to regenerate naturally and stop the ongoing damage, and
- Disposal of the vessel as proposed would have very little impact on marine resources and wildlife.

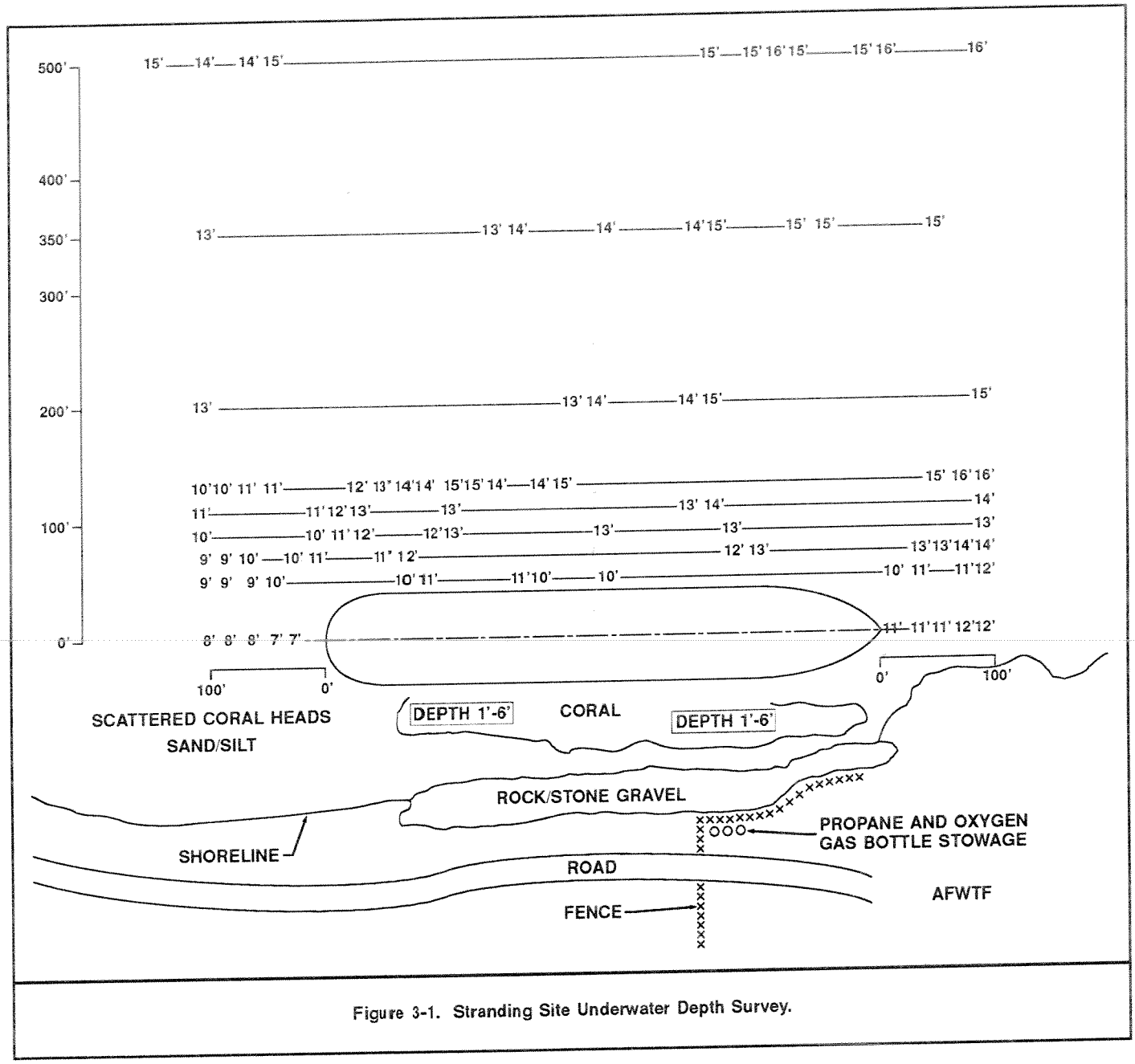


Figure 3-1. Stranding Site Underwater Depth Survey.

BROOKINGS broke and crushed reef coral as it drifted towards shore and came to rest on *Isla Cabras'* fringing reef. Grounded in close proximity to the shoreline, BROOKINGS effectively obstructed normal wave action and surface currents from sweeping the nearshore reef, creating a stagnant environment. Reduction in nutrient availability, silt accumulation, and growth of brown algae had killed a large proportion of the coral between BROOKINGS and the shoreline by the winter of 1991.

Removal of the wreck would re-expose the impacted area of the reef to normal wave and current patterns. The resulting increased water flow would prevent siltation and increase water transparency, inhibit brown algae growth, and increase nutrient availability and so allow corals and other reef components to re-establish themselves naturally. Disposal of the BROOKINGS was deemed to have little impact on marine resources and wildlife as the vessel was free of petroleum products and other contaminants and would be scuttled at least 50 miles from land in water deeper than 1,000 fathoms, as required by 40 *CFR* 229.2.

Environmental issues and considerations colored all aspects of the BROOKINGS removal. Environmental remediation (the restoration of the *Isla Cabras* fringing reef) was the major objective of the operation. BROOKINGS was not an operational asset, carried neither fuel nor cargo, and her value as a target would not have justified a difficult salvage. She posed no threat to human life or health, did not obstruct harbor berths or waterways, did not interfere with any naval station activities, and did not endanger economically important marine resources. The sale of scrap earned no profit, offsetting only a tiny portion of the wrecking operations cost.

Various aspects of the operation were governed by environmental regulations. At-sea disposal was subject to approval by the U.S. Environmental Protection Agency and U.S. Department of Interior, Fish and Wildlife Service, and by the Puerto Rico Department of Natural Resources. Fuel tanks containing residual traces of fuel were not used for ballast water to avoid contaminating the reef when the tanks were pumped. Sale of scrap to commercial vendors dictated complete removal of asbestos insulation and PCB-contaminated gaskets to ensure the scrap was free of environmental or human health hazards. The desire to avoid further damage to the reef dictated:

- Removing sufficient weight to allow the wreck to float free.
- Ruling out the option to build a temporary causeway to the wreck to facilitate scrap removal.
- Not using anchors to moor support craft.
- Not using beach gear, if possible, to remove the wreck from the strand.

3-1.2 Removal Plan. The original BROOKINGS removal plan, as submitted by DONJON Marine in November 1991, was broken down into seven phases (Table 3-1):

Phases IV, V, and VI were projected to involve the cutting and removal of 2,800 to 2,900 long tons of superstructure, outfit, machinery, and hull structure down to the second deck. See Chapter 4 and Appendix C for the calculation of weight to be removed.

An important aspect of the plan was the ultimate disposition of the asbestos on-board. Airborne asbestos is a known carcinogen. The salvors were requested to strip all asbestos from all structure to be removed and sold as scrap. The plan called for licensed HAZMAT contractors to seal the asbestos in plastic refuse bags, and entomb the bags in the double-bottom tanks. The asbestos would thus be safely disposed of when the BROOKINGS hulk was sunk offshore. All other pollutant materials, including miscellaneous garbage and oil products, would be disposed of before the vessel was scuttled. This procedure had been previously accepted by the State of California, Department of Fish and Game, NOAA, and the U.S. Navy Pacific Missile Test Center Environmental Affairs Office during the wreck removal of ex-TORTUGA from San Miguel Island in August 1989.

3-2 LOGISTICS

3-2.1 Mobilization. Contractor mobilization commenced 26 December 1991; the wrecking team arrived at Roosevelt Roads on 3 January 1992.

Table 3-1. BROOKINGS Removal Plan Phases.

PHASE	TIMEFRAME	DESCRIPTION
PHASE I	14 days, independent of other phases	Survey and preparation of a removal plan. This work was accomplished by the 7-14 October survey and the subsequent development of the DONJON Marine ship-breaking and hulk refloating plan and the COMSUPPRON 8 tow and disposal plan.
PHASE II	Initial mobilization to day 18	Mobilize contractor equipment from DONJON Marine's Port Newark, N.J. warehouse facility. All necessary equipment would be placed into 20-foot ocean-going salvage containers and shipped via liner service to San Juan, P.R. and then trucked to NAVSTA Roosevelt Roads.
PHASE III	Day 17 to day 18	Mobilize contractor personnel to the project area. The initial 10-man team would consist of a salvage master, an assistant salvage master, four burners, three laborers, and a diver/salvage technician.
PHASE IV	Day 19 to day 49	Begin the actual preparation of the ship for removal: • Transport salvage containers, gas and air, and other salvage gear to wreck site. • Begin to remove and dispose of the garbage and miscellaneous debris onboard BROOKINGS. • Begin asbestos removal from structure designated for removal from the wreck. • Begin to cut steel superstructure and hull in preparation for lightening.
PHASE V	Day 30 to day 49	Mobilize a tug, crane barge, and scrap barge to the work site. Mobilize to the job site a salvage engineer and logistics coordinator. The salvage engineer will assist in determining the approximate locations for the cut lines. The logistics coordinator will assist the salvage master in coordinating local contractors as well as handling contractor/naval relations.
PHASE VI	Day 49 to day 84	Complete ship lightening/breaking: • Complete the removal and disposal of all debris, including asbestos. • Begin and complete the removal of all steel superstructure, hull and deck sections, and engine room gear necessary for removal of the vessel from strand. • Affix the necessary attachment points to the hull to facilitate refloating and tow to the disposal site. • Transport to San Juan scrap dealers the steel scrap generated by the ship breaking effort. Two potential dealers had expressed an interest the BROOKINGS scrap. Once a firm work schedule is determined, actual sale of scrap would be based on the best offer by competing dealers.
PHASE VII	Day 84 to day 103	Demobilize unnecessary personnel and equipment from the work site. Refloat hulk, tow to disposal site, and sink. Demobilize remaining personnel.

Initial plans called for DONJON Marine to mobilize a tug, crane, and scrap barge from their Port Newark, New Jersey facility on day 30 of the operation. However, after arriving in Puerto Rico 3 January 1992, the DONJON Marine salvage master began to investigate local hiring of a tug, barge, and floating crane to reduce operational costs. On 1 February (day 38), a 2,200-horsepower tug and a 210-foot, 3,000-ton (DWT) barge (PS-201) were chartered from Crowley Maritime Incorporated of Puerto Rico; efforts to charter a crane locally, however, proved fruitless. Arrangements were made by the SUPSALV representative to use the NAVSTA Roosevelt Roads Derrick, YD-251. The YD-251 proved to be unsuited for the task of removing the topside weight. Her extreme height accentuated the effect of sea state, forcing many weather-related delays. A number of mechanical failures also slowed the weight removal process. Consequently, DONJON Marine began mobilization of the crane barge OBS-2250 on 18 February. The DONJON Marine tug, J. A. WITTE, left Port Newark on 29 February with the OBS-2250, a DONJON-owned floating crane, in tow, arriving at Roosevelt Roads on 7 March.

3-3 MANAGEMENT

3-3.1 Command Post. The SUPSALV representative established a command post in a room at the Navy Lodge on the naval station. The room served as an office and provided access to telephone lines. To meet its role as a command post, the room was provided with a facsimile machine and a microcomputer for running *POSSE* and word processing programs for correspondence and logs.

3-3.2 Liaison and Coordination. As the operation developed, the SUPSALV representative was required to coordinate operations with a number of activities. These activities included:

- Naval Station Security – arranging for access for contractor personnel and contractor support vendors.
- AFWTF – development and implementation of a plan which allowed wreck removal operations to continue during FLEETEX drone firings.
- Naval Station Public Works – as the NAVSTA point of contact, Public Works had to kept informed of progress and pertinent issues including environmental coordination with Puerto Rican authorities.
- Naval Station Port Operations – coordination of contractor support craft movements, service craft support, and waste oil removal/handling.
- EOD GROUP TWO, NAVSTA Roosevelt Roads Detachment – developing at-sea disposal plan incorporating EOD explosive handling expertise.
- COMSUPPRON EIGHT – information dissemination on operations progress and Fleet integration for disposal.
- U.S. Department of Transportation, Maritime Administration – provide justification to MARAD Headquarters allowing the bare boat charter of the barge SANTO DOMINGO for scrap removal. Although chartered through Crowley Maritime, control of the SANTO DOMINGO's employment was exercised by MARAD. The SUPSALVREP personally intervened at the highest levels at MARAD Headquarters in Washington, D.C. to expedite the barge's charter.
- Environmental oversight agencies – a continuous process of information exchange and issue resolution occurred between the onsite SUPSALVREP, SUPSALV, NAVSTA, and the respective agencies throughout the operation.


CHAPTER 4

SALVAGE CALCULATIONS

The bulk of the engineering calculations incident to the removal of BROOKINGS were performed with a developmental version of the *Program of Ship Salvage Engineering (POSSE)*. This was the first use of *POSSE* on a wreck removal operation. Salvors removed fittings, machinery, and structure totally nearly 45 percent of BROOKINGS' lightship weight. Topside structure was cut down to the second deck or lower over the whole of the ship's length. The reduction in section modulus resulting from such drastic removal of structure, including all of the strength (main) deck, made weight management and the coordination of structural cutting with ongoing weight removal critical aspects of the operation.

4-1 *POSSE*

POSSE's detailed analysis mode bases hydrostatic and stability calculations on a numeric hull model defined by offsets. Offsets may be retrieved from stored hull data files or entered from the keyboard. Calculations are based on numerical integration rules similar to the Trapezoidal and Simpson's rules. Vertical shear and longitudinal bending moments are calculated from buoyancy distributions as determined from the numeric hull model and weight distributions entered or modified by the operator and stored in a ship data file. As an option, section strength data (moment of inertia, section moduli, location of neutral axis, shear area) may be entered and stored in the ship data file to support calculation of hull shear and longitudinal bending stresses. *POSSE* includes a section modulus editor that can be used to calculate section properties from section descriptions entered from the keyboard. A detailed treatment of the operation and capabilities of *POSSE* can be found in the *U.S. Navy Salvage Engineer's Handbook, Volume 2* (S0300-A8-HBK-020). Printouts from the *POSSE* data files developed for BROOKINGS at various stages of the operation are included in Appendix B.

4-2 DETERMINING GROUND REACTION

BROOKINGS suffered little hull damage in stranding. The 14 – 16 October survey determined that all spaces were intact and relatively clean. Figure 3-1 shows BROOKINGS position relative to *Isla Cabras* and deep water. The vessel was found to be hard aground throughout the midships region, with clearances of three feet or more under bow and stern, as shown in Figure 4-1 (Page 4-2). The rudder shoe and bow were in "nestling" contact with the bottom. Subsequent periodic underwater surveys by COMSUPPRON EIGHT and SUPSALV personnel revealed minor changes in the extent of bottom contact.

4-2.1 Stranded Drafts. Stranded drafts were determined by a number of methods to ensure accuracy:

- Direct measurement of draft from the keel to the stranded waterline by swimmers,
- Observation of draft marks at the stern frame, and
- Measurement of freeboard to the bulwark at 3 locations: frame 44 (106.5 feet aft of the forward perpendicular), frame 77 (205.5 feet aft), and frame 91 (247.5 feet aft).

Molded drafts (T) at the three locations were determined from the sum of molded depth (D), sheer (S), main deck plating thickness (t), and bulwark height (h), less measured freeboard (F):

$$T = D + S + h + t - F$$

Draft and freeboard readings were taken at high tide. Freeboard was measured both port and starboard to allow for the approximate 3-degree port list. The freeboard readings and resulting drafts are summarized in Table 4-1. Based on these figures, mean draft aground was estimated as 9.25 feet.

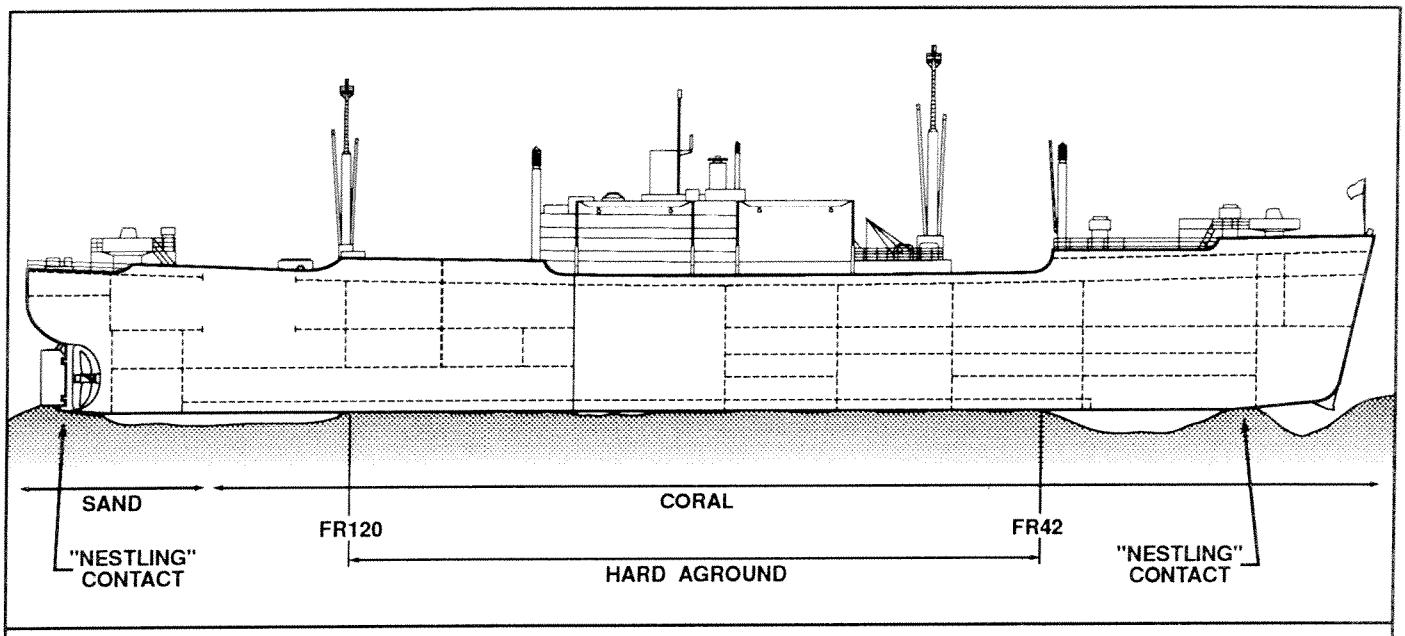


Figure 4-1. BROOKINGS Aground.

Table 4-1. Ex-USS BROOKINGS Stranded Drafts.

Location (frame)	Main deck height $D + S + t$ ft	Bulwark height h ft	Freeboard F ft	Molded Draft T ft	Average of P & S drafts ft
44 S	38.257	3.042	34.75	6.55	9.09
44 P	38.257	3.042	29.67	11.63	
77 S	38.106	2.833	34.00	6.94	9.69
77 P	38.106	2.833	28.50	12.43	
91 S	38.145	3.083	34.50	6.73	9.27
91 P	38.145	3.083	29.42	11.81	
AFT Perpendicular	Direct Measurement of Draft from Keel				9.17
FWD Perpendicular	Direct Measurement of Draft from Keel				9.17 (@ -0.09-foot tide)

4-2.2 Buoyancy, Weight, and Ground Reaction. Initial estimates for weight, buoyancy, and ground reaction were made using available ship's documents and data from similar ships. These estimates were subsequently refined with *POSSE* as more data became available. Ship's characteristics from the Damage Control Book and General Plans are given in Appendix B.

From the capacity plan, available onboard, displacement for a mean draft of 9.25 feet is 4,220 long tons.

The initial survey indicated that all tanks, voids, and bilges were dry. Ship's weight was estimated as shown in Table 4-2.

This estimate was supported by the prestranding waterline (shown by sea growth) at a draft of approximately 14 feet. From the capacity plan and DC Book draft diagram, a 14-foot mean draft corresponds to a displacement of 6,750 long tons. A conservative estimate of 6,800 long tons was adopted as ship's weight and prestranding displacement. From the estimates for buoyancy (B) and weight (W), ground reaction (R) was estimated as:

$$R = 6{,}800 - 4{,}220 = 2{,}580 \text{ long tons}$$

Table 4-2. Ex-USS BROOKINGS Stranded Weight.

Item	Weight long tons
Lightship weight, dry	6,872
Weights included in lightship but removed for conversion to target ship: 10 life boats (20 lton) Guns, armor, rigging, & anchors (60 lton) Miscellaneous outfit (10 lton)	-90
Miscellaneous Equipment onboard not included in lightship weight	+8
Total stranded weight:	6,790

On coral and coarse sand, with coefficients of friction estimated to range from 0.3 to 0.5, the 2,580 long ton ground reaction correlates to a freeing force of 774 to 1,290 long tons (867 to 1,445 short tons).

Although the ship had been thought completely dry, an in-depth investigation after the start of weight removal operations in January 1992 revealed that 3 tanks—B-902-W, C-905-W, and C-906-W—were partially filled with seawater totalling approximately 375 long tons. The estimate of weight removed during the target ship conversion was revised downwards to 52 long tons and better estimates were obtained for stranded drafts forward. As the on-scene salvage engineer and SUPSALV representative had prepared data files for BROOKINGS, *POSSE* was used to refine the estimates of ship's weight, displacement, and ground reaction. The *POSSE* printouts for the initial stranded condition are shown in Figures 4-2 and 4-3.

APA-140--EX-BROOKINGS (STRANDING on NOVEMBER 1989) OOC POSSE-SALV VB1
Rev. 0 (by:HOOPER) 01-24-1992

STRANDED CONDITION
ASSTRAND: CONDITION AS STRANDED

ITEM	WEIGHT LTons	KG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	6872.0	25.90	215.00A	0.00	
Constant	0.0	0.00	218.25A	0.00	0.0
Misc Weight	-52.0	55.10	182.90A	5.77S	0.0
Fuel Oil	0.0	0.00	218.25A	0.00	0.0
Lube Oil	0.0	0.00	218.25A	0.00	0.0
SW Ballast	374.7	8.49	348.91A	0.14P	1,442.6
Misc	0.0	0.00	218.25A	0.00	0.0
TOTALS	7194.7	24.78	222.21A	0.05P	1,442.6

		INTACT	AFTER OUTFLOW	AS STRANDED
Draft at F.P.	(ft)	13.23	----	7.98
Draft at A.P.	(ft)	16.58	----	9.17
Trim	(ft)	3.34A	----	1.20A
Draft at Fwd Marks	(ft)	13.29	----	8.00
Draft at Aft Marks	(ft)	16.55	----	9.17
Static Heel Angle	(deg)	0.00	----	3.00P
Total Weight	(LT)	7,194.7	7,194.7	7,194.7
KG	(ft)	24.78	24.78	24.78
LCG	(ft-FP)	222.21A	222.21A	222.21A
TCG	(ft-CL)	0.05P	0.05P	0.05P
Buoyancy	(LT)	7,194.7	----	3,807.2
KB	(ft)	8.01	----	4.64
LCB	(ft-FP)	222.27A	----	219.24A
TCB	(ft-CL)	0.00	----	1.73P
KMt	(ft)	28.86	----	----
FSc	(ft)	0.20	----	----
GMt	(ft)	3.88	----	----
Shear Force	(LT)	646.1	----	1,009.7
Bending Moment	(ft-LT)	60,965.3H	----	94,254.5H

Figure 4-2. *POSSE* Printout for Initial Stranded Condition.

APA-140 -- EX-BROOKINGS (STRANDING on NOVEMBER 1989) OOC POSSE-SALV VB1
Rev. 0 (by:HOOPER) 01-24-1992

STRANDED CONDITION
ASSTRAND: CONDITION AS STRANDED

OBSERVED DATA

Draft at F.P.	7.98	ft
Draft at A.P	9.17	ft
Draft at Fwd Marks	8.00	ft
Draft at Aft Marks	9.17	ft
Static Heel Angle	3.00P	deg
Tidal Height	-0.09	ft

Specified Ground Contact	SHELF AFT		SHELF FWD	
Longitudinal Location	340.00A	ft-FP	120.00A	ft-FP
Transverse Location	0.00	ft-CL	0.00	ft-CL

COMPUTED DATA

Type of Ground Contact	ON SHELF	
(R) Ground Reaction	3387.5	LTons
(LCR) Long'l Ctr. of Grd. Reaction	225.68a	ft-FP
Water Depth at LCR	8.60	ft
Ht of Contact Pt. abv Baseline	0.00	ft
Fwd Boundary of Ground Contact	120.00A	ft-FP
Aft Boundary of Ground Contact	340.00A	ft-FP
(TCR) Transv. Ctr. of Grd. Reaction	0.67P	ft-CL
Long'l Extent of Ground Contact	220.00	ft
Transv. Extent of Ground Contact	20.00	ft
Grounding Contact Area	4400.00	ft2
Pressure on Hull	0.77	LT/ft

Neutral Load Point	---
LBP	436.50
LCF	217.65A
Mtlin	809.9
TPI	42.46
(F) Force to Free	1897.0
Coefficient of Friction	0.50
Seafloor Type	CORAL

Figure 4-3. *POSSE* Printout for Initial Stranded Condition, Part 2.

4-3 REQUIRED WEIGHT REMOVAL

Major weight removal was required prior to any retraction attempt. The primary operational objective of environmental restoration precluded dragging BROOKINGS across intervening coral reef to deep water, even if sufficient pulling force could be mustered. This meant removing weight equal to or slightly more than the as-stranded ground reaction. Plans were accordingly laid for the removal of 2,600 long tons, an estimate that would be revised upwards to over 3,000 long tons, due to the uncertainty of pre-stranding displacement. The relatively coarse estimate of the afloat waterline, based on observation of accumulated sea growth, resulted in an uncertainty in the estimates of pre-stranding displacement of ±400 long tons.

BROOKINGS was a MARAD-type VC2-S-AP5 hull. No detailed weight summaries for MARAD C2 hulls were available during the planning stages. A detailed weight summary for a MARAD-type C4-S-1a hull, with a lightship weight of 7,682 long tons was obtained from *Principles of Naval Architecture, First Revision*, published by the Society of Naval Architects and Marine Engineers (SNAME) in 1967. Item weights for BROOKINGS were estimated by multiplying weights from the C4 weight summary by the ratio of lightship weights (6,872/7,682 = 0.8946). Items selected for removal are shown in Appendix C.

4-4 HULL GIRDER STRENGTH

The structural members of a ship (frames, longitudinals, decks, shell plating, etc.), provide the hull girder's strength. The weight of these members and attached ancillary structures also loads the hull girder. In a wreck-in-place operation, the ship is cut into pieces whose size is dictated by the capacity of available cranes and barges, working from the top down. When decks and stringers are cut to section the wreck, the hull is weakened longitudinally. If the wreck is to be completely broken in place, hull strength is of little importance so long as the hull is not so weakened that it collapses on itself and endangers workers and attending craft. If the wreck is to be only partially broken, leaving a hulk to be floated off or perhaps towed some distance, it is important to avoid overstressing the remaining hull structure. The cut-down hull must be strong enough to carry the static loads imposed by the stranded and still water conditions, and the dynamic forces experienced during extraction and/or towing to a disposal site.

Ideally, hull sections are removed as they are cut, unloading the hull girder as it is weakened. By removing sections as they are cut, overstressing the hull can usually be avoided by working from the top down one deck at a time, and working from midships out on a sagging ship, and from the ends inward on a hogging ship. Starting with an unladen vessel, as is usually the case, a safety factor is provided in that longitudinal bending stresses are generally quite low in unladen vessels, leaving a wide margin of reserve strength.

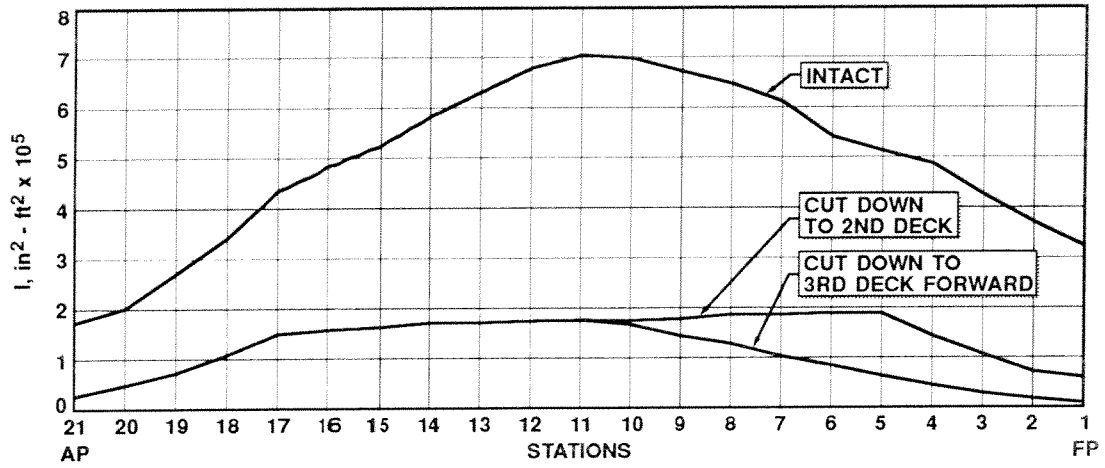
During the BROOKINGS wreck removal, ship sections were not removed as they were cut (see Chapter 5 for details of conditions during weight removal). The desire to minimize costs incurred by chartering cranes, tugs, and scrap barges dictated completing a majority of the structural cutting before any weight was removed. Consequently, it was necessary to calculate stresses for the hull after structural cutting and before weight removal.

With the aid of *POSSE*, the on-scene salvage engineer was able to perform real-time calculations in minutes, updating hull girder loading and/or modifying the hull model and calculating the resulting stresses. The speed and ease of data entry and calculations with *POSSE* allowed optimization of the cutting effort during times when ship sections could not be removed as cut. While hull stresses could be calculated manually, the tedious and lengthy nature of hull strength calculations would have precluded the "fine-tuning" that was attainable with *POSSE*.

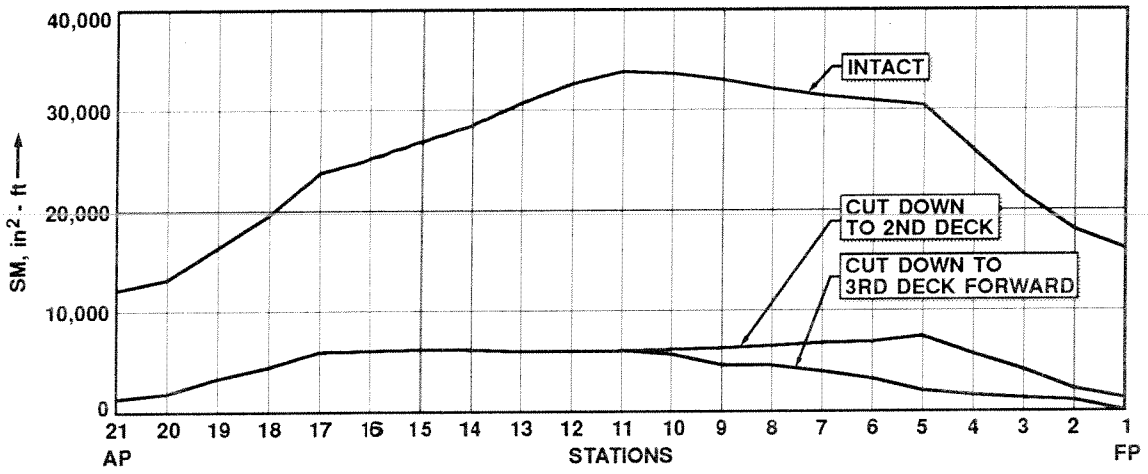
4-4.1 Ship Data Files. A 21-station hull offset file for BROOKINGS was developed by taking offsets from the general plans. Three POSSE numeric models were developed for BROOKINGS to predict hydrostatic characteristics and to model strength the hull girder and stresses experienced during the wreck removal and while towing to the disposal site. The three models were based on a common hull offset file and three ship data files:

- BROOKINGS as stranded, with all structure intact.
- BROOKINGS with "damage": The same hydrostatic and stability characteristics as the intact model, but with section strength data modified to reflect removal of all material to the second deck.
- BROOKINGS with "final damage": The same as hydrostatic and stability characteristics as the other two models, but with section strength data modified to reflect removal of all material to the third deck forward of frame 43.

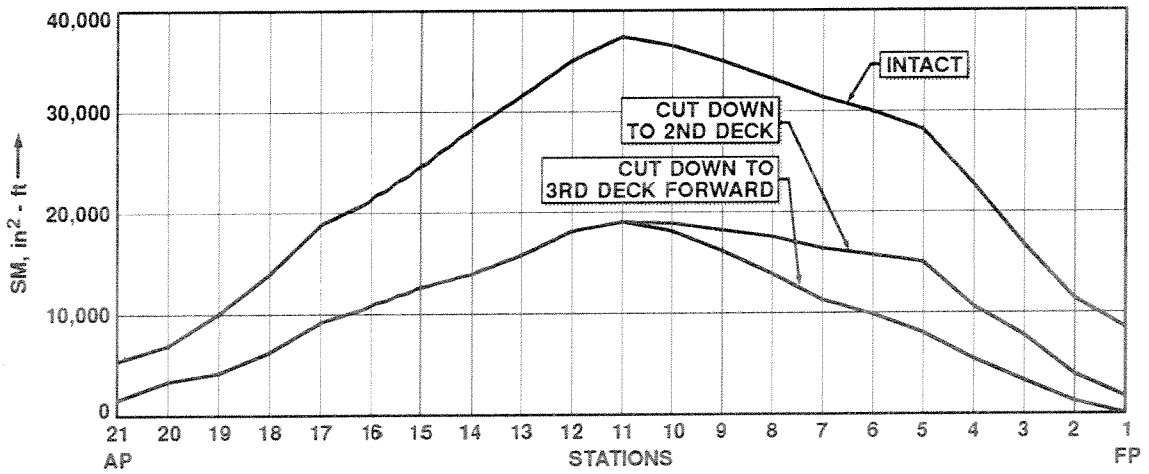
POSSE printouts showing hydrostatic data and hull strength data from the three ship data files are reproduced in Appendix B. Section properties for the three conditions are plotted in Figure 4-4 (Page 4-6). The *POSSE* Section Modulus Editor was used to calculate section properties for five sections (frames 13, 43, 86, 129, and 148) based solely on the hull form and hand measurements of structural members by the salvage engineer, including inspection of double-bottom tanks. Section properties for intermediate stations were estimated by parabolic interpolation using the automatic interpolation function in *POSSE*'s Ship Data Entry program. To determine reduced section properties for hull cut down to the second deck, the Section Modulus Editor was used to calculate properties for the 5 sections by specifying the damage (material removed). The adjusted section properties for the 5 stations were imported into the Ship Data Entry program and properties for the intervening sections interpolated as before. For the final damaged condition, only frames 13 and 43 were modified and imported. Sample Section Modulus Editor calculations for frames 13 and 43, in their intact and two damaged conditions, are shown in Figures 4-5, 4-6, and 4-7 (Pages 4-7 through 4-9).



(a) MOMENT OF INERTIA



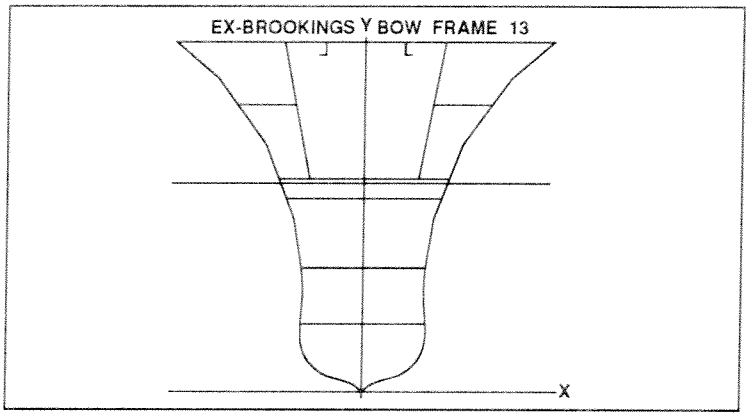
(b) SECTION MODULUS, DECK



(c) SECTION MODULUS, KEEL

Figure 4-4. Strength Properties.

SECTION MODULUS COMPARISON
EX-BROOKINGS BOW FRAME 13

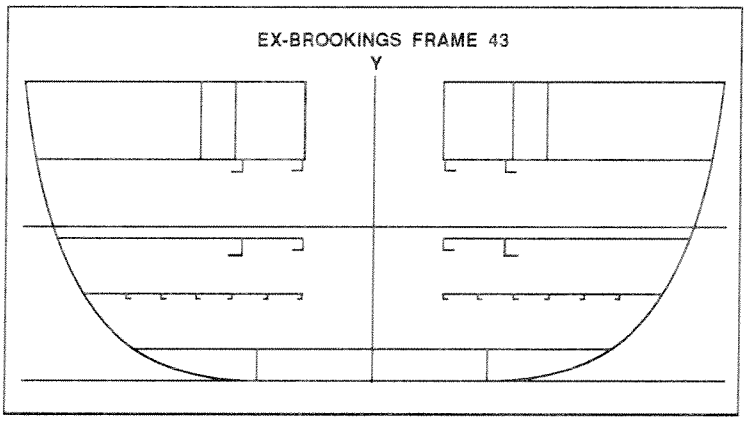


SM COMPARISON TABLE

About Horizontal Neutral Axis

	Intact		Damaged	%Loss
Area:	1528	in2	-----	
Ixx:	3.7260E+05	in2-ft	-----	
SM - Upper Flg:	18051	in2-ft	-----	
Y upper:	20.64	ft	-----	
SM - Lower FLg:	12251	in2-ft	-----	
Y lower:	30.42	ft	-----	
Shear Area y:	960	in2	-----	

SECTION MODULUS COMPARISON
EX-BROOKINGS FRAME 43



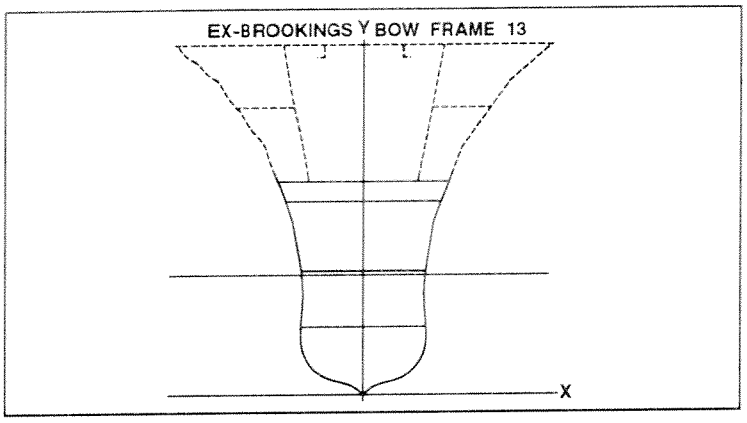
SM COMPARISON TABLE

About Horizontal Neutral Axis

	Intact		Damaged	%Loss
Area:	2998	in2	-----	
Ixx:	5.7047E+05	in2-ft	-----	
SM - Upper Flg:	30754	in2-ft	-----	
Y upper:	18.56	ft	-----	
SM - Lower FLg:	29135	in2-ft	-----	
Y lower:	19.58	ft	-----	
Shear Area y:	1085	in2	-----	

Figure 4-5. *POSSE* Section Property Calculation for Frames 13 and 43, Undamaged.

SECTION MODULUS COMPARISON
EX-BROOKINGS BOW FRAME 13

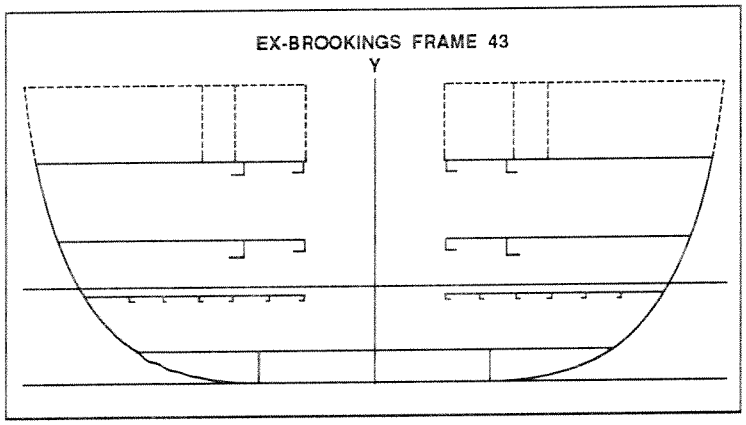


SM COMPARISON TABLE

About Horizontal Neutral Axis

	Intact		Damaged	%Loss
Area:	1528	in2	784	48.7 %
Ixx:	3.7260E+05	in2-ft	76978	79.3 %
SM - Upper Flg:	18051	in2-ft	2293	87.3 %
Y upper:	20.64	ft	33.57	
SM - Lower FLg:	12251	in2-ft	4401	64.1 %
Y lower:	30.42	ft	17.49	
Shear Area y:	960	in2	526	45.2 %

SECTION MODULUS COMPARISON
EX-BROOKINGS FRAME 43



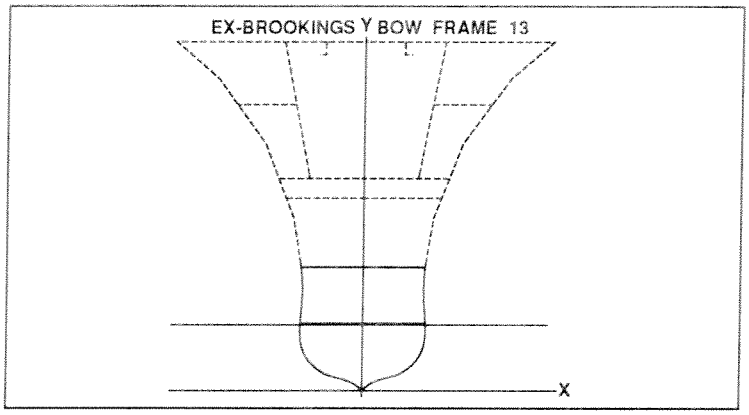
SM COMPARISON TABLE

About Horizontal Neutral Axis

	Intact		Damaged	%Loss
Area:	2998	in2	2074	30.8 %
Ixx:	5.7047E+05	in2-ft	1.9307E+05	66.2 %
SM - Upper Flg:	30754	in2-ft	7436	75.8 %
Y upper:	18.56	ft	25.96	
SM - Lower FLg:	29135	in2-ft	15863	45.6 %
Y lower:	19.58	ft	12.17	
Shear Area y:	1085	in2	739	31.9 %

Figure 4-6. *POSSE* Section Property Calculation for Frames 13 and 43, Cut Down to 2nd Deck.

SECTION MODULUS COMPARISON
EX-BROOKINGS BOW FRAME 13

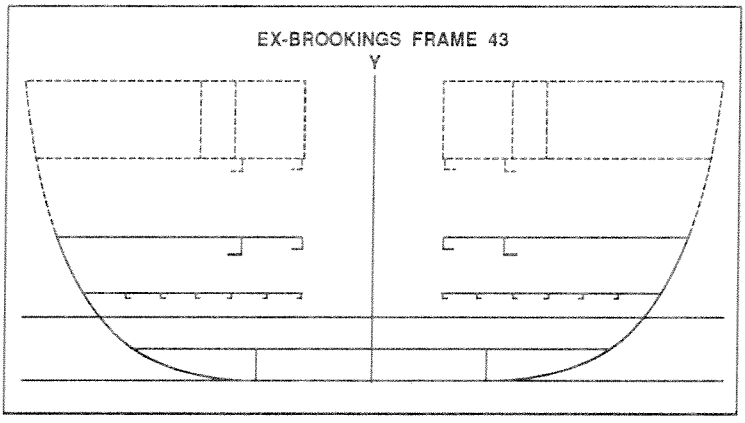


SM COMPARISON TABLE

About Horizontal Neutral Axis

	Intact		Damaged	%Loss
Area:	1528	in2	432	71.7 %
Ixx:	3.7260E+05	in2-ft	14252	96.2 %
SM - Upper Flg:	18051	in2-ft	345	98.1 %
Y upper:	20.64	ft	41.30	
SM - Lower FLg:	12251	in2-ft	1460	88.1%
Y lower:	30.42	ft	9.76	
Shear Area y:	960	in2	324	66.2 %

SECTION MODULUS COMPARISON
EX-BROOKINGS FRAME 43



SM COMPARISON TABLE

About Horizontal Neutral Axis

	Intact		Damaged	%Loss
Area:	2998	in2	1600	46.7 %
Ixx:	5.7047E+05	in2-ft	65744	88.5 %
SM - Upper Flg:	30754	in2-ft	2178	92.9 %
Y upper:	18.56	ft	30.18	
SM - Lower FLg:	29135	in2-ft	8264	71.6 %
Y lower:	19.58	ft	7.96	
Shear Area y:	1085	in2	590	45.9 %

Figure 4-7. *POSSE* Section Property Calculation for Frames 13 and 43, Cut Down to 3rd Deck.

4-4.2 Load Case and Salvage Response Files. The *POSSE* Intact Loading and Salvage Response programs base their calculations on a specified hull offset and ship data file. The effect on hull girder stresses of altering section properties without changing load can thus be examined by running calculations with the same load case or salvage response file with different ship data files loaded. This basic approach was used to examine the effects of cutting structure on BROOKINGS to the second deck without removing the cut sections.

Rather than develop numerous ship data files for BROOKINGS cut down the second deck over varying lengths, only the files for BROOKINGS intact and cut down to the second deck throughout were used. Loading conditions reflecting weight removal as it occurred during windows of opportunity (see Paragraph 5-5) were entered into the Salvage Response program to develop salvage response files. Longitudinal strength calculations were then run with both ship data files. Predicted stresses for the cut down hull with all structure remaining onboard were dramatically greater than those for the intact ship (maximum deck stress above 36,000 psi as opposed to just under 7,000 psi for the intact hull). The analysis did predict, however, that the hull could be cut to the second deck with all weight remaining in place without exceeding the ultimate strength of 1940's era shipbuilding steel (approximately 50,000 psi). The *POSSE* printout in Figure 4-8 shows hull stresses on stranding; the *POSSE* printouts summarizing the as stranded loading and hydrostatic characteristics are shown in Figures 4-2 and 4-3.

After the hull forward was cut down to the third deck, the "final damage" ship data file was loaded as the basis of calculations for the salvage response and (after refloating) intact loading programs. Figures 4-9 and 4-10 (Pages 4-12 and 4-13) summarize the condition of the hulk immediately prior to refloating. The 109.2 tons of fuel oil shown in Figure 4-10 is saltwater ballast in fuel tank A-904-F. This value was attained by specifying that the tank was 100 percent full of a liquid with specific gravity of 1.025. Figures 4-11 and 4-12 (Pages 4-14 and 4-15) show the hulk's condition while under tow to the disposal site.

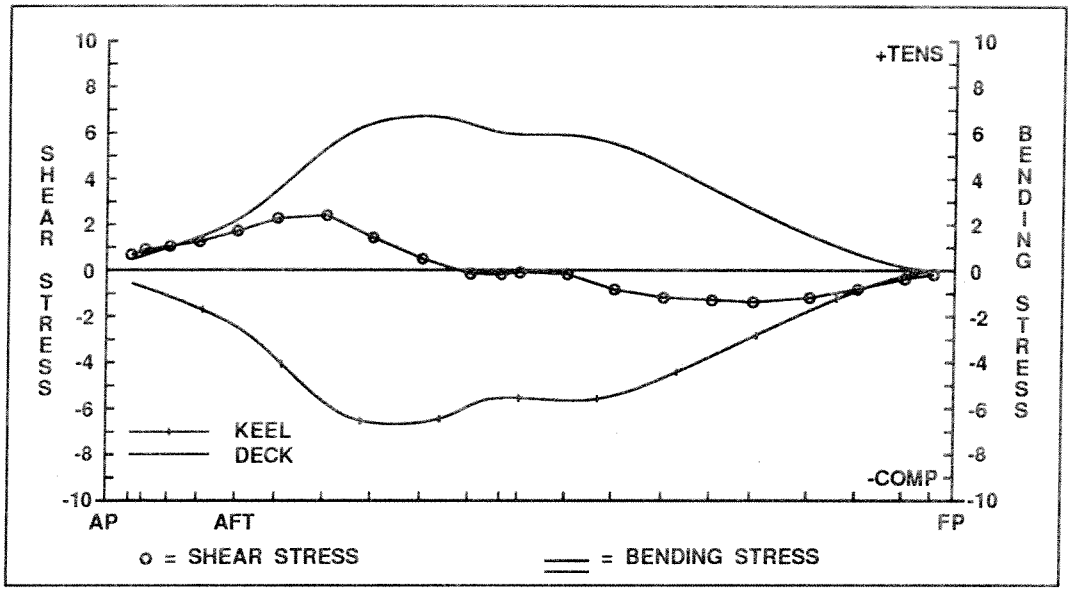
4-5 STABILITY

Stability while aground was never a concern while BROOKINGS was hard aground. BROOKINGS had been stable in her light condition before stranding. It was anticipated that the removal of less than 500 tons from low in the ship (turbines, condenser, and 375 tons of saltwater ballast) while more than 2,000 tons were removed from high in the ship, would result in an increase in transverse stability. These assumptions were borne out by the values for *GM* shown in Figures 4-10 and 4-12. It was also assumed that the relatively even longitudinal distribution of weight removed would prevent the refloated hulk from assuming an extreme trim.

4-6 SCRAP WEIGHT ESTIMATES

Weights of scrap actually removed were estimated from crane load cell readings, and by change of draft on the scrap barges. Estimates based on load cell readings were typically 20 to 25 percent low, as indicated by reports of scrap offloaded at the receiving scrapyards. When SANTO DOMINGO was placed on hire, a *POSSE* hull model was prepared to enable the SUPSALVREP to estimate the weight of scrap on board quickly and easily.

SHEAR & LONGITUDINAL BENDING STRESS SUMMARY
Stresses in ksi
(Based on Direct Calculation from Hull Offsets)

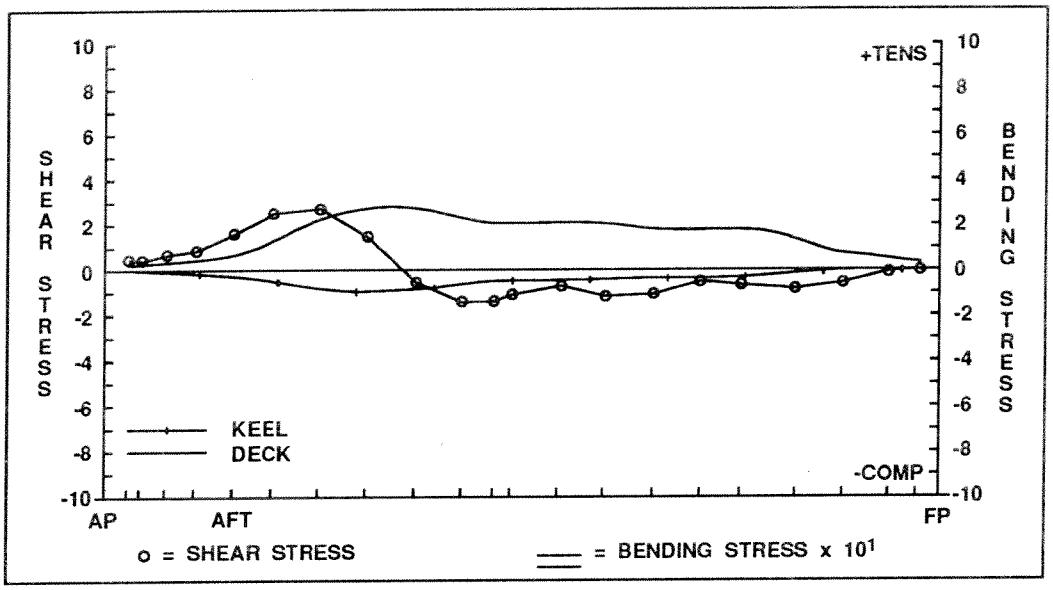


		SHEAR FORCES		BENDING MOMENTS		
	LOCATION	SHEAR	SHEAR STRESS	MOMENT	DK STRESS	KL STRESS
No	ft-FP	LTons	ksi	ft-LTons	ksi	ksi
	425.00A	152.7	0.53	1,591.1H	0.29	-0.65
STN	417.50A	220.0	0.72	2,995.6H	0.48	-0.91
	405.00A	299.5	0.90	6,264.9H	0.85	-1.33
	390.00A	408.5	1.12	11,498.2H	1.30	-1.80
AFT	370.00A	650.5	1.60	22,063.0H	2.06	-2.56
	350.00A	907.5	2.16	37,753.8H	3.32	-3.84
	325.00A	1,009.7	2.30	63,843.2H	5.24	-5.64
	300.00A	601.1	1.31	83,911.2H	6.47	-6.54
	275.00A	179.4	0.38	93,692.3H	6.80	-6.53
	250.00A	-139.5	-0.28	94,254.5H	6.46	-5.95
ER	234.00A	-127.6	-0.25	91,776.7H	6.08	-5.46
	225.00A	-86.3	-0.17	90,789.2H	6.05	-5.49
	200.00A	-110.4	-0.22	88,514.3H	6.01	5.60
	175.00A	-441.7	-0.89	82,080.6H	5.67	-5.44
	150.00A	-620.3	-1.26	68,071.9H	4.79	-4.74
	125.00A	-631.2	-1.29	52,368.4H	3.75	-3.84
FWD	104.00A	-667.0	-1.38	38,814.2H	2.83	-2.98
	75.00A	-543.9	-1.17	19,885.0H	1.71	-1.95
	50.00A	-357.8	-0.80	7,392.6H	0.75	-0.95
BOW	26.00A	-156.1	-0.36	1,660.5H	0.21	-0.30
	12.00A	-72.5	-0.17	13.9H	0.00	-0.00

Maximum Shear Stress at : 2.30 ksi
Maximum Deck Bending Stress at : 6.80 ksi
Maximum Keel Bending Stress at : -6.54 ksi

Figure 4-8. *POSSE* Hull Stress Calculation for As-Stranded Condition.

SHEAR & LONGITUDINAL BENDING STRESS SUMMARY
Stresses in ksi
(Based on Direct Calcuation from Hull Offsets)



		SHEAR FORCES		BENDING MOMENTS		
No	LOCATION ft-FP	SHEAR LTons	SHEAR STRESS ksi	MOMENT ft-LTons	DK STRESS ksi	KL STRESS ksi
	425.00A	71.9	0.38	865.9H		
STN	417.50A	88.2	0.42	1,481.1H	1.86	-1.15
	405.00A	141.9	0.59	2,894.8H	2.29	-1.39
	390.00A	233.2	0.84	5,619.0H	3.08	-1.85
AFT	370.00A	502.8	1.52	12,897.6H	5.01	-2.98
	350.00A	810.3	2.50	26,104.6H	10.17	-5.24
	325.00A	843.3	2.65	49,359.0H	19.28	-8.50
	300.00A	426.5	1.37	64,986.4H	25.47	-9.80
	275.00A	-189.1	-0.62	68,027.6H	26.74	-9.12
	250.00A	-439.9	-1.47	59,225.0H	23.35	-7.15
ER	234.00A	-436.0	-1.48	51,868.1H	20.49	-5.88
	225.00A	-337.4	-1.15	48,357.2H	19.95	-5.72
	200.00A	-211.8	-0.74	41,906.6H	19.73	-5.61
	175.00A	-359.5	-1.28	35,004.6H	19.19	-5.39
	150.00A	-325.0	-1.18	25,702.2H	16.86	-4.67
	125.00A	-187.6	-0.70	19,668.2H	16.06	-4.35
FWD	104.00A	-215.4	-0.82	16,159.2H	16.62	-4.38
	75.00A	-224.6	-0.96	8,789.0H	12.71	-3.37
	50.00A	-157.3	-0.75	2,659.9H	5.93	-1.59
BOW	26.00A	-44.0	-0.24	744.4H	3.44	-0.96
	12.00A	-36.0	-0.21	125.1H	1.56	-0.49

Maximum Shear Stress at : 2.65 ksi
Maximum Deck Bending Stress at : 26.74 ksi
Maximum Keel Bending Stress at : -9.80 ksi

Figure 4-9. *POSSE* Hull Stress Calculation for Pre-Retraction Condition (Stage 5 Weight Removal).

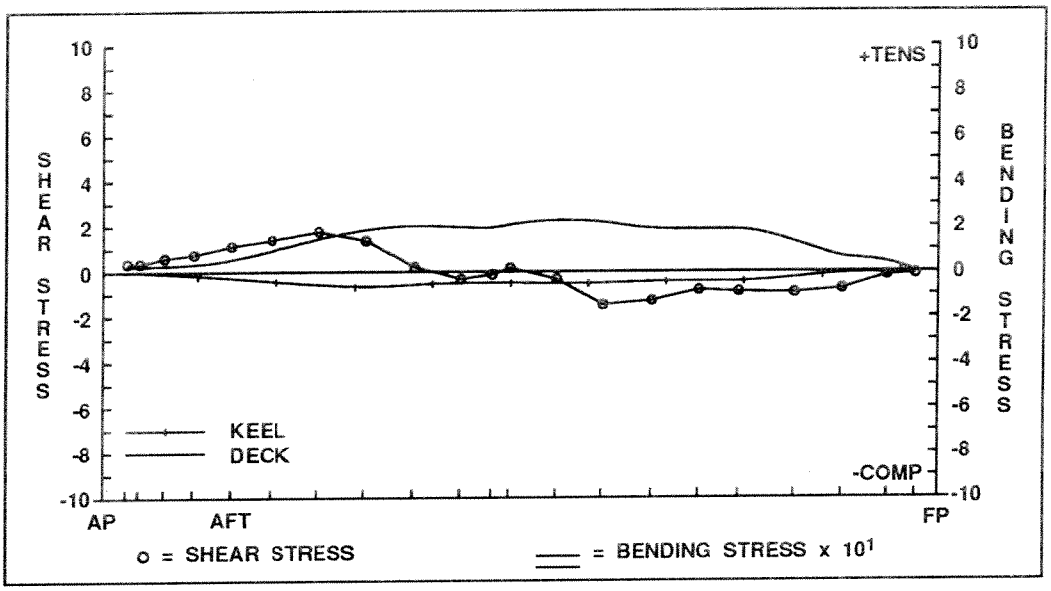
STRANDED CONDITION
PHASE5: 3/27 , W/BROOKDMF.SDA (CUTDOWN TO 3RD DK FWD)

ITEM	WEIGHT LTons	KG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	6,872.0	25.90	215.00A	0.00	
Constant	0.0	0.00	218.25A	0.00	0.0
Misc Weight	-2,614.8	48.6	203.96A	0.00	0.0
Fuel Oil	0.0	0.00	218.25A	0.00	0.0
Lube Oil	0.0	0.00	218.25A	0.00	0.0
SW Ballast	725.8	9.13	314.85A	0.09P	1,114.8
Misc.	17.2	2.09	210.00A	0.02S	101.8
TOTALS	5,000.2	11.80	235.25A	0.01P	1,216.6

		INTACT	AFTER OUTFLOW	AS STRANDED
Draft at P.P.	(ft)	6.26	----	7.98
Draft at A.P.	(ft)	15.42	----	9.17
Trim	(ft)	9.16A	----	1.20A
Draft at Fwd Marks	(ft)	6.43	----	8.00
Draft at Aft Marks	(ft)	15.36	----	9.17
Static Heel Angle	(deg)	0.00	----	4.30P
Total Weight	(LT)	5,000.2	5,000.2	5,000.2
KG	(ft)	11.80	11.80	11.80
LCG	(ft-FP)	235.25A	235.25A	235.25A
TCG	(ft-CL)	0.01P	0.01P	0.01P
Buoyancy	(LT)	5,000.2	----	3,814.7
KB	(ft)	6.01	----	4.70
LCB	(ft-FP)	235.59A	----	219.25A
TCB	(ft-CL)	0.00	----	2.47P
KMt	(ft)	33.44	----	----
FSc	(ft)	0.24	----	----
GMt	(ft)	21.40	----	----
Shear Force	(LT)	678.4	----	8.43
Bending Moment	(ft-LT)	54,711.6H	----	68,027.6H

Figure 4-10. *POSSE* Weight and Hydrostatics Summary for Pre-Refloating Condition (with Ballast).

SHEAR & LONGITUDINAL BENDING STRESS SUMMARY
Stresses in ksi
(Based on Direct Calcuation from Hull Offsets)



		SHEAR FORCES		BENDING MOMENTS		
No	LOCATION ft-FP	SHEAR LTons	SHEAR STRESS ksi	MOMENT ft-LTons	DK STRESS ksi	KL STRESS ksi
	425.00A	71.9	0.38	865.7H		
STN	417.50A	87.5	0.42	1,478.6H	1.86	-1.15
	405.00A	138.7	0.58	2,871.0H	2.27	-1.38
	390.00A	219.0	0.79	5,504.3H	3.02	-1.81
AFT	370.00A	357.6	1.08	11,333.9H	4.40	-2.62
	350.00A	448.3	1.38	19,615.1H	7.64	-3.94
	325.00A	549.1	1.73	32,687.4H	12.77	-5.63
	300.00A	420.5	1.35	44,673.3H	17.51	-6.73
	275.00A	38.1	0.12	50,604.3H	19.89	-6.78
	250.00A	-128.1	-0.43	49,067.8H	19.34	5.92
ER	234.00A	-45.0	-0.15	47,477.4H	18.75	-5.39
	225.00A	40.0	0.14	47,431.3H	19.57	-5.61
	200.00A	-103.4	-0.36	47,756.6H	22.48	-6.39
	175.00A	-434.1	-1.55	40,437.8H	22.17	-6.23
	150.00A	-390.8	-1.42	29,343.4H	19.25	-5.33
	125.00A	-239.7	-0.89	21,798.0H	17.80	-4.83
FWD	104.00A	-253.4	-0.96	17,344.5H	17.83	-4.70
	75.00A	-245.0	-1.04	9,186.1H	13.29	-3.52
	50.00A	-167.2	-0.80	2,741.3H	6.11	-1.64
BOW	26.00A	-46.8	-0.25	662.6H	3.06	-0.85
	12.00A	-36.2	-0.21	27.7H	0.34	-0.11

Maximum Shear Stress at : 1.73 ksi
Maximum Deck Bending Stress at : 22.48 ksi
Maximum Keel Bending Stress at : -6.78 ksi

Figure 4-11. *POSSE* Hull Stress Calculation for As-Scuttled Condition.

FREE-FLOATING DAMAGED CONDITION

ITEM	WEIGHT LTons	KG ft-BL	LCG ft-FP	TCG ft-CL	FSmom ft-LTons
Light Ship	6,872.0	25.90	215.00A	0.00	
Constant	0.0	0.00	218.25A	0.00	0.0
Misc Weight	-3,028.3	43.97	203.08A	0.00	0.0
Fuel Oil	0.0	0.00	218.25A	0.00	0.0
Lube Oil	0.0	0.00	218.25A	0.00	0.0
SW Ballast	0.0	0.00	218.25A	0.00	0.0
Misc.	0.0	0.00	218.25A	0.00	0.0
TOTALS	3,843.7	11.66	224.39A	0.00	0.0

		INTACT	AFTER OUTFLOW	AS STRANDED
Draft at F.P.	(ft)	7.05	----	7.04
Draft at A.P.	(ft)	10.28	----	10.28
Trim	(ft)	3.23A	----	3.24A
Draft at Fwd Marks	(ft)	7.11	----	7.10
Draft at Aft Marks	(ft)	10.26	----	10.26
Static Heel Angle	(deg)	0.00	----	0.00
Total Weight	(LT)	3,843.7	3,843.7	3,843.7
KG	(ft)	11.66	11.66	11.66
LCG	(ft-FP)	224.39A	224.39A	224.39A
TCG	(ft-CL)	0.00	0.00	0.00
Buoyancy	(LT)	3,843.7	----	3,843.7
KB	(ft)	----	----	4.66
LCB	(ft-FP)	216.22A	----	224.44A
TCB	(ft-CL)	----	----	0.00
KMt	(ft)	37.79	----	37.54
FSc	(ft)	0.00	----	0.00
GMt	(ft)	26.13	----	25.74
Shear Force	(LT)	----	----	549.1
Bending Moment	(ft-LT)	----	----	50,604.3H

Figure 4-12. *POSSE* Weight and Hydrostatics Summary for As-Scuttled Condition.

CHAPTER 5

OPERATIONS

5-1 SUMMARY

The NAVSEA Salvage Contractor, DONJON Marine began mobilization on 26 December 1991. Over the period 2 – 3 January 1992, two SUPSALV representatives and 9 contractor personnel arrived at NAVSTA Roosevelt Roads. Additional contractor personnel would subsequently arrive to undertake removal of asbestos and PCB-laden materials. The operation was directed by a SUPSALV salvage engineer (salvage-trained engineering duty officer) who was relieved from time to time by civilian salvage and environmental specialists from the SUPSALV office. A number of salvage-trained engineering duty officers and Fleet salvors visited the site for indoctrination and training in wreck removal operations. Appendix D is a detailed chronology of the wreck removal.

5-2 OCCUPATIONAL HEALTH AND SAFETY

In keeping with practices standard when BROOKINGS was built, asbestos was used extensively for pipe and bulkhead lagging and ceiling tiles. Gaskets in the ventilation system contained a significant percentage (up to 30 percent) of polychlorinated biphenyls (PCBs). Burning operations produced smoke which accumulated in confined spaces, and released heavy metal fumes from galvanized coatings and World War II era paints containing lead and chromate. Measures were taken to protect workers, and to ensure that all scrap sold presented neither environmental nor occupational hazard.

As the ship was without power, ventilation, lighting, and sanitary systems were inoperative. The ship was structurally sound, with all hatches, ladders, doors, and hand rails in place, and so presented no extraordinary mechanical injury hazard, other than dim lighting in some areas, and the normal hazards associated with industrial and shipboard environments.

5-2.1 Asbestos and PCB Removal. Asbestos removal was slated to begin 19 days after mobilization. After arriving in Puerto Rico, the SUPSALV representative approached a San Juan environmental services firm about the job; on 13 January, this firm advised that it could not take the job, and DONJON Marine contracted its subsidiary, Clean Ventures Incorporated, who dispatched an eight-man asbestos removal team that arrived 16 January. Materials containing asbestos were completely removed from all structure and machinery designated for removal to ensure that all scrap sold was asbestos-free. After removal, asbestos lagging and insulation were sealed in plastic bags and stowed in the ship's refrigeration storage spaces for disposal by sinking with the hulk. Areas where asbestos removal was in progress were cordoned off and placarded to prevent entry of unprotected workers or observers. Exposed asbestos was kept wet to limit the release of fibers into the air. Licensed asbestos removal workers were provided protective clothing consisting of full face mask respirators with combination filter cartridges for protection against dust, asbestos, and metal fumes, disposable (Tyvek) coveralls, hoods, boot covers, and gloves, as shown in Figures 5-1A and 5-1B (Pages 5-2 and 5-3). A change room was established on board, so that contaminated clothing was not worn off the vessel.

PCB-containing gaskets in ventilation ducting were removed without disturbing the gaskets by cutting the ducting on either side of the gasketed joint. The disposal of the entire joint lessened the danger of contamination.

Figure 5-1A. Asbestos Removal.

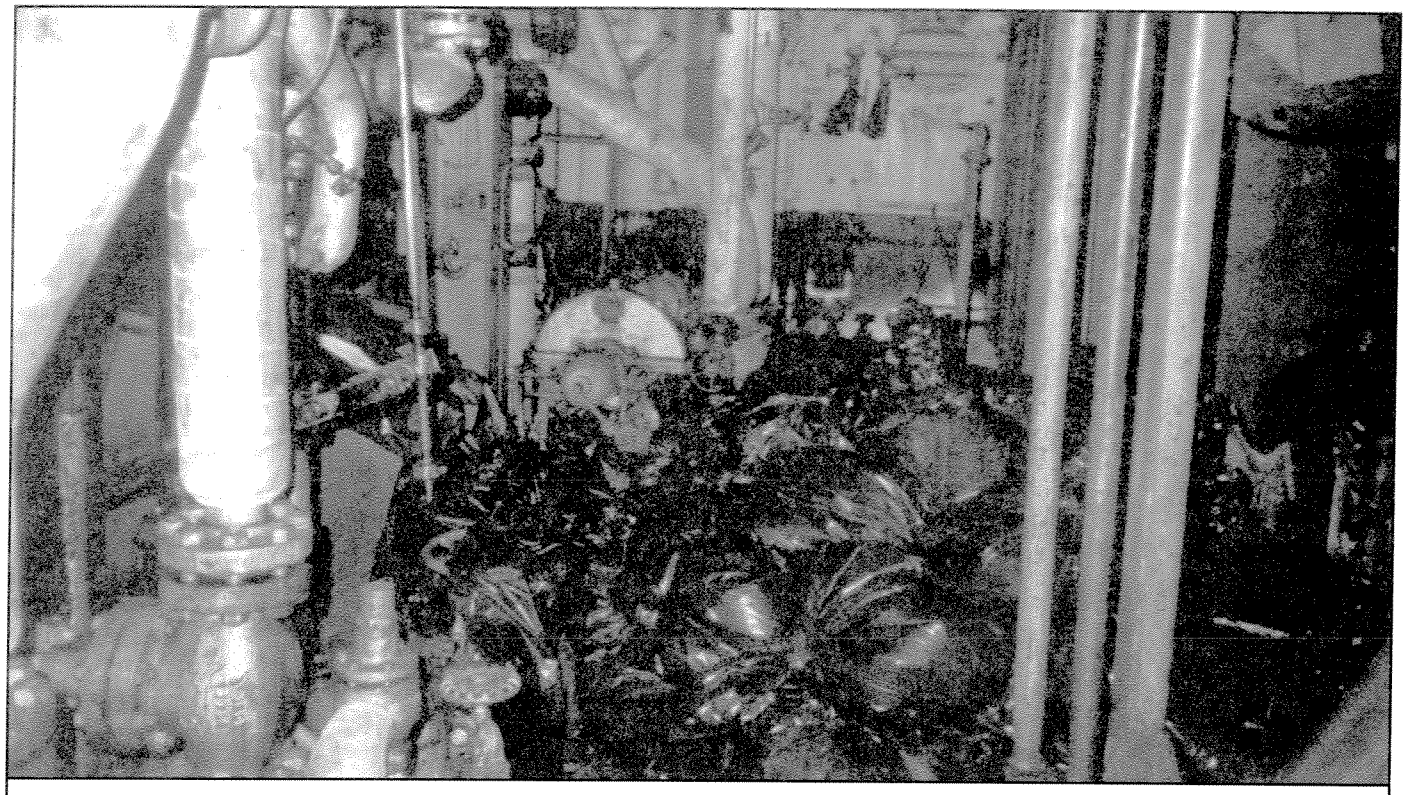


Figure 5-1B. Asbestos Removal.

5-2.2 Light and Ventilation. Main deck and 'tween decks hatch covers were removed, while doors and air ports were opened throughout the ship to admit light and air. Where necessary below decks, approximately two-foot-square openings were cut in the shell plating above the waterline to admit light and fresh air and allow burning smoke to escape. Open hatches not surrounded by bulwarks were roped off to prevent falls.

5-2.3 Fire. The potential for fire during burning operations on a powerless ship is obvious. Fire watches were maintained by the contractor during all burning work. Due to preventive measures in place, fire incidents were negligible.

5-3 TRAINING

Salvage-trained engineering duty officers and salvage officers from various commands were assigned to the site for brief training periods. Training consisted of surveying the wreck, observing operations in progress, and developing a detailed engineering estimate summarizing the wreck's condition. Each officer was also tasked with computing his own salvage plan incorporating detailed engineering analysis with resolution of environmental issues.

5-4 FLEET PARTICIPATION

With the exception of YD-251 and a naval station yard tug (YTB), which assisted J.A. WITTE with the debeaching and mooring of the hulk, the BROOKINGS removal was performed entirely with commercial assets.

Four personnel from Mobile Diving and Salvage Unit 2 (MDSU-2) arrived 6 January to observe operations in preparation for eventual Fleet involvement. Initial plans called for BROOKINGS to be removed from her strand and towed to a disposal site by a COMSUPPRON EIGHT asset following weight removal, and had contemplated involving active duty and reserve MDSU-2 salvors in the weight removal operations. As weight removal progressed, it became apparent that it would be difficult to predict the exact date that the BROOKINGS hulk would be ready to refloat, complicating the scheduling of COMSUPPRON EIGHT assets. It also became apparent that the hulk could be handled with a relatively small tug and would not require the services of a fleet or salvage tug (ARS, ATS, or ATF). Fleet participation in the operation was eventually reduced to one first class diver/salvor from MDSU-2 who functioned as Fleet liaison and assistant to the SUPSALV representative, and divers from the USS KITTIWAKE (ASR 13) who conducted an underwater survey.

5-5 WEIGHT REMOVAL

Salvage and burning equipment were loaded on BROOKINGS on 4 January; cutting began the following day. Initial intentions were to complete all cutting above the main deck before bringing a crane and scrap barge alongside.

Precutting of topside structure plus removal of hazardous material from affected sections proceeded for weeks prior to employing a crane barge for weight removal. Charter costs for tugs, scrap barges, and derricks were a large portion of total costs. Efficient use of charter equipment was essential to staying within the budget. Structural cutting could not proceed indefinitely without removing weight. Hull girder shear forces and bending moments remained constant until weight was removed, while structural cutting steadily reduced hull strength. Care had to be exercised so that remaining structures were not overstressed. As events unfolded, the length and timing of windows of opportunity for weight removal were framed by equipment availability, ability to dispose of scrap, and most importantly, wind and sea conditions at the site. Over 2,600 long tons would be removed in 5 distinct stages dictated by these windows of opportunity where weather, machinery, and scrap disposal allowed work to proceed. The ship sections removed in each of these stages are shown in Figures 5-2 and itemized in Table 5-1.

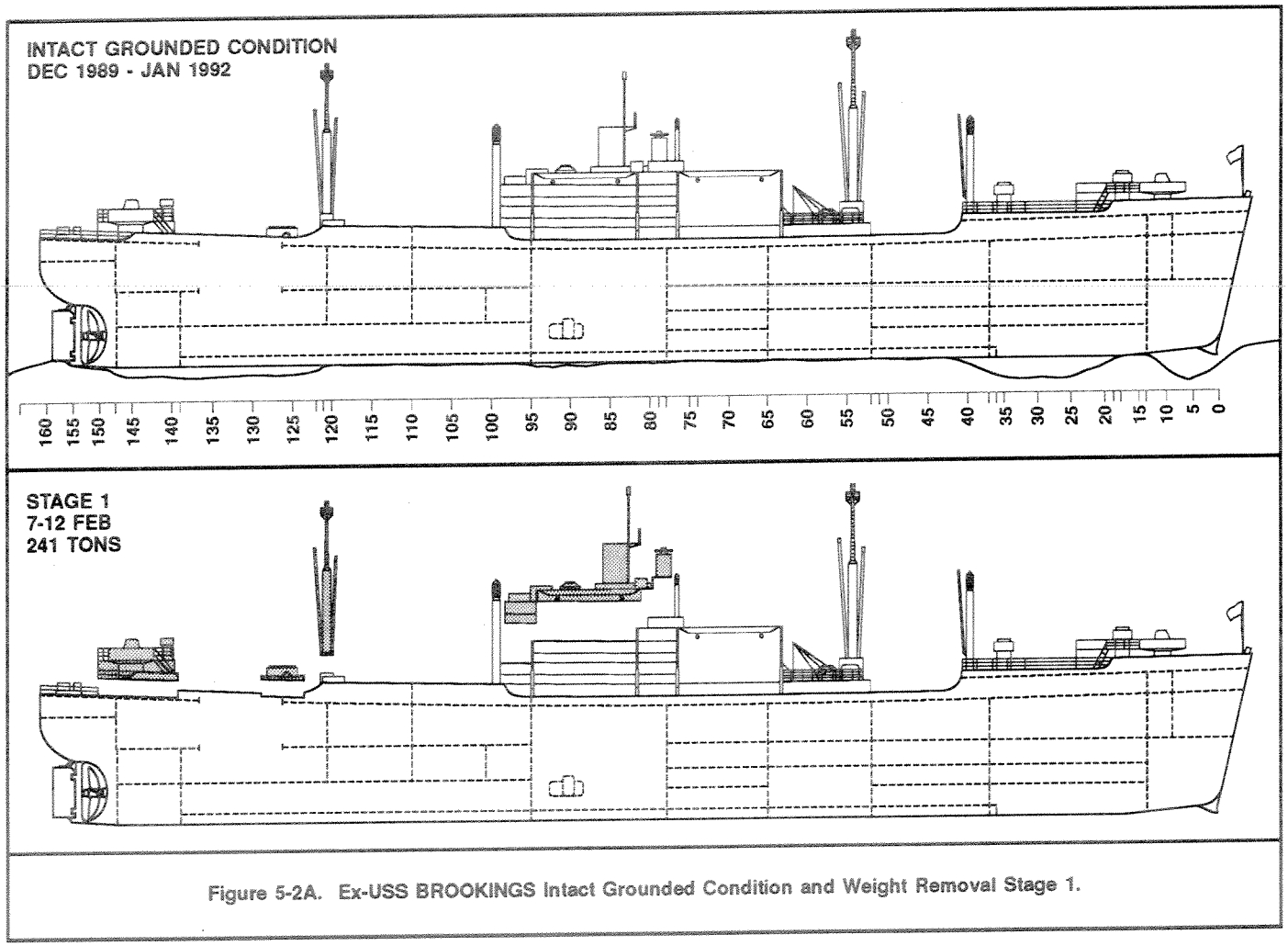


Figure 5-2A. Ex-USS BROOKINGS Intact Grounded Condition and Weight Removal Stage 1.

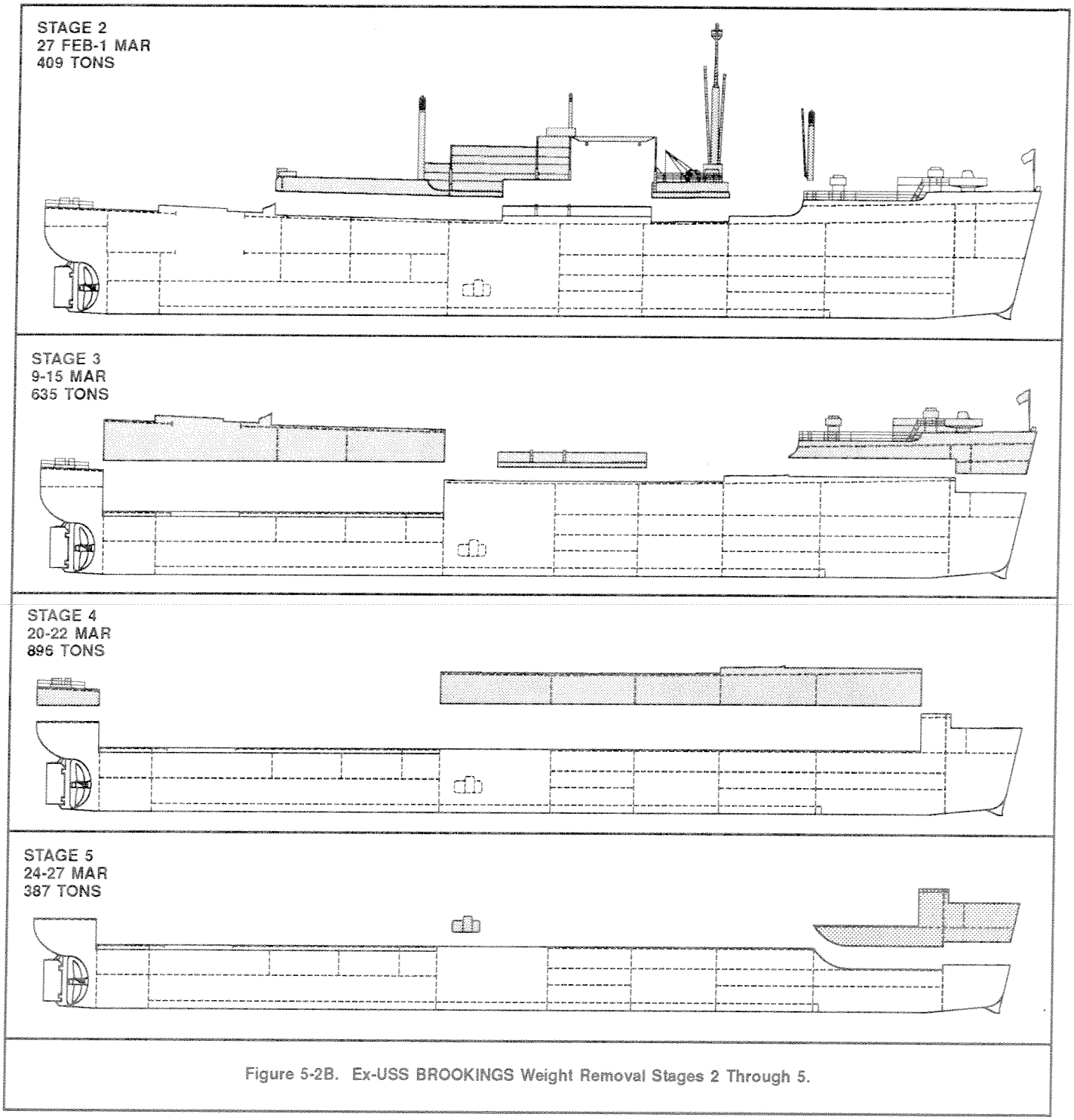


Figure 5-2B. Ex-USS BROOKINGS Weight Removal Stages 2 Through 5.

5-5.1 Problems. The ability to remove weight was hampered by a number of factors:

- Difficulties in hiring floating cranes, scrap barges, and tugs locally.
- Equipment casualties.
- Frequent wind and sea conditions that prevented floating cranes and barges from mooring alongside, or prevented their movement from the naval station harbor to the stranding site.
- Difficulties in locating a reputable scrap dealer willing and able to take the steel removed from BROOKINGS.
- Turn-around for the scrap barges offloading.

5-5.1.1 Floating Equipment. A 210-foot, 3,000-ton (DWT) barge (PS 201) and the 2,200-horsepower tug EL MORRO were chartered from Crowley Maritime Incorporated of Puerto Rico on 4 February. No commercial floating crane could be obtained locally. Arrangements were made to utilize the naval station derrick, YD-251. These assets were on site to begin weight removal on 7 February. The barge would carry three loads of scrap, totalling approximately 1,295 tons, to scrap dealers in Yabucoa and San Juan. The utility of the YD-251 was limited by the in-experience of her operators in salvage work and by equipment casualties. After removing 660 tons of topside structure from BROOKINGS, YD-251 would be relieved on 8 March by DONJON's floating crane OBS-2250. The DONJON Marine tug J. A. WITTE, which had towed the OBS-2250 from her Port Newark berth, relieved the Crowley tug, which was taken off charter.

Table 5-1. Ex-USS BROOKINGS Weight Removal Summary.

Item	Weight long tons	*KG* ft-BL	*LCG* ft-FP	Comments
Debris	8.0	20	360	Debris in aft hold (Nr 5) not accounted for previously
Misc Outfit	-10.0	25	218.25	Items removed in conversion to target ship
Landing Craft (10)	-20.0	52	200	
Forward guns	-9.0	52	34	
Aft guns	-21.0	47	420	
Subtotals, as stranded weights:	-52.0	TBD	TBD	
Winches aft	-57.1	44	310	Stage 1 weight removal 7 to 12 Feb
Aft deckhouse	-35.7	50	402	
Bridge	-68.8	65	230	
Aft mast	-38.4	66	337	
Superstructure aft	-41.1	60	237	
Subtotals, Stage 1:	-241.1	TBD	TBD	
Aft kingpost	-22.6	73	275	Stage 2 weight removal, 27 Feb to 1 March
Bridgewings & tubs	-20.3	69	205	
Exhaust steam piping	-1.2	76	223	
01 to 02 level superstructure	-63.1	54	220	
Main deck/01 level	-50.7	46	330	
Aft davits	-12.3	53	305	
Forward davits	-12.3	44	102	
Forward mast set B	-43.9	60	131	
Forward kingposts	-21.3	70	86	
Forward kingpost winch	-11.3	52	76	
Forward mast winch	-13.5	44	125	
01 level, frame 52 to 64	-52.4	46	146	
01 level, frame 98 to 102	-27.8	50	275	
01 level, frame 91 to 98	-31.0	50	257	
01 level, frame 87 to 91	-25.3	50	242	
Subtotals, Stage 2:	-409.0	TBD	TBD	
01 level, frame 64 to 87	-123.4	50	200	Stage 3 weight removal, 9 to 11 Mar, 14 & 15 Mar
01 level, bow to frame 37	-181.0	50	40	
Main deck, frame 96 to 147	-330.8	50	284	
Subtotals, Stage 3:	-635.2	TBD	TBD	
Stage 4 aft	-143.4	50	428	Stage 4 weight removal, 20 to 22 Mar
Stage 4 forward	-752.6	50	185	
Subtotals, Stage 4:	-896.0	TBD	TBD	
Stage 5, bow to frame 14	-45.6	38	18	Stage 5 weight removal, 24 to 27 Mar
Stage 5, frame 14 to 37	-128.3	28	66	
Stage 5, frame 37 to 51	-111.1	28	110	
Main engine (HP and LP turbines)	-42.4	16	240	
Main engine condenser and FND	-30.0	12	240	
Anchor and chain	-30.0	45	20	
Subtotals, Stage 5:	-387.4	TBD	TBD	
Totals:	-2,620.7	TBD	218.25	

5-5.1.2 Scrap Sale. The scrap market was depressed during the wreck removal, making scrap disposal difficult. A scrap sale arrangement for the first barge load was not concluded until 19 February, approximately one week after the barge PS-201 had been loaded. It would take the scrap dealer 5 days to offload the barge PS-201 after its arrival at his yard in Yabucoa on 20 February. By 11 March, another load of scrap was in place on the barge PS-201, which was moored at a buoy in the naval station harbor to wait until a San Juan scrapyard was ready to receive the scrap. The PS-201 was taken off charter after discharging her load of scrap in San Juan 18 - 20 March. The 5,000-ton (DWT), 250-foot barge SANTO DOMINGO, shown in Figure 5-3, was chartered 13 March to allow weight removal to proceed without interruption. SANTO DOMINGO would carry the fourth and final load of 1,326 tons of scrap to a dealer in Yabucoa on 3 April.

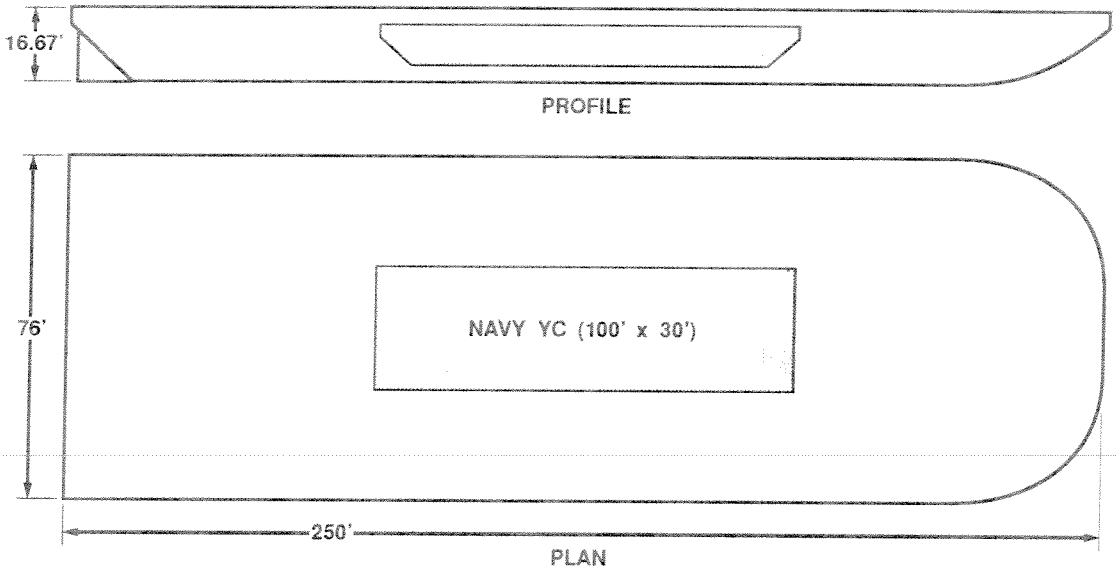


Figure 5-3. Scrap Barge SANTO DOMINGO as Compared with USN YC.

5-5.1.3 Weather. The sea state was a major factor limiting crane and barge operations. The stranding site, *Isla Cabras*, forms part of the southern boundary of *Bahia de Puerca*, a small cove at the eastern extremity of Puerto Rico (see Figure 1-1). As the cove opens to the southeast and *Isla Cabras* extends slightly beyond *Punta Puerca* on the north side of the cove, BROOKINGS was exposed to seas, swells, and weather from the north and east. Even moderate winds from the northeast quadrant could produce three-foot swells that would rise into 4- to 8-foot combers in the rapidly shoaling water around BROOKINGS (see Figure 3-1). Swells and surf were sufficient to damage vessels moored alongside and prohibit crane operations, especially operation of the YD-251 where any sea state coupled with the extreme height of the crane boom made for extremely dangerous rigging. Winds and swell from the south, on the other hand, left *Bahia de Puerca* undisturbed, even glassy. Lying in the path of the easterly trades, with prevailing winds from the north to east from November to April, southerly winds are the exception rather than the rule. The Naval Station harbor, located in an adjacent southwest-facing cove, is sheltered from the northeast trade winds. The exit channel and passage around the south side of *Isla Cabras*, however, are exposed to southerly winds and seas. Frequently, conditions were suitable for working alongside BROOKINGS, but not for moving a crane barge from the naval station harbor to the stranding site. Equipment casualties and delays in offloading scrap were particularly frustrating when they occurred during favorable weather windows.

5-5.2 Tide. The tides at Roosevelt Roads are semi-diurnal with an average tide range in the naval station harbor of about one foot. Tide tables prepared for the naval station harbor for the first three months of 1992 predicted lower low tides typically 0.08 to 0.22 feet below tidal datum, with higher high tides from 0.56 to 0.87 feet above datum. During the operation, salvors noted that the tide range at the stranding site seemed to be 3 to 6 inches greater than in the naval station harbor, for a maximum total tide range of 1.5 feet. With a *TPI* of about 43 tons for BROOKINGS, maximum variation in ground reaction was about 775 long tons. Plans were therefore made to ballast clean water tanks with about 275 long tons of seawater as weight removal progressed, to ensure that the hulk remained solidly grounded at all states of tide and swell.

5-5.3 Tug and Barge Operations. Movements of the 210-foot Crowley barge PS-201 was initially handled by the 2,200-horsepower Crowley tug hired at the same time, as was the YD-251. When equipment casualties or lack of a scrap market kept the barge PS-201 and the crane moored in the naval station harbor for extended periods, the tug was taken off hire to reduce costs. The Crowley tug was taken off hire after the arrival of the DONJON tug J. A. WITTE, which subsequently handled the crane barge OBS-2250, the 210-foot barge, and the 250-foot Crowley barge SANTO DOMINGO. MR RUDY, a shallow-draft, Fajardo-based pusher boat was hired to assist the tugs and handle the barges in the shallow water alongside BROOKINGS.

5-5.3.1 Barge Moorings. During weight removal operations, the cranes and scrap barges were made up to BROOKINGS with nylon mooring lines without laying outboard anchors. Additionally, six Yokohama fenders supplied by the naval station were used to protect the crane and scrap barges from self-destruction in the relentless sea swell. This arrangement avoided further damage to the coral reef, but meant that the craft could not remain at the site when a significant swell was running. In periods of inclement weather or when waiting on a scrap sale, the scrap barges were moored to a buoy in the naval station harbor.

5-5.3.2 Scrap Barges. The first scrap barge, PS-201, was a simple 210-foot, flat-topped, steel-decked, rake-bowed barge. The 250-foot SANTO DOMINGO, hired later in the operation, was better suited to hauling scrap. In addition to her larger size, SANTO DOMINGO's deck was sheathed with heavy timber, an important feature when hauling heavy scrap loads. The timber decking protected the barge deck from chafing and gouging by the scrap, but more importantly, helped prevent shifting as the heavy and sharp edged pieces of scrap bite into the wood. This is important as scrap is a high-volume cargo and must be piled high to even approach the barge's deadweight capacity. This is shown clearly in Figure 5-4. The 40-foot pile of scrap on the 5,000-ton (DWT) SANTO DOMINGO weighs approximately 1,325 long tons. SANTO DOMINGO was also fitted with 5-foot timber side and end bulwarks to help contain the scrap.

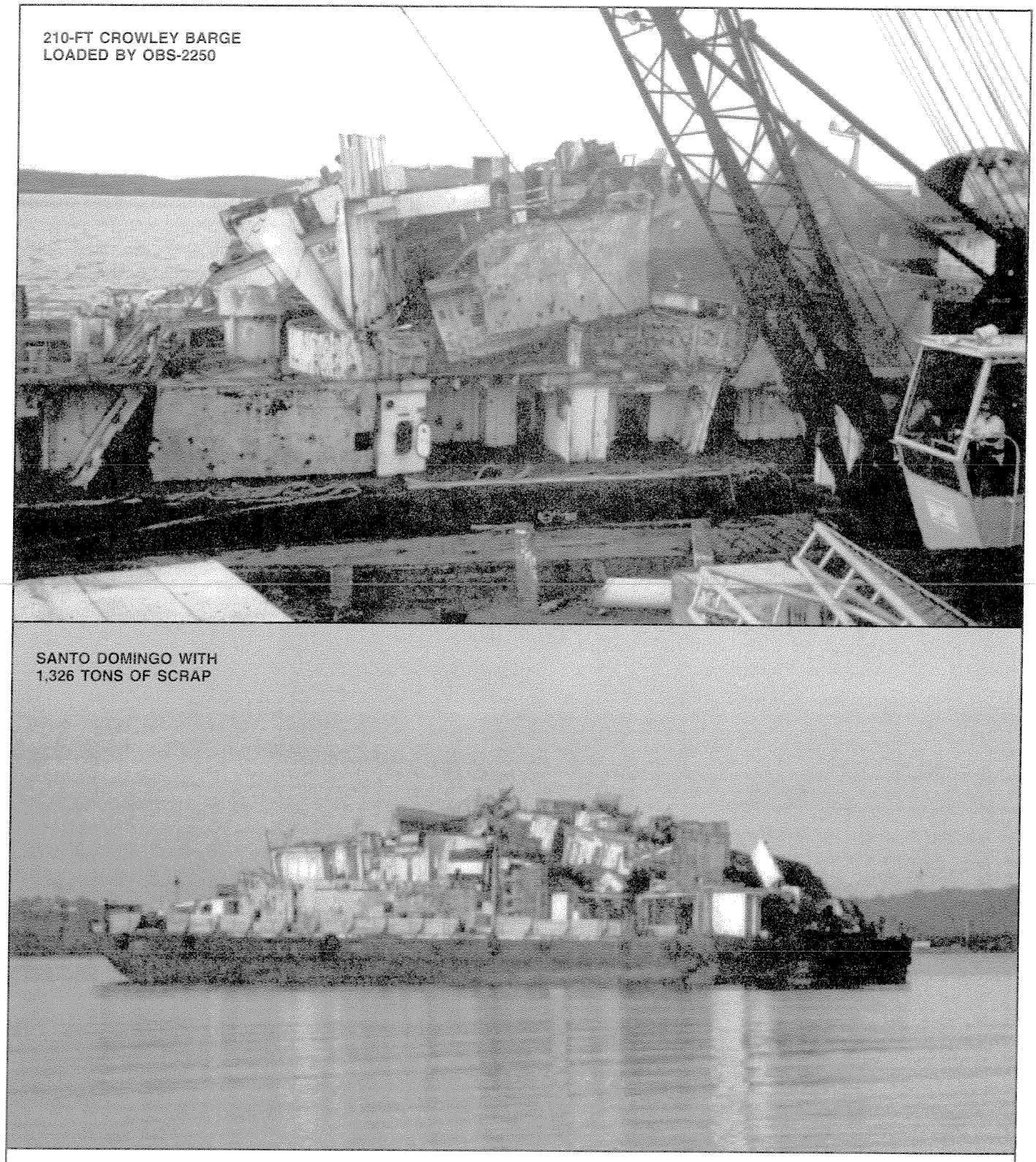


Figure 5-4. Scrap Barges.

5-5.4 Structural Cutting. The upper portions of the ship were broken by a burning crew using oxy-propane torches. In general, cutting progressed from top to bottom, one deck at a time, to the second deck over most of the ships length, and to the third deck over a 60-foot section at the bow. Cut lines were designated by the DONJON Marine salvage master. Typical cut lines are shown in Figure 5-5. The bulk of the cutting was conducted during periods when the crane and scrap barge were not at the site. Over 60 percent of all cutting was completed before cranes were used to offload structure. Preliminary cuts were made at the bases of the kingposts before YD-251 and the scrap barge were brought to the site, with the final cuts made after each kingpost had been rigged to the derrick so they could be lifted off directly and placed on the scrap barge, as shown in Figure 5-6. Deck houses, superstructure, and hull structure were cut into convenient-sized pieces, typically 10 to 20 feet long, 10 feet high (or depth of one deck) and 10 to 15 feet wide, as shown in Figure 5-7. The pieces were left in place until a crane and scrap barge were available. The main engine HP and LP turbines and condenser were lifted out individually after all asbestos insulation was removed. The machinery was freed by cutting their associated foundations from the tank top, lube oil lines, and steam lines. The main boilers, originally slated for removal, were left in place when it became apparent that they could not be removed easily without cutting access through the second deck, which would unacceptably weaken the hull girder. Deck machinery, galley gear, and laundry equipment were similarly removed as they were exposed by cutting foundations and connecting piping or electrical cables.

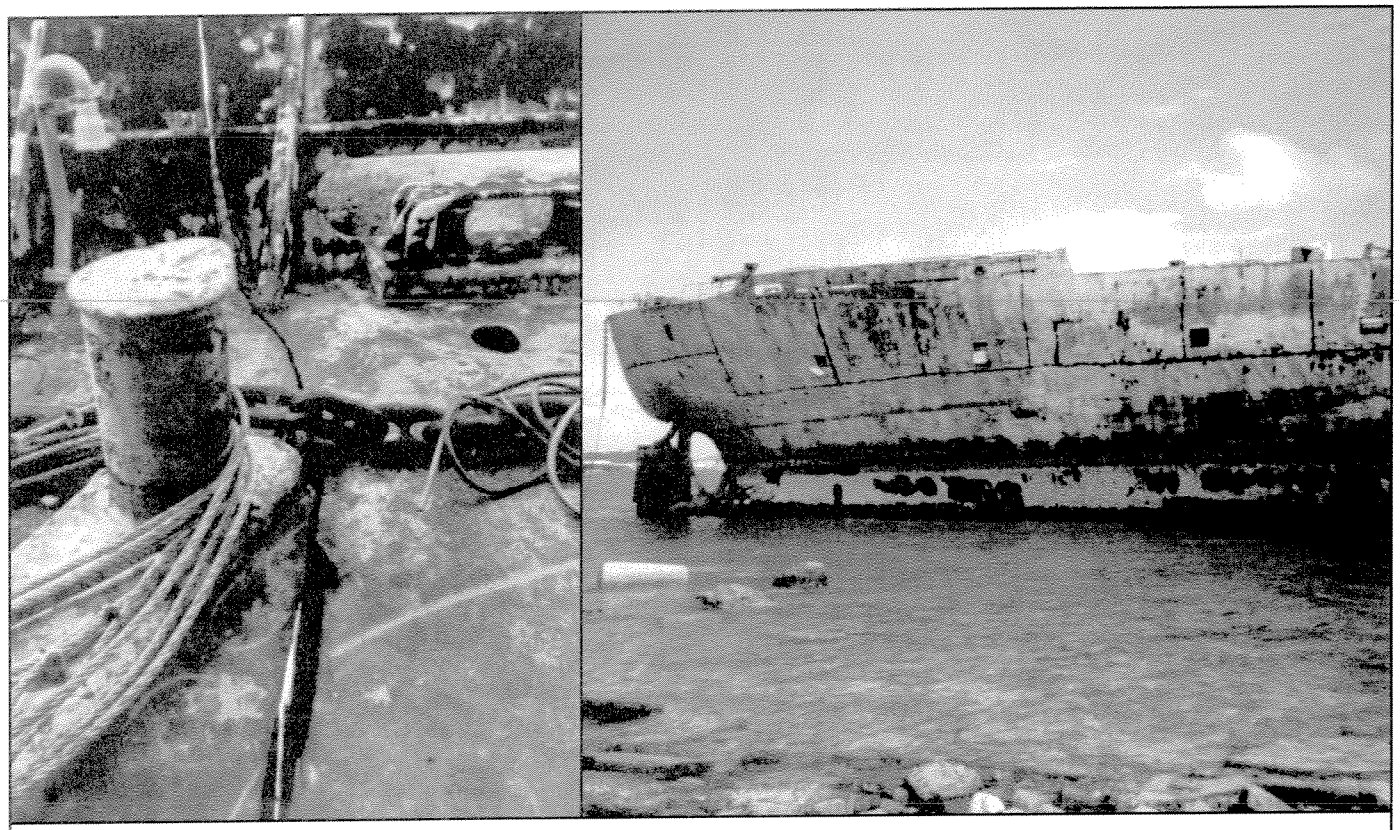


Figure 5-5. Cut Lines.

5-5.4.1 Preserving Hull Strength. As cutting of the hull structure progressed through the main deck, it was necessary to limit cutting until cut structure could be removed, to avoid overstressing the structure of the hulk that was to be towed to sea and sunk. Hull stresses were monitored by on-scene Navy and contractor salvage engineers as described in Chapter 4. As a preventive measure, the main deck over the midships quarterlength was left intact as long as possible.

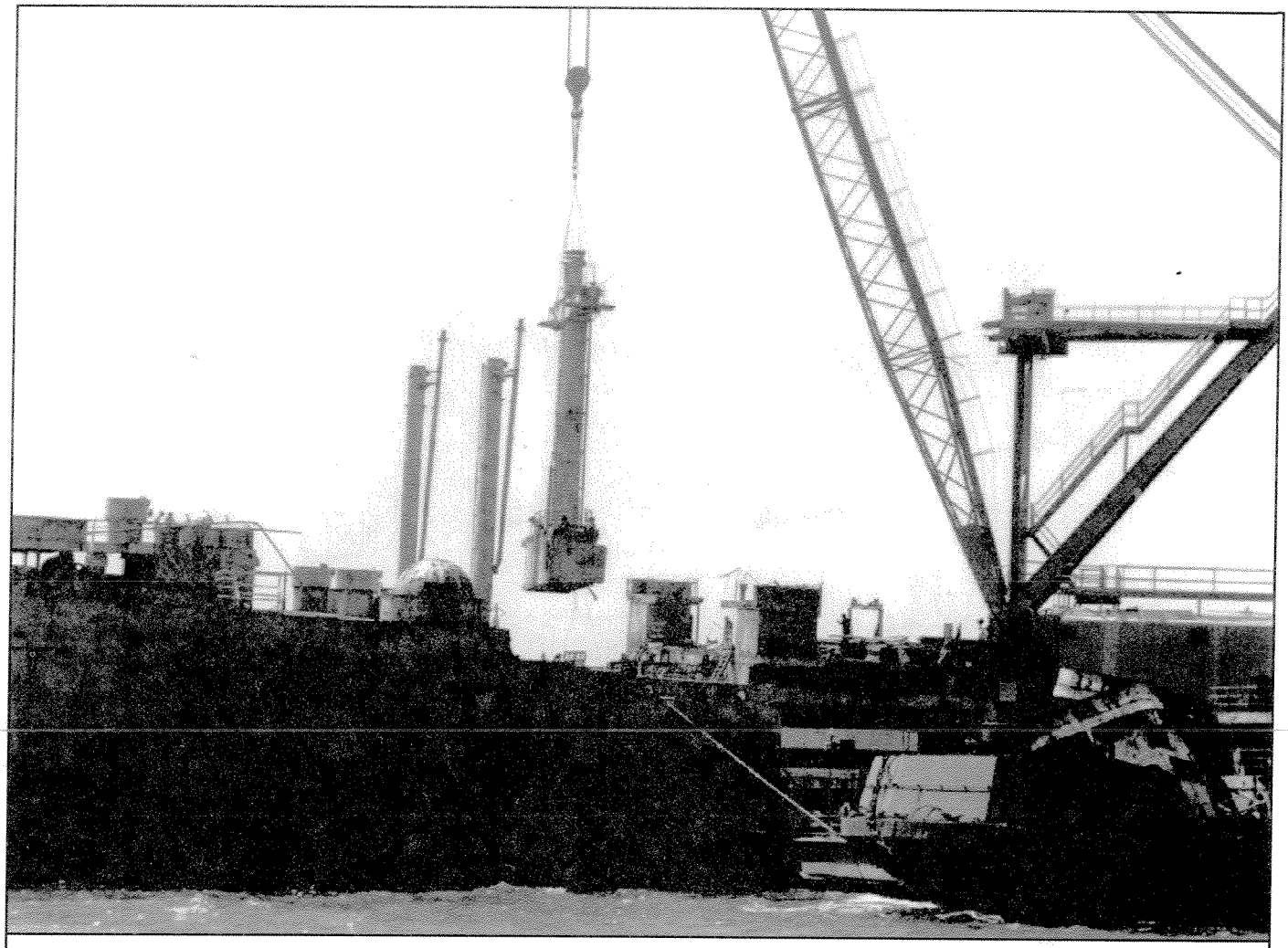


Figure 5-6. YD-251 Removing Kingposts.

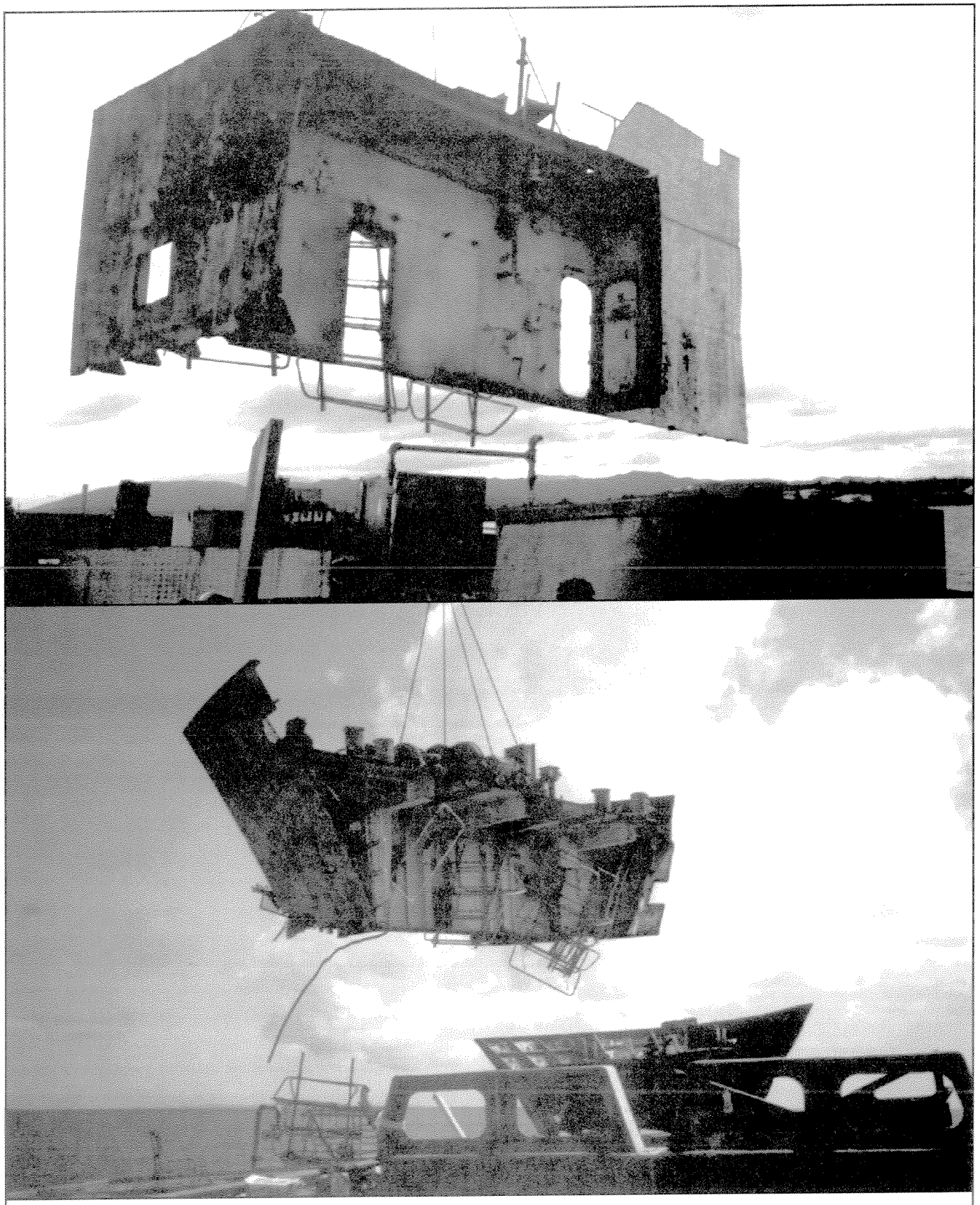


Figure 5-7A. Scrap Sections.

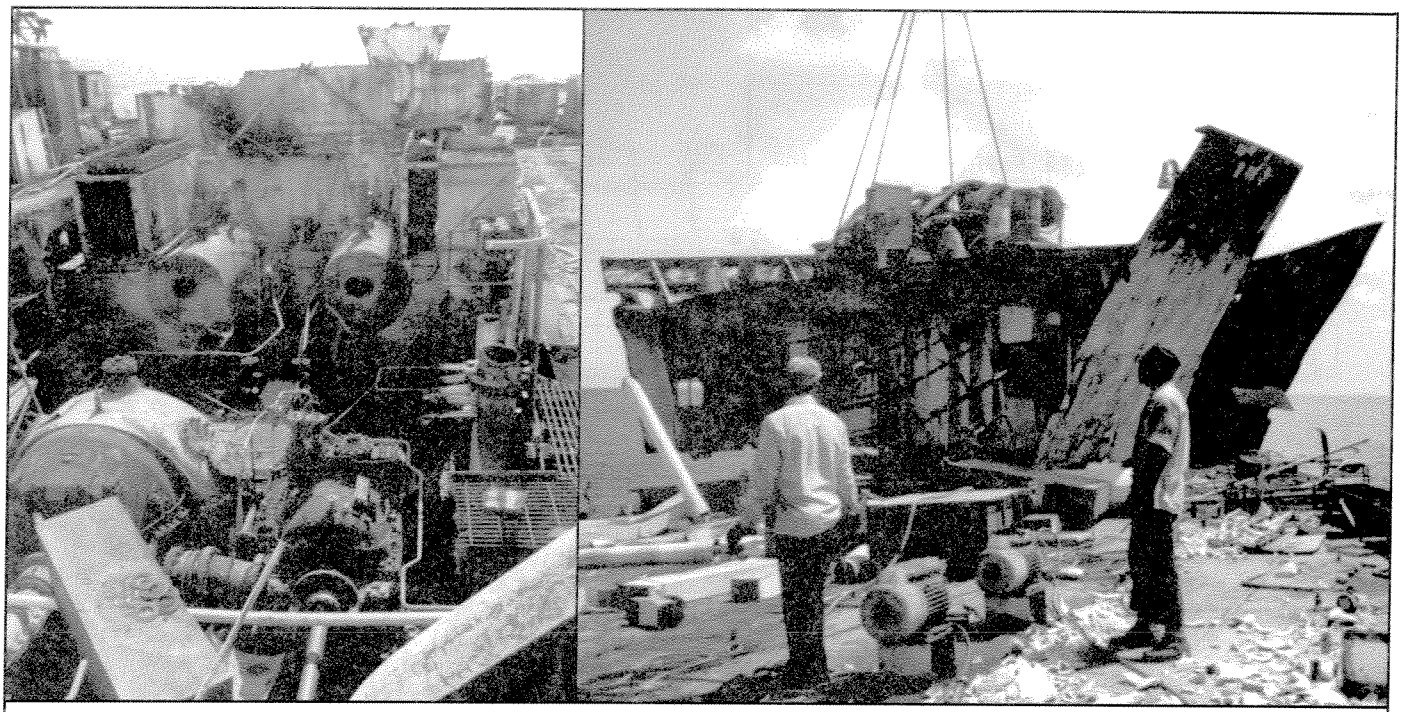


Figure 5-7B. Scrap Sections.

5-5.4.2 Scrap Lifts. For lifting, holes were cut in the top of each scrap section, often in the corners, to receive the hooks of a multi-leg sling. The slung sections were lifted, swung out, and placed directly on the scrap barge. Skill and experience of the crane operator had a direct bearing on the speed of the operation, and the amount of scrap that could be placed on the barge safely.

5-5.4.3 Ballasting. When BROOKINGS was stranded in September 1989, there was approximately 375 long tons of water ballast in tanks B-902-W, C-905-W, and C-906-W (see Figure 5-8). This ballast was in place so that BROOKINGS was trimmed by the stern for towing purposes while she was a target ship. On 16 March, after 1,200 tons of steel had been removed, BROOKINGS was loaded with additional ballast to keep her hard aground. This was accomplished by pressing up B-902-W, C-905-W, and C-906-W and filling the following water tanks and voids: B-903-W, B-904-W, C-301-W, and B-901-V (see Figure 5-8 for liquid load diagram). This ballasting provided an additional 374 long tons of ground reaction making total ballast on 16 March 649 long tons. On 25 March, after removing approximately 2,450 long tons from the wreck, slight movement was noticed at the bow. On 26 March, after removing approximately 2,500 long tons, BROOKINGS was noticeably lively. An underwater survey by the SUPSALV representative and MDSU-2 representative revealed that the hulk was in constant motion and had moved aft about 5 feet and swung her bow about 10 feet away from the beach. Fuel tank A-904-F was ballasted with 114 long tons of seawater to stop further movement. Seawater ballasting on the evening of 26 March totalled 857 long tons.

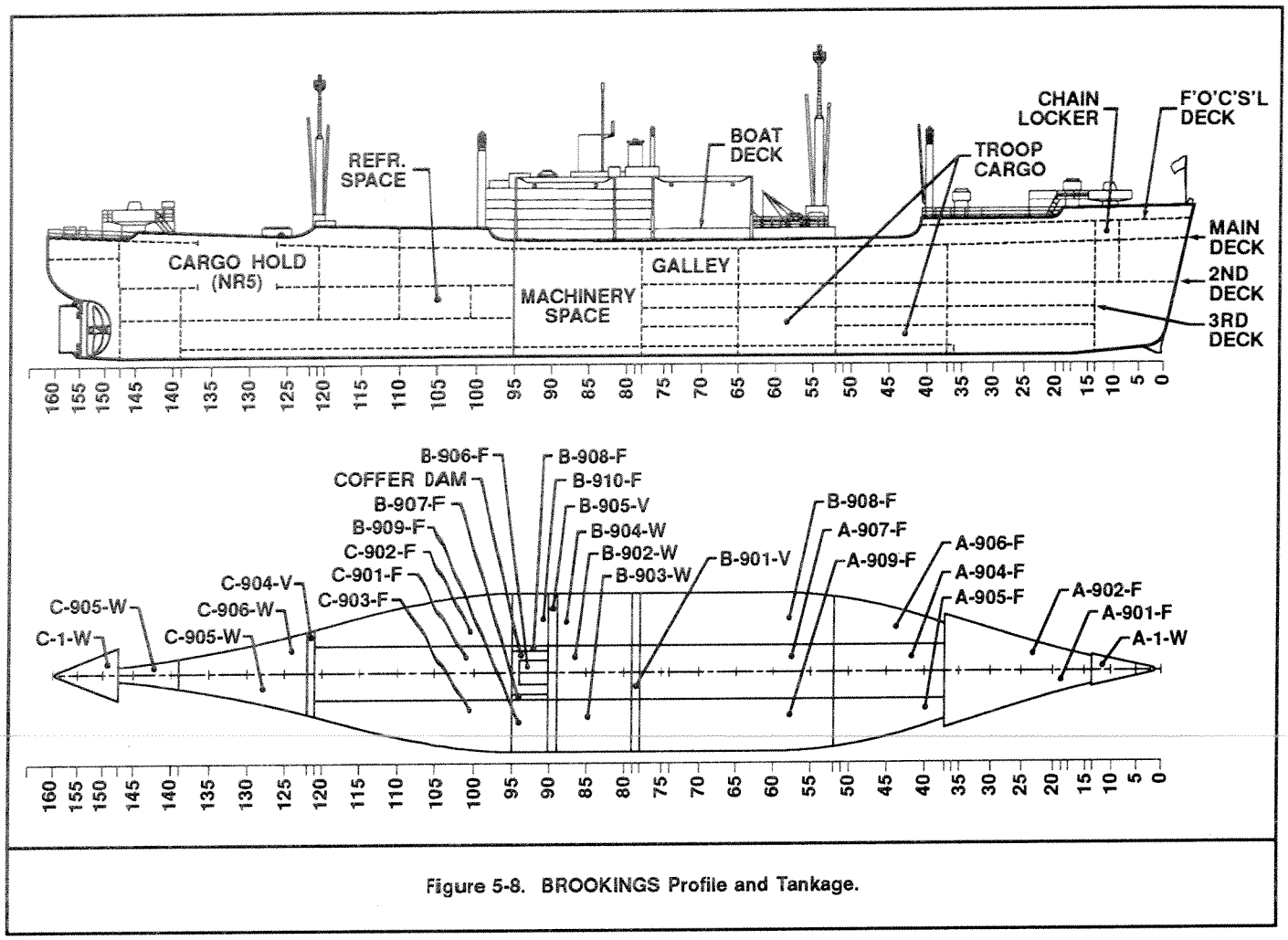


Figure 5-8. BROOKINGS Profile and Tankage.

5-6 REFLOATING AND SCUTTLING

By 27 March, considerable oily waste had accumulated in the machinery space bilges from severed lube oil lines to the main engine and reduction gear. All the waste oil was stripped into a tank truck on shore (see Figure 5-9) to prevent an oil spill during deballasting or scuttling. The HP and LP turbines were lifted off in the morning and main engine condenser in the afternoon. Dewatering pumps staged and made ready forward, midships, and aft.

The following day, with still air and a glass-calm sea, deballasting began at 0730. BROOKINGS was pulled off the strand at 1037 by the DONJON tug J. A. WITTE and berthed pierside with the assistance of a NAVSTA YTB to begin scuttling preparations (see Figure 1-1).

5-6.1 Preparation for Scuttling. The following preparations were made for at-sea scuttling between 28 and 31 March:

- All tank covers were opened and openings were cut in transverse bulkheads to allow progressive flooding,
- Salvaged machinery room gratings were welded over the cargo hold hatches and other openings on the second deck to prevent floating debris from exiting the wreck (see Figure 5-10),
- A tow-bridle was rigged, and
- Two hogging lines were rigged at the engine room and hold number 5, allowing placement of explosive charges against the hull. Explosive scuttling was selected as all sea chests and discharges had been welded closed when the ship was mothballed.

Figure 5-9. Stripping Bilges of Oily Waste.

5-6.2 Disposal. On 1 April 1992 BROOKINGS was towed to the designated scuttling site, 17°11'N, 65°37'W, by the tug J. A. WITTE, arriving at 0620 (dawn, see Figure 5-11). The tow bridle disconnected at 0640. Explosive ordinance disposal divers from EOD Detachment Roosevelt Roads and the MDSU-2 representative rigged two 20-pound charges on the hogging line under the engine room and two 20-pound charges on the hogging line underneath hold number 5. The charges were detonated at 0900. At 1030, ex-USS BROOKINGS slid stern first beneath the surface of the Caribbean to her final resting place in 14,000 feet of seawater (see Figure 5-12). No oil was released from the vessel, and three small pieces of debris that floated free were recovered and disposed of ashore.

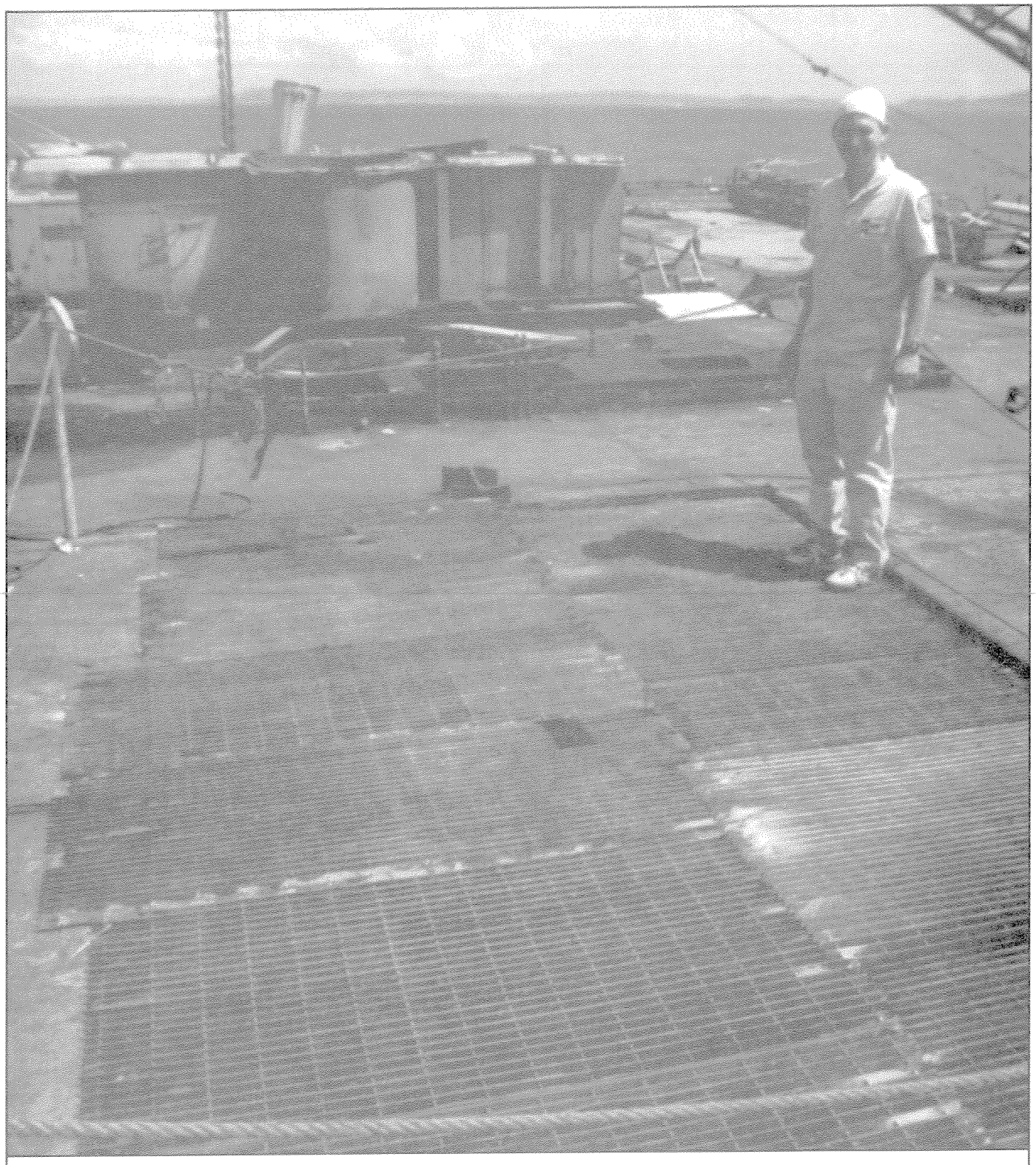


Figure 5-10. Gratings Over 2nd Deck Openings.

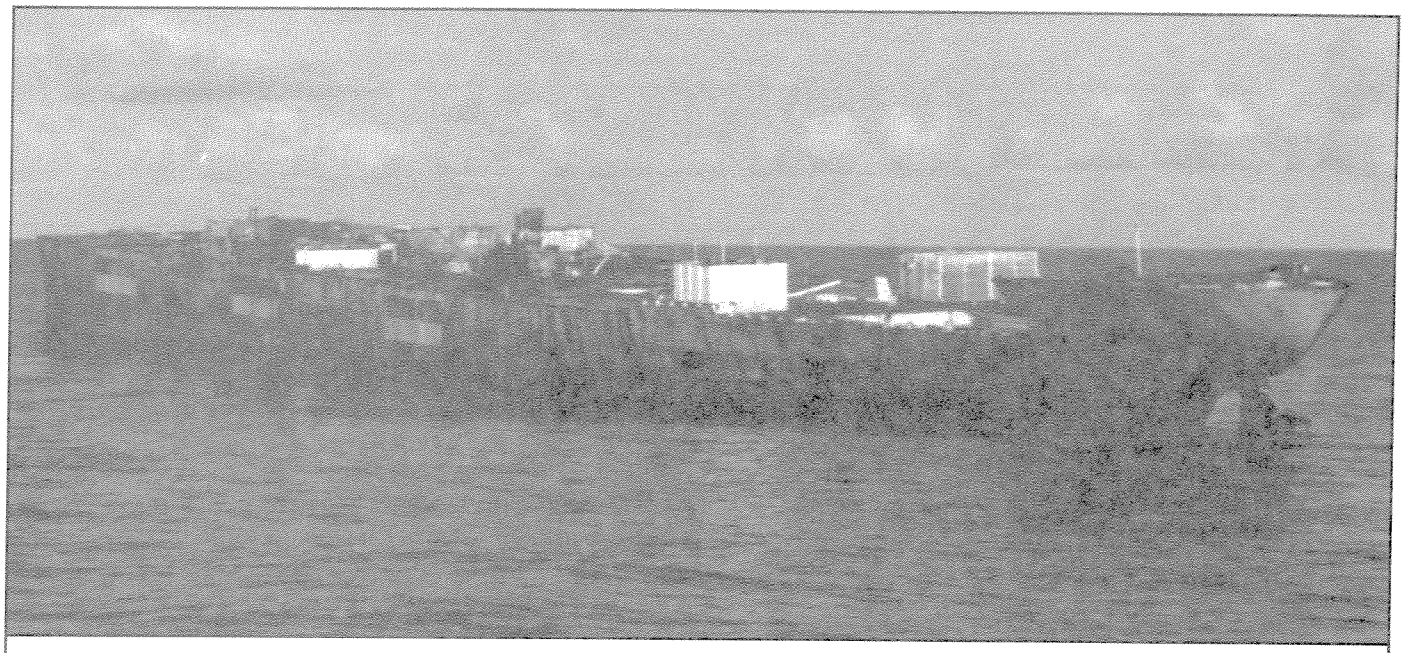


Figure 5-11. BROOKINGS Hulk at Scuttling Site.

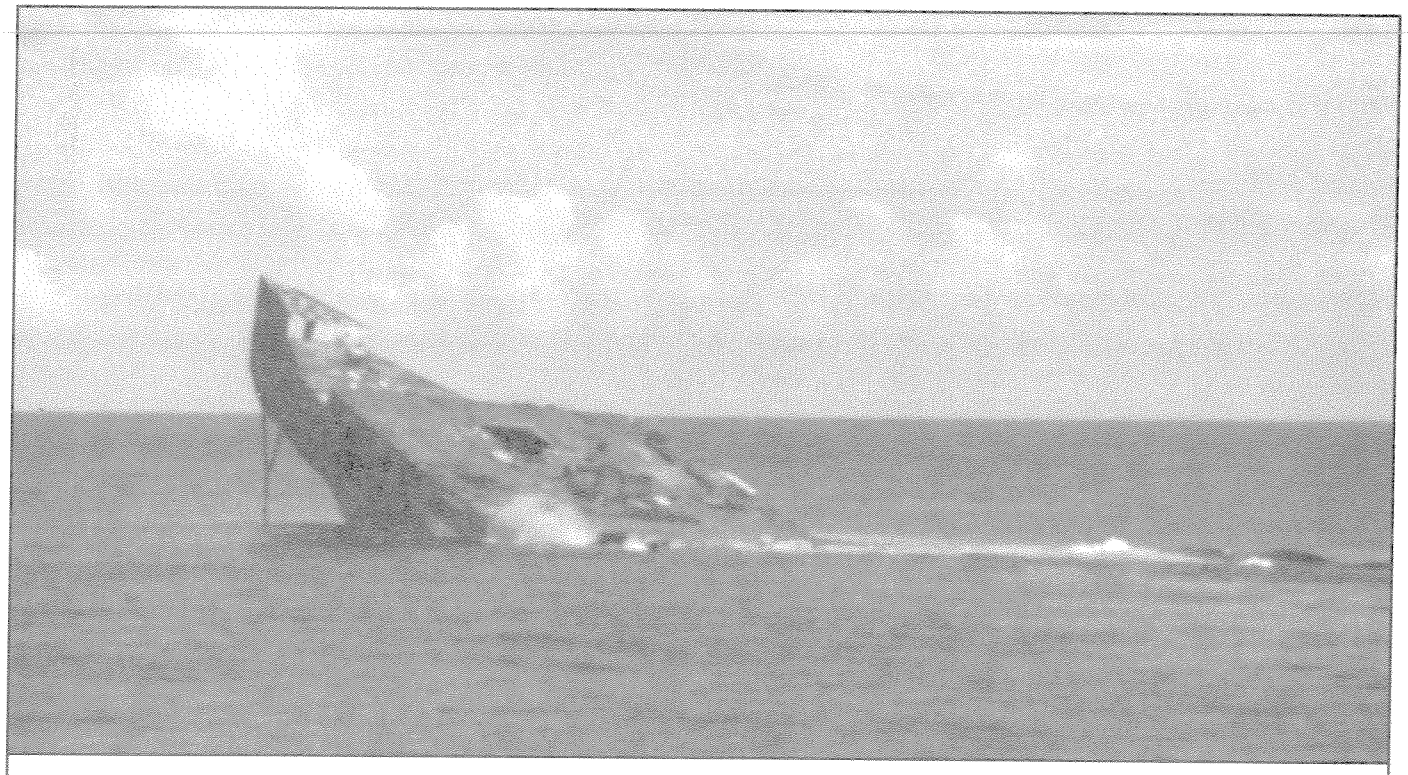


Figure 5-12. BROOKINGS Scuttled.

APPENDIX A

MESSAGES AND CORRESPONDENCE

Exhibits:

```
ADMINISTRATIVE MESSAGE
ROUTINE
R 131232Z AUG 91 ZYB
FM       PEOCMPANDUAV WASHINGTON DC//PEO\CU-CT//
TO       CNO WASHINGTON DC//43/225/354//
INFO     COMNAVAIRSYSCOM WASHINGTON DC//42//
         COMNAVSURFLANT NORFOLK VA//N3//
         COMNAVAIRLANT NORFOLK VA//60//
         NAVSTA ROOSEVELT ROAD RQ//90//
         COMNAVSEASYSCOM WASHINGTON DC//OOC/OOL/OOT//
         COMFAIRCARIB ROOSEVELT ROADS RQ//N3//
         NAVAIRTESTCEN PATUXENT RIVER MD//RD-20//
BT
UNCLAS //N03960//
SUBJ:    DISPOSAL OF TARGET HULK EX-BROOKINGS
MSGID/GENADMIN/PEOCMPANDUAV WASHDC//
REF/A/RMG/CINCLANTFLT041721Z/JUN 91//
REF/B/RMT/COMSUPPRON EIGHT/102012Z/JAN 90//
REF/C/RMG/PEOCMPANDUAV WASH DC/021430Z/MAR 90//
REF/D/CON/PEOCMPANDUAV/NAVSEA/11JUN91//
AMPN/PHONECON BTWN MR J STRATAKES (PEO\CU)-CT-10) AND MR. T.
SALMON\SEA-00C2).//
REF/E/CON/PEOCMPANDUAV/NAVSEA/07AUG91//
AMPN/PHONCON BTWN CAPT R. KELLY \PEO(CU)-CA) AND MR. T. SALMON (SEA-
00C2(.//
RMKS/1.  REF A REQUESTED NAVAIR TAKE LEAD TO RESOLVE DISPOSAL OF EX-
BROOKINGS TARGET HULK.  NAVAIR HAS FORWARDED REF A TO ORIG FOR
ACTION.
2.  EX-BROOKINGS WAS BEACHED AT NAVSTA ROOSEVELT ROADS DURING
HURRICANE HUGO. FUNDS PROVIDED CINCLANTFLT TO CLEAN UP STORM DAMAGE
DID NOT COVER REF B ESTIMATE OF $2M FOR SALVAGE OF EX-BROOKINGS.  BY
REF C, ORIG NOTIFIED OP-642 & OP-354 FUNDING NOT AVAILABLE TO
SUPPORT RECOVERY.  SUBSEQUENTLY, RECOVERY EFFORTS FOR EX-BROOKINGS
WERE TERMINATED.  ALTHOUGH NAVSTA ROOSEVELT ROADS HAS PROPOSED
OPTION OF REMOVAL AT NO COST TO GOVERNMENT, FURTHER ACTION HELD IN
ABEYANCE UNTIL FEASIBILITY IS RESOLVED.
3.  FOLLOWING COURSE OF ACTION RECOMMENDED TO DISPOSE OF EX-
BROOKINGS:
    A.  CNO (OP-43) TASK NAVSEA \SEA-00C) TO CONTRACT FOR REMOVAL
AND DISPOSAL OF EX-BROOKINGS.  REF D DISCUSSIONS INDICATED SEA-00C
HAS TECHNICAL EXPERTISE REQUIRED, WAS WILLING TO TAKE ON
RESPONSIBILITY IF TASKED, AND HAS SALVAGE CONTRACT ALREADY IN PLACE
WHICH COULD SUPPORT EFFORTS.  BY REF E, SEA-00C INDICATED THAT FIRST
STEP WOULD BE TO DEVELOP DISPOSAL PLAN AND REFINE COST ESTIMATE.
POSSIBILITY OF USING SALVAGE FIRM WILLING TO REMOVE HULK AT NO COST
TO GOVERNMENT WOULD BE EXAMINED,
    B.  CNO \OP-35 & 22) ASSIST IN IDENTIFYING O&MN FUNDS TO SUPPORT
DISPOSAL EFFORT.  ORIG HAS NO FY91 OR FY92 FUNDS TO SUPPORT DISPOSAL
EFFORTS.  ADDITIONAL FUNDING WILL BE NECESSARY TO PREVENT IMPACT ON
IN-SERVICE TOMAHAWK MISSILES.
4.  OUR POC IS JAY STRATAKES, PEO(CU)-CT10, AV-222-6896, COMM (703)
692-2896.//
BY
```

Exhibit A-1. PEOCMPANDUAV WASHINGTON DC 131232Z AUG 91.

ROUTINE
R 091947Z SEP 91 ZYB
FM CNO WASHINGTON DC//43//
TO COMNAVSEASYSCOM WASHINGTON DC//SEA00C//
INFO PEOCMPANDUAV WASHINGTON DC//PEOCU-CT10//
COMNAVAIRSYSCOM WASHINGTON DC//42//
COMNAVSEASYSCOM WASHINGTON DC//00L/DOT//
CINCLANTFLT NORFOLK VA//N44//
COMNAVSURFLANT NORFOLK VA//N3//
COMFAIRCARIB ROOSEVELT ROADS RQ//N3//
NAVSTA ROOSEVELT ROAD RQ//90//
NAVAIRTESTCEN PATUXENT RIVER MD//RD-20//

UNCLAS //N03960//
SUBJ: DISPOSAL OF TARGET HULK EX-BROOKINGS
MSGID/GENADMIN/OPNAV 431//
REF/A/PEOCMPANDUAV WASH DC/131232Z AUG91//
RMKS/
1. REQUEST COMNAVSEASYSCOM (SEA-00C) INITIATED PROCEDURES TO CONTRACT FOR REMOVAL AND DISPOSAL OF EX-BROOKINGS. IF CONTRACT CANNOT BE EXECUTED AT NO COST TO GOVERNMENT, PEOCMPANDUAV WILL BE RESPONSIBLE FOR PROVIDING FUND CITE.//BY

Exhibit A-2. CNO WASHINGTON DC 091947Z SEP 91.

ROUTINE
R 110030Z SEP 91 ZYB PSN 646836M33
FM COMNAVSEASYSCOM WASHINGTON DC//00C//
TO CNO WASHINGTON DC//43/64/36//
NAVSTA ROOSEVELT ROAD RQ//90/18//
PEOCMPANDUAV WASHINGTON DC//PEOCU-CT10//
INFO COMLOGGRU TWO
COMSUPPRON EIGHT
COMNAVAIRSYSCOM WASHINGTON DC//42//
CINCLANTFLT NORFOLK VA//N44//
COMNAVSURFLANT NORFOLK VA//N3//
COMFAIRCARIB ROOSEVELT ROADS RQ//N3//
NAVAIRTESTCEN PATUXENT RIVER MD//RD-20/RD-64//

BY
UNCLAS //N04740//
SUBJ: DISPOSAL OF TARGET HULK EX-BROOKINGS
MSGID/GENADMIN/NAVSEA//
REF/A/RMG/CNO WASHINGTON DC/091947Z SEP 91/-/NOTAL/-
AMPN/REQ CONTRACT ACTION FOR TARGET HULK REMOVAL AND
IDENTIFIES FUNDING SOURCE//
REF/B/TEL/NAVSTA ROOSEVELT ROADS RQ/10SEP91//
AMPN/BTWN ROOSEVELT ROADS RQ CDR YBANEZ AND NAVSEA JIM BLADH/
REF/C/TEL/COMSUPPRON 8/10SEP91//
AMPN/BTWN COMSUPPRON 8 CDR NIBBS AND NAVSEA JIM BLADH
RMKS/1. IRT REF A, INTEND CONDUCT PRELIMINARY SURVEY WITH
SALVAGE CONTRACTOR AT ROOSEVELT ROADS SECOND WEEK OF OCT 91
TO IDENTIFY LOCAL RESOURCES. NAVSTA SUPPORT AND GFE
AVAILABLE TO SUPPORT OPS.

2. THIS OPERATION WILL BE CONDUCTED IN TWO PHASES. PHASE
ONE WILL BE A DETAILED SURVEY OF THE HULK AND DEVELOPMENT OF
SALVAGE/REMOVAL PLAN. PHASES TWO WILL IMPLEMENT THE PLAN.

3. FOR PEOCMPANDUAV: REQ 20K TO ACTIVATE PHASE ONE. NAVY
ASSETS WILL BE USED, WHEN POSSIBLE, TO DEFRAY COSTS.

4. FOR NAVSTA ROOSEVELT ROADS: REQUEST POC TO DISCUSS LOCAL
SUPPORT AND ENVIRONMENTAL RESTRICTIONS WHICH MAY IMPACT
REMOVAL EFFORT. REF B REFERS.

5. ANTICIPATE FLEET PARTICIPATION TO EXTRACT HULK ONCE
SUFFICIENT TOP SIDE WEIGHT HAS BEEN REMOVED. AS DISCUSSED
REF C, FLEET DIVERS CAN PROVIDE BOTTOM SURVEY TO DETERMINE
HULL CONDITION.

6. NAVSEA 00C POC JIM BLADH 703-697-7403, A/V 227-7403.//
BY

Exhibit A-3. COMNAVSEASYSCOM WASHINGTON DC 110030Z SEP 91.

DEPARTMENT OF NATURAL RESOURCES

December 4, 1991

Rear Admiral L. F. Norton
Commander, Fleet Air Caribbean
Department of the Navy
FPO Miami 34051-8000

Dear Admiral Norton:

I have the following comments for your consideration with regard to the salvage plan prepared by DonJon Marine Co., Inc, [1] for the removal of the target vessel Ex-Brookings, now aground at NAVSTA Roosevelt Roads.

(1) The removal of the superstructure and machinery as necessary to attain the required residual buoyancy for refloating is endorsed by this agency as the best wreck-removal alternative from an environmental point of view.

(2) For the ship-breaking operation, the method of steel scrap removal using a floating crane is endorsed. I understand that the steel removed will be placed on a barge and sold for recycling purposes. Use of the floating crane method avoids further damage to the reef as a result of the removal operation.

(3) The DNR endorses the disposal of the vessel as per 40 CFR Parts 229.2 or 229.3. I understand that the U.S. Navy anticipates scuttling the wreck in water at least 1,000 fathoms deep and at least 50 nautical miles north of Cabo San Juan, as discussed in the December 3, 1991 meeting. Disposal in that area is acceptable to this agency.

(4) The disposal of the asbestos containing material by removal in accordance with EPA regulations, double bagging in specially designated plastic refuse bags and sealing the material in the double bottom tanks is endorsed. However, I recommend that the material be encapsulated in cement, if feasible, to avoid release of floating asbestos material if the hull is breached when the vessel strikes the bottom.

---

[1]. Salvage Plan, Technical Volume; Removal of Ex-Brookings aground at NAVSTA Roosevelt Roads. Performed for the Commander NAVSEASYSCOM Supervisor of Salvage, Contract No. N00024-90-D-4148, Delivery Order 0011; By Donjon Marine Co., Inc., 1250 Liberty Ave., Hillside, NJ 07205 (Zone A - Salvage Contractors) as presented and discussed on 3 December 1991 by your staff, NAVSEASYSCOM and Donjon representatives at COE meeting.

Exhibit A-4A. Commonwealth of Puerto Rico Department of Natural Resources Letter of 4 December 1991 (Page 1).

(5) The contractor shall take all appropriate measures to remove, to the maximum extent possible, all materials that may cause degradation to the marine environment as per 40 CFR 229.2 or 229.3. This includes removal of residual amounts of fuel, lubricants, hydraulic fluids and readily detachable materials capable of causing floating debris. The vessel must be basically oil free and any floating debris that surfaces after scuttling should be picked up. The Contractor should remain on the scene for a reasonable period of time to determine if buoyant materials come to the surface.

(6) I recommend that great care be exercised in the placement of the crane/barge anchors to avoid or minimize damage to the marine habitat during the wreck removal operation.

(7) Care must be taken when dewatering the double bottom tanks (during refloating) to avoid marine pollution by release of oils and residual substances.

(8) The Contractor should prepare an Oil Pollution Contingency Plan to deal with accidental discharges resulting from the wreck-removal operation. The contractor should have staged on board pollution control equipment such as containment boom, absorbent sausage boom, absorbent; he should also have specially designated small craft for pollution containment. It is the responsibility of the salvage master to assess any discharge and determine if it may be contained/cleaned up with the resources available, or if the discharge is beyond the containment/cleanup capability at hand. In the latter case the Salvage Master should contact and contract such outside assistance as may be required. Qualified cleanup contractors in the area should be identified to ensure a quick response.

(9) We would appreciate receiving a brief report containing the scuttling coordinates. This may be done by FAX, on your behalf by the Contractor, upon termination of the operation.

The Salvage Plan presented by Donjon Marine Co., Inc., is environmentally acceptable to this agency. Removal of this wreck and its proper disposal in deep water is a major step in the restoration of the marine habitat affected by this grounding.

I wish to congratulate you and the Naval Sea Systems Command for the effective actions taken to resolve this environmental problem. Thank you for inviting us to comment. If we can be of further assistance please contact the office of the Assistant Secretary for Research (Dr. Eduardo Cardona) at 809-722-1429.

Sincerely yours,

Santos Rohena Betancourt
Secretary

Exhibit A-4B. Commonwealth of Puerto Rico Department of Natural Resources Letter of 4 December 1991 (Page 2).

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Caribbean Field Office
P.O. Box 491
Boquerón, Puerto Rico 00622

December 6, 1991

Jose R. Negrón
Director
Environmental Engineering Division
Department of the Navy
U.S. Naval Station, Roosevelt Roads
Ceiba, P.R. 00735

Dear Mr. Negrón:

Our office wishes to confirm our meeting resolutions of December 3, 1991 held at the U.S. Army Corps of Engineers facilities in San Juan, P.R. concerning the removal and disposal of the cargo-carrying vessel "Ex Brooking." It is anticipated that approximately 2,900 tons of above deck steel including the engine room machinery will be removed prior to re-floating. The parts removed will be placed on a barge and sold for scrap recycling purposes. After removing the excess weight, the residual hull will be re-floated and sunk.

Our office believes that the removal and disposal of the vessel will have very little impact on the marine resources and wildlife of the site. The vessel will be sunk at least 50 miles from Cabezas de San Juan, and in no less than 1000 fathoms in accordance with 40 CFR 229.2. The site proposed for the disposal of the vessel is far from special aquatic sites (e.g. coral reefs, seagrass beds) and from foraging grounds of marine endangered species (e.g. sea turtles and manatees). Furthermore, our office is satisfied with the proponent in selecting the least impacting alternative to remove the Ex-Brooking. The cleaning of the vessel prior to the dumping as proposed (e.g. removal of the asbestos covering the majority of the piping, the removal of fuel and lubricants) will also make the disposal of the vessel more environmentally compatible.

However, the Ex-Brooking did cause severe damage to the reef as it drifted towards the shore during Hugo, and continues to impact the marine environment while remaining grounded on a coral reef at Isla Cabras, within the confines of Roosevelt Roads Naval Base at Ceiba, P.R. Our office wishes to propose for consideration an on-site, in-kind mitigation to compensate for the damage inflicted upon the reef. The proposed mitigation may be achieved with the joint efforts of all agencies concerned with the removal and disposal of the Ex-Brooking.

Exhibit A-5A. U.S. Department of the Interior Letter of 6 December 1991 (Page 1).

The Ex Brooking was originally tied up to a mooring buoy and broke loose as Hurricane Hugo swept the north east coast of Puerto Rico in September 18, 1989. The vessel drifted towards the northern shore of Isla Cabras impacting a fringing reef. One of our biologists (Dr. Vance P. Vicente) inspected the reef for damage assessment purposes. With respect to the position of the ship on the reef, our findings are similar to those included in the Salvage Plan Technical Volume (page 4 and 5) in that: the vessel is sitting on hard bottom throughout the midship section; the bow and stern have some clearance from the bottom; and, that the rudder shoe is in direct contact with the bottom.

The following ecological impacts were observed during the evaluation. The vessel had direct and indirect impacts on the fringing reef. The direct impacts consisted of the crushing and transformation of live elkhorn coral (Acropora palmata), finger coral (Porites porites) and of other corals (Montastrea annularis) into coral rubble and coarse sand. Indirect impacts were caused by the actual position of the vessel after drifting towards shore. The vessel created a depositional environment between the vessel itself and the shoreline. As a consequence, sediments and brown algae (e.g. Padina sp., Dictyota sp.) have killed practically all remaining live corals. Corals killed by siltation and overgrowth still remain in standing position. An in-kind, on-site mitigation, as explained below, should be considered.

Once the vessel is removed, the impacted benthic (= bottom) environment will become re-exposed to normal wave action, natural surface current patterns, and increased water transparency. Under these conditions, elkhorn corals and other reef components will eventually establish naturally. At present, however, available dead reef surfaces are not adequate for the settling of coral larvae (planulae). Natural coral recruitment may be enhanced by removing the thick algal mats and sediments that have developed over dead coral surfaces. This may happen naturally and readily if herbivore populations (parrot fishes, sea urchins) restore quickly, but clearing the thick algal mats by hand and transplanting live elkhorn segments will accelerate the recovery of the coral reef.

The following conditions make the above mitigation task feasible: 1) the impacted coral reef is close to shore;2) it is next to an existing road at Isla Cabras; 3) It is very accessible from the sea (Bahia de Puerca); 4) it is a shallow and small reef; and, 5) necessary conditions for coral growth will be restored once the vessel is remove. Furthermore, transplants of elkhorn coral (Acropora palmata) is quite feasible since the genus Acropora is one of the fastest growing scleractinian coral in the Caribbean. Transplant techniques are simple. Clonal segments of Acropora are chipped from a parent colony with a hammer and chisel. The segments (10 x 10 cm) are then kept and transported in a bucket with sea water to the transplanting site.

Exhibit A-5B. U.S. Department of the Interior Letter of 6 December 1991 (Page 2).

The bottom surfaces (hard and stable substrate) are brushed clean or sterilized with small amounts of formalin. Once the surfaces are cleaned, the coral segments are glued to the substrate with non-toxic underwater epoxy.

Please do not hesitate to contact our office for any further assistance.

Sincerely,

James P. Oland
Field Supervisor

vpv
cc:
COE, San Juan
COE, Jacksonville
EPA, San Juan
EPA, New York
NMFS, Florida
CFMC, San Juan

Exhibit A-5C. U.S. Department of the Interior Letter of 6 December 1991 (Page 3).

ADMINISTRATIVE MESSAGE
PRIORITY
P 100030Z DEC 91 ZYB PSN 275730M24
FM COMNAVSEASYSCOM WASHINGTON DC//00C//
TO CNO WASHINGTON DC//43/603G/36/354/225/45//
INFO PEOCMPANDUAV WASHINGTON DC//PE0CU-CT10//
COMSUPPRON EIGHT
MCBDIVSALU TWO
COMNAVAIRSYSCOM WASHINGTON DC//42//
COMLOGGRU TWO
CINCLANTFLT NORFOLK VA//N44//
COMNAVSURFLANT NORFOLK VA//N3//
NAVSTA ROOSEVELT ROAD RQ//90/18//
COMFAIRCARIB ROOSEVELT ROADS RQ//01/N3//
NAVAIRTESTCEN PATUXENT RIVER MD//RD-20/RD-64//
BY
UNCLAS //N04740//
SUBJ: EX-BROOKINGS, SALVAGE AND DISPOSAL
MSGID/GENADMIN/NAVSEA//
REF/A/RMG/CNO /091947ZSEP91//
AMPN/CNO TASKING, EX-BROOKINGS REMOVAL//
REF/B/DOC/CODE OF FEDERAL REGULATIONS//
AMPN/TITLE 40 PART 229.2 OCEAN DUMPING//
REF/C/TEL/CNO/9DEC91//
AMPN/BTWN CNO CAPT RENARD/NAVSEA (00C22) JIM BLADH//
RMKS/1. IRT REF A, ORIG WAS REQUESTED TO INITIATE PROCEDURES TO CONTRACT FOR REMOVAL AND DISPOSAL OF EX-BROOKINGS. PROJECT HAS BEEN FUNDED BY PEOCMPANDUAV. ACCORDINGLY A SALVAGE SURVEY HAS BEEN COMPLETED AND A SALVAGE PLAN DEVELOPED.
2. THE MOST COST EFFECTIVE PROCEDURE, MINIMIZING IMPACT ON SURROUNDING BEACH AND REEF AREA, IS TO BREAK AND REMOVE APPROX 2600 LONG TONS OF STEEL AND FLOAT THE REMAIN 4,220 LONG TONS OF THE HULK TO A DISPOSAL SITE FOR SINKEX IN ACCORDANCE WITH REF B. SCRAP REMOVAL WILL BE ACCOMPLISHED BY UTILIZATION OF A FLOATING CRANE AND SCRAP BARGE FROM THE SEAWARD SIDE OF THE HULK. ARRANGEMENTS HAVE BEEN MADE FOR A LOCAL DEALER TO ACCEPT THE SCRAP.
3. THE CONDITION OF HULK PRECLUDES EXTENSIVE ONBOARD PCB SURVEY, HOWEVER, SALVAGE PLAN WILL ADDRESS REMOVAL, TO MAXIMUM EXTENT PRACTICABLE, OF PCB ITEMS KNOWN TO EXIST ON THIS SHIP TYPE PRIOR TO SINKING.
4. A MEETING WAS HELD IN SAN JUAN PR 3 DEC 91 WITH REPRESENTATIVES FROM NAVSEA 00C, ENVIRONMENTAL MANAGER NAVSTA ROOSEVELT RDS, DEPARTMENT OF NATURAL RESOURCES (DNR) PR, US FISH AND WILDLIFE SERVICE AND ACOE. IT WAS AGREED BY ALCON THAT THE REMOVAL EFFORT SHOULD COMMENCE EARLIEST USING THE ABOVE SALVAGE/DISPOSAL PLAN.
5. AS DISCUSSED REF C, OPERATION WILL BE CONDUCTED IN TWO PHASES. PHASE 1 WILL REMOVE TOPSIDE WEIGHT. PHASE 2 WILL INCLUDE DISPOSAL OF REMAINING HULK BY SINKING OR BY BREAKING THE ENTIRE HULK. PHASE 2 COURSE OF ACTION WILL DEPEND ON ABILITY TO SATISFACTORILY REMOVE TO MAXIMUM EXTENT PRACTICABLE REMAINING PCBS AND ON OP-43 AUTHORIZATION. BREAKING THE HULK IN LIEU OF SINKING WILL INCREASE COST FM 1.9m TO APPROX 3.4M.
6. ORIG INTENDS TO COMMENCE MOBILIZATION OF SALVAGE ASSETS LATE DEC91 AND COMMENCE PHASE 1 OPS EARLY JAN92.
7. ORIG POC JIM BLADH, 00C22, (703) 607-2758, A/V 327-2758.//
BY

Exhibit A-6. COMNAVSEASYSCOM WASHINGTON DC 100030Z DEC 91.

ADMINISTRATIVE MESSAGE

ROUTINE

R 172151Z DEC 91 ZYB

FM CNO WASHINGTON DC//43//

TO COMNAVSEASYSCOM WASHINGTON DC//00C/00T/RM5330//

INFO PEOCMPANDUAV WASHINGTON DC//PEOCU-CT10//
COMSUPPRON EIGHT
MOBDIVSALU TWO
COMNAVAIRSYSCOM WASHINGTON DC//42//
COMLOGGRU TWO
CINCLANTFLT NORFOLK VA//N44//
COMNAVSURFLANT NORFOLK VA//N3//
NAVSTA ROOSEVELT ROAD RQ//90//
COMFAIRCARIB ROOSEVELT ROADS RQ///01/N3//
NAVAIRTESTCEN PATUXENT RIVER MD//RD-20/RD-64//

BY
UNCLAS //N04740//
MSGID/GENADMIN/OPNAV 431//
SUBJ/EX-BROOKINGS SALVAGE AND DISPOSAL//
REF/A/RMG/COMNAVSEASYSCOM/100030ZDEC91//
RMKS/

1. REF A PROVIDED A SALVAGE PLAN FOR BROOKINGS. IT DEFINED A TWO PHASE PLAN - PHASE ONE REMOVING TOPSIDE WEIGHT AND PHASE TWO EITHER BREAKING THE ENTIRE HULK OR UNDERTAKING OCEAN DISPOSAL. REF A REQUESTED AUTHORIZATION FOR PHASE TWO OCEAN DISPOSAL.

2. UPON COMPLETION OF PHASE ONE, REQUEST INITIATE PCB SURVEY. BASED UPON RESULTS OF SURVEY AND EPA RESPONSE TO NAVSEA LETTER REQUESTING APPROVAL FOR OCEAN DISPOSAL OF BROOKINGS, NAVSEA WILL CONSIDER OCEAN DISPOSAL.//

BY

Exhibit A-7. CNO WASHINGTON DC 172151Z DEC 91.

DEPARTMENT OF THE NAVY

NAVAL SEA SYSTEMS COMMAND
WASHINGTON DC 20362-5101

IN REPLY REFER TO
5090
OPR 00T
Ser 00T/001
13 Jan 1992

Ms. Marian Mlay
Director
Oceans and Coastal Protection Division
United States Environmental Protection Agency
Washington, D.C. 20460

Dear Ms. Mlay:

The purpose of this letter is to bring to your attention an urgent issue involving the disposition of a wrecked Naval vessel, the ex-BROOKINGS, stranded on a coral reef in Puerto Rico, and the Navy's plan to resolve the issue. We are seeking the Environmental Protection Agency's (EPA's) concurrence with this plan. The issue is complicated by the fact that, as with most older Navy ships, there may be some PCB items on the vessel.

The ex-BROOKINGS was identified as a target vessel and towed to Puerto Rico for such exercises before the Navy knew about the problem of PCBs on surface vessels. During Hurricane Hugo, the vessel broke loose from its moorings and ended up on a coral reef on the island. The vessel has had direct and indirect impacts on the reef. The direct impacts consist of crushing and transformation of live elkhorn and other corals into coral rubble and coarse sand. Indirect impacts have been caused by the actual position of the vessel, which has created a depositional environment between the vessel and the shoreline. As a consequence, sediments and brown algae have been killing practically all remaining live corals. Once the vessel is removed, however, the impacted environment will become exposed to normal wave action, natural surface current patterns and increased water transparency. Under these conditions, the coral will begin to reestablish itself. The vessel should be removed and disposed of as soon as possible to permit this to occur.

Navy salvage and environmental personnel met with representatives from the Puerto Rico Department of Natural Resources, the U.S. Fish and Wildlife Service, and the Army Corps of Engineers. All agreed that the removal effort should commence as early as possible using this salvage/removal plan outlined below followed by ocean disposal of the hulk in deep water.

The most cost effective procedure for removing the vessel, which will also minimize impact on the surrounding beach area, is to remove approximately 2600 long tons of steel above the second deck to lighten the hulk for refloating. The remaining 4220 long tons can then be floated to a disposal site for sinking in a

Exhibit A-8A. Naval Sea Systems Command Letter 5090 OPR 00T Ser 00T/001 of 13 January 1992 (Page 1).

target exercise in accordance with existing ocean dumping regulations (40 CFR 229.2).

While a PCB survey has not yet been performed aboard this ship, similar Naval vessels have been found to contain some PCB items, with a total estimated weight of less than 100 pounds PCBs, distributed throughout the vessel. These items include wire cable insulation in which PCBs are inextricably bound within the plastic material, felt gaskets bolted between ventilation duct flanges, and incidental items such as paints, adhesives, small capacitors, and rubber machinery mounts. Following the initial removal of weight, a PCB survey will be taken aboard the hulk.

The Navy will take steps to provide that any PCBs remaining in the portions of the hulk that are removed before refloating are disposed of in accordance with the storage and disposal requirements of 40 C.F.R. part 761. The salvage plan will specifically notify contractors of the possible presence of PCB items, which applications they may be found in, and provide that the contractors are engaged by the Navy for the purpose of disposing of the topside of the vessel, including any PCBs contained therein, as provided by 40 C.F.R. part 761.20(c)(2).

Before sinking the remaining hulk, the Navy will review the survey and drain any free oil from any PCB transformers, drain capacitors containing 3 pounds or more of dielectric fluid and remove all readily detachable PCB items that are capable of creating debris or contributing to chemical pollution unless, considering the condition of the hulk, removal of the item would threaten the structural integrity of the vessel or pose cost or threat of injury to personnel performing the removal disproportionate to the risk to the environment of leaving the item in place. Wire cables, felt gasket material that is bonded in a bolted flange, paints, adhesives, small capacitors, and rubber mounts are not readily detachable and will remain aboard.

On November 19, 1991, the Navy met with Mr. John Lishman and Ms. Susan Hitch of your staff for discussions on the requirements under the Ocean Dumping Act for sinking Navy vessels with PCBs at sea for purposes of target exercises and ocean disposal. As a result of this meeting, the Navy intends to forward information to your office regarding the subjects of PCB solubility, transport, concentrations in the marine environment from exposure to felt, comparisons with applicable water quality criteria, and any information we might have about biological impacts. This information will be provided to assist your office in determining whether, in light of treaty obligations and regulatory requirements on ocean disposal, further conditions will be imposed on the Navy's use of its general permit for sinking target vessels or the general permit for ocean disposal of vessels when the vessels to be sunk contain PCBs.

The situation with the ex-BROOKINGS is urgent, however, and requires resolution before any decision is made regarding routine

Exhibit A-8B. Naval Sea Systems Command Letter 5090 OPR 00T Ser 00T/001 of 13 January 1992 (Page 2).

use of the general permits. Therefore, we are requesting EPA's specific concurrence on our plan of action described above for the ex-BROOKINGS. If you require additional information on this matter, my point of contact is Mr. Paul Hankins, Naval Sea Systems Command (00C25), Washington, DC 20362, telephone (703) 607-2758.

Sincerely,

Kurt W Riegel

KURT W. RIEGEL
Director, Environmental Protection,
Occupational Safety and Health

Exhibit A-8C. Naval Sea Systems Command Letter 5090 OPR 00T Ser 00T/001 of 13 January 1992 (Page 3).

SUPERVISOR OF SALVAGE
U.S. NAVY
7320
OPR: 00C22
20 Feb 1992

MEMORANDUM

From: Head, Operations Branch
To: Donjon Marine Company, Inc.

Subj: REMOVAL OF EX-BROOKINGS

1. EX-BROOKINGS, currently stranded at Roosevelt Roads, Puerto Rico, is being removed by your company as the prime contractor under NAVSEA Contract N00024-90-D-4148, Requisition Number N00024.91.FR.00670, Delivery Order 0011, effective September 18, 1991.

2. Your contractual obligation to remove EX-BROOKINGS includes the authority to transfer title to the scrap and hulk. In the event that you receive value for the scrap, hulk or both, such funds will be credited against monies due you under the removal Delivery Order referred to in paragraph (1) above. Any transfer of title to the hulk of EX-BROOKINGS will provide that the United States of America and the Department of the Navy be held harmless from any and all damages or claims arising from the removal, subsequent movement, use and disposition of the hulk.

JAMES C. BLADH

Exhibit A-9. Supervisor of Salvage Memorandum 7320 OPR: 00C22 of 20 February 1992.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR 3 1992

OFFICE OF WATER

Kurt W. Riegel, Director
Environmental Protection, Occupational
Safety and Health
Department of the Navy
Naval Sea Systems Command
Washington, D.C. 20362-6101

Dear Mr. Riegel:

This letter is in response to your request for concurrence from EPA on the Navy's plan to dispose of the Naval vessel, the ex-BROOKINGS, that was wrecked and stranded on a coral reef in Puerto Rico during Hurricane Hugo. As you indicated, it is important to remove the vessel soon. The vessel has crushed live coral. In addition, because of sediments that have collected and brown algae that has proliferated in the depositional environment created between the vessel and the shoreline, it is indirectly killing the remaining live coral.

We have determined that after removal of the approximately 2600 long tons of above deck steel, the remaining 4220 long tons of the ex-BROOKINGS may be disposed in accordance with ocean dumping regulations for the transport and sinking of naval target vessels (40 CFR 229.2). These regulations include requirements that

- o all material that may degrade the marine environment be removed to the maximum extent practicable;
- o the vessel is sunk to the bottom rapidly and permanently in water at least 6000 feet deep and at least 50 nautical miles from shore; and
- o an annual report be made to the EPA Administrator including the name and tonnage of the vessel, and the location and date of its sinking.

Material that EPA is concerned with include PCBs, fuel, and fuel oil. In addition, we understand that the Puerto Rico Department of Natural Resources has requested that asbestos be removed from the ex-BROOKINGS in their December 4, 1991, letter. Fuel and oil had already been removed prior to the ex-BROOKINGS original use as a target vessel.

Exhibit A-10A. U.S. Environmental Protection Agency Letter of 3 March 1992 (Page 1).

Because of the urgency of removing this vessel and the adverse environmental impacts of this vessel remaining on the reef, we are willing to allow the Navy to proceed with the plan which you outlined in your January 13, 1992, letter to me for removing PCBs from the ex-BROOKINGS.

As you know, EPA is now evaluating data you have sent us regarding PCBs in Navy ships and is deciding how best to address this issue in its general permit for sinking target vessels or the general permit for ocean disposal of vessel. As a result, the procedure which we have agreed to in this letter may not be applicable for future vessels containing PCBs.

If you have any questions or need further information, please contact me at FTS-260-1952, or John Lishman at FTS-260-8448.

Sincerely,

for Marian Mlay, Director
Oceans and Coastal Protection Division

Exhibit A-10B. U.S. Environmental Protection Agency Letter of 3 March 1992 (Page 2).

SUPERVISOR OF SALVAGE
U.S. NAVY

13 March 1992

MEMORANDUM

From: NAVSEA Supervisor of Salvage Representative
To: Department of Natural Resources, Puerto Rico

Subj: OCEAN DISPOSAL, SCUTTLING SITE FOR "EX-BROOKINGS"

Ref: DNR, ltr "Santos Rohena Betancourt" of 4 Dec 1991

Paragraph 3 of referenced letter discusses a scuttling area in water at least 1000 fathoms, no less than 50 nautical north of Cabo, San Juan, PR. Paragraph 9 requests scuttling coordinates.

Accordingly, as result of a survey conducted by the NAVSEA SALVAGE rep on scene, COMSUPPRON EIGHT and contractor salvage master it was determined that coordinates 17 degrees 11 min North and 65 degrees 37 min West, approximately 65 miles due south of Roosevelt Roads in 2600 fathoms of water would be a more suitable scuttling site than going North as originally planned. This area meets all requirements and is readily accessible and a more desirable tow than going north.

Unless otherwise directed the coordinates identified above will be used as the "EX BROOKINGS" scuttling site.

Jim Bladh

Copy to: ACOE, San Juan, Puerto Rico, ATTN Mr. Carmelo Caez
NAVBASE Roosevelt Roads, Public Works EED environmental
ATTN Carmen Villanueva

NOTE: This letter was delivered via fax on 13 March 92

DNR	809-724 0365
ACOE	809-729 6879
PW EED	809-865 0422

Exhibit A-11. Supervisor of Salvage Memorandum of 13 March 1992.

SUPERVISOR OF SALVAGE
U.S. NAVY

OPR:OOC22
16 March, 1992

MEMORANDUM

From: COMNAVSEASYSCOM Supervisor of Salvage (Code OOC22)
To: Commanding Officer, U.S. Naval Station, Roosevelt Roads

Subj: SINKEX SUPPORT FOR EX-BROOKINGS

Ref: a) CNO Washington DC OP43 MSG 102144Z Mar 92
b) Meeting, NAVSEA J Bladh/EOD Det LT Ferris, 16 Mar 92
c) Phonecon J Bladh/COMSUPPRON EIGHT 16 Mar 92

1. By ref (a) COMNAVSEASYSCOM (Code OOC) has been authorized ocean disposal of Ex-BROOKINGS if breaking or scrapping is not economicallY feasible.

2. At a meeting with EOD Det, Lt George Ferris and MCPO John Conway, the capability of the EOD Det providing personnel and explosives for this task was discussed and confirmed. Ref (b) refers.

3. As discussed ref (c) COMSUPPRON EIGHT will have operational control of the extraction and scuttling of BROOKINGS. It is contemplated that this will be accomplished utilizing MDSU 2 and the USS PAIUTE (ATF-159) during the first ten days of April 92. Utilization of the EOD team should not exceed three days.

4. It is requested that a team from the EOD Det Roosevelt Roads be made available to support this operation under the operational control of COMSUPPRON EIGHT.

Jim Bladh
Supervisor of Salvage Rep
Roosevelt Roads

Copy to: COMSUPPRON EIGHT
Public Works Officer, RR
EOD Det RR
MDSU 2

Exhibit A-12. Supervisor of Salvage Memorandum OPR: 00C22 of 16 March 1992.

ADMINISTRATIVE MESSAGE

ROUTINE

R 071600Z APR 92 ZYB PSN 026841M21

FM COMFAIRCARIB ROOSEVELT ROADS RQ///00//

TO CNO WASHINGTON DC//43/603G/36/354/225//
CINCLANTFLT NORFOLK VA//N44//
COMNAVSEASYSCOM WASHINGTON DC//00/09/00C/00T//

INFO PEOCMPANDNAV WASHINGTON DC//PEOCU-CT10//
COMNAVAIRSYSCOM WASHINGTON DC//42//
COMNAVSURFLANT NORFOLK VA//N3//
COMLOGGRU TWO
AFWTF ROOSEVELT ROADS RQ //33/32//
COMSUPPRON EIGHT
MOBDIVSALU TWO
NAVAIRTESTCEN PATUXENT RIVER MD//RD-20/RD-64//
NAVSTA ROOSEVELT ROAD RQ//00/90/15/18//

BY
UNCLAS //N04740//
MSGID/GENADMIN/COMFAIRCARIB//
SUBJ/EX-BROOKINGS SALVAGE//

RMKS/1. EX-BROOKINGS BROKE FREE FROM HER MOOR DURING HURRICANE HUGO IN SEPTEMBER 1989 AND HAS BEEN GROUNDED AT ISLA CABRAS ON NAVAL STATION ROOSEVELT ROADS SINCE. DUE TO THE EXTREME STORM SURGE, EX-BROOKINGS POSED NOT ONLY A DIFFICULT SALVAGE PROBLEM BUT AN ACUTE ENVIRONMENTAL HAZARD TO THE WATERS AND BEACHES OF PUERTO RICO.

2. THE ENVIRONMENTAL THREAT DICTATED THAT EX-BROOKINGS BE REMOVED FROM ITS STRAND. DETERMINING THE MOST ENVIRONMENTALLY RESPONSIBLE MEANS TO ELIMINATE THE THREAT REQUIRED CLOSE COORDINATION BETWEEN NUMEROUS AGENCIES WITH OVERSIGHT RESPONSIBILITY INCLUDING THE U.S. ENVIRONMENTAL PROTECTION AGENCY, THE ARMY CORPS OF ENGINEERS, PUERTO RICO DEPARTMENT OF NATURAL RESOURCES AND PUERTO RICO DEPARTMENT OF FISH AND GAME. ONCE ALL PARTIES AGREED ON A COURSE OF ACTION, PHYSICAL WORK TO REMOVE THE SHIP BEGAN IN EARLY JANUARY AND COMPLETED RECENTLY WITH THE EXTRACTION AND AT-SEA DISPOSAL.

3. THE SUCCESSFUL SALVAGE OF EX-BROOKINGS BY PERSONNEL FROM THE NAVSEA SUPERVISOR OF SALVAGE AND COMBAT SUPPORT SQUADRON EIGHT, WITH SUPPORT FROM NAVSTA ROOSEVELT ROADS, WAS PERFORMED WITH TECHNICAL PROFICIENCY AND PROFESSIONALISM. A TRIBUTE TO THEIR MANAGERIAL EXPERTISE WAS THE COMPLETION OF THE PROJECT WITHIN THE ORIGINAL COST AND SCHEDULE ESTIMATES, DESPITE NUMEROUS WEATHER INDUCED DELAYS. I EXTEND MY COMPLIMENTS FOR A JOB WELL DONE!//
BY

Exhibit A-13. COMFAIRCARIB ROOSEVELT ROADS RQ 071600Z APR 92.

APPENDIX B

BROOKINGS CHARACTERISTICS

General characteristics from Damage Control Book:

PRINCIPAL CHARACTERISTICS

Length between Perpendiculars . . . . . 436'-6"
Length Overall . . . . . 455'-3"
Breadth Extreme outside of Plating . . . . . 62'-1 5/8"
Designer's Normal Load Water Line (L.W.L.) . . . . . 24'-0"

Frame Spacing:

Frames 0-14	24"
Frames 14-37	30"
Frames 37-147	36"
Frames 147-161	24"

PROPULSION MACHINERY

Turbines:

1 - Set Double Reduction cross compound turbines.
H.P. Turbine - Impulse - Reaction 5,358 RPM
L.P. Turbine - 7 Row Impulse (Ahead) and
2 Row Impulse (Astern) -
4,422 Designed RPM
S.H.P. - 8,500 normal and 9,350 maximum.
Steam conditions 440 psig, 740 °F., 28-1/2" vacuum.

Reduction Gears:

1 - Set Double Reduction Gears.
Ratio: H.P. 63.03/1;
L.P. 52.02/1;
S.H.P. 5,500

Boilers:

2 - Combustion Engineering Company Manufactures; double casing , sectional header type; 4-burner, express, with superheater and economizer. Economizer feed-in at 240 °F. Steam condition at superheater outlet 465 psig., 750 °F.
Evaporation: 34,000#/hr. normal, and 51,000#/hr. maximum.

Propeller:

1 - Four bladed, right hand, solid manganese bronze 20'-5" diameter; 22'-9" pitch at .6R to tip.

ARMAMENT

1 -	5"/38 Caliber D.P. Single Mount
1 -	40 M/M Quad. Mount
4 -	40 M/M Twin Mounts
4 -	20 M/M Twin Mounts

SUMMARY OF MAXIMUM OPERATING CONDITION

ITEM	TONS	VERTICAL CENTER OF GRAVITY	VERTICAL MOMENT
Ship in light condition	6872	25.6	183936
Ship's complement & effects	56	29.8	1660
Ammunition	103	28.6	2943
Provisions & stores for personnel	389	15.2	5912
General stores	64	27.2	1754
Potable water	512	10.9	5587
Reserve feed water	199	3.6	725
Fuel oil	1183	4.3	5110
Diesel oil	130	2.5	325
Lubricating oil	12	31.3	370
Cargo	683	17.5	11965
Troops and effects	163	29.3	4773
TOTALS	10679	21.08	225060

DRAFT AND STABILITY CHARACTERISTICS IN MAXIMUM OPERATING CONDITION

Mean draft (at center of flotation)	20'-11 1/2"
C.G. above base (KG), no correction for free surface	21.08'
Free Surface correction at zero degrees inclination	0.75'
Transverse metacenter above base (KM)	25.52'
Metacentric height (GM), corrected for free surface, at zero degrees inclination	3.69'

SUMMARY OF MINIMUM OPERATING CONDITION

ITEM	TONS	VERTICAL CENTER OF GRAVITY	VERTICAL MOMENT
Ship in light condition	7185	25.6	183936
Ship's complement & effects	56	29.8	1660
Ammunition	34	46.3	1593
Provisions & stores for personnel	130	14.4	1862
General stores	21	26.0	556
Potable water	256	5.8	1472
Reserve feed water	100	3.1	306
Fuel oil	394	5.4	2130
Diesel oil	43	2.6	114
Lubricating oil	4	30.0	117
Cargo (as in Max. Oper. Cond.)	683	17.5	11965
Troops and effects	163	29.3	4773
Saltwater ballast	604	2.0	1233
TOTALS	9673	21.89	211717

DRAFT AND STABILITY CHARACTERISTICS
IN MINIMUM OPERATING CONDITION

Mean draft (at center of flotation)	19'-2 1/2"
C.G. above base (KG), no correction for free surface	21.89'
Free Surface correction at zero degrees inclination	0.43'
Transverse metacenter above base (KM)	25.80'
Metacentric height (GM), corrected for free surface	3.48'

APA-140 -- EX-BROOKINGS (STRANDING on NOVEMBER 1989) OOC POSSE-HINPUT VC1
Rev. 0 (by: HOOPER) 11-07-1991

EX-BROOKINGS
HULL OFFSETS

General Information

Units	=	2 (ft:L.Tons)			
Long'l Ref.	=	3 (F.P.)			
Integ. Rule	=	1 (Simpson's)	BP	=	436.500 ft
BEAM	=	62.000 ft			
DEPTH	=	38.000 ft			

Keel Thickness = 0.000 in

Appendage Allowance = 0.0050 x Displacement

GENERAL & LIGHTSHIP DATA
EX-BROOKINGS

General Data

Ship Name	EX-BROOKINGS
Ship Class	APA-140
Yard No.	APA-140

Units	2	(ft|L.Tons)
Length Precision	2	(.xx)
Weight Precision	1	(.x)
Long'l Ref.	3	(abt FP))
Order of Long'l Data	2	(F to A)

Length Overall	455.25	ft
Length B.P.	436.50	ft
Beam	62.00	ft
Depth	38.00	ft
Propeller Diameter	20.50	ft
Shaft Centerline (above BL)	12.00	ft
Draft Reference	Baseline	
Summer Load Line	30.00	ft

Lightship & Constant

Lightship Weight:	6,872.00	LTons
KG:	25.90	ft
LCG:	215.00A	ft-FP
TCG:	0.00	ft
Constant Weight:	0.0	LTons
KG:	0.00	ft
LCG:	218.00A	ft-FP
TCG:	0.00	ft
FSmom:	0.0	ft-LTons

Draft Mark Locations

Fwd Marks:	8.00A	ft-FP
Midship Marks:	0.00	ft-FP
Aft marks:	433.50A	ft-FP

APA-140 -- EX-BROOKINGS (STRANDING on NOVEMBER 1989) OOC POSSE-SHIPD VA6
Rev. 0 (by: HOOPER) 02-23-1992

HYDROSTATIC TABLES
EX-BROOKINGS

DRAFT ft	DISPL. LTons	KMt ft	LCB ft-FP	LCF ft-FP	MT1in ft-LT/in
2.000	711.2	104.91	214.65A	215.68A	547.79
4.000	1,572.8	64.27	215.36A	216.26A	664.16
6.000	2,516.2	47.94	215.77A	216.50A	735.17
8.000	3,507.7	39.34	216.08A	216.95A	795.38
9.792	4,426.2	35.11	216.47A	217.13A	835.82
10.000	4,535.2	34.75	216.49A	217.15A	840.80
12.000	5,600.7	31.76	216.69A	217.39A	886.59
14.000	6,692.3	29.53	216.87A	217.61A	926.23
16.000	7,805.8	28.07	217.05A	218.04A	964.17
18.000	8,936.9	27.09	217.20A	218.46A	1001.44
20.000	10,085.6	26.49	217.37A	218.91A	1038.04
22.000	11,245.3	26.16	217.47A	219.70A	1077.66
24.000	12,426.6	26.08	217.72A	220.59A	1120.53
26.000	13,626.9	26.21	218.05A	222.32A	1184.13
28.000	14,849.6	26.50	218.48A	224.04A	1249.13
28.563	15,197.5	26.60	218.61A	224.55A	1268.05
30.000	16,094.7	26.90	218.98A	225.85A	1316.20

TANK TABLES
EX-BROOKINGS

Fuel Oil

No.	Name	Weight (L.Tons)	Sp. Vol (ft3/LT)	Volume (ft3)	KG (bt-BL)	LCG (ft-FP)	TCG (ft-CL)	Slack Free Surface (ft-LTons)	(ft4)	98% Free Surface (ft-LTons)	(ft4)	Fwd Bnd (ft-FP)	Aft Bnd (ft-FP)
1	A-901-F	134.3	37.7699	5071.7	5.88	63.87A	5.97S	445.6	16830.4	246.3	9302.7	28.00A	85.50A
2	A-902-F	134.3	37.7699	5074.1	5.88	63.88A	5.97P	445.4	16822.5	246.4	9306.2	28.00A	85.50A
3	A-904-F	101.2	37.7699	3822.9	2.01	109.99A	0.00	864.9	32666.7	188.9	7134.9	85.50A	134.50A
4	A-905-F	44.0	37.7699	1661.5	2.32	113.22A	14.94S	198.3	7488.9	59.5	2247.8	85.50A	134.50A
5	A-906-F	43.9	37.7699	1659.2	2.33	113.23A	14.94P	198.3	7488.9	59.4	2245.4	85.50A	134.50A
6	A-907-F	153.5	37.7699	5796.1	2.00	171.52A	0.00	1306.2	49333.4	286.3	10812.3	134.50A	208.50A
7	A-908-F	117.6	37.7699	4443.5	2.16	173.12A	17.87P	937.9	35423.5	202.3	7640.8	134.50A	208.50A
8	A-909-F	117.6	37.7699	4443.5	2.16	173.12A	17.87S	937.9	35423.5	202.3	7640.9	134.50A	208.50A
9	B-907-F	3.1	37.7699	117.6	2.00	252.00A	9.00S	0.3	10.0	0.3	10.0	244.50A	259.50A
10	B-908-F	3.1	37.7699	117.6	2.00	252.00A	9.00P	0.3	10.0	0.3	10.0	244.50A	259.50A
11	B-909-F	25.4	37.7699	958.9	2.14	252.00A	18.28S	213.8	8074.9	45.4	1714.9	244.50A	259.50A
12	B-910-F	25.4	37.7699	958.9	2.14	252.00A	18.28P	213.8	8075.1	45.4	1714.9	244.50A	259.50A
13	C-901-F	161.3	37.7699	6092.6	2.01	298.41A	0.00	1376.8	52000.2	301.0	11369.1	259.50A	337.50A
14	C-902-F	94.6	37.7699	3571.9	2.24	291.09A	16.78P	710.9	26849.5	173.9	6566.5	259.50A	337.50A
15	C-903-F	94.6	37.7699	3571.9	2.24	291.09A	16.78S	710.9	26850.1	173.9	6566.5	259.50A	337.50A
		1254.0		47362.0	2.93	177.72A	0.00	8561.0	323347.7	2231.5	84282.7		

Lube Oil

No.	Name	Weight (L.Tons)	Sp. Vol (ft3/LT)	Volume (ft3)	KG (bt-BL)	LCG (ft-FP)	TCG (ft-CL)	Slack Free Surface (ft-LTons)	(ft4)	98% Free Surface (ft-LTons)	(ft4)	Fwd Bnd (ft-FP)	Aft Bnd (ft-FP)
16	B-906-LO	10.4	42.2134	439.0	2.00	251.50A	0.00	14.2	597.3	6.6	279.7	244.50A	258.50A
		10.4		439.0	2.00	251.50A	0.00	14.2	597.3	6.6	279.7		

SW Ballast

No.	Name	Weight (L.Tons)	Sp. Vol (ft3/LT)	Volume (ft3)	KG (bt-BL)	LCG (ft-FP)	TCG (ft-CL)	Slack Free Surface (ft-LTons)	(ft4)	98% Free Surface (ft-LTons)	(ft4)	Fwd Bnd (ft-FP)	Aft Bnd (ft-FP)
17	A-1-W	114.5	35.0062	4006.8	16.58	20.18A	0.00	54.0	1890.2	61.6	2157.1	0.00	28.00A
18	B-902-W	67.2	35.0062	2352.0	2.00	226.50A	0.00	571.3	20000.0	125.3	4386.9	211.50A	241.50A
19	B-903-W	54.8	35.0062	1917.0	2.14	226.50A	18.27S	461.2	16146.1	97.9	3428.0	211.50A	241.50A
20	B-904-W	54.6	35.0062	1910.9	2.14	226.50A	18.26P	461.2	16145.4	97.7	3418.4	211.50A	241.50A
21	C-1-W	27.3	35.0062	954.0	23.81	421.71A	0.00	78.6	2760.7	37.9	1327.5	417.50A	427.00A
22	C-301-W	94.5	35.0062	3307.5	22.25	258.00A	0.00	325.4	11390.6	165.0	5777.3	252.00A	264.00A
23	C-905-W	218.7	35.0062	7657.5	9.10	360.76A	9.39S	397.0	13897.3	293.1	10260.1	340.50A	391.50A
24	C-906-W	236.0	35.0062	8262.0	9.16	361.15A	9.00P	474.3	16602.2	335.8	11755.4	340.50A	391.50A
		867.5		30367.9	10.57	279.33A	0.08P	2823.3	98832.6	1214.4	42510.8		

Misc.

No.	Name	Weight (L.Tons)	Sp. Vol (ft3/LT)	Volume (ft3)	KG (bt-BL)	LCG (ft-FP)	TCG (ft-CL)	Slack Free Surface (ft-LTons)	(ft4)	98% Free Surface (ft-LTons)	(ft4)	Fwd Bnd (ft-FP)	Aft Bnd (ft-FP)
25	B-901-V	17.2	35.884	618.4	2.09	210.00A	0.02S	1301.6	46704.0	101.8	36.52	208.50A	211.50A
26	B-905-V	17.7	35.884	635.2	2.09	242.96A	0.02S	1337.3	47983.4	104.5	3751.2	241.42A	244.50A
27	C-904-V	8.5	35.884	306.3	2.21	338.99A	0.00	223.8	8031.5	27.4	983.5	337.50A	340.50A
28	C-905-ET	54.6	35.884	1959.5	5.66	402.38A	0.00	76.7	2751.8	49.1	1761.2	391.50A	417.50A
		98.1		3519.3	4.09	334.29A	0.01S	2939.4	105470.8	282.8	10148.4		

APA-140 -- EX-BROOKINGS (STRANDING on NOVEMBER 1989) OOC POSSE-SHIPD VA6
Rev. 0 (by: HOOPER) 02-23-1992

LIGHTSHIP WEIGHT DISTRIBUTION
EX-BROOKINGS

No.	LOCATION (ft-FP)	ORDINATE (L.Tons/ft)
1	0.00	4.000
2	28.000A	5.000
3	86.000A	7.000
4	143.000A	8.500
5	275.000A	8.500
6	416.000A	7.000
7	450.000A	4.000

1	318.00	208.00A	144.00A	272.00A
2	33.00	16.00A	0.00	32.00A
3	25.00	396.00A	388.00A	412.00A
4	30.00	208.00A	0.00	436.00A
5	91.00	84.00A	81.00A	87.00A
6	183.00	128.00A	120.00A	136.00A
7	92.00	268.00A	262.00A	274.00A
8	183.00	336.00A	328.00A	344.00A
9	16.00	166.00A	120.00A	204.00A
10	36.50	120.00A	115.00A	125.00A
11	36.50	136.00A	131.00A	141.00A
12	36.50	280.00A	275.00A	285.00A
13	36.50	344.00A	339.00A	349.00A
14	53.00	428.00A	408.00A	436.00A
15	97.00	242.00A	232.00A	252.00A
16	221.00	235.00A	225.00A	245.00A
17	24.00	420.00A	415.00A	425.00A
18	219.00	216.00A	204.00A	228.00A
19	176.00	226.00A	204.00A	252.00A
20	143.00	334.00A	252.00A	416.00A
21	14.00	190.00A	176.00A	204.00A
22	129.00	226.00A	204.00A	252.00A
23	70.00	51.00A	41.00A	61.00A
24	140.00	56.00A	28.00A	84.00A
25	560.00	149.00A	130.00A	170.00A
26	190.00	197.00A	182.00A	209.00A
27	110.00	374.00A	359.00A	392.00A
28	291.50	106.27A	0.00	450.00A

Lightship: 6,872.0 LTons
LCG: 215.00A ft-FP

STRENGTH DATA
EX-BROOKINGS

No.	Desc.	LOCATION (ft-FP)	--LIGHTSHIP-- WEIGHT (LT)	WT. MOMT (ft-LT)
21		12.00A	6788.4	1395513.0
20	BOW	36.00A	6685.1	1301192.0
19		50.00A	6426.3	1143584.0
18		75.00A	6134.0	986810.3
17	FWD	104.00A	5776.5	814784.8
16		125.00A	5493.6	695768.7
15		150.00A	4775.2	567496.2
14		175.00A	4211.7	455881.3
13		200.00A	3784.7	355445.6
12		225.00A	3066.6	269813.7
11	ER	234.00A	2768.6	243607.8
10		250.00A	2296.7	203413.5
9		275.00A	1884.5	150933.4
8		300.00A	1606.3	107591.8
7		325.00A	1374.1	70355.9
6		350.00A	932.0	41586.1
5	AFT	370.00A	717.4	24913.2
4		390.00A	486.6	12884.6
3		405.00A	342.8	6725.1
2	STN	417.50A	236.1	3078.6
1		425.00A	157.3	1600.4

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STRENGTH DATA
EX-BROOKINGS

SECTION MODULUS PROPERTIES ABOUT HORIZONTAL AXIS

No.	Desc.	LOCATION	INERTIA in2-ft2	SMdeck in2-ft	SMkeel in2-ft	NAdeck ft	NAkeel ft	Shear Area (in2)
21		12.00A	11020.4	180.2	572.1	61.17	19.26	385.29
20	BOW	26.00A	19347.9	484.2	1742.6	39.95	11.10	416.45
19		50.00A	33623.7	1005.5	3749.2	33.44	8.97	469.86
18		75.00A	48494.4	1548.5	5839.5	31.32	8.30	525.50
17	FWD	104.00A	68887.0	2241.7	8322.2	30.73	8.28	569.53
16		125.00A	83654.0	2743.6	10120.1	30.49	8.27	601.42
15		150.00A	104975.3	3416.6	12329.5	30.73	8.51	614.95
14		175.00A	126256.7	4087.8	14536.6	30.89	8.69	628.44
13		200.00A	147538.1	4759.1	16743.6	31.00	8.81	641.93
12		225.00A	168810.6	5430.0	18950.1	31.09	8.91	655.41
11	ER	234.00A	176467.6	5671.5	19744.4	31.11	8.94	660.26
10		250.00A	173333.2	5682.4	18560.5	30.50	9.34	669.52
9		275.00A	168435.7	5699.4	16710.7	29.55	10.08	683.98
8		300.00A	163538.3	5716.4	14860.9	28.61	11.00	698.44
7		325.00A	158640.8	5733.4	13011.1	27.67	12.19	712.91
6		350.00A	153743.4	5750.4	11161.3	26.74	13.77	727.37
5	AFT	370.00A	149825.4	5764.0	9681.4	25.99	15.48	738.94
4		390.00A	106418.3	4087.8	6817.0	26.03	15.61	624.79
3		405.00A	73863.0	2830.6	4668.7	26.09	15.82	539.18
2	STN	417.50A	46733.6	1782.9	2878.4	26.21	16.24	467.83
1		425.00A	30456.0	1154.4	1804.2	26.38	16.88	425.03

SECTION MODULUS PROPERTIES ABOUT VERTICAL AXIS

No.	Desc.	LOCATION	INERTIA in2-ft2	SMport in2-ft	SMstbd in2-ft	NAport ft	NAstbd ft	Shear Area (in2)
21		12.00A	-53153.7	-1443.7	-1427.9	36.82	37.22	66.71
20	BOW	26.00A	14060.8	755.2	755.2	18.62	18.62	250.52
19		50.00A	129285.9	4524.8	4497.7	28.57	28.74	565.62
18		75.00A	249311.9	8451.4	8396.1	29.50	29.69	893.85
17	FWD	104.00A	375300.4	12417.8	12360.3	30.22	30.36	1122.51
16		125.00A	466533.5	15290.0	15231.0	30.51	30.63	1288.09
15		150.00A	559380.7	18008.7	17984.1	31.06	31.10	1304.17
14		175.00A	652162.6	20725.1	20735.0	31.47	31.45	1320.17
13		200.00A	744944.4	23441.6	23486.0	31.78	31.72	1336.17
12		225.00A	837711.6	26157.6	26236.5	32.03	31.93	1352.15
11	ER	234.00A	871106.1	27135.3	27226.6	32.10	31.99	1357.90
10		250.00A	801260.6	25106.2	25187.3	31.91	31.81	1337.99
9		275.00A	692127.1	21935.6	22000.9	31.55	31.46	1306.89
8		300.00A	582993.5	18765.0	18814.5	31.07	30.99	1275.78
7		325.00A	473860.2	15594.5	15628.1	30.39	30.32	1244.67
6		350.00A	364726.6	12423.9	12441.8	29.36	29.31	1213.56
5	AFT	370.00A	277419.9	9887.5	9892.7	28.06	28.04	1188.67
4		390.00A	167176.8	6023.0	6026.0	27.76	27.74	835.24
3		405.00A	84494.6	3124.6	3125.9	27.04	27.03	570.18
2	STN	417.50A	15592.8	709.3	709.2	21.98	21.99	349.29
1		425.00A	-25748.3	-739.9	-740.8	34.80	34.76	216.75

Strength data for ex-USS BROOKINGS after all structural cutting completed. Reflects strength of hull girder during extraction from strand, tow to scuttling site, and as-scuttled.

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STRENGTH DATA
EX-BROOKINGS

SECTION MODULUS PROPERTIES ABOUT HORIZONTAL AXIS

No.	Desc.	LOCATION	INERTIA in2-ft2	SMdeck in2-ft	SMkeel in2-ft	NAdeck ft	NAkeel ft	Shear Area (in2)
21		12.00A	337093.0	15772.3	9220.2	21.37	36.56	937.14
20	BOW	26.00A	372602.6	18050.5	12250.5	20.64	30.42	959.60
19		50.00A	433476.2	21955.9	17445.4	19.74	24.85	998.60
18		75.00A	496897.1	26024.7	22857.0	19.09	21.74	1038.25
17	FWD	104.00A	570465.4	30744.5	29134.5	18.56	19.58	1084.80
16		125.00A	593572.6	31240.5	30510.0	19.00	19.46	1093.08
15		150.00A	621080.9	31830.9	32147.5	19.51	19.32	1102.92
14		175.00A	648605.7	32422.2	33785.5	20.00	19.20	1112.79
13		200.00A	676151.6	33014.7	35424.3	20.48	19.09	1122.67
12		225.00A	703713.5	33608.1	37063.6	20.94	18.99	1132.57
11	ER	234.00A	713637.6	33821.8	37653.8	21.10	18.95	1136.13
10		250.00A	681819.9	32665.6	35492.2	20.87	19.21	1109.43
9		275.00A	632143.3	30861.0	32115.9	20.48	19.68	1067.73
8		300.00A	582552.4	29061.2	28742.5	20.05	20.27	1026.10
7		325.00A	533063.3	27267.0	25372.4	19.55	21.01	984.55
6		350.00A	483647.2	25476.8	22004.8	18.98	21.98	943.06
5	AFT	370.00A	444114.4	24044.7	19310.7	18.47	23.00	909.87
4		390.00A	343290.3	19782.6	14285.4	17.35	24.03	813.74
3		405.00A	267672.3	16586.0	10516.5	16.14	25.45	741.64
2	STN	417.50A	204657.2	13922.2	7375.7	14.70	27.75	681.56
1		425.00A	166848.2	12323.9	5491.3	13.54	30.38	645.51

SECTION MODULUS PROPERTIES ABOUT VERTICAL AXIS

No.	Desc.	LOCATION	INERTIA in2-ft2	SMport in2-ft	SMstbd in2-ft	NAport ft	NAstbd ft	Shear Area (in2)
21		12.00A	-39345.2	1389.3	1388.4	-28.32	-28.34	557.52
20	BOW	26.00A	112556.4	6045.3	6045.4	18.62	18.62	790.03
19		50.00A	372959.4	14027.0	14028.9	26.59	26.59	1188.61
18		75.00A	644218.6	22341.5	22345.2	28.84	28.83	1603.81
17	FWD	104.00A	958879.2	31986.3	31992.2	29.98	29.97	2085.45
16		125.00A	1031880.0	33998.7	33868.1	30.35	30.47	2064.40
15		150.00A	1118786.0	36394.4	36101.2	30.74	30.99	2039.35
14		175.00A	1205707.0	38790.6	38334.9	31.08	31.45	2014.31
13		200.00A	1292650.0	41187.5	40569.3	30.38	31.86	1989.31
12		225.00A	1379608.0	43585.0	42804.1	30.65	32.23	1964.32
11	ER	234.00A	1410915.0	44448.1	43608.7	31.74	32.35	1955.33
10		250.00A	1314917.0	41714.6	40973.7	31.52	32.09	1922.41
9		275.00A	1164961.0	37444.7	36857.9	31.11	31.61	1871.02
8		300.00A	1015092.0	33177.8	32744.9	30.60	31.00	1819.75
7		325.00A	865327.7	28914.4	28635.3	29.93	30.22	1768.60
6		350.00A	715638.5	24653.5	24528.0	29.03	29.18	1717.55
5	AFT	370.00A	595887.3	21244.7	21242.2	28.05	28.05	1676.70
4		390.00A	411884.1	15342.5	15341.0	26.85	26.85	1355.59
3		405.00A	273881.8	10915.8	10915.1	25.09	25.09	1114.76
2	STN	417.50A	158880.0	7226.9	7226.8	21.98	21.98	914.07
1		425.00A	89878.8	5013.6	5013.9	17.93	17.93	793.66

Strength data for ex-USS BROOKINGS as-stranded prior to any structural cutting or weight removal.

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STRENGTH DATA
EX-BROOKINGS

SECTION MODULUS PROPERTIES ABOUT HORIZONTAL AXIS

No.	Desc.	LOCATION	INERTIA in2 ft2	SMdeck in2-ft	SMkeel in2-ft	NAdeck ft	NAkeel ft	Shear Area (in2)
21		12.00A	56140.4	1370.2	2343.8	40.97	23.95	487.27
20	BOW	26.00A	76977.5	2293.3	4401.0	33.57	17.49	525.56
19		50.00A	112698.3	3875.7	7927.7	29.08	14.22	591.19
18		75.00A	149907.5	5524.0	11601.3	27.14	12.92	659.55
17	FWD	104.00A	193070.1	7436.1	15862.7	25.96	12.17	738.85
16		125.00A	190388.2	7151.0	16489.7	26.62	11.55	726.16
15		150.00A	187195.5	6811.7	17236.2	27.48	10.86	711.04
14		175.00A	184002.7	6472.3	17982.7	28.43	10.23	695.93
13		200.00A	180809.9	6133.0	18729.2	29.48	9.65	680.82
12		225.00A	177617.0	5793.6	19475.7	30.66	9.12	665.70
11	ER	234.00A	176467.6	5671.5	19744.4	31.11	8.94	660.26
10		250.00A	173333.3	5682.4	18560.5	30.50	9.34	669.52
9		275.00A	168435.8	5699.4	16710.7	29.55	10.08	683.98
8		300.00A	163538.4	5716.4	14860.9	28.61	11.00	698.44
7		325.00A	158640.9	5733.4	13011.1	27.67	12.19	712.91
6		350.00A	153743.4	5750.4	11161.3	26.74	13.77	727.37
5	AFT	370.00A	149825.4	5764.0	9681.4	25.99	15.48	738.94
4		390.00A	106418.3	4087.8	6817.0	26.03	15.61	624.79
3		405.00A	73863.0	2830.6	4668.7	26.09	15.82	539.18
2	STN	417.50A	46733.6	1782.9	2878.4	26.21	16.24	467.83
1		425.00A	30456.0	1154.3	1804.2	26.38	16.88	425.03

SECTION MODULUS ABOUT VERTICAL AXIS

No.	Desc.	LOCATION	INERTIA in2-ft2	SMport in2-ft	SMstbd in2-ft	NAport ft	NAstbd ft	Shear Area (in2)
21		12.00A	-78524.2	-2042.2	-2032.2	38.45	38.64	221.81
20	BOW	26.00A	24269.0	1303.5	1303.5	18.62	18.62	416.88
19		50.00A	200486.0	7038.9	7021.8	28.48	28.55	751.29
18		75.00A	384045.4	13013.3	12978.3	29.51	29.59	1099.63
17	FWD	104.00A	596974.3	19943.5	19888.0	29.93	30.02	1503.71
16		125.00A	641257.1	21105.3	21073.4	30.38	30.43	1480.16
15		150.00A	693974.8	22488.3	22484.7	30.86	30.86	1452.12
14		175.00A	746692.4	23871.4	23896.0	31.28	31.25	1424.08
13		200.00A	799410.1	25254.4	25307.2	31.65	31.59	1396.04
12		225.00A	852127.8	26637.4	26718.5	31.99	31.89	1368.00
11	ER	234.00A	871106.1	27135.3	27226.6	32.10	31.99	1357.90
10		250.00A	801260.6	25106.2	25187.3	31.91	31.81	1337.99
9		275.00A	692127.1	21935.6	22000.9	31.55	31.46	1306.89
8		300.00A	582993.7	28765.0	18814.5	31.07	30.99	1275.78
7		325.00A	473860.2	15594.5	15628.2	30.39	30.32	1244.67
6		350.00A	364726.7	12423.9	12441.8	29.36	29.31	1213.56
5	AFT	370.00A	277419.9	9887.5	9892.7	28.06	28.04	1188.67
4		390.00A	167176.9	6023.0	6026.0	27.76	27.74	835.25
3		405.00A	84494.7	3124.6	3125.9	27.04	27.03	570.18
2	STN	417.50A	15592.8	709.3	709.2	21.98	21.99	349.29
1		425.00A	-25748.3	-739.9	-740.8	34.80	34.76	216.75

Strength data for ex-USS BROOKINGS after structural cutting and removals down to the 2nd deck.

APPENDIX C

SALVAGE PLAN

SALVAGE PLAN

TECHNICAL VOLUME

REMOVAL OF EX-BROOKINGS
AGROUND AT NAVSTA ROOSEVELT ROADS

PERFORMED FOR THE

COMMANDER,
NAVAL SEA SYSTEMS COMMAND
SUPERVISOR OF SALVAGE

UNDER CONTRACT NO.
N00024-90-D-3148
DELIVERY ORDER 0011

BY

DONJON MARINE CO., INC.
1250 LIBERTY AVE.
HILLSIDE, NJ 07205
ZONE A - SALVAGE CONTRACTOR

SALVAGE PLAN

TECHNICAL VOLUME

REMOVAL OF EX-BROOKINGS
AGROUND AT NAVSTA ROOSEVELT ROADS

TABLE OF CONTENTS

SALVAGE PLAN
TECHNICAL VOLUME
REMOVAL FROM STRAND
USN EX-BROOKINGS, ROOSEVELT ROADS
NAVAL BASE, PUERTO RICO

This report explores the options available to salvors to remove the U.S. Naval Target Ship, EX-BROOKINGS, from its present stranded position within the confines of Roosevelt Roads Naval Base, Puerto Rico. This report is prepared for, and on behalf of, U.S. Navy SUPSALV under contract number N00024-90-D-4148, delivery order 0011.

The EX-BROOKINGS is presently lying aground off of Cabras Island, Puerto Rico. This grounding was a result of Hurricane "Hugo" during September of 1989. The EX-BROOKINGS was tied up at one of the station's mooring buoys and broke loose due to the abnormally high winds and heavy sea conditions which were a result of "Hugo".

On 10/7/91, there were meetings held at Naval Station Roosevelt Roads, Puerto Rico to discuss the options relating to the removal and disposal of the EX-BROOKINGS as well as the possible role in the salvage effort of both naval and commercial assets. In attendance at the meetings were representatives of Naval Station Roosevelt Roads, including the Base Commander, Captain Roulstone; Commander A. M. Nibbs, Commodore Combat Support Squadron 8; Captain Therrell, Chief of Staff for the Commander

of the Caribbean Theater; Mr. Jim Bladh of NAVSEA/SUPSALV, Washington, D.C.; and Mr. J. Arnold Witte representing Donjon Marine Co., Inc., NAVSEA Zone A Salvage Contractor. Based upon these discussions, it was decided that the SALVOPS would be performed using both Naval and commercial assets. The overall operation would be under the control of NAVSEA/SUPSALV. The specific breakdown of operational responsibilities would be as follows:

1. Survey and Engineering: Combat Support Squadron 8
   Donjon Marine Co., Inc.

2. Preparation of the vessel for removal:
   Combat Support Squadron 8
   Donjon Marine Co., Inc.

3. Removal of the vessel: Combat Support Squadron 8
   Donjon Marine Co., Inc.

4. Tow to disposal site and SINKEX operations:
   Combat Support Squadron 8

It was also understood that NAVSTA Roosevelt Roads would be available to support the removal and disposal operations when it

came to access to the base for all salvage personnel and gear as well as providing a staging area for the SALVOPS. More specific responsibilities will be worked out when the actual on-site work begins.

On October 13, 1991, a survey team was dispatched from Port Newark, N.J. to the wreck site for the purpose of a general condition survey. The survey team was met at NAVSTA Roosevelt Roads by representatives of Combat Support Squadron 8. On October 14, 1991 a joint survey of the EX-BROOKINGS commenced. The objective of this survey was to develop sufficient information to enable salvors to prepare a salvage/removal plan complete with a sequence of events and corresponding cost estimates.

Based upon our survey, and aside from the normal problems associated with a removal and disposal effort of this kind, the overriding concerns are environmental in nature. The vessel is presently aground in an environmentally sensitive area. The vessel's removal is of the utmost importance to insure continued adherence to the overall national sentiments when dealing with the environment and potential hazards to it. When preparing a salvage plan, these concerns must be evaluated and properly dealt with. An issue that is also of some concern when dealing with the removal of the EX-BROOKINGS is the presence of

asbestos. Obviously, these are issues that figure prominently in the planning of the removal and disposal of the EX-BROOKINGS. The survey was completed on October 16, 1991.
The survey consisted of a General Condition Survey of all topside compartments and structures, internal compartments, engine spaces and accessible double bottom tanks. The survey also consisted of an underwater hull survey. The underwater area survey was performed to make sure the seaward bottom contour did not present any barriers or impediments when the actual removal of the vessel from her present position is attempted.

The top side survey revealed that all spaces were relatively clean except for the asbestos covering which is found over the majority of the piping on the vessel. There is also a substantial amount of surplus asbestos lagging found throughout the vessel which would have been used as replacement material while underway. The bilge is clean and all fuel and ballast tanks were found to be basically empty. There is some evidence of oily residue in the main engines and machinery compartments, but nothing substantial.

The underwater survey revealed that the vessel is sitting hard aground throughout the midship section. Both the bow and stern

sections of the wreck have a minimum of three (3) feet bottom clearance. The rudder shoe is also contacting the bottom. A bottom survey of the offshore area shows that the bottom is made up of hard packed sand. The bottom contour is relatively flat, approximately two hundred feet from the side of the ship seaward, and then begins a gentle decline in slope. There were no apparent high spots which would inhibit the pulling/removal effort.

Please refer to the sketch on page C-2 which shows general water depths in the wreck area.

Based upon all available information, the vessel weight is approximately 6,800 long tons. The buoyancy of the vessel in her present condition is approximately 4,220 long tons. Therefore, the approximate weight that needs to be removed from the vessel to insure minimal ground reaction when attempting to remove the vessel from strand is approximately 2,600 long tons. Please refer to pages A-1 and A-2 for the weight calculations.

Based upon this information, the removal operation is straight-forward. Due to the fact that there is substantial residual buoyancy in the vessel in her present condition, the easiest way to remove the EX-BROOKINGS from her present position is to utilize the residual buoyancy to our advantage. The vessel must

have enough weight removed to allow the residual buoyancy to assist in the removal effort. Since there is no liquid weight that can be removed, the required weight must come from the vessel itself.

To insure removal, we propose to remove and dispose of approximately 2,800 to 2,900 long tons of material. To accomplish this all superstructure to the main deck as well as the main deck itself must be removed from the vessel. We must also remove the bulk of the engine room machinery, as well as the rudder, propeller and steering gear. Please refer to pages A-2 and A-3 for the breakdown of required removals.

The removal of the required weight necessary for refloating the hull will be accomplished by cutting the superstructure and deck into pieces that are large enough to hold cutting costs and times to a minimum but not so large they cannot be handled by on-site lifting gear. The removal of the engine room equipment will also be accomplished by cutting all necessary equipment free from the hull and removed with the attendant lift equipment. All cutting will be performed by oxygen/propane cutting torches.

Due to the ever present possibility of fire when dismantling a vessel in this manner, a fire watch will be required at all

times. This procedure is both preventative as well as problem-solving in nature. Due to the obvious water source, all fire watches will consist of a man equipped with a water pump which will draw from the available sea water.

To insure the vessel stays in her present location while we are removing weight, we will flood double bottom ballast tanks as needed to replace the steel which will be removed. When it comes time for removal, the water can simply be pumped off, therefore facilitating removal.

Based upon our survey, we feel there are two (2) methods that should be explored to support the ship breaking portion of the removal operation.

The first method for placement of equipment to support the ship breaking operation would be to build a staging area and two (2) berms on the in-shore side of the vessel running from the shore line to the side of the vessel. Please refer to the sketch on page B-3 for illustration purposes. Based upon our volume calculations, we will need a minimum of 5,550 cubic yards of material to create the berm. Please refer to the information on pages B-1, B-2 and B-4 for our volume calculations. The advantages to this method are that the shipbreaking portions of the work would not be effected by weather. Access to the vessel

would be made easier due to the fact we could, in essence, access the vessel directly from land. Transfers would not have to be made over water which is obviously considerably more time-consuming. There are a number of problems associated with this method. First and foremost is the environmental impact. Based upon our survey, the reef may be alive.

Building a berm on top of the existing reef infrastructure as well as walking and utilizing heavy equipment on this berm could cause further damage to the reef. Another problem associated with the berm proposal is residual fill material on the berm. Although we plan on removing the bulk of the fill which would be used in the construction of the berm once the vessel is removed, there will remain some fill on the reef that could cause further damage. There is no realistic way to insure 100 percent of the fill material is removed. It should be pointed out that the Department of Natural Resources (DNR) for the Commonwealth of Puerto Rico and other associated interested agencies should be contacted before removal commences.

Another issue which may impact this method is continual access to NAVSTA Roosevelt Roads for the substantial amount of trucks, equipment, and local manpower that will need to be run to the work site and more importantly, the effect that this operation may have on the day-to-day operations of the base. Based upon

our meetings with base personnel, it seems that the general view of this removal effort by base personnel is that they will provide as much support as is necessary as long as it does not have a substantial impact on their daily activities. The station is presently manned to deal with the normal day-to-day activities. Attempting to accomplish all work associated with the berm method will undoubtedly require the attention of a substantial amount of base personnel. These types of issues are "costs" that cannot be measured in dollars but must be taken into consideration when evaluating the plausibility of the work.

Taking into account all these issues, the total estimated cost for the "berm" method of removal is $1,916,509.00.

The other method for the ship breaking portion of the work is to do all removal of steel from offshore of the vessel with the use of a floating crane, an attendant tug, and a cargo barge. In this way, the impact to the reef as well as base operations will be minimal. The total estimated cost for the offshore removal method is $1,732,560.00.

Due to the estimated costs utilizing the inshore "berm" method, which is approximately $200,000.00 higher than the offshore method, combined with the environmental impact to the reef and

the disruption of normal base operations, the "berm" alternative has been discounted.

The salvage plan for the water side removal method is broken down into seven (7) phases. One very important consideration when discussing the removal of the necessary weight from the EX-BROOKINGS for removal from strand is the ultimate disposition of the asbestos onboard. We propose to remove all asbestos materials in accordance with EPA regulations, double bag the material in specially designed plastic refuse bags, and place and seal all the asbestos into the double bottom tanks of the EX-BROOKINGS. In this way, when the EX-BROOKINGS is sunk offshore, the asbestos will be entombed and, therefore, disposed of. All other materials, including miscellaneous garbage and oil by products will be disposed of before the vessel is scuttled. This operation will cause few problems due to the minimal quantities of each presently onboard the EX-BROOKINGS.

This procedure was accepted by the State of California, Dept. of Fish and Game, NOAA, and the USN Pacific Missile Test Center Environmental Affairs Office, when NAVSEA/SUPSALV disposed of the "TORTUGA" by sinking in August, 1989.

Based upon these disposal assumptions the schedule of work for each phase is as follows:

PHASE I - Survey and proposal preparation - this work has been accomplished between the meeting of 10/7/91 and our subsequent survey of the vessel and site from 10/13 through 10/16 of this year.

PHASE II - During this phase, we will mobilize all necessary equipment from our Port Newark, N.J. warehouse facility to begin the pre-cutting and asbestos removal and disposal portion of the work at the wreck site. All necessary equipment will be placed into two (2) 20' ocean-going salvage containers and will be shipped via common carrier to San Juan, P.R. and then trucked to NAVSTA Roosevelt Roads. Please refer to page D-1 for an equipment list.

PHASE III - During this phase we will mobilize all necessary personnel to the project area. The initial salvage team will consist of the following personnel:

(1) Salvage Master
(1) Assistant Salvage Master
(4) Burners
(3) Laborers
(1) Diver/Salvage Technician

PHASE IV - During this phase of the work we will begin the actual preparation of the ship for removal. The specific work which will be accomplished during this phase is as follows:

1. Transport salvage containers, gas and air and other salvage gear to wreck site.

2. Begin to remove and dispose of the garbage and miscellaneous debris presently onboard the EX-BROOKINGS.

3. Begin to remove and place within double bottom tanks the asbestos debris.

4. Begin to pre-cut steel superstructure and hull in preparation for lightening efforts.

PHASE V - During this phase we will mobilize a tug, crane-barge, and material barge to the work site. We will be utilizing a cranebarge equipped with a 4100 Manitowoc ringer crane and four point anchor system. The cranebarge size is 200' x 56' x 14' which is a very stable work platform. Due to the size of the cranebarge, we will be able to work during the majority of the weather conditions which can be expected during the non-hurricane season. Please refer to pages E-1 through E-4 for specifications on the proposed crane barge. The cargo barge will be of sufficient size to not only carry a substantial load at the site, but will also serve to transport the material to the eventual unloading site for sale. The barges presently available are in the 250' x 70' x 16' class.

We will also mobilize to the job site a salvage engineer and logistics coordinator. The salvage engineer will assist in determining the approximate locations for the cut lines. The logistics coordinator will assist the

salvage master in coordinating local contractors as well as handling contractor/naval relations.

PHASE VI - During this phase of the work, we will be performing the following activities:

1. Complete the removal and disposal of all debris, including asbestos.

2. Begin and complete the removal of all steel superstructure, hull and deck sections, and engine room gear necessary for removal of the vessel from strand.

3. Affix the necessary attachment points to the hull to facilitate COMSUPPRON Eight's removal operation.

4. Transport to San Juan the steel scrap generated by the ship breaking effort for sale. We have identified two possible scrap dealers who have expressed an interest in purchasing the steel scrap. Once a firm work schedule is determined, we will choose between the two possible scrap dealers. This decision will be made based upon the best monetary offer for the material.

PHASE VII - During this phase, we will begin to demobilize men and equipment from the ship breaking/lightening portion of the work. We will also be assisting COMSUPPRON Eight in the actual removal portion of the work. Once the vessel is removed and safe, we will complete the demobilization of all men and equipment from the work site.

Please refer to page C-3 for a chronology of events that show the phases and the estimated number of days necessary to complete each phase.

Although it is our understanding that the remaining hull of the EX-BROOKINGS will be disposed of exclusively by Navy assets and personnel, we have done some research into potential disposal criteria for the hull to be scuttled. Based upon past work in Puerto Rico, all interested parties (including U.S. Coast Guard and Puerto Rican Department of Natural Resources) have agreed that the only criteria they have for dumping wrecks at sea is that there must be a minimum depth of 300', the vessel must be basically oil free and any floating debris that appears after the sinking must be picked up.

Based upon this criteria, it would seem there are quite a few suitable sites south/southeast of Isla De Vieques. Please refer to page C-1 for a visual perspective.

For a visual perspective of the wreck site, please refer to figures 1 through 5 located on pages C-4 through C-6. These photographs are self-explanatory.

APPENDIX A

ESTIMATE OF WEIGHT TO BE REMOVED FROM EX-BROOKINGS

PRESENT DISPLACEMENT:

Lightship Weight Dry		: 6872 LT
Misc. Eqpt. onboard not incl. in Lightship weight		: 8 LT

Weights included in the Lightship weight but have been removed for the conversion to target ship:

a) 10 Life Boats	= 20 LT	
b) Guns, Armor, Rigging and Anchors	= 60 LT	
c) Misc. Outfit Onboard	= 10 LT	
Total weight removed		: 90 LT

Displacement in present condition = 6872 + 8 - 90 = 6790 LT

The observed waterline mark on the hull is at approximately 14 feet draft which corresponds to a displacement of 6750 LT. We shall use an estimate of 6800 LT in order to be conservative.

PRESENT BUOYANCY:

Freeboard readings were taken port and starboard along with the bulwark heights at three different locations on the vessel. Due to the fact that the vessel is exposed to the incoming weather on the starboard side, the freeboards on the starboard side are less accurate.

Molded Draft = Molded depth at midships + shear at the location + plating thickness + height of bulwark above deck at the location - freeboard from the bulwark at the location.

LOCATION	MLD DK HT+SHEER+PLTG . THK.	BULWARK HT	FREEBD	MLD DRAFT
FR 91 S	38.145′	3.083′	34.50′	6.73′
FR 91 P	38.145′	3.083′	29.42′	11.81′
FR 77 S	38.106′	2.833′	34.00′	6.94′
FR 77 P	38.106′	2.833′	28.50′	12.43′
FR 44 S	38.257′	3.042′	34.75′	6.55′
FR 44 P	38.257′	3.042′	29.67′	11.63′

LOCATION	MEAN DRAFT	
FR 91	9.27′	
FR 77	9.69′	APPROXIMATE DRAFT = 9.25′
FR 44	9.09′	
STERN FRAME	9.17′	FROM SIGHTING.

From the CAPACITY PLAN, the buoyancy corresponding to a draft of 9.25′ is 4220 FT.

WEIGHT TO REMOVE IN ORDER TO REFLOAT THE EX-BROOKINGS:

Present Displacement = 6800 LT
Present Buoyancy = 4220 LT

Weight to be removed to refloat the EX-BROOKINGS = 6800 - 4220
= 2500 LT

Approximate TPI at 9.00′ draft is 43.3 LT/IN. The Tide range is approximately 6 inches. Thus, the ground reaction will vary over a range of 260 LT during the tide cycle.

Conservatively, the weight to be removed is approximately 2600 LT. This will allow a maximum possible ground reaction of 240 LT at low tide, assuming the freeboards were taken at high tide. This will require a pull of 120 LT to 170 LT in order to move the vessel at low tide.

ITEMS TO BE REMOVED IN ORDER TO REFLOAT EX-BROOKINGS:

The weight estimates of the different items listed below are based on weights data of a MARAD Class C4-S-1a vessel as presented in the "Principles of Naval Architecture". The EX-BROOKINGS is a MARAD Class C1 vessel. The weights were estimated by multiplying the weight given in the data by the ratio of the lightship weights of the two vessels.

Weights on the Main Deck Level:

STEEL:

Superstructure	=	318 LT
Main Dk Plt & Beams	=	496 LT
Forecastle	=	33 LT
Aft Deck House	=	25 LT
Bulwarks	=	30 LT
Total Steel	=	902 LT

OUTFIT:

Masts, Booms, Posts	=	549 LT
Dk Castings, Mooring Fittings	=	46 LT
Rails and Stanchions	=	17 LT
Doors, Ladders, etc.	=	29 LT
Joiner Work, Furniture	=	76 LT
Rigging, Paint and Cement	=	150 LT
Galley and Pantry Outfit	=	16 LT
Plumbing, Drains and Fans etc.	=	45 LT
Piping in Superstructure	=	14 LT
Deck Machinery	=	146 LT
Total Outfit	=	1088 LT

MACHINERY TO BE REMOVED:

Steering Gear & Rudder	=	53 LT
Electric Plant	=	97 LT
Main Engines & Red. Gear	=	188 LT
Feed & Condensate System	=	33 LT
Propeller	=	24 LT
Boilers and Burners	=	204 LT
Exhaust Piping	=	10 LT
Misc. Eqpt. in E. R.	=	5 LT
Total Machinery	=	614 LT

Total Weight of Items to be Removed = 902 + 1088 + 614 = 2604 LT

APPENDIX B

ESTIMATE OF FILL NEEDED TO BUILD ROADWAYS AND PLATFORMS FOR SHORE-BASED OPERATIONS TO REFLOAT EX-BROOKINGS

The vessel is stranded on a coral reef. While it is possible to almost wade out to the vessel, there are large pockets of deep water. The bottom is not a smooth sloping shelf. These calculations are based on the average depths as sounded, with the assumption that soil will not settle once it is deposited and compacted. Drawing F1190-001 shows the layout of the shore-based operations including the proposed roadway and platforms.

Fill Needed to Build Road From the Shore to the Crane Platform:

The road is assumed to be built up to a level 2.5 feet above the surface of the water. The edges of the berm are to be sloping away at an angle of 30 degrees with the horizontal. Sketch SK-F1190-01 shows a typical cross-section.

Cross-sectional Area = $h(a + 1.732h)$

where a = road width = 25 feet
h = height of the berm = water depth + 2.5 feet

The volume of fill needed is calculated using Simpson's 1-4-1 method of numerical integration.

Dist. from Shore	Height	Area	S.M.	Vol.
0′	2.50′	73.33	1	73.33
10′	4.50′	147.57	4	590.30
20′	5.50′	189.89	2	379.79
30′	5.75′	201.01	4	804.06
40′	6.00′	212.35	2	424.70
50′	6.25′	223.91	4	895.63
60′	6.50′	235.68	2	471.35
70′	7.00′	259.87	4	1039.47
80′	7.50′	284.93	2	569.85
90′	7.75′	297.78	4	1191.11
100′	8.00′	310.85	1	310.85
			Total	6750.44

Volume of fill needed = 10 x 6750.44/(3 x Cos 48.19°) = 33752 cft

This does not include any allowance for compaction and erosion.

Volume of fill needed for 2 roadways = 2 x 33752 = 67504 cft.

(B-1)

Fill Needed to Build a Road from Existing Road to New Roadways:

Length of the connector road = 20 feet

Width of the connector road = 35 feet

Average height of the berm = 2 feet

Volume of fill needed = 20 x 2(35 + 2 x 1.7332) = 1539 cft.

Fill Needed to Build Crane Platforms:

Average height of the berm = 10.0 feet

Area at top for 30' x 30' platform = 30 x 30 = 900 sq. ft.

Width of berm at bottom = 30 x 2 x 10 x 1.732 = 64.64 feet

Area at the bottom = 64.64 x 64.64 = 4178 sq. ft.

Volume of fill needed per platform = 10(900 + 4178)/2 = 25390 cft.

Volume of fill needed for 2 platforms = 25390 x 2 = 50780 cft.

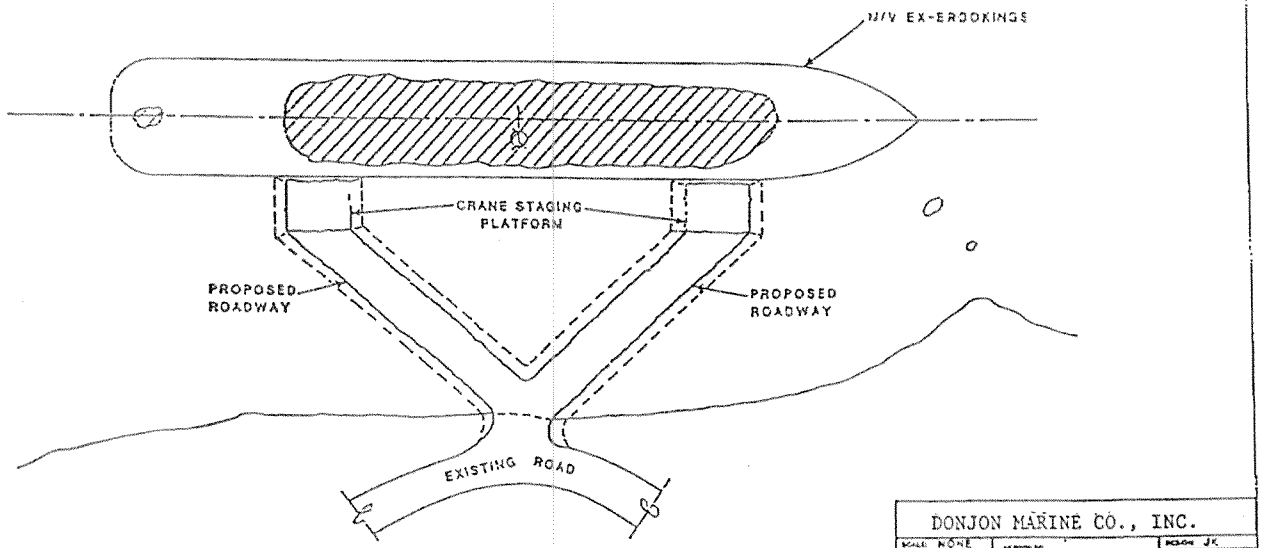
No allowance for compaction and erosion has been included.

Total volume of fill needed for Shore-Based Operations = 67504 + 1539 + 50780 = 119,823 cft. = 4438 cu. yds.

Adding 25% for miscellaneious = 1110 cu. yds.

Total fill needed = 5548 cu. yds.

DISTANCE FROM SHORE	WATER DEPTH
8'	1'
15'	2'
25'	3'
60'	4'
85'	5'
100'	5.5'
120'	6.5'
130'	8'



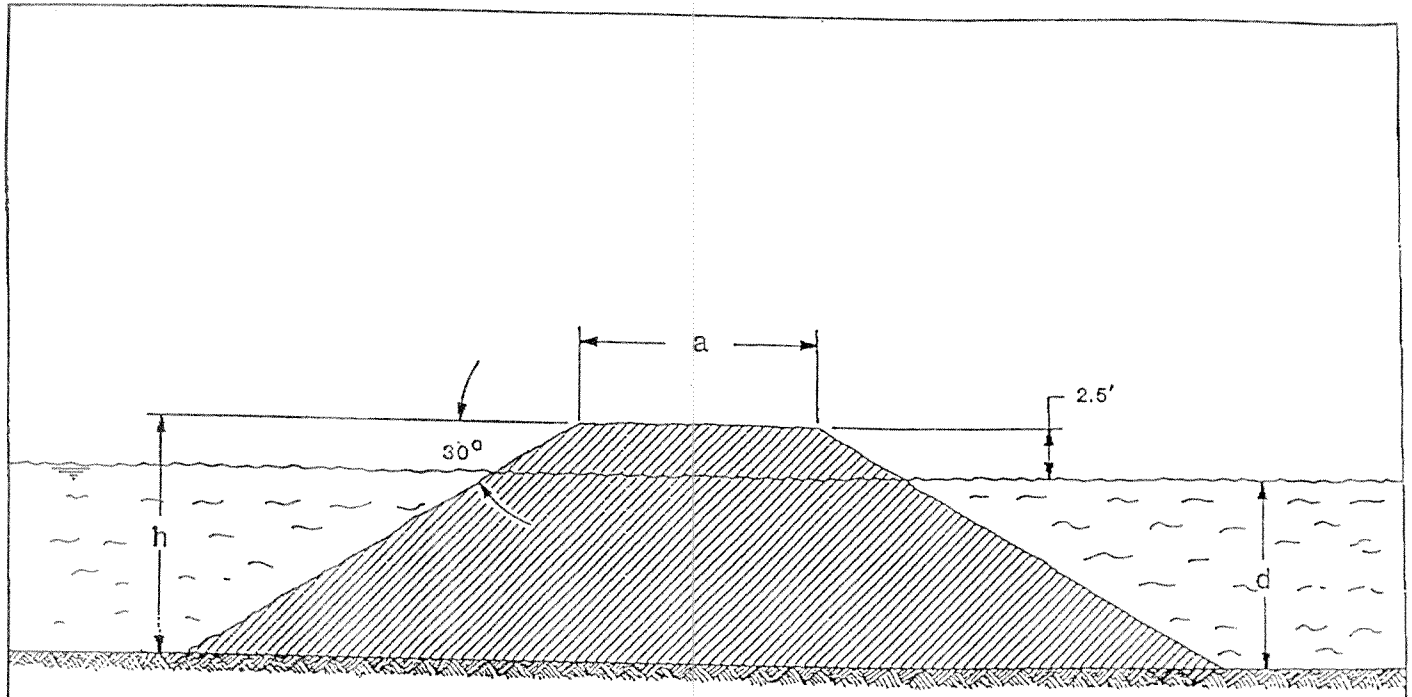
DONJON MARINE CO., INC.

SCALE NONE | APPROVED | DESIGN JK

DATE 10/23/81 | DRAWN EGT

SHORE BASED OPERATIONS LAYOUT FOR REMOVAL OF EX-BROOKINGS

DRAWING NO F1190-001 | SHEET 1 OF 3



d = WATER DEPTH

h = HEIGHT OF THE BERM

a = ROAD WIDTH 25 FEET

DONJON MARINE CO., INC.		
SCALE: NONE	APPROVED:	DESIGN JK
DATE: 10/28/91		DRAWN ECT
PROPOSED ROADWAY CROSS SECTION		
DRAWING NO SK-F1190-01		SHEET 1 OF 1

APPENDIX D

CHRONOLOGY

18 Sep 89	Ex-BROOKINGS strands on *Isla Cabras*, U.S. Naval Station Roosevelt Roads, Puerto Rico.
Jan 90	Ex-BROOKINGS stranding surveyed by personnel from USS PRESERVER (ARS 8).
9 Sep 91	Chief of Naval Operations tasks Supervisor of Salvage to initiate procedures to contract for removal and disposal of ex-BROOKINGS (CNO 091947ZSEP91).
7 Oct 91	Meetings between interested parties at Naval Station Roosevelt Roads, Puerto Rico to discuss options.
7-14 Oct 91	Survey of ex-BROOKINGS by DONJON and CSR 8 personnel.
8 Nov 91	SUPSALV removal plan complete: Remove 2,600 to 3,000 long tons of structure and machinery to allow wreck to float off reef, dispose of wreck at sea.
20 Nov 91	Cruise missile PEO assigns funding.
17 Dec 91	CNO (OP-43) approves weight removal portion of SUPSALV plan.
26 Dec 91	Contractor (DONJON) mobilization begins.
2-3 Jan 92	2 SUPSALV Representatives and 9 contractor personnel arrive at NAVSTA Roosevelt Roads.
4 Jan 92	Salvage and burning equipment loaded on ex-BROOKINGS; cut lines laid out.
5 Jan 92	Weight removal cutting begins. Superstructure will be cut down to main deck before barge and crane brought alongside to remove weight.
6 Jan 92	4 MDSU-2 personnel arrive.
7 Jan 92	SUPSALV Rep meets with AFWTF Reps to draft plan of action to minimize work stoppage during target drone launches from *Isla Cabras*.
10 Jan 92	Burning oxygen bottles onboard ex-BROOKINGS replenished after delay caused by adverse winds and seas.
13 Jan 92	Local environmental firm unable to strip asbestos from superstructure. DONJON decides to accomplish task through their subsidiary, Clean Ventures.
14 Jan 92	SUPSALV requests EPA concurrence on disposal of ex-BROOKINGS by sinking at sea.
15 Jan 92	Permission obtained to store oxygen and propane bottles inside AFWTF fence and run torch lines to ship, avoiding weather dependent resupply of bottles onboard.
16 Jan 92	Clean Ventures asbestos removal team arrives with equipment.
17 Jan 92	Asbestos removal begins aft, working forward behind cutters. Asbestos bagged and stowed in refr flats. Time required for asbestos removal estimated at 30+ days.
20 Jan 92	All topside structure above main deck cut and ready for removal. Burners shift to removing ventilation ducting joints which include gaskets containing PCBs.

21 Jan 92	SUPSALV Rep and remaining MDSU-2 Rep inspect double bottoms and tanks under main machinery space to document structural elements. Scantlings obtained utilized to generate structural sections in *POSSE* section modulus editor. All fuel tanks opened and found empty except for residual heavy fuel scum. Centerline feed bottom tank, B-902-W found to be half full of water (about 50 tons).
22 Jan 92	Remaining voids and water tanks opened and inspected: aft fresh water tanks, C-905-W and C-906-W found to contain 12 feet of water each (about 325 tons). DONJON efforts to charter local crane, barge, and tug unsuccessful as the three assets cannot be obtained simultaneously for any significant period.
23 Jan 92	SUPSALV Rep investigates hiring naval station floating derrick YD-251. Naval station can provide derrick, operators, and fenders, but naval station tugs, drawing 14' 9", cannot bring derrick alongside ex-Brookings. Burners shift from removing ventilation ducting joints to cutting shell plating and structural members between second and main decks, starting from bow and stern and moving towards midships.
30 Jan 92	Lack of crane and barge threatening to cause work stoppage as burners run out of work. Cutting confined to rigging points in kingposts and masts and some second deck structure. Structural cutting cannot proceed until some weight removed. All topside structures clear of asbestos; removal work concentrating on main deck and beginning on second deck.
1 Feb 92	2,200-horsepower tug and 210-foot barge hired from Crowley of Puerto Rico; YD-251 hired from Naval Station for weight removal starting 5 Feb.
5-6 Feb 92	Weight removal delayed by easterly winds and rain squalls which preclude bringing or leaving derrick and barge alongside. Scrap barge moored to buoy mooring on north side of Bahia de Puerca.
7 Feb 92	Fair weather with moderate southerly winds permits mooring derrick alongside by 1230. Approximately 60 tons of deck machinery and associated foundations removed by 1700.
8 Feb 92	After deckhouse, bridge, stack, and ventilation rooms above engine rooms removed, bringing total weight removed to 175 tons.
9 Feb 92	YD-251 out of commission because auxiliary hook wire has jumped sheave. ETR 11 Feb.
11 Feb 92	Repairs to YD-251 complete.
12 Feb 92	Weight removal continues with YD-251: 89 tons (264/324 tons total) removed. Outer hook (skyhook) wire frays, placing derrick out of commission.
13 Feb 92	Additional problems noted with YD-251: several main engine foundation bolts loosened; major oil leak from port planetary reduction gear.
15 Feb 92	Scrap barge moved to buoy mooring in inner harbor, tug EL MORRO released pending availability of scrap yard and floating crane. Asbestos removal and steel cutting continue.
16 Feb 92	Asbestos removal and steel cutting continue.
17 Feb 92	Holiday (Presidents Day). All contractor personnel take much needed day off; 12 hour days for over a month have cut into productivity.
18 Feb 92	DONJON floating crane OBS-2250 mobilized from New Jersey. OBS-2250 to be underway 25 Feb with estimated 10- to 12-day transit Puerto Rico. DONJON foreman meets with Dutch scrap dealer.

19 Feb 92	Wind from northeast, with 3-foot and higher seas on outboard (port) side of BROOKINGS - weight removal would have been impossible even if crane was available. Attempts to charter crane in Virgin Islands unsuccessful.
	Dutch scrap merchant agrees to take barge load of scrap for $10 per ton and expresses interest in buying entire hulk. Refloated hulk would be towed to breaking yard in Columbia. This option would require scrap dealer to certify that asbestos and PCBs would be disposed of properly.
20 Feb 92	Scrap barge underway at 0730 for scrap yard at Yabucoa. DONJON foreman accompanies barge to ensure barge is not damaged during offload, as charterer would have to pay for damage.
	NAVSEA authorizes DONJON to act as agent for the sale of scrap from BROOKINGS, applying proceeds from scrap sale against project costs.
	Wind from the northeast
21 Feb 92	Repairs to YD-251 complete. Skyhook being removed, derrick estimated available 24 or 25 Feb.
22 Feb 92	Strong (15+ knots) winds from the northeast.
23 Feb 92	Weather extremely bad; 4+ foot swell, waves breaking on the bow, 20+ knots wind.
	Scrap offload at Yabucoa complete, barge and tug at naval station by 1500.
24 Feb 92	YD-251, with skyhook and wire removed, ready for operations.
	Weather worsens. Wind shifts to more easterly direction, reducing swells at stranding site, but increasing seas in naval station harbor,making it impossible to move derrick.
25 Feb 92	Weather improves but still 20+ knots wind with 3+ foot swells. Possible to move derrick, but lifts would be questionable.
27 Feb 92	YD-251 on site. 115 tons removed before auxiliary hook wire jumps sheave. Derrick returned to naval station harbor for repairs.
28 Feb 92	With auxiliary hook and wire removed, YD-251 towed back to BROOKINGS.
29 Feb 92	Wind from southeast at 10-15 knots, leaving calm seas at stranding site. 155 tons removed. Hull down to 01 level throughout and to main deck over last third of ship.
1 Mar 92	Wind continues from southeast, but weight removal ceases at noon as scrap barge filled. 76 tons removed. Hull down to main deck aft of forward engine room bulkhead.
2 Mar 92	Word received that scrap offload dock in Yabucoa unavailable until 14 Mar or later.
3 Mar 92	SUPPRON EIGHT personnel arrive to examine wreck and site to determine how to remove hulk from strand following weight removal.
	Scrap dealer in San Juan indicates interest in second barge load of scrap.
	Examination of barge draft marks indicates that approximately 460 tons of scrap have been placed onboard from 27 Feb to 1 Mar, vice 346 as indicated by derrick load cell.
4 Mar 92	EPA approves disposal of BROOKINGS hulk at sea.
	Scrap barge departs in the afternoon for offload in San Juan.

5 Mar 92	Barge offload complete. Official readings indicate 419 long tons scrap offloaded.
7 Mar 92	DONJON tug J.A. WITTE arrives at naval station 1330 with DONJON crane OBS-2250 in tow.
8 Mar 92	Minor repairs and mobilization work on OBS-2250.
9 Mar 92	OBS-2250 and scrap barge alongside BROOKINGS to commence weight removal. 250 long tons removed.
10 Mar 92	150 long tons scrap removed. All structure above main deck removed. Crane moved aft to prepare to remove structure to second deck.
11 Mar 92	Scrap barge loaded and moved to buoy in naval station harbor until scrap yard is ready to offload.
13 Mar 92	The 250-foot barge SANTO DOMINGO chartered from Crowley Maritime. Tug J.A. WITTE underway in the afternoon for San Juan to return with SANTO DOMINGO.
14 Mar 92	SANTO DOMINGO made up to BROOKINGS and weight removal commenced. 25 tons removed before operations secured at noon due to deteriorating weather.
15 Mar 92	After removing 30 tons, OBS-2250 breaks down. Repairs expected to take two or three days. OBS-2250 and SANTO DOMINGO moved into the naval station harbor pending crane repairs.
17 Mar 92	Essential repairs to OBS-2250 complete, but some maintenance items remain. 210-foot barge underway for scrap yard in San Juan in the evening.
19 Mar 92	Weather at site too rough for crane operations.
20 Mar 92	Good weather at site. Eight main deck sections removed, along with the emergency diesel generator, switchboard, motor generator set, and capstan from the stern, and an anchor from the number 4 hold. Blocks, copper and alloy pipe and stock, wire rope pendants, and similar materials offloaded from after hold and stowed aboard OBS-2250 for scrap sale in Port Newark NJ where they will fetch a better price than the $10 to $20 per ton offers in Puerto Rico. 210-foot barge offloaded in San Juan and taken off hire.
21 Mar 92	Glass calm sea and productive day. All structure above the second deck aft of frame 51 removed. Cutting of bow structure down to third deck 75 percent complete. Engine room totally exposed, making it apparent that removal of boilers would require cutting through second deck. Plans to remove boilers abandoned as cutting second deck would reduce hull strength to unacceptable level. *POSSE* model of SANTO DOMINGO indicates that approximately 850 long tons of steel have been loaded.
22 Mar 92	Strong winds from the north prevent movement OBS-2250 and SANTO DOMINGO, thus preventing removal of main deck sections forward of frame 50. Incinerator, galley gear, laundry machinery, and engine room interferences removed. OBS-2250 and SANTO DOMINGO moved to naval station harbor in evening.
23 Mar 92	Weather too rough for barge movements or crane operations.
24 Mar 92	OBS-2250 and SANTO DOMINGO brought alongside BROOKINGS early in the morning. Three section main deck between frames 40 and 50 removed along with some miscellaneous debris. Work stopped at noon as weather deteriorated. OBS-2250 and SANTO DOMINGO moved to buoy in naval station harbor for the night.

25 Mar 92	Remainder of main deck, with exception of chain locker, removed. Anchor chain, ovens, galley equipment and other miscellaneous items removed. Movement in bow felt and noted by the swaying of bunks and chains when waves and barges struck ship.
26 Mar 92	Weight removal continues in face of winds from northeast. Movement of bow becomes very noticeable as structure is removed to the third deck between frames 14 and 37. Snorkel survey by SUPSALV Rep and MDSU-2 Rep reveals that BROOKINGS is lively and has moved aft about 5 feet and swung her bow about 10 feet away from the beach. Fuel tank A-904-F ballasted and cutting on bow stepped up. Final section of bow removed after ballasting.
27 Mar 92	Oily waste in bilges stripped into tank truck on shore. HP and LP turbines lifted off in the morning and main engine condenser in the afternoon. Dewatering pumps staged and ready forward, midships, and aft.
28 Mar 92	With still air and a glass-calm sea, deballasting begins at 0730. BROOKINGS pulled off her strand at 1037 by tug J.A. WITTE and naval station YTB and moored along side finger pier near graving dock in *Bahia de Puerca*.
31 Mar 92	All scrap sale offers unacceptably low. Preparations proceed for at sea scuttling.
01 Apr 92	BROOKINGS towed to scuttling site by tug J.A. WITTE, arriving at dawn (0620). Tow bridle disconnected at 0640. EOD team and MDSU-2 Rep set rig four 20-pound charges on hogging lines under engine room. Charges detonated at 0900. BROOKINGS sank stern first at 1030 with no oil slick. Three small pieces of debris recovered.
2 Apr 92	Contractor demobilization commences.

APPENDIX E

KEY PERSONNEL, SALVOPS

NAVSEA 00C

Lieutenant Commander Rich Hooper, NAVSEA 00C Assistant for Salvage

Mr. Jim Bladh, NAVSEA 00C Head Operations Branch

Mr. Paul Hankins, NAVSEA 00C Environmental Specialist

COMSUPPRON-8

Commander "Mac" Nibbs, COMSUPPRON-8

Lieutenant Commander Glenn A. Piper, Material Officer, SUPPRON-8

MDSU-2

Lieutenant Commander Raymond Machasick, CO, MDSU-2

MMC (DV) David Gibson, MDSU-2

NAVSTA ROOSEVELT ROADS

Commander Robert Ybanez, NAVSTA Roosevelt Roads Public Works Officer

Mr. Jose B. Negron, NAVSTA Roosevelt Roads Public Works Department - Environmental

Mr. Winston Martinez, NAVSTA Roosevelt Roads Public Works Department - Environmental

Mr. Carmen Villanueva, NAVSTA Roosevelt Roads Public Works Department - Environmental

Lieutenant Commander Gerald E. Loporto, NAVSTA Roosevelt Roads Security

BMCS (SW) Bryant, Senior Pilot, NAVSTA Roosevelt Roads Port Operations

AFWTF

Commander Jim Long, AFWTF Safety Officer

Lieutenant Rich Howarth, AFWTF Assistant Safety Officer

EOD DETACHMENT

Lieutenant George Ferris, OIC, NAVSTA Roosevelt Roads EOD Detachment

BMCM John Conway, LCPO, NAVSTA Roosevelt Roads EOD Detachment

DON-JON MARINE

Mr. John A. Witte, Sr., CEO, DONJON Marine

Mr. Dale Springer, Don-Jon Marine Salvage Master

Mr. Jack Kalro, Don-Jon Marine Salvage Engineer

Mr. Steve Newes, Government Contractor Officer

NAVY LODGE

Ms. Dorothy Glawson, Manager, Navy Lodge, NAVSTA Roosevelt Roads