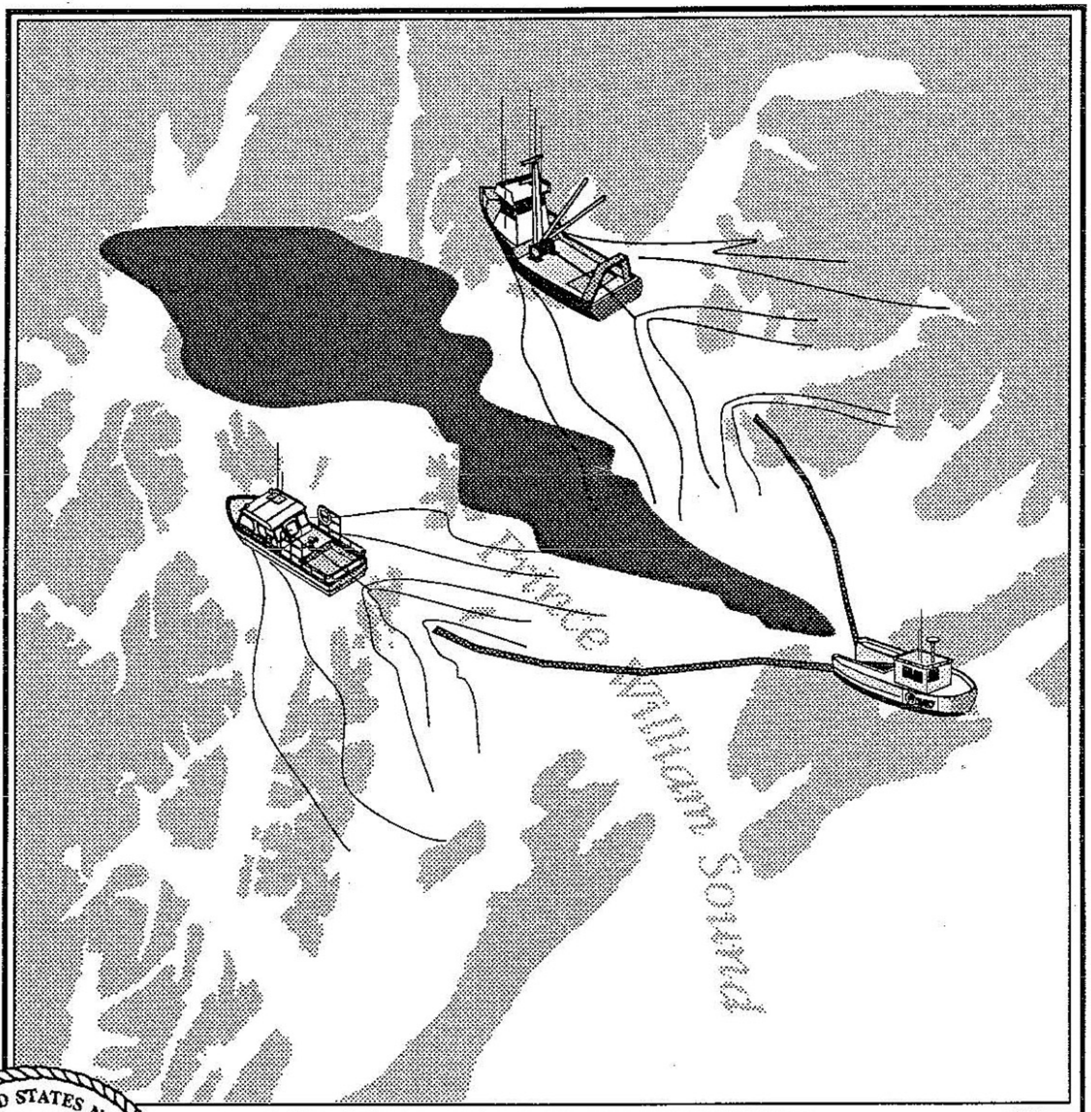
SUPERVISOR OF SALVAGE
U.S. NAVY

EXXON VALDEZ OIL SPILL RESPONSE



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FOREWORD

In the early 1970's, in response to a rapidly escalating national environmental awareness, the Naval Sea Systems Command embarked on an innovative program to design and procure an inventory of oil spill response equipment intended to be maintained in a ready-for-issue condition for fly-away response to a Navy oil spill anywhere in the world. Because this equipment, now in place and managed by the Supervisor of Salvage (SUPSALV), U.S. Navy, is considered a *national asset*, it is often utilized by other Federal agencies as a major element of the National Oil and Hazardous Substances Contingency Plan. Such was the case when the VLCC EXXON VALDEZ grounded on Bligh Reef on 24 March 1989.

Between March and November, 1989, SUPSALV deployed over 90 percent of his major Emergency Ship Salvage Material (ESSM) inventory of oil spill response equipment in support of the EXXON VALDEZ oil spill cleanup in Prince William Sound and its environs. SUPSALV was the largest single provider of oil skimmers and field support equipment to the multiorganizational response and was credited with recovering approximately one-half (albeit a small percentage of the total oil spilled) of all of the oil recovered.

This report is intended to educate pollution response managers in the demands of decision-making for operational and logistical support and asset coordination that prevail in large-scale spill response operations. Managers must understand the requirements if they are to respond effectively. The spill size and geography of the Alaskan operation placed rigorous demands on the SUPSALV equipment and organization, providing valuable lessons that have broad application for future responses worldwide.

This report is also intended to provide U.S. Navy salvage officers with a clear insight into the importance and mechanics of oil spill response operations. Because most major oil spills result from a ship-related disaster, ship salvage operations performed by organic Navy assets are likely to occur simultaneously with oil spill response operations performed by NAVSEA contractors. The OTC for the salvage and the NOSC for the spill response are clearly interrelated. Their relationship must be understood by all concerned. These issues and the important lessons learned from the EXXON VALDEZ operation are being incorporated into the *U.S. Navy Ship Salvage Manual, Volume 6* (S0300-A6-MAN-060) currently in production.

EXECUTIVE SUMMARY

The Supervisor of Salvage, U.S. Navy (SUPSALV) deployed over 90 percent of his inventory of oil pollution control equipment from Emergency Ship Salvage Material bases on the Atlantic and Pacific coasts of the United States to Prince William Sound, Alaska in response to the EXXON VALDEZ oil spill. This was the largest response by SUPSALV to date and the single largest block of equipment deployed to contain and collect free oil in the operation. During the 205-day operation, 22 skimmers operated by over 100 contractor personnel provided more than 3,000 skimmer-days of services. These skimmers were credited with recovering approximately one-half of all the oil that was recovered at a cost of approximately $17.5 million.

The operation demonstrated that SUPSALV equipment can be deployed and operated successfully in a large-scale oil spill response operation in a remote area. The performance of SUPSALV equipment validated the wisdom of the Navy's investment in procuring, maintaining, and exercising the equipment. Further, it demonstrated its value as a national asset.

Logistics and management were the limiting factors in the operation. The size and relative remoteness of the spill, geographic area, number of organizations involved, *ad hoc* structure, and extraordinary national interest placed exceptional demands on responders. The Supervisor of Salvage (SUPSALV) was integrated with Federal and state agencies and commercial organizations in a reasonable, workable, flexible, and effective operation.

The ESSM system was responsive. Equipment performed at a high standard—with only 14 skimmer-days of down-time. Experience gained in the EXXON VALDEZ response identifies areas where improvements must be made. Judicious application of the lessons can make the system function more smoothly and effectively in future operations. The requirements of each job differ in detail. Care must be taken in analyzing each operation to ascertain which lessons fit conditions beyond the particular spill.

The SUPSALV equipment and deployment system worked, logistics proved manageable, and the organization made a significant contribution to the overall response. The SUPSALV oil spill response organization and equipment demonstrated that these are national assets sufficiently flexible to be integrated easily into any type of organization.

The existing Interagency Agreement between the Navy and Coast Guard was again validated as an excellent operational instrument—one that should continue to form the basis for SUPSALV responses to Coast Guard requests for assistance.

TABLE OF CONTENTS

Chapter/Paragraph		Page

4 LESSONS LEARNED AND RECOMMENDATIONS

5 CONCLUSIONS

Appendix/Paragraph		Page

A REQUEST FOR POLLUTION CONTROL ASSETS

B EQUIPMENT LISTING AND CHARACTERISTICS

Appendix/Paragraph **Page**

LIST OF ILLUSTRATIONS

LIST OF ACRONYMS USED IN THIS REPORT

ADEC . . . . Alaska Department of Environmental Conservation
AFB . . . . Air Force Base
APM . . . . Assistant Project Manager
AST . . . . Alaska Standard Time
BBL . . . . Barrel(s)
BHB . . . . Boom-Handling Boat
CFR . . . . Code of Federal Regulations
CGDSEVENTEEN . . . . . Coast Guard District Seventeen
CINCPACFLT . . . . Commander-in-Chief, U.S. Pacific Fleet
COGARD . . . . U.S. Coast Guard
COMDT COGARD . . . . . Commandant, U.S. Coast Guard
COMNAVFACENGCOM . Commander, Naval Facilities Engineering Command
COMNAVSEASYSCOM . Commander, Naval Sea Systems Command
COMPACAREA . . . . Commander, Pacific Area
COMPHIBRON . . . . Commander, Amphibious Squadron
CONUS . . . . Continental United States
COTP . . . . Captain of the Port
CWA . . . . Clean Water Act
DOD . . . . Department of Defense
DOMS . . . . Director of Military Support
DWT . . . . Deadweight Ton
EPA . . . . Environmental Protection Agency
ESSM . . . . Emergency Ship Salvage Material
ETA . . . . Estimated Time of Arrival
FAX . . . . Facsimile
FOSC . . . . Federal On-Scene Coordinator
FPN . . . . Federal Project Number
GPC . . . . Global Associates/Phillips Cartner & Co.
HAZMAT . . . . Hazardous Materials
HF . . . . High Frequency
IAA . . . . Interagency Agreement
JCC . . . . Joint Communications Center
JTF . . . . Joint Task Force (Alaska)
LPD . . . . Amphibious Transport Dock
LSD . . . . Landing Ship, Dock
MAC . . . . Military Airlift Command
MIPR . . . . Military Interagency Procurement Request
MSO . . . . Marine Safety Office
MSV . . . . Maintenance Support Vessel
NAVSEA . . . . Naval Sea Systems Command
NAVSEAINST . . . . Naval Sea Systems Command Instruction
NCP . . . . National Contingency Plan

NOSC . . . . Naval On-Scene Coordinator
NRT . . . . National Response Team
OPNAVINST . . . . Chief of Naval Operations Instruction
OSC . . . . On-Scene Coordinator
PM . . . . Project Manager
POL . . . . Petroleum, Oil, Lubricant
PWS . . . . Prince William Sound
RRT . . . . Regional Response Team
SAAM . . . . Special Assignment Airlift Mission
SATCOM . . . . Satellite Communications
SSB . . . . Single Sideband
SUPSALV . . . . Supervisor of Salvage
SUPSALVREP . . . . Supervisor of Salvage Representative
T/V . . . . Tanker/Vessel
UHF . . . . Ultra High Frequency
USC . . . . U.S. Code
USCG . . . . U.S. Coast Guard
USCGC . . . . U.S. Coast Guard Cutter
USN . . . . U.S. Navy
USNR . . . . U.S. Naval Reserve
VHF . . . . Very High Frequency
VLCC . . . . Very Large Crude Carrier
VOSS . . . . Vessel of Opportunity Skimmer System

CHAPTER 1

INTRODUCTION AND BACKGROUND SUMMARY

1-1 THE INCIDENT

Shortly after midnight on 24 March 1989, the 987-foot, U.S. registered, 213,755 dwt Very Large Crude Carrier (VLCC) *T/V EXXON VALDEZ stranded* on Bligh Reef, Prince William Sound, Alaska. Figure 1-1 shows the EXXON VALDEZ and Figure 1-2 depicts Prince William Sound and Bligh Reef. The stranding resulted in extensive damage to 8 of the vessel's 11 cargo tanks and 3 ballast tanks. The *resulting oil spill* was estimated to be about 20 percent of the tanker's total cargo of Alaskan crude oil, or about *250,000 barrels*—the largest oil spill in U.S. history. The cleanup operation was extraordinary in size, intensity and magnitude of effort, geographic extent, remoteness, and political sensitivity. The resources of the *Supervisor of Salvage, U.S. Navy (SUPSALV)* made a major contribution to the 205-day response operation. SUPSALV assets were allocated among operations conducted along a line extending from Valdez more than 300 miles southwestward to Afognak Island in the Gulf of Alaska. These assets were part of a total of over 1,400 vessels used in the cleanup of Prince William Sound and the Gulf of Alaska.

The cost of SUPSALV participation in this response was approximately $17.5 million. About $10.0 million of this was the cost of renting SUPSALV's equipment, and $7.5 million for operations. The costs of air transport and services provided by Exxon and other government agencies are not included in these figures.

1-2 REGULATORY FRAMEWORK

The 1972 *Federal Water Pollution Control Act*, later amended to become the *Clean Water Act (CWA)*, codified as *33 USC* 1251 et seq., established a Federal-State-Local infrastructure for coordinating response to minimize damage from spills of oil and hazardous substances. The U.S. Coast Guard and the Environmental Protection Agency (EPA) are the two lead Federal agencies. Contingency plans, ranging in scope from local to national, were invoked when the EXXON VALDEZ stranded.

Section 311(k) of the CWA created a Pollution Fund, commonly called the *311(k) Fund.* The Coast Guard administers the Fund to underwrite cleanup costs of pollution incidents when the spiller is either unknown or not acting responsibly, or when the Coast Guard deems that the spiller's effort to remove the pollution is insufficient. When the Coast Guard assumes funding control of the cleanup under these circumstances, the spill has been *federalized.* In this case, the Coast Guard partially federalized the response to provide additional Federal assets.

The 311(k) Fund is activated when the *Federal On-Scene Coordinator (FOSC)* opens the fund and assigns a Federal Project Number (FPN) to a spill response. This eight-digit control number is used to track expenses chargeable to that response activity. The FPN for the EXXON VALDEZ spill was 33-179007. Rather than using the Federal Project Number, SUPSALV charges against accounting data provided to him by a Military Interagency Procurement Request (MIPR). In this case, the MIPR was prepared by the Coast Guard Maintenance and Logistics Command at Alameda, California.

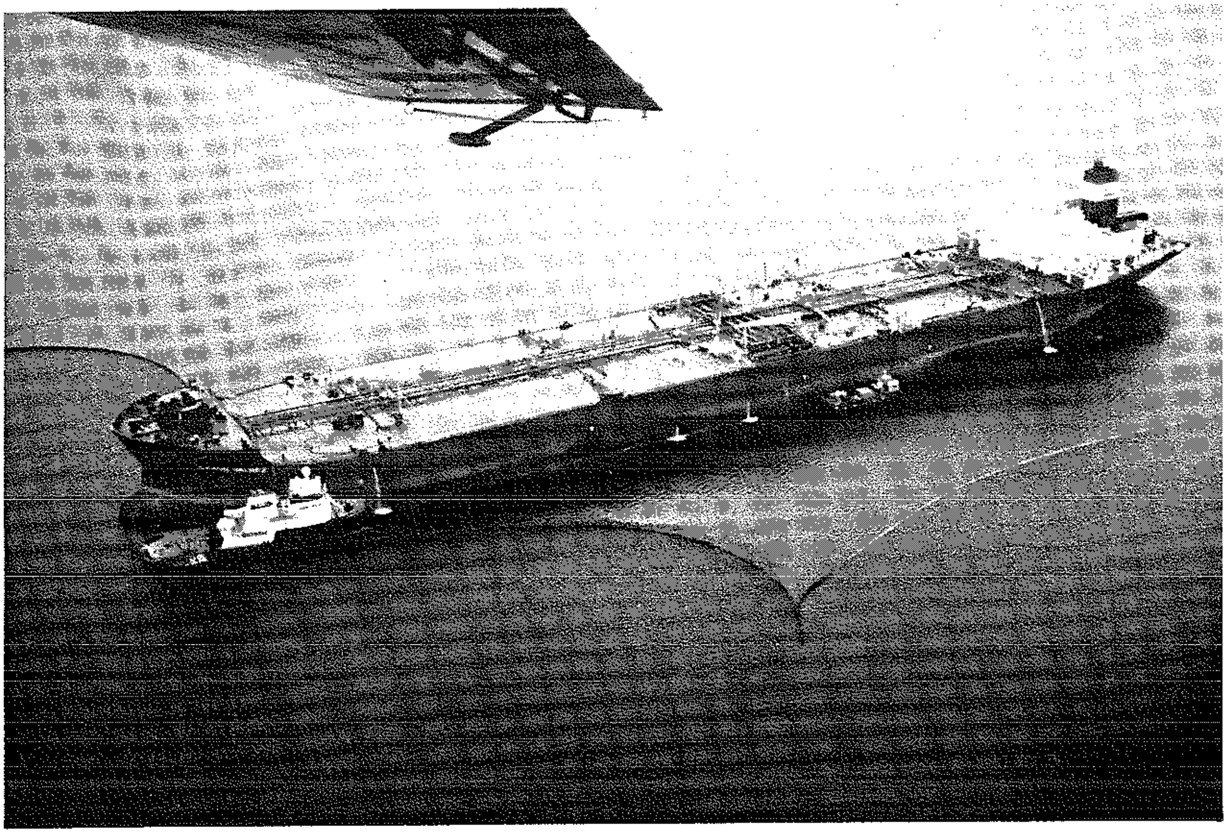

Figure 1-1. T/V EXXON VALDEZ — Source of the Oil Spill.

When the Coast Guard requests SUPSALV resources for response to a non-Navy spill, the FPN is provided to SUPSALV immediately. Among other things, this signifies that it is an official request and that the Coast Guard has agreed in advance to reimburse SUPSALV from the 311(k) Fund.

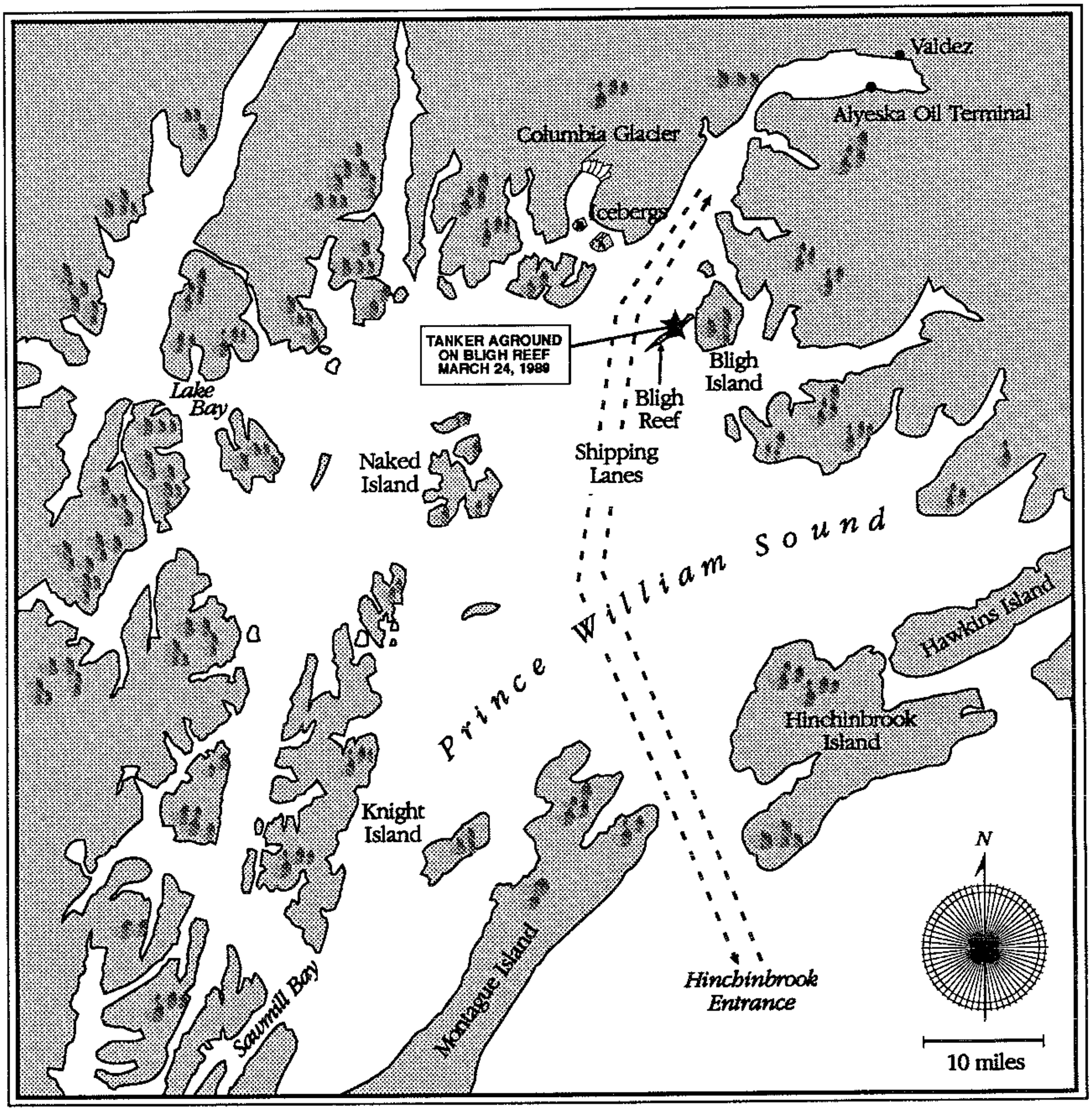

Figure 1-2. Prince William Sound.

The Clean Water Act mandated the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), codified as 40 *CFR* 300, which in turn established the National Response Team (NRT), and 13 Regional Response Teams (RRT). The NRT is a planning and oversight body whose members represent 14 Federal agencies. Figure 1-3 illustrates the agencies represented. The incumbent Department of Defense (DOD) representative to the NRT is Dr. Brian Higgins, Office of the Deputy Assistant Secretary of Defense (Environment). Representatives from the EPA and Coast Guard, respectively, chair and vice-chair the NRT. The National Response Center (NRC), located at USCG Headquarters, is the national communications center that is continuously manned for handling activities related to response actions. The NRC acts as the single Federal point of contact for all pollution incident reporting and as the NRT communications center.

The two principal components of the RRT mechanism are a standing team, which consists of designated representatives from each participating Federal agency and state governments (as agreed upon by the states), and incident-specific teams, which are formed from the standing team when the RRT is activated for a response. On incident-specific teams, participation by the RRT member agencies will relate to the technical nature and geographical location of the incident. RRTs work with state governments in their geographic regions to expedite Federal assistance to affected areas when the FOSC requests such assistance.

The Coast Guard predesignates the FOSC for spills in U.S. coastal areas.[1] FOSCs are charged, on a regional basis, with monitoring all spill response actions and directing all Federal activities at the site of a spill. Figure 1-4 outlines the interrelationships of cognizant organizations in the EXXON VALDEZ spill response.

A 1980 Interagency Agreement (IAA) between the U.S. Navy and Coast Guard provides a mechanism by which the Coast Guard can access SUPSALV pollution response and ship salvage equipment routinely to augment its own capabilities. Under the terms of the agreement, SUPSALV frequently works with both the Atlantic and Pacific Coast Guard oil pollution Strike Teams. The Navy follows a policy of working through the predesignated FOSC rather than providing oil spill assistance directly to a civilian customer.

1-3 NAVY POLLUTION RESPONSE

OPNAVINST 5090.1 promulgates the Navy's environmental protection program. The Naval Sea Systems Command (NAVSEA) has technical and operational support responsibilities for Navy-originated open ocean and salvage-related oil spills. The responsibilities of SUPSALV (NAVSEA Code 00C), as NAVSEA's internal agent for salvage and oil spill response, are addressed in OPNAVINST 4720.2E and NAVSEAINST 4740.8. In addition, the global Naval establishment is subdivided into 32 regional zones, with responsibility for spill response planning and operations assigned to a Navy On-Scene Coordinator (NOSC) for each region. Under the direction of Chief of Naval Operations Op-45, NAVSEA is assisting in development of spill contingency plans for Navy oil and hazardous substances on behalf of each of the 32 jurisdictions.

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1 Any reference in this report to *FOSC* indicates the Federal On-Scene Coordinator (OSC) as designated in the National Contingency Plan. Throughout the Alaska response, he was referred to as *FOSC*, or Federal On-Scene Coordinator, to distinguish the position from others with similar designations.

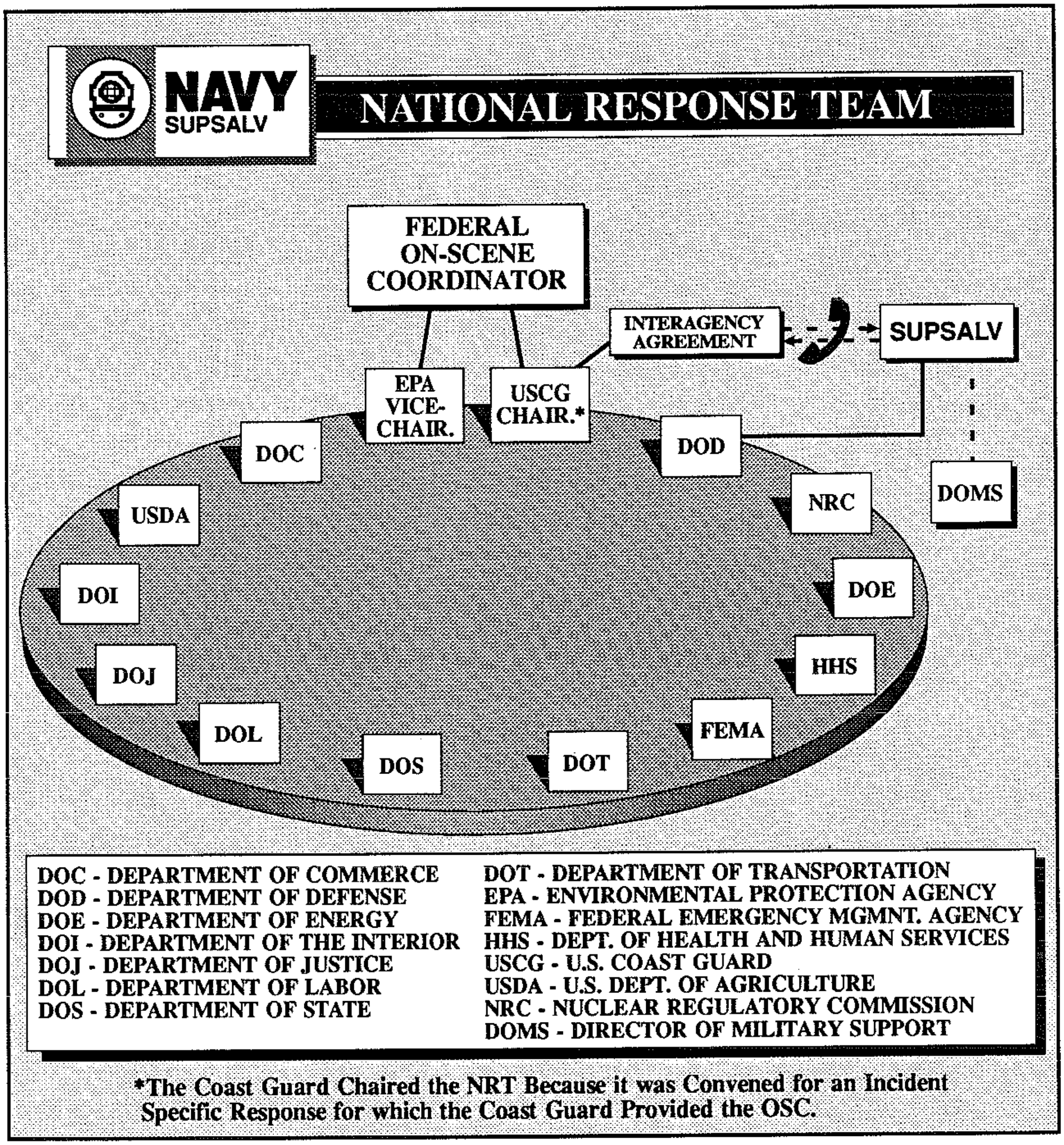

Figure 1-3. National Response Team Organization Chart.

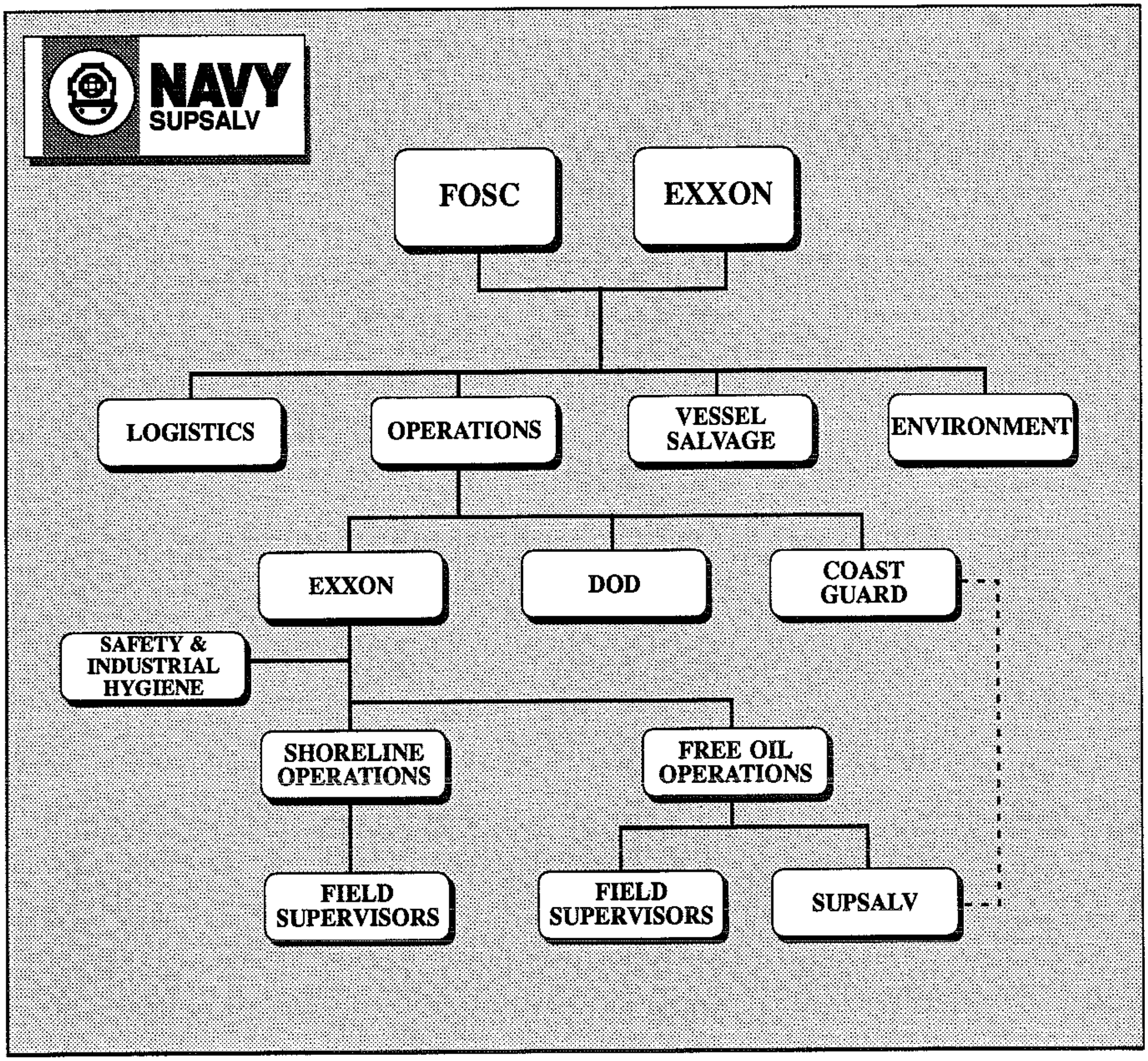

Figure 1-4. EXXON VALDEZ Spill Response Organization Chart.

To properly support NOSCs for offshore or salvage-related spills, SUPSALV has assembled the most extensive public or private inventory of oil spill response equipment in the United States. A contractor maintains this equipment in a ready-for-issue status within NAVSEA's Emergency Ship Salvage Material (ESSM) System. The ESSM system and its equipment and response procedures are evaluated and revised through semiannual oil spill response exercises and drills staged in Navy ports. The drills are a means of validating each area's contingency plan, exercising spill response equipment, maintaining and improving proficiency of operating personnel, testing new or improved equipment, and refining operational tactics.

SUPSALV spill response equipment is configured and packaged for mobilization by all modes of military and commercial transportation to spill sites worldwide. The inventory is considered a national asset and is available to any FOSC. As occurred in the EXXON VALDEZ oil spill, the equipment often is employed for non-Navy spills—usually at the request of the FOSC.

When the EXXON VALDEZ went aground and spilled her cargo, there was an immediate need for a large quantity of cleanup equipment that could be mobilized and transported to the spill site quickly. SUPSALV's inventory of such equipment was attractive to spill response managers from several standpoints. The equipment was:

Available in a significant quantity with experienced operators

Controlled by a single "owner/manager"

Maintained centrally for rapid deployment worldwide.

For these reasons, SUPSALV assets were a logical choice to assist in cleanup of the resulting spill. Exxon, through an agreement with the Coast Guard, exercised operational control over SUPSALV assets to augment Exxon's in-house and leased cleanup equipment. Exxon reimbursed the Navy via the 311(k) fund for costs of SUPSALV equipment and personnel.

Exxon USA retained financial responsibility and operational control of the cleanup operations. Because of its responsibilities under the NCP and the resources and expertise available to it, the U.S. Coast Guard played a major oversight role. At Valdez, the role of the FOSC was twofold. First, he monitored cleanup operations conducted by Exxon; second, he coordinated the cleanup assistance provided by Federal agencies. This dual role required careful coordination among the FOSC, SUPSALV, and Exxon. Because of the extremely high cost of conducting the cleanup operation and the small reserve in the Coast Guard Oil Spill Contingency Fund, the Coast Guard was fiscally unable to federalize the cleanup operation without enactment of emergency legislation by Congress. Therefore, although the Coast Guard and other Federal and state agencies provided oversight, guidance, and assistance, Exxon retained operational control of the spill response operation. The NAVSEA oil spill response team reported to Exxon management for the tactical and logistical execution of the response operation.

Exxon agreed to underwrite the costs of the operation. The Coast Guard opened the Pollution Fund and paid Federal agencies directly from it; Exxon periodically replenished the fund. This method of operation could be categorized as a partial federalization of the spill. Figure 1-5 details the SUPSALV organization during the EXXON VALDEZ spill response.

The initial response organization conformed to the NCP, in that Commander Steven A. McCall, USCG, Captain of the Port (COTP) of Valdez, the predesignated FOSC, initially served as FOSC. Due to a growing awareness of the magnitude of the spill, on 6 April, Rear Admiral Edward Nelson, Jr., Commander, 17th Coast Guard District, assumed the FOSC duties. Finally, on 19 April, because of the enormity of the spill, Vice Admiral Clyde E. Robbins, Coast Guard Commander, Western Area, assumed the role of the FOSC. The presence of a three-star flag officer in this position facilitated coordination among participating Federal agencies.

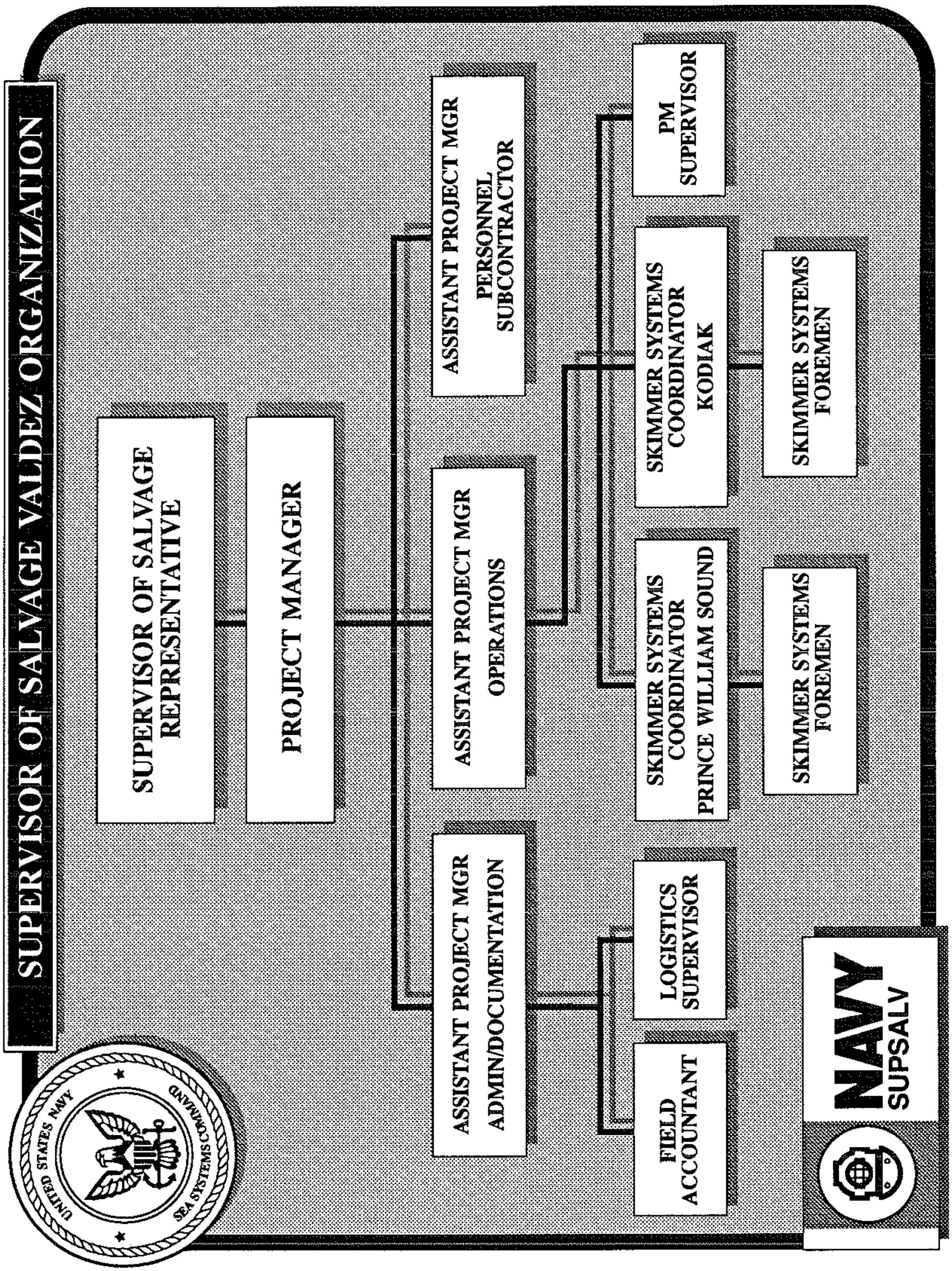

Figure 1-5. Supervisor of Salvage Valdez Organization.

1-4 INITIATION OF SUPERVISOR OF SALVAGE PARTICIPATION

NAVSEA was first contacted on behalf of the predesignated FOSC on 25 March 1989. Through the Chief of Naval Operations, the USCG requested SUPSALV assistance in accordance with the provisions of the NCP and procedures established in the 1980 USN-USCG IAA, for cooperation in responding to salvage and spill incidents. This was the beginning of an operation that was to last until 8 October 1989—nearly seven months.

1-5 IMMEDIATE RESPONSE

SUPSALV tasked its pollution control contractor, Global Associates/Phillips Cartner & Co. (GPC), to provide two MARCO Class V skimmer systems and operators from the ESSM Base in Stockton, California. Mobilization commenced immediately. On Easter Sunday, 26 March 1989, the skimmers and operators departed Travis Air Force Base, California, via a USAF C-5A, en route to Elmendorf Air Force Base, near Anchorage, Alaska. On arrival, the equipment was offloaded onto flatbed trucks for the 8-hour, 310-mile journey to Valdez. By the morning of Wednesday, 29 March, both skimmer systems had been made ready and deployed, and were collecting oil in Prince William Sound. Figures 1-6 and 1-7 show Class V skimmers in Alaska prior to deployment and during operations, respectively. Figure 1-8 shows a Class XI skimmer prior to deployment.

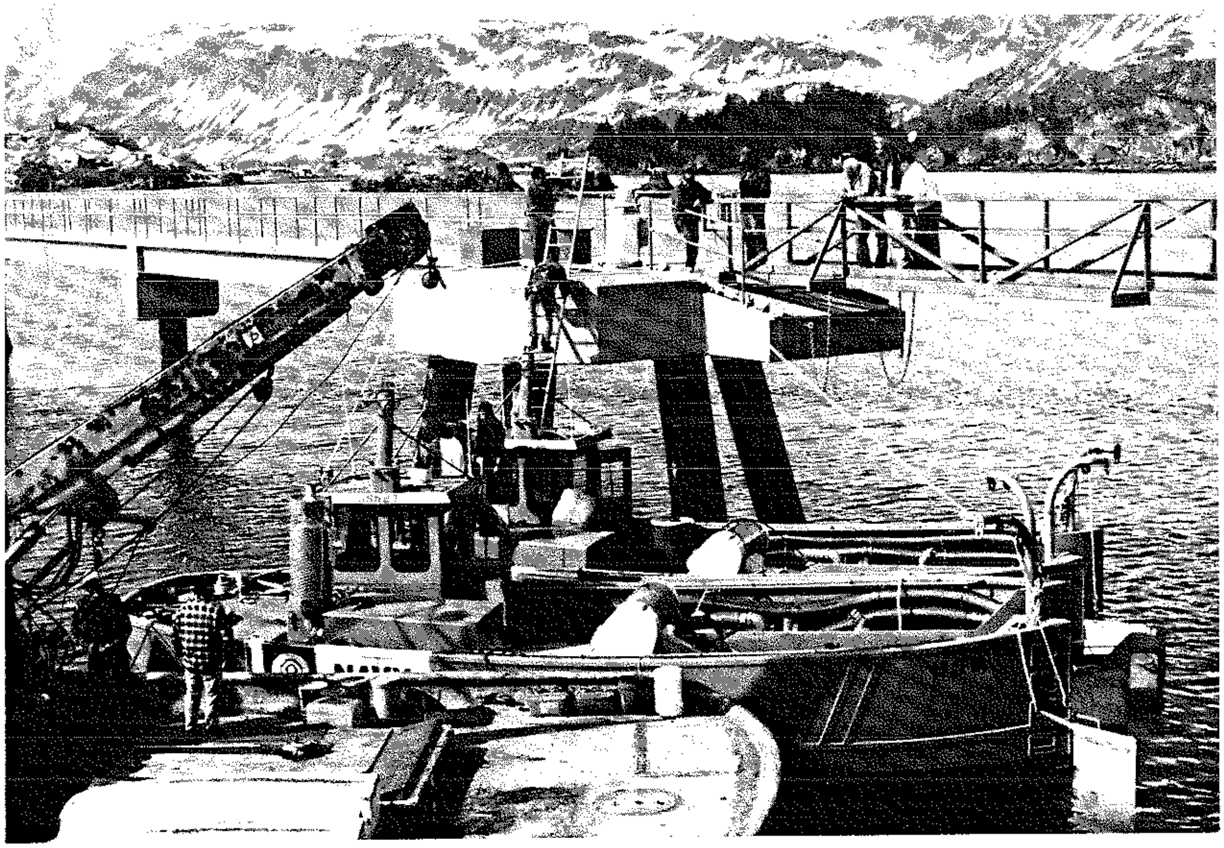

Figure 1-6. Class V Skimmers Prior to Deployment.

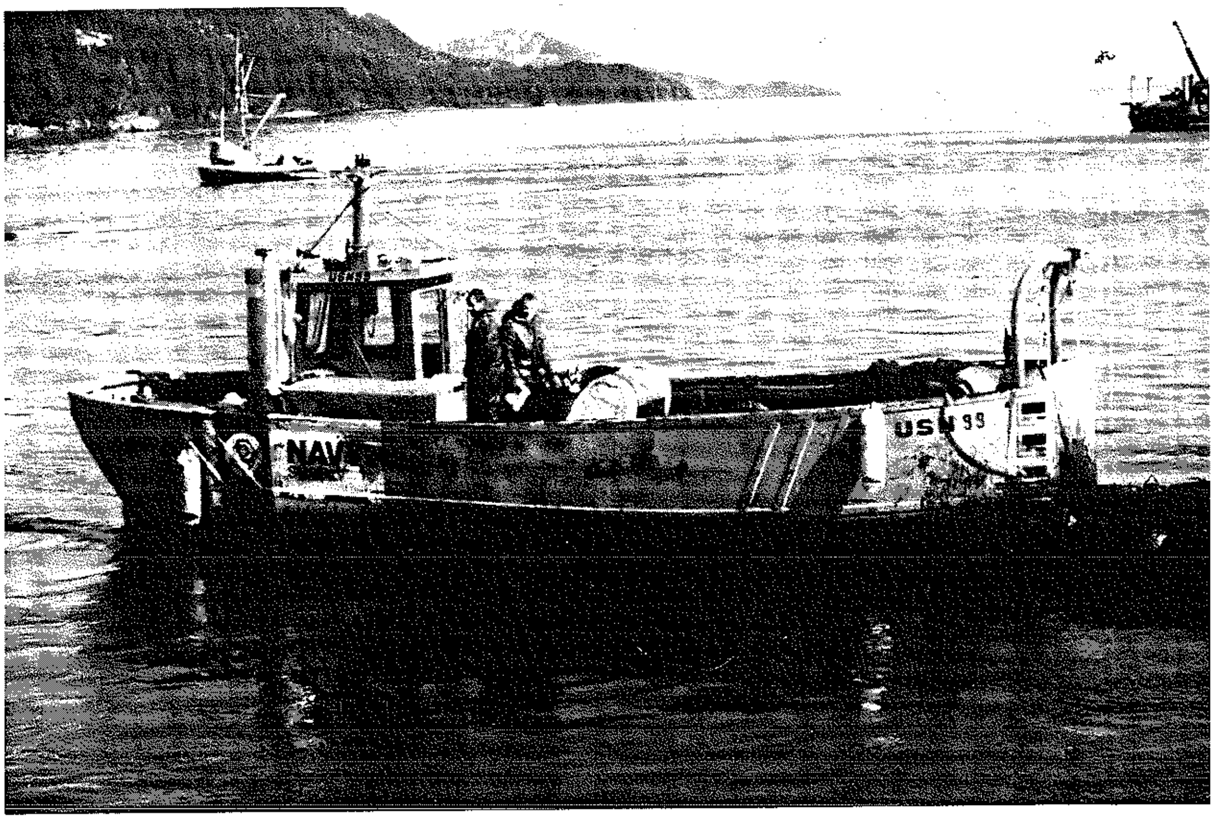

Figure 1-7. Class V Skimmer During Operations.

1-6 FOLLOW-ON RESPONSE

On 31 March 1989, SUPSALV received a second request for five additional skimming systems, boom-handling boats (BHBs), operator personnel, and ancillary support equipment. A third request for additional equipment was received on 2 April. On 3 April, the fourth request for oil skimming equipment was received. In total, SUPSALV furnished 20 Marco Class V skimmers, 2 Marco Class XI skimmers, 10 BHBs, over 25,000 feet of 42-inch open sea containment boom, and a significant amount of support equipment. Over 700 tons of equipment were air transported to Alaska from the Williamsburg, Virginia and Stockton, California ESSM bases, on a total of 10 C-5A and 2 C-141 USAF Military Airlift Command (MAC) flights. At the peak of the operation, over 100 NAVSEA and contractor personnel were on scene.

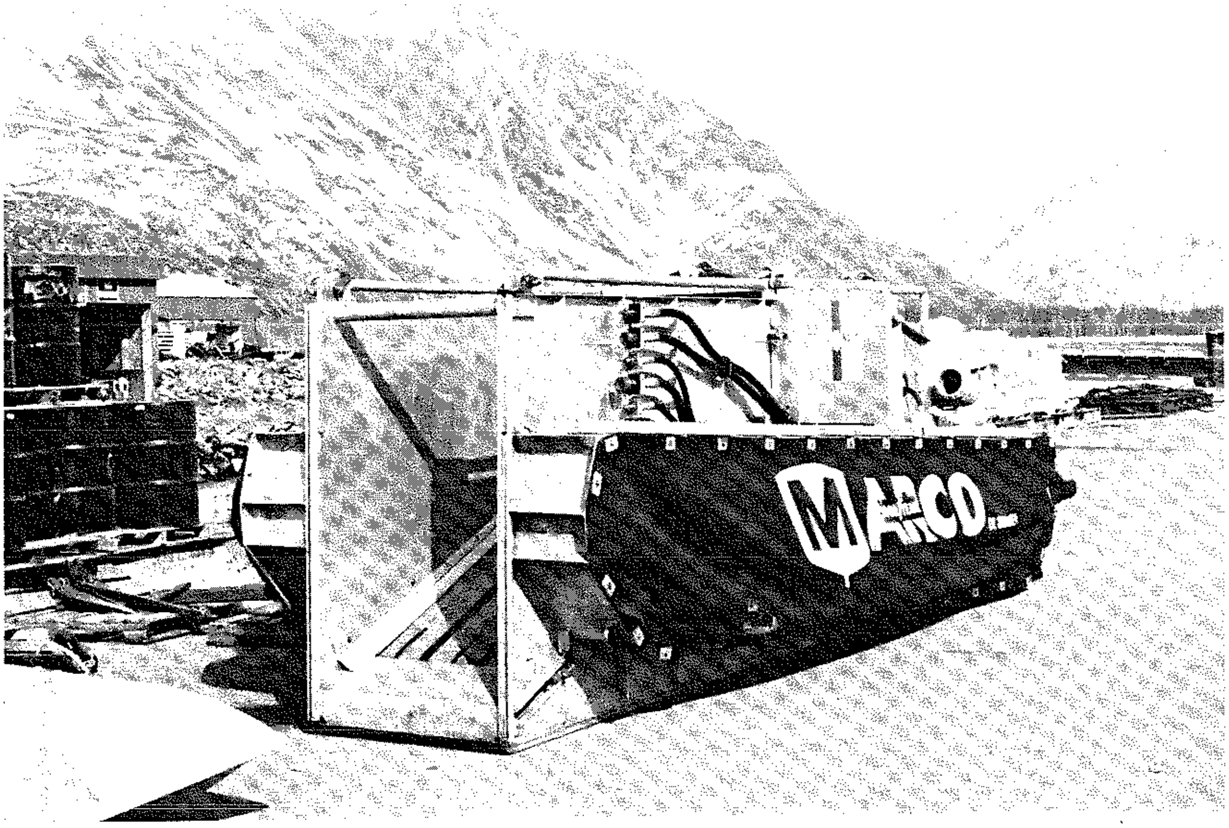

Figure 1-8. Class XI Skimmer Prior to Deployment.

CHAPTER 2

COMMAND AND ORGANIZATION

2-1 COMMAND AND CONTROL

A Naval Sea Systems Command (NAVSEA) contract provides for maintenance of the Supervisor of Salvage (SUPSALV) oil pollution equipment within the Emergency Ship Salvage Material (ESSM) system. When a major oil pollution situation occurs, full-time ESSM maintenance and support and subcontractor personnel are mobilized with the equipment to the spill site.

Upon notification of a major spill, SUPSALV places ESSM bases on alert and, upon official tasking, requests that the U.S. Air Force (USAF) Military Airlift Command (MAC) provide aircraft.

The Navy's participation in the EXXON VALDEZ oil spill began with the response of SUPSALV to the initial request from the FOSC to send two skimmer systems to Alaska.

Upon arrival at the site, the SUPSALV representative (SUPSALVREP), Mr. Erik "Glaub" Glaubitz, established a coordination center in the town of Valdez. Working conditions were decidedly Spartan at the outset. The SUPSALV base of operations was a room attached to the Valdez hotel until a command van arrived during week two. When they arrived, one SUPSALV 40-foot trailer and two 20-foot vans were stationed on property belonging to the U.S. Coast Guard Marine Safety Office, adjacent to the Valdez Westmark Hotel. The coordination complex was centrally located and was convenient to the principal offices with which SUPSALV dealt daily. Figure 2-1 shows the SUPSALV coordination complex in Valdez.

The coordination trailer served as the management center and provided office space for the SUPSALVREP, a contractor Program Manager (PM), and Assistant Program Manager (APM). It served as a conference center for daily staff meetings and SUPSALV briefings for VIPs and other guests. Figure 2-2 shows two subsequent SUPSALVREPs, Jim Bladh and Eric Lindberg, working in the command trailer.

One of the 20-foot vans was used for a variety of accounting and administrative functions. These functions included generating a daily accounting summary, purchasing materials, locating and contracting for housing, and coordinating efforts such as telephone installation and mail service; two people manned this van. The other 20-foot van was used for administrative functions such as typing correspondence, telephone answering, sending and receiving facsimile messages, and filing; one person manned this van. Toward the end of the operation, one van was taken out of service and returned to its ESSM base. The three positions were eventually consolidated and became the responsibility of one person.

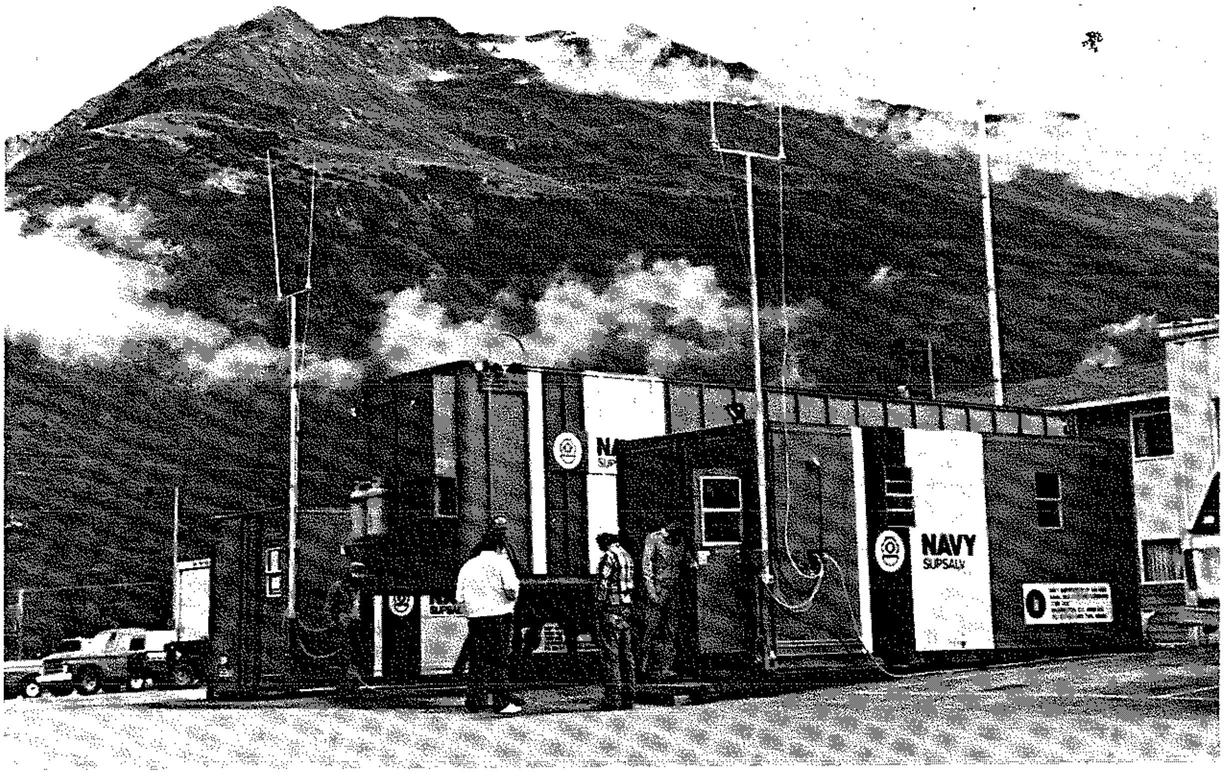

Figure 2-1. The SUPSALV Command Complex in Valdez was Headquarters for both SUPSALV and Contractor Project Managers and Staff.

The first few weeks of the spill response were extremely hectic. As in any major salvage operation, seven-day work weeks were standard throughout the entire project. For roughly the first two months, workdays of 16 hours or more were common. Problems were resolved as they arose, and priorities were established as necessary. With the passage of time, the organization matured, and the management style underwent a natural progression from *reactive* to *planned.*

The geographic area of this operation was immense. The operating area was 350-400 miles long along a NE-SW axis, and was divided into two major areas: Prince William Sound and Western Alaska. This separation was consistent with the Coast Guard's division of administrative and operational responsibilities in Alaska. The Western Alaska area was subdivided into the Homer, Seward, and Kodiak regions. The SUPSALV organization established additional field personnel primarily in two locations: on a living barge located in Herring Bay, Prince William Sound, and in the town of Kodiak on Kodiak Island. Small-scale skimmer operations were also controlled by a coordinator alternating between the towns of Seward and Homer. The majority of the skimmer operations were in Prince William Sound.

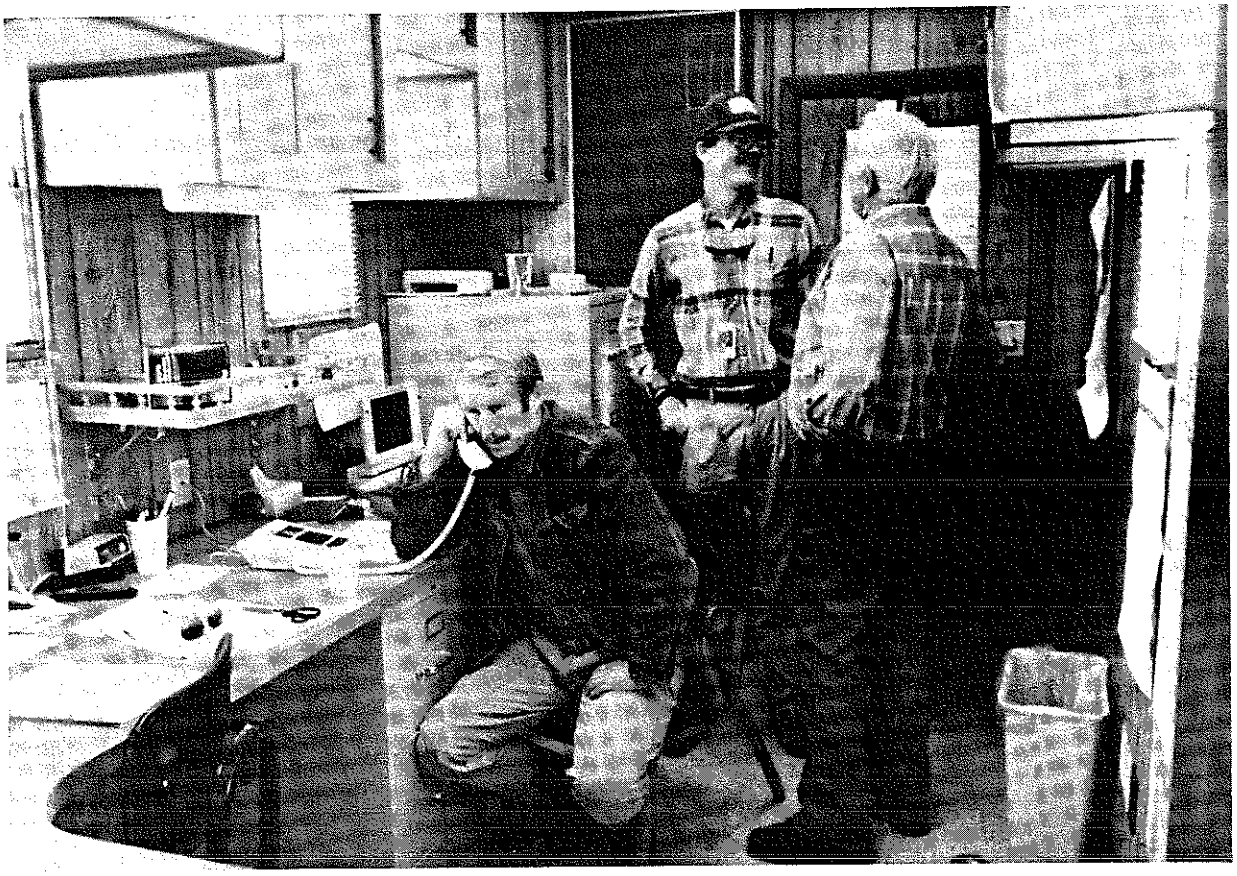

Figure 2-2. Left to Right - CAPT C. A. "Bart" Bartholomew, E. Lindberg, and J. Bladh in Valdez Command Van.

Exxon chartered and made available to SUPSALV a DeHavilland Beaver—a six-passenger, fixed-wing, float airplane—and pilot for airborne reconnaissance and logistic support of Prince William Sound operations. The plane permitted daily flights for skimmer location; skimmer relief crew transport; transport of mail, spare parts, and other essentials to field personnel; and direct management interface with the field. The APM usually was aboard the routine daily flights to communicate with skimmer crews. In his absence, the contractor PM or SUPSALV-REP would be aboard.

Major changes to personnel and skimmer status were made only by approval of the SUPSALV Valdez Coordination Center, while skimmers shifted locations under the direction of the Exxon field operations manager. Once skimmers relocated, their new positions were passed to the SUPSALV Coordination Center in Valdez via SUPSALV contractor personnel aboard the Exxon command barge.

2-2 COMMAND ORGANIZATION

SUPSALV interfaced primarily with two other organizations—the U.S. Coast Guard and Exxon USA. SUPSALV supported the U.S. Coast Guard, and was tasked by and reported to the FOSC.

SUPSALV maintained daily liaison with the FOSC through the Coast Guard Marine Safety Office (MSO) Operations Officer in Valdez. Decisions that would have a major impact on SUPSALV personnel or equipment were formalized through this office. Final approval or disapproval were granted by the Operations Officer or the FOSC. FOSC approval was required for requests involving changes in manning levels or logistic support.

Exxon Operations orchestrated day-to-day operations. Exxon provided the SUPSALVREP with daily operational direction. This direction was generally given in a morning meeting between Exxon operations personnel and the SUPSALV contractor APM. Frequently, the SUPSALVREP and/or the contractor PM met with Exxon operations personnel to resolve problems. SUPSALV daily reporting requirements were limited to NAVSEA, the Coast Guard, and Exxon—in that order.

2-3 DEPARTMENT OF DEFENSE ORGANIZATION

On 7 April, President Bush declared the oil spill a national emergency. He directed the Department of Defense (DOD) to make available all facilities, personnel, and equipment that could be used effectively in assisting the cleanup effort. The Secretary of the Army, as executive agent for military assistance to civil authorities, was responsible for planning, coordinating and managing all DOD support. The Director of Military Support (DOMS), a DOD organization that supports non-DOD agencies in times of national crisis or emergency, was activated to serve as the action agent for the Oil Spill Task Force. Commanded by a U.S. Army general officer and staffed by personnel from all the DOD services, DOMS operated from the U.S. Army Operations Center in the Pentagon where communications and other facilities were available. To facilitate support within Alaska, DOMS designated the Commander, Alaskan Air Command, Lieutenant General Thomas G. McInerney, as the On-Site Defense Senior Representative and Commander, Alaska Oil Spill Joint Task Force (JTF). JTF was located at Elmendorf AFB.

The interagency agreement between the Navy and the Coast Guard, as well as arrangements developed with the Air Force for emergency transportation of SUPSALV equipment from ESSM bases to spill sites, are extremely efficient and effective. In spills of national interest, such as that in Prince William Sound, activation of the DOMS organization can be expected and the shipment of SUPSALV equipment may be subject to integration into the DOMS system. There may be delays in the shipment of equipment that is needed for pollution control and abatement operations as it is integrated into overall priorities. In such operations, staff work that prepares justifications for assignment of shipment priorities is a critical link in delivering equipment to the spill site.

The DOD representative to the National Response Team (NRT), Dr. Brian Higgins, Office of the Assistant Secretary of Defense (Environment), coordinated initial transportation requirements with the Air Force Transportation Command to send the first two planeloads of skimmers to Alaska. The NRT subsequently handed off logistics requirements to DOMS, where personnel having more thorough knowledge of available DOD resources and the means to communicate with the proper persons could make things happen. The DOMS organization coordinated aircraft tasking for the subsequent 10 planeloads of SUPSALV equipment.

In this spill, as in many others, SUPSALV supported the Coast Guard, a Department of Transportation agency, and had no direct interface with other DOD organizations. Because of this unique relationship, the Supervisor of Salvage, Captain Bart Bartholomew, was able to arrange with Lieutenant General McInerney for SUPSALV operations to be divorced from DOMS and JTF administrative and logistic concerns, and to be exempt from the voluminous and manpower-intensive reporting requirements required of other organizations.

2-4 PERSONNEL

The response was manned by civilian and military SUPSALV and civilian contractor and subcontractor personnel. The contractor provided project and administrative field operations management, and a skimmer work force. Subcontractor personnel augmented the nucleus of the SUPSALV ESSM field response contingent.

The SUPSALVREP is a key figure in any contractor response. He is the personal representative of the Supervisor of Salvage, and is responsible for liaison with the customer and with other agencies. He is directly responsible for administering the contract throughout the operation, and for providing technical direction and assistance to the contractor. The SUPSALVREP maintains daily contact with the SUPSALV office and is able to bring additional resources to bear when appropriate.

The first SUPSALVREP was Eric Glaubitz, a senior civil servant with extensive oil spill control experience. He arrived on site 27 March. He focused his immediate attention on offshore operations, in order to assess the magnitude and severity of the spill and logistical issues associated with it. Eric Lindberg relieved Eric Glaubitz as SUPSALVREP on 7 April. Mr. Lindberg established the organization that was used throughout the response. 14 April, Jim Bladh, Commander Marc Jones, USNR, and Lieutenant Commander Bill Poole, Combat Support Squadron 5 Salvage Officer, arrived. Jim Bladh relieved Eric Lindberg as SUPSALVREP. As operational procedures had been established and were working, Mr. Bladh coordinated logistics and crew relief operations. Lieutenant Commander Poole was assigned to oversee SUPSALV Prince William Sound skimming operations and associated logistic and maintenance support requirements. On 25 April, he came ashore to relieve Mr. Bladh as SUPSALVREP. Commander Jones' primary assignment was to serve as SUPSALV liaison with JTF Alaska staff.

Mr. Lloyd Saner, the initial contractor PM, proved that experience is a very valuable quality. A veteran of several response efforts, his background and previous field experience was invaluable, particularly during the early days of the response effort. His knowledge of operations, equipment maintenance requirements, and coordination among other organizations served to enhance SUPSALV response effort.

In early April, SUPSALV sought additional Naval Reserve officer volunteers from the Reserve Mobile Diving and Salvage Unit community to provide long-term project management and liaison with other DOD activities and with the U.S. Coast Guard. A Reserve volunteer, Captain Ed Murphree, USNR, arrived on 16 May and remained as the SUPSALVREP for the duration of the project.

The contractor organization provided and managed the work force. The PM provided daily operational and managerial direction for contractor personnel. APMs provided the technical expertise for the operation. Their responsibilities included skimmer functional control, supervision of loading and unloading of equipment, and coordination of operations with Exxon personnel. Contractor personnel, augmented by subcontractors, provided the manpower base for all phases of the operation—rigging boom, laying mooring systems, assembling skimmer systems, operating and maintaining skimmers and BHBs, installation and operation of the satellite communications van, and accounting, administrative, and clerical support.

CHAPTER 3

LOGISTICS AND OPERATIONS

3-1 SEQUENCE OF EVENTS

The Captain of the Port (COTP) of Valdez received his first report of the incident at 0028 Alaska Standard Time (AST) on Good Friday, 24 March. He closed the Port of Valdez immediately. By 0100, a pilot boat was en route to the stranded vessel with a U.S. Coast Guard (USCG) investigator and a representative of the Alaska Department of Environmental Conservation (ADEC) aboard. Within 8 hours, an estimated 10.3 million gallons of EXXON VALDEZ's cargo of Prudhoe Bay (North Slope) crude oil had spilled into Prince William Sound.

The Supervisor of Salvage (SUPSALV) received a preliminary telephone request for assistance from a staff officer in the Marine Environmental Response Division at USCG Headquarters, Washington, D.C. on the afternoon of Saturday, 25 March. A message request, Coast Guard Marine Safety Office, Valdez, 260439Z MAR 89, was sent to the following addressees:

- CGDSEVENTEEN JUNEAU AK
- COMPACAREA COGARD ALAMEDA CA
- COMNAVSEASYSCOM WASHINGTON DC
- COMNAVFACENGCOM ALEXANDRIA VA
- CINCPACFLT PEARL HARBOR HI
- COMDT COGARD WASHINGTON DC

The text of the message was:

> "1. On 24 MAR 89 T/V EXXON VALDEZ grounded in Prince William Sound releasing more than 250,000 bbls. of crude oil. The responsible party has requested the use of the Marco skimmer system to clean oil in the areas unavailable to onscene equipment.
>
> 2. Request that one Marco skimming system with operating personnel be shipped to Valdez as soon as possible."

During the first hours, meetings of the National Response Team (NRT) and Regional Response Team (RRT) took place, in Washington, D.C. and Alaska. To facilitate the spill response the NRT sent a list of Emergency Ship Salvage Material (ESSM) equipment available to the RRT.

The original Coast Guard request for a single skimmer system was subsequently modified to include two skimmer systems, in order to fill a C-5A aircraft. ESSM base personnel in Stockton, California, loaded the equipment onto trucks, transported it 45 miles to Travis Air Force Base (AFB), California. At Travis it was offloaded from the trucks and loaded onto a C-5A Military Airlift Command (MAC) flight arranged by the USCG, bound for Elmendorf AFB, Alaska. The skimmers arrived at Elmendorf at 0230 AST Monday, 27 March. They were offloaded from the aircraft, reloaded onto flatbed trailers and trucked 310 miles to Valdez, an 8-hour trip. Contractor personnel offloaded, assembled, tested, and deployed the skimmers. They were skimming oil by the morning of Wednesday, 29 March.

Pollution response equipment was requested incrementally. The first shipment supported deployment of two skimmers, provided some boom, and got the operation going. As described in Section 1-6, additional equipment was shipped by the same general method in response to further requests. Figure 3-1 shows the buildup of SUPSALV equipment for the EXXON VALDEZ spill response.

3-2 EQUIPMENT

The core of the SUPSALV oil spill response equipment inventory is a fleet of 24 Marco Class V oil recovery vessels, Marco Class XI skimmers, MonArk Model 2408-1 Boom-Handling Boats (BHB), 30,000 feet of heavy-duty oil containment boom with its associated mooring systems, and oil storage bladders (Dracones). Additional equipment includes: rigid-hulled and inflatable support craft, hydraulically powered submersible pumps, and large fenders for ship offloading operations. There are a variety of operational support systems including repair shops, rigging shops, command complexes, and communications systems.

The principal skimmer in the Valdez operation was the Marco Class V oil recovery vessel. This boat is an aluminum-hulled, 36-foot long vessel built for recovery of oil spilled on the water's surface. The oil recovery mechanism is a rotating, inclined sorbent belt assembly fitted to the skimmer hull. As the skimmer advances through the water, floating oil is intercepted by the leading belt assembly. Aided by an induction pump, water flows through the filter belt while oil is retained by the rotating belt, lifted from the water's surface, and transported to the top of the incline, where it is squeezed or scraped from the sorbent belt into the skimmer's sump.

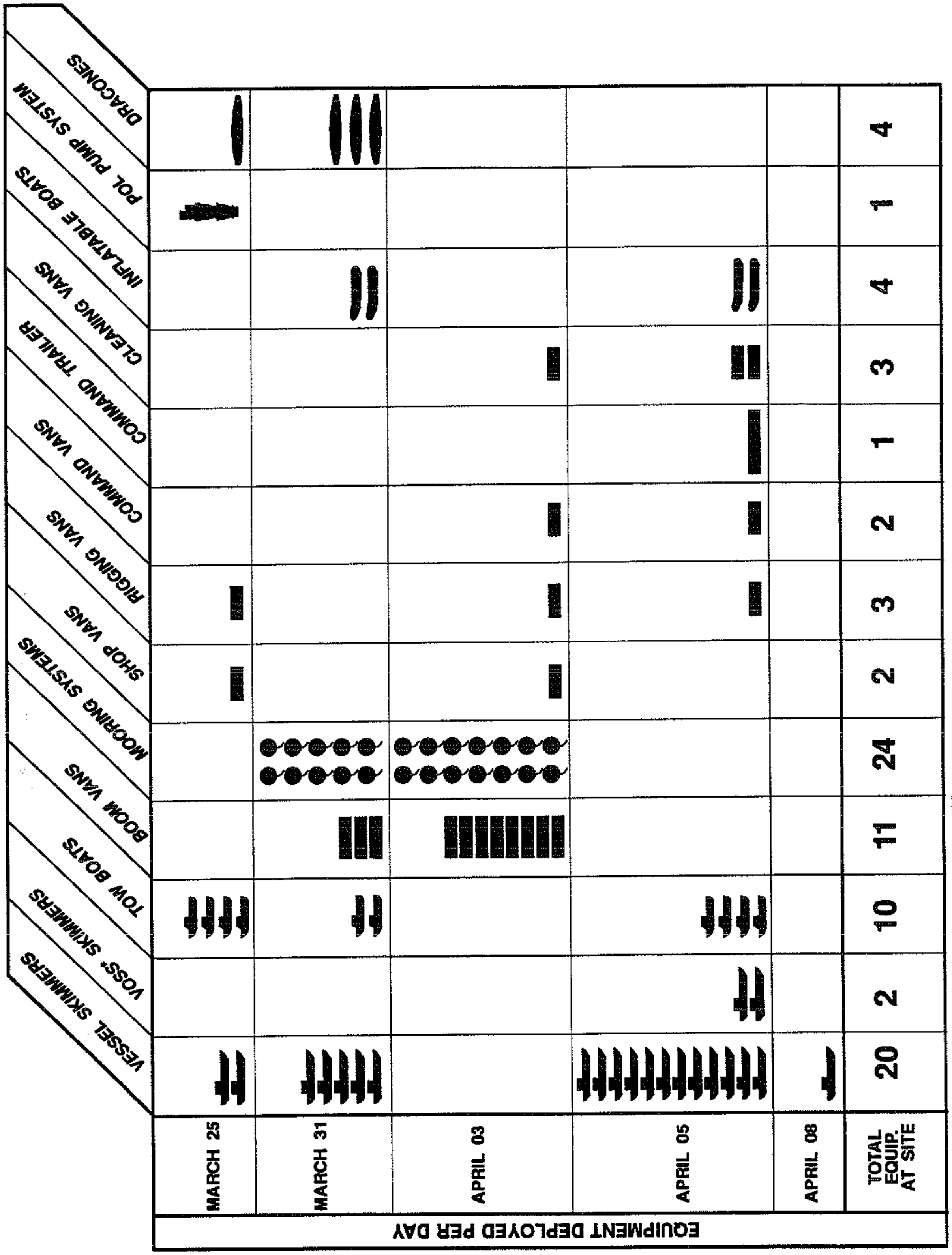

Figure 3-1. Major SUPSALV Equipment Sent to Alaska and Mobilization Dates.

Light- to medium-viscosity oils are recovered by a sponge-like filter belt constructed of reticulated polyurethane foam with relatively large cell dimensions. Because of the cell size and the oleophilic/hydrophobic characteristics of the polyurethane material, the water passes freely through the belt, but the oil is retained in the belt until the belt passes through squeeze rollers positioned over the sump. For recovery of high-viscosity oils and solids, the polyurethane foam material is removed from the open mesh backing belt. Again, water passes freely through the backing belt, but viscous oils and solids are absorbed onto the surface of the mesh belt. A scraper bar over the sump scrapes viscous oils and small solids into the sump. The scraper bar is not used with the polyurethane foam belt. Large solids are removed manually from a debris screen over the sump. An on-board pump offloads the skimmer periodically to suitable storage, or continuously to a trailing barge or bladder. Figure 3-2 is a schematic of the Class V skimmer oil collection system.

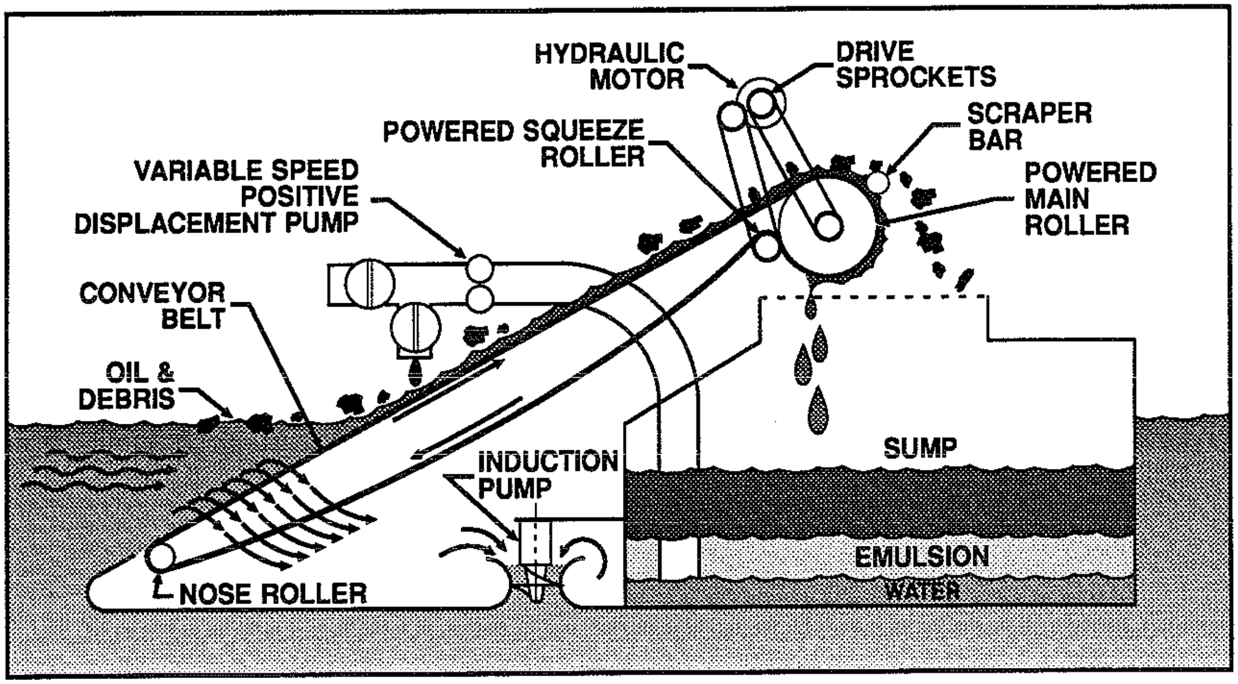

Figure 3-2. Class V Skimmer Schematic.

Large oil spills in open waters are recovered most effectively by towing two legs of oil containment boom in a "V," or funnel, configuration with the skimmer towed in the apex. The standard offshore skimming system consists of a pair of 24-foot BHBs towing two 300-foot legs of boom and Class V skimmer that, in turn, tows a 26,000-gallon oil storage bladder. This arrangement allows a 200-foot-wide sweep and continuous oil recovery. Figure 3-3 represents oil recovery with towed Class V skimmers.

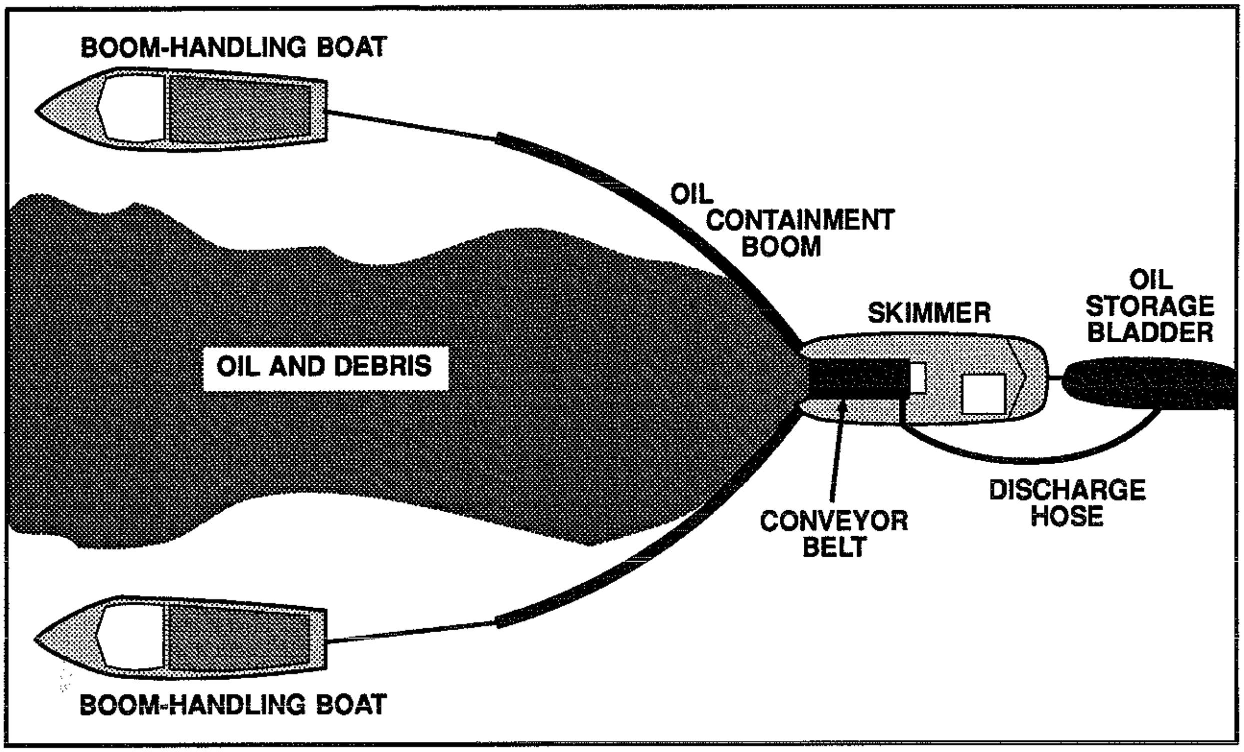

Figure 3-3. ESSM Skimmer Arrangement.

The Marco Class V skimmer is self-propelled and can be operated independently to skim around piers and in other confined areas. In this mode, aluminum sweeping plates are positioned to funnel floating oil to the three-foot-wide recovery belt. In this configuration the skimmer has a 12-foot sweeping width.

Twelve of the 24 ESSM skimmer systems are modularized to facilitate land shipment. Most State over-the-road shipping regulations prohibit trucking loads more than eight feet wide after dark or on weekends. For shipping, a two-foot section is removed from each side of the modular skimmer to give a width of eight feet. The sides are bolted back onto the skimmer at the operations site. Sump capacity, which is 43 barrels for the nonmodular skimmers, has been reduced to 32 barrels in the modular version of the Class V. The nonmodular skimmer systems are 12 feet wide in both shipping and skimming configurations. Their transportability is limited because they cannot be trucked at night or on weekends without special permits.

Modular skimmer sides are shipped in sponson racks that accompany the skimmers. The racks also contain the following:

- One 26,000-gallon Dracone

- One 600-foot skimming boom

- Ancillary equipment (fire extinguisher, tool kit, belt repair kit, suction and discharge hoses, slings, protective cover, filter belt, spare parts kit, lifejackets).

Two Marco Class XI skimmers were also used in Prince William Sound. The class XI system is a non-self propelled, remote operated ocean skimmer built for use with vessels of opportunity. The Class XI is called a *Vessel of Opportunity Skimmer System* (VOSS). It is designed so that the host vessel may be transformed quickly into an oil recovery vessel, without welding. The system consists of an in-water oil recovery unit, oil collection boom, portable outriggers, and a prime mover. Within a few hours, suitable fishing vessels or offshore supply vessels can be rigged for oil skimming.

The VOSS prime mover is a diesel-driven hydraulic pump, powering both the rotating belt and oil transfer pump. When the skimmer is operating, skimmed oil is pumped continuously into tanks aboard the vessel of opportunity. A major advantage of this system is that it is self-supporting, and can be operated independently of other units. As accommodations, sanitary and messing facilities, and communications and mechanical support are available in the vessel of opportunity, the system is limited only by the onboard capacity for storage of recovered oil. This unmanned system requires human intervention only for operation and maintenance of its mechanical systems. Because suitable vessels are larger than those required for towing the Class V skimmer, the VOSS is best suited for open water oil recovery. Figure 3-4 is a schematic of the VOSS recovery system as configured on the M/V ALLIANCE SULTON OF THE SEA.

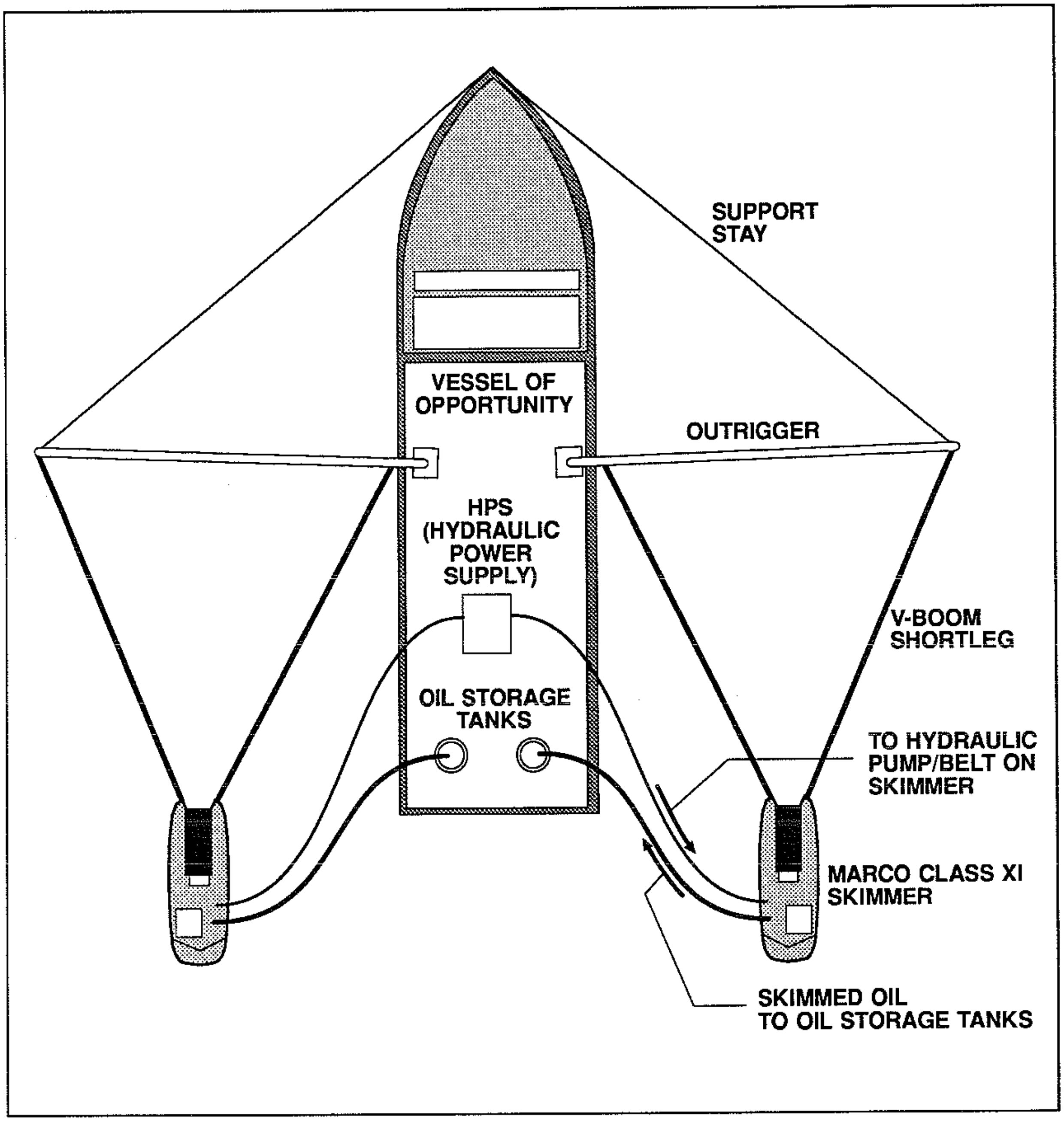

Figure 3-4. VOSS Skimmer System.

Another significant piece of equipment in the operation was the 24-foot MonArk Model 2408-1 BHB. BHBs are designed primarily for towing the V-boom and Class V skimmers, with one boat made up to each leg of the skimmer boom as shown in Figure 3-5. The boats are small for transportability, but have a maximum bollard pull of 5,242 pounds at 2.2 knots and are configured for towing. Figure 3-6 is a sketch of a BHB.

Figure 3-5. SUPSALV Boom-Handling Boats Towing a Class V Skimmer.

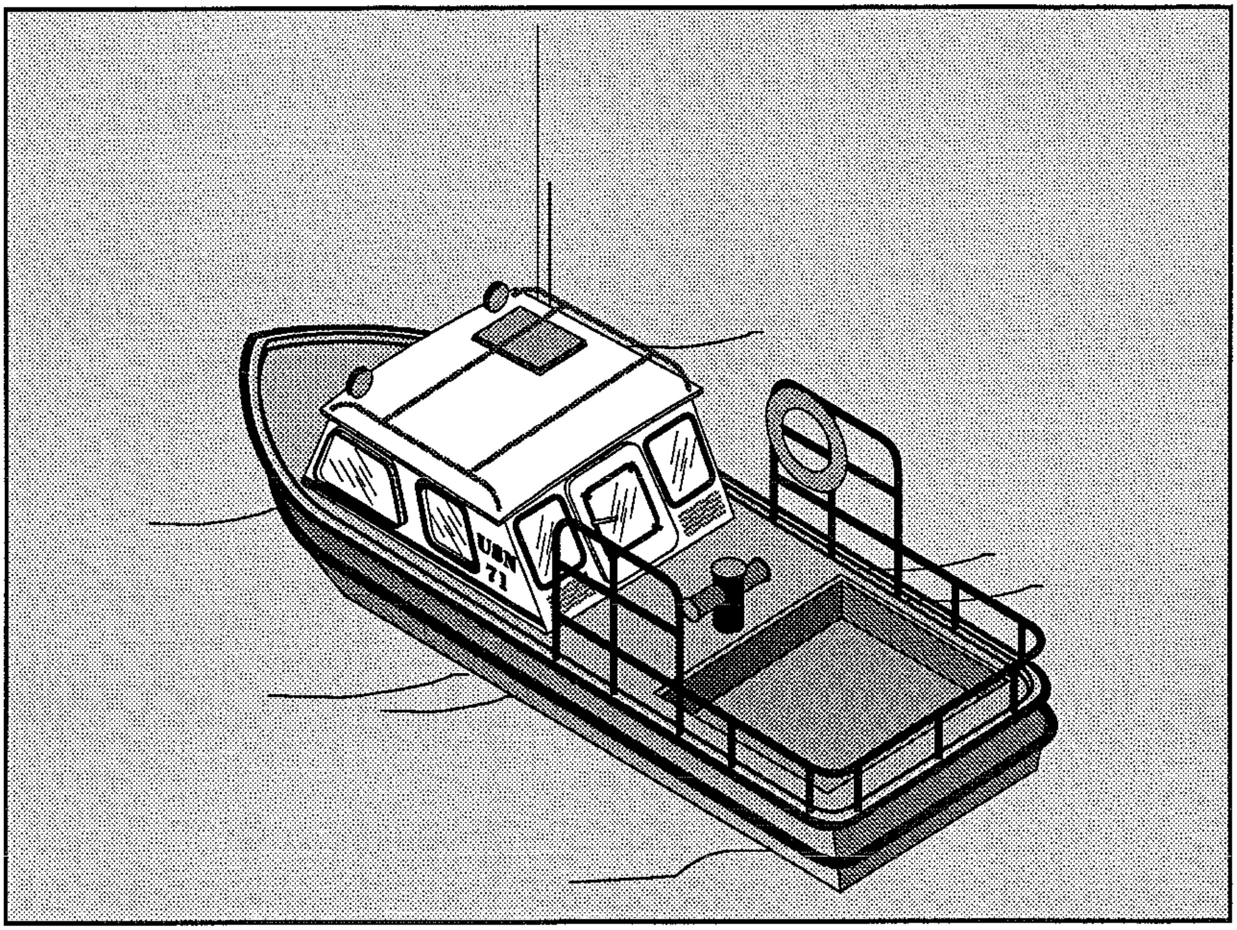

Figure 3-6. Boom-Handling Boat.

An essential tool for any containment and skimming operation involving floating oil is the containment boom. The ESSM boom is Goodyear Model FUG inflatable oil containment boom. The boom comes in 990-foot lengths consisting of 18 inflatable sections fitted with towing chain, bridle, and ropes. Figure 3-7 shows the major components of the Goodyear boom. The boom is supplied with inflation and repair kits and spare parts. The boom mooring system consists of several mooring legs designed to hold the boom in place in a maximum water depth of 200 feet. Each leg consists of a 500-pound Stato anchor, chain, wire and polypropylene line, and buoys. Figure 3-8 shows the mooring components and their shipping container.

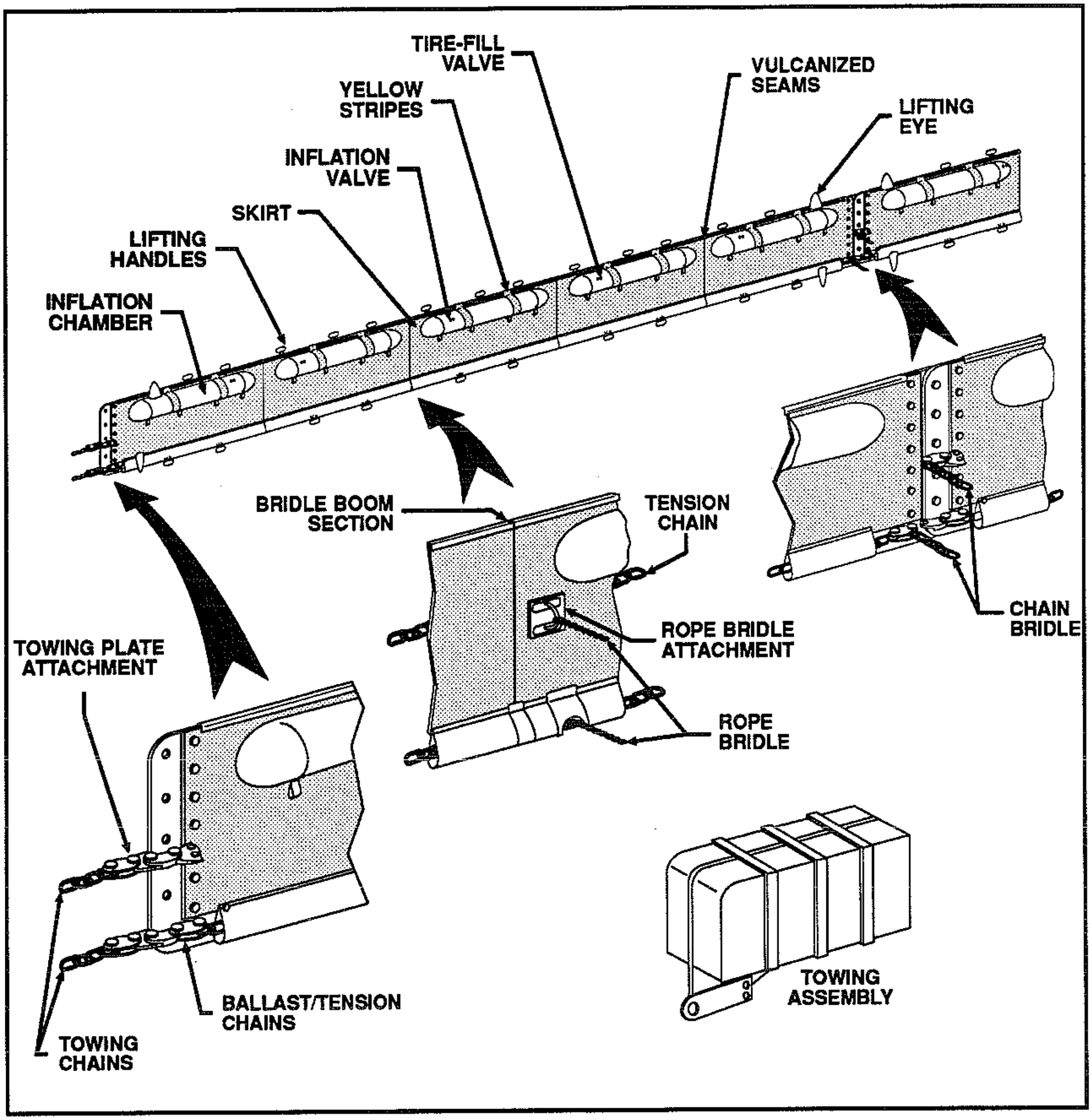

Figure 3-7. Major Sub-Assemblies of the Goodyear Oil-Containment Boom.

The oil storage bladders (Dracones) used in Valdez were the E-type 26,000-gallon flexible rubber bladders. These bladders, one of three types in the ESSM system, are 126 feet long, 6 feet 2 inches in diameter, and are designed for towing. Dracones left on standby at the Cheatham Annex ESSM base included:

- Five E-type (26,000 gallons)
- Ten L-type (136,000 gallons)
- Two O-type (approximately 300,000 gallons).

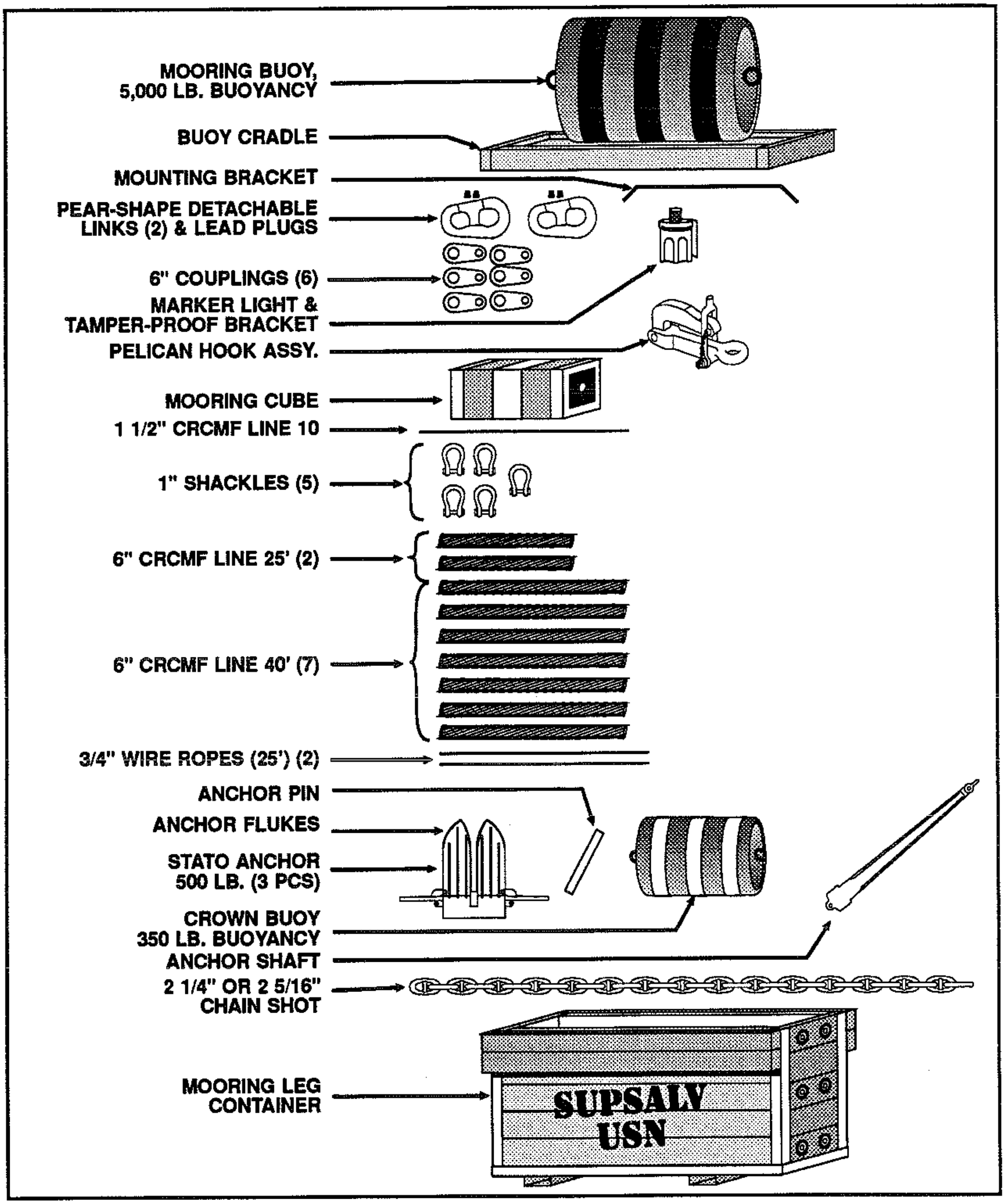

Figure 3-8. Small Container (Mooring Leg) Loadout.

3-3 MOBILIZATION AND TRANSPORTATION

The U.S. Air Force Military Airlift Command routinely transports ESSM assets for rapid response over long distances. The range, availability, loading arrangements, and cargo capacity of C-5A and C-141 aircraft make them suitable for transporting heavy equipment.

The C-5A, which has a cargo capacity of 226,000 pounds, can carry two complete modular Class V skimmer systems. Included in a planeload are two each of the central skimmer modules, sponson racks, two Boom-Handling Boats and detachable skimmer pilot houses. Because only two of the required four skimmer tow vessels are included in the flyaway modular configuration, the two additional boats must be either procured locally or sent by a second aircraft. Figure 3-9 shows a representative C-5A aircraft loading configuration for two modular skimming systems. The C-5A is also capable of carrying two nonmodular skimmer systems and several vans of ancillary equipment, or three nonmodular skimmer systems. C-141 aircraft have a cargo capacity of 64,200 pounds and can carry the equivalent of three-quarters of a modular skimmer system. The nonmodular skimmers may be flown only in a C-5A because their width exceeds the width limit of the C-141 cargo hold.

The C-5A has a maximum range of approximately 6,500 nm, while the C-141 maximum range is approximately 4,500 nm. Full load ranges are appreciably less. Aircraft range and mission profile vary with temperature, winds, cargo weight, etc. No two planeloads bound for Alaska weighed the same or were configured the same way. For the fixed distances to Elmendorf from points of origin in either California (1,861 nm) or Virginia (3,825 nm), the combined effect of other variables dictated the cargo weight of the flight. A nonstop flight carried less cargo than one that included a fueling stop at McChord AFB, Washington.

Shipment of pollution response equipment suffered delays due to differing interpretations of U.S. Air Force regulations governing air shipment of hazardous materials (HAZMAT), including diesel fuel and battery acid. The net results were delays in mobilizing critical equipment.

The cargo-carrying requirements for this mission dictated using planes that required the landing and cargo handling facilities available at Elmendorf AFB near Anchorage. After the aircraft were offloaded at Elmendorf, it was necessary to truck the equipment overland to Valdez.

The unprecedented volume of cargo arrivals caused a breakdown in the logistics management plan for transshipping cargo after its arrival at Elmendorf. Exxon took charge of expediting the equipment movement. In some cases, instead of immediately forwarding equipment to Valdez or other destinations, Exxon directed its carriers to transport the gear to holding areas throughout the Anchorage area. As a result equipment could not always be located readily. Eventually, Navy and contractor managers were asked to find the SUPSALV equipment and move it on to Valdez. They spent several days doing so.

Naval Sea Systems Command (NAVSEA) contractor personnel were on scene to meet the ESSM skimmer equipment when it arrived in Valdez. They unloaded and assembled the skimmers, arranged crane services, and coordinated events so that skimming could begin as soon as the skimmers were operational.

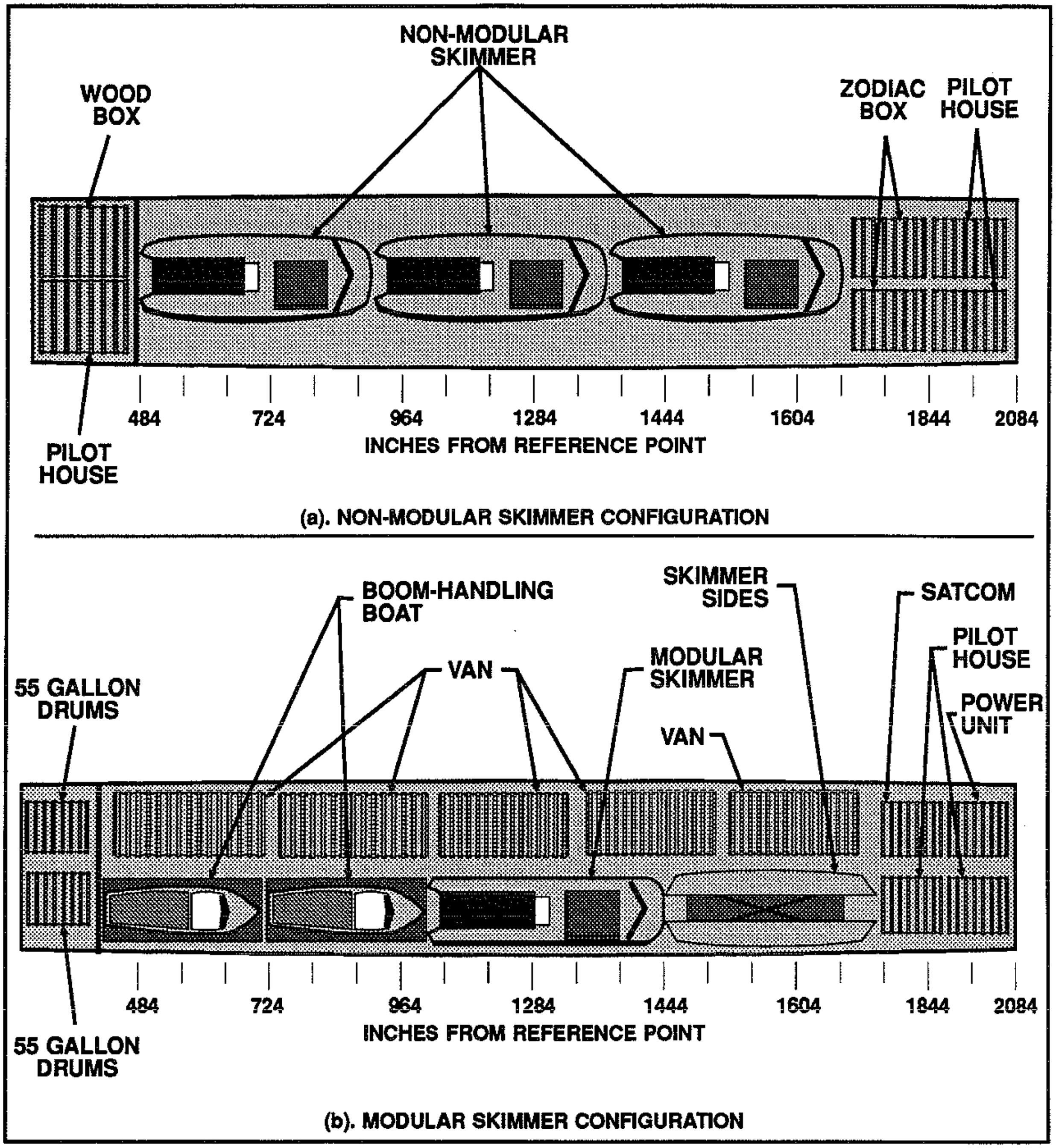

Figure 3-9. Representative Loading Plan for C-5A Aircraft - Modular and Non-Modular Skimmers.

The remoteness of the spill site from the two ESSM bases was only a small part of the logistical challenge. All aspects of mission demanded a high degree of coordination of assets and resources by ESSM managers. Collectively, logistical problems made the greatest demand on managers throughout the operation.

3-4 OPERATIONS

The EXXON VALDEZ oil spill response taxed SUPSALV pollution response resources heavily. During the operation, about 90 percent of the ESSM oil spill response equipment was deployed to Alaska. To maintain a capability to respond to other emergencies, one complete skimmer system was retained at each CONUS ESSM base and at Pearl Harbor.

Government and commercial organizations joined forces in a common effort to remove oil from Prince William Sound and nearby areas as quickly as possible. However, unity of purpose did not always translate into unity of method and management techniques. Most offshore operations are characterized by management lessons deriving from both successful mission aspects and those in which improvements can be made in future evolutions. This operation fit the pattern.

For two of the three days immediately preceding the arrival of SUPSALV equipment, Valdez weather remained as favorable as it had been on the night of the stranding on 24 March, with light variable winds. Beginning on Sunday, 26 March, the day before the first planeload arrived, the weather changed dramatically for the worse. Winds increased to 50 knots, with associated heavy seas in Prince William Sound. Skimming operations already begun by Exxon were stopped as operators sought safe havens.

Although the heavy weather had subsided by the time SUPSALV personnel and assets arrived on 27 March, it had begun to move the massive oil slick in a southwesterly direction out of Prince William Sound into the Gulf of Alaska and toward Kodiak Island and the Alaska Peninsula. The oil eventually impacted both mainland shoreline in Prince William Sound and along the Kenai and Alaska peninsulas. It also impacted a number of islands along the western side of Prince William Sound, and in the Gulf of Alaska; it entered Cook Inlet. Figure 3-10 shows the geographic scope of the spill as of 10 August. The area was huge; if the spill had occurred along the seaboard of the United States, it would have extended from north of Cape Cod to southern North Carolina, as shown by Figure 3-11.

The low height of eye of the skimmers and most of the towing vessels made it difficult for operators to see where the oil lay on the surface of the water. Observers in spotter aircraft were able to see the oil much better than the crews of boats and were able to establish priorities by observing where the most threatening concentrations lay. Spotter aircraft were used throughout the operation to direct skimmers to locations where they could be employed most profitably.

Besides spreading the oil and creating pollution over a wide area, the weather created two other problems: wind and wave action accelerated water-in-oil emulsification, turning much of the oil to a mousse; in addition, evaporation of volatile constituents left the remaining oil more viscous than when originally spilled and, therefore, more difficult to recover. Noticeable weathering of the oil occurred in about four days. As the relatively heavy crude oil weathered, increasingly viscous oil was left on the surface. Skimmers were able to draw the more viscous oil onto the belt only when the induction pump was operated at full speed. Offloading oil from the skimmer became progressively slower as the oil became more viscous and the effectiveness of the onboard pump decreased.

Weathered oil tended to submerge, which made it less visible from the skimmers. Although oil warmed by the sun tended to rise and was visible to skimmer operators, oil cooled by the water late in the day or on overcast days sank below the water surface and was less visible. Frequently, skimmer operators had difficulty in locating sunken oil after being vectored toward it by spotter aircraft.

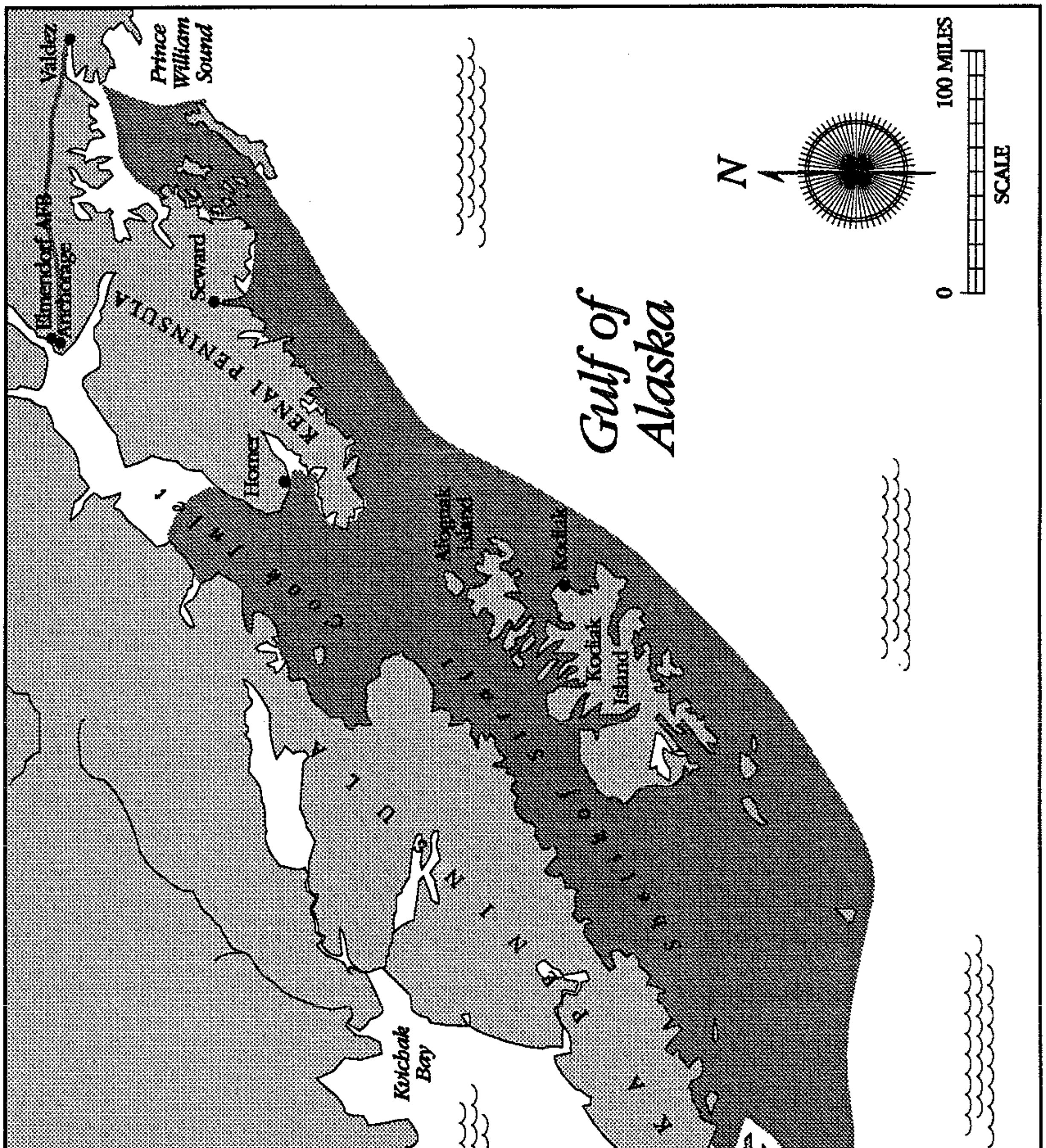

Figure 3-10. Observed Outer Limits of Sheens, Tar Balls, and Mousse Suspected to be from the Spill as of August 10.

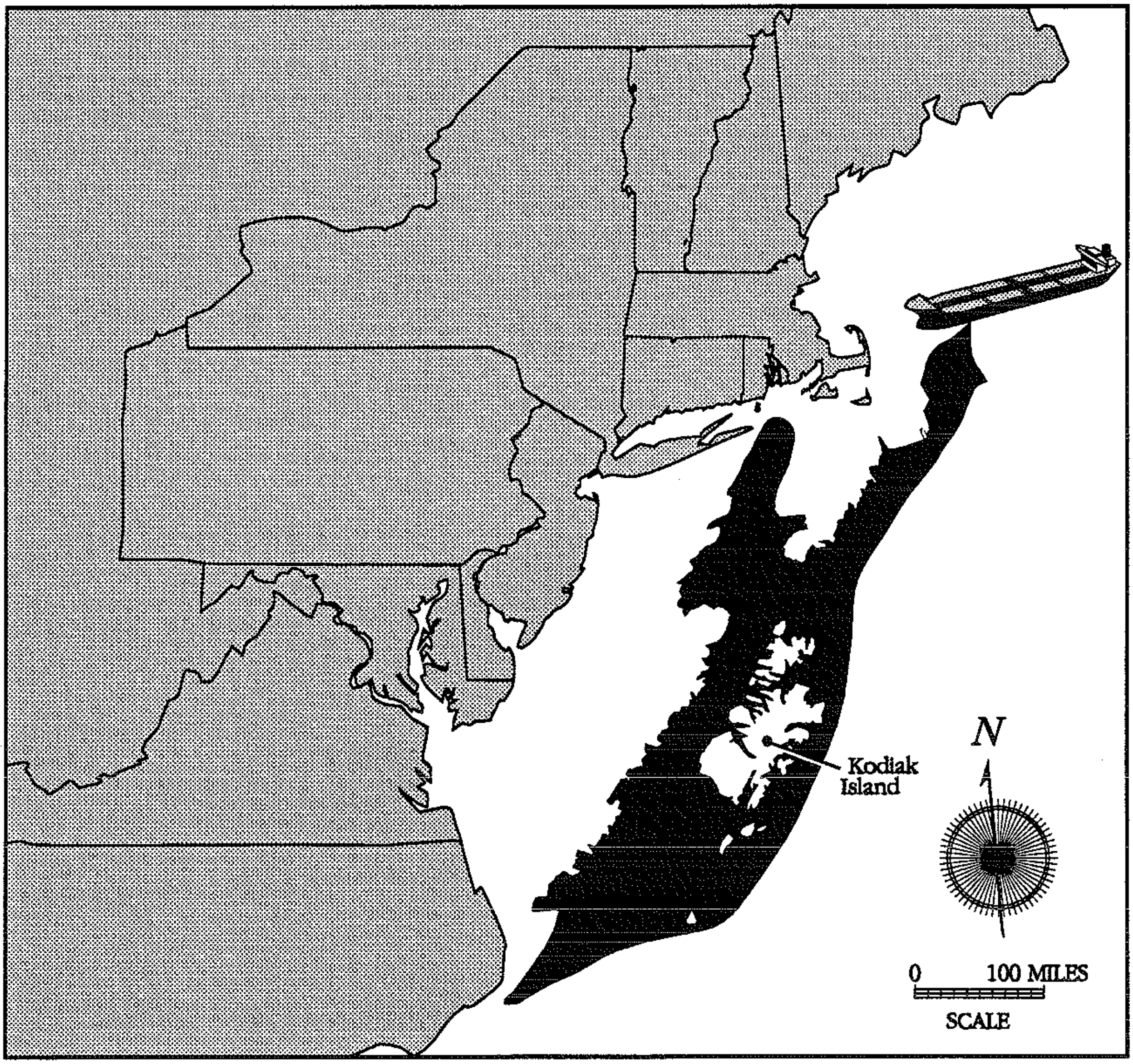

Figure 3-11. Outer Boundaries of Spill Compared with U.S. Eastern Seaboard.

Oil adhered to kelp and the forest debris typical of Alaskan waters so that the skimmers gathered a significant amount of this material along with oil. As the oil became more viscous, the quantity of debris recovered increased. A third crew member was added to the Class V skimmer's normal crew of two to keep the skimmer belt free from debris and to assist in placing recovered debris in bags. The third person was essential to keep the skimmer in operation (see Figure 3-12). As skimmers were deployed progressively farther apart during this response, large quantities of bagged debris accumulated on skimmer decks where it sometimes interfered with skimmer operations. Workers recovered thousands of bags containing a mixture of oil, and debris. Trash barges circulated among skimmers collecting bagged debris.

Figure 3-12. A Third Crew Member was added to the Class V Skimmer's Normal Crew.

Disposal of both bagged debris and recovered oil from skimmers presented a problem throughout the operation. Sumps of both modular and nonmodular skimmers filled within minutes. Skimmers lost time while transiting to barges where the oil could be offloaded, waiting their turn to offload and returning to the skimming site.

The two Class XI skimmer systems arrived in Valdez on 6 April. They were fitted aboard the offshore supply vessel ALLIANCE SULTAN OF THE SEAS, chartered by Exxon, and operated from that vessel. Both Class V and Class XI skimmers were most effective in open water with booms deployed to guide oil onto the recovery belts.

The 20 Class V skimmers in Alaska would have required 40 Boom Handling Boats (BHBs) for a completely self-contained operation. The ESSM inventory contains 16 BHBs; of this total 10 were available for the operation. Fishing boats were chartered to supplement the BHBs. Skimmers were normally towed by one BHB and one fishing boat or by two fishing boats. Figure 3-13 shows the latter case. In addition to acting as towing vessels, the fishing boats provided essential berthing, messing, and sanitary facilities for skimmer crews.

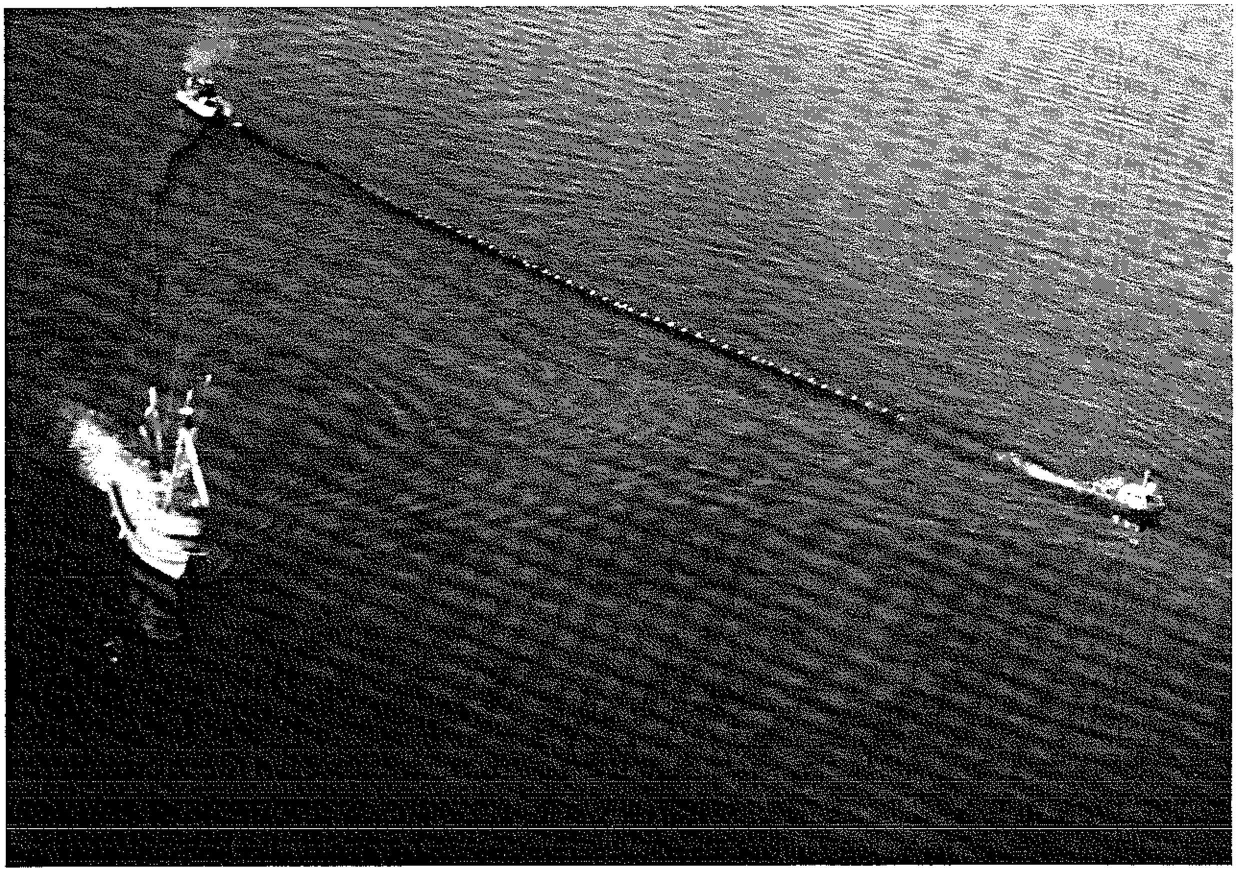

Figure 3-13. Class V Skimmer Operating with One Fishing Boat and One Boom-Handling Boat.

Skimmers operated for 16 to 18 hours a day for lengthy periods. Despite the demanding operating schedule, the skimmers performed with nearly perfect reliability. Of almost 3,000 skimmer operating days only 14 were lost. Five-man maintenance crews worked on equipment at every opportunity. Much of the maintenance work was performed at night because the urgency of the spill response operations demanded as many skimmers as possible operating during daylight. The EXXON VALDEZ spill was the first time an oceangoing vessel was available to support skimming operations. Three chartered offshore supply vessels, employed consecutively, did yeoman's service as mobile bases for periodic maintenance and minor repairs. The skimmer systems worked very well for the first two weeks needing only minor maintenance. The initial low maintenance requirements were attributed to the excellent level of preventive maintenance performed at the ESSM bases. However, as the skimmer systems' hours of use increased, routine preventive maintenance and repairs became necessary to keep this equipment operational.

An offshore supply vessel (OSV), set up as an *operations and maintenance center*, permitted maintenance to be done near the area of skimmer operation. The short transit times to and from the OSV enabled crews to do maintenance work during the night. A rigging van, shop van, spare parts van, cleaning van, communications unit, drum storage, and a portable crane were set up on the long open stern deck. The OSV provided messing and berthing for skimmer and support crews and enabled skimming operations to become virtually self-sufficient while several miles away from Valdez and the command site.

Work done included oil changes, removal and reinstallation of filter belt modules, and clearing of induction pump inlet screens. SUPSALV contractor crews aboard the OSVs also performed maintenance on the boom handling boats. Two OSVs had shipboard cranes with sufficient capacity to lift a Class V skimmer on deck. This capability made inspections and repair of underwater portions of the skimmers a routine task. The crane, part of the ship's equipment or a portable crane from the ESSM inventory, became crucial to handling the BHBs and skimmers for maintenance.

In the early phases of the cleanup, Class V skimmers conducted night skimming operations in the Sawmill Bay area. Night skimming was carried out only during calm seas and good visibility. Particular attention was paid to safety of both personnel and vessels. In one case, a skimmer was moored so that tidal conditions brought the oil to the stationary skimmer. In general, night skimming operations were considerably less effective than those conducted during daylight hours, because spotter aircraft could not direct skimmers to areas where oil was concentrated, and surface oil was not visually distinguishable from water in the dark.

The Federal On-Scene Coordinator (FOSC) set up command posts in Homer, Seward, and Kodiak to control resources assigned near those communities. Skimmers and contractor operators were assigned to each of those areas when the need for them was identified. Assistant Project Managers (APM) coordinated and supported skimmer activities from shore locations in Seward, Homer, and Kodiak. Of these, Kodiak is the farthest from the Prince William Sound.

Skimmers in Kodiak were spread over a much larger geographic area than in Prince William Sound. Some were located as far as 200 miles from their skimmer coordinator. Command and control of skimmers was difficult because the Kodiak area is more exposed to weather than Prince William Sound. Prevailing inclement weather impeded contact with skimmers; overflights and air-to-surface communications were sometimes impossible. Because radio communications were irregular, days would sometimes pass without a coordinator contacting his skimmer crews. Spotter aircraft would direct skimmers toward oil, but their direction could not be passed to the Kodiak APM by radio. The Kodiak APM, in turn, was unable to pass current skimmer location information to the Valdez Coordination Center.

Containment boom is a major tool for any containment and skimming operation involving floating oil. A total of 16,000 feet of ESSM containment boom and 16 mooring systems were flown to Elmendorf AFB, and trucked to Valdez, arriving there on 4 April. That evening the mooring systems were loaded aboard the USCGC IRONWOOD (WLB-297), filling its buoy deck, while the boom systems were placed aboard the Exxon-chartered offshore supply vessel BLUE FIN.

The San Juan hatchery at Sawmill Bay was identified early in the response as an environmentally sensitive resource, to be protected from oil. One of the four largest fish hatcheries in the world, it was identified as an "area of highest concern" by the FOSC.

NAVSEA contractor personnel worked with USCG buoy tenders to deploy the 42-inch boom and mooring systems to deflect oil from the fish hatcheries near Perry Island at Sawmill and Lake Bays. Figure 3-14 shows the boom at Sawmill Bay.

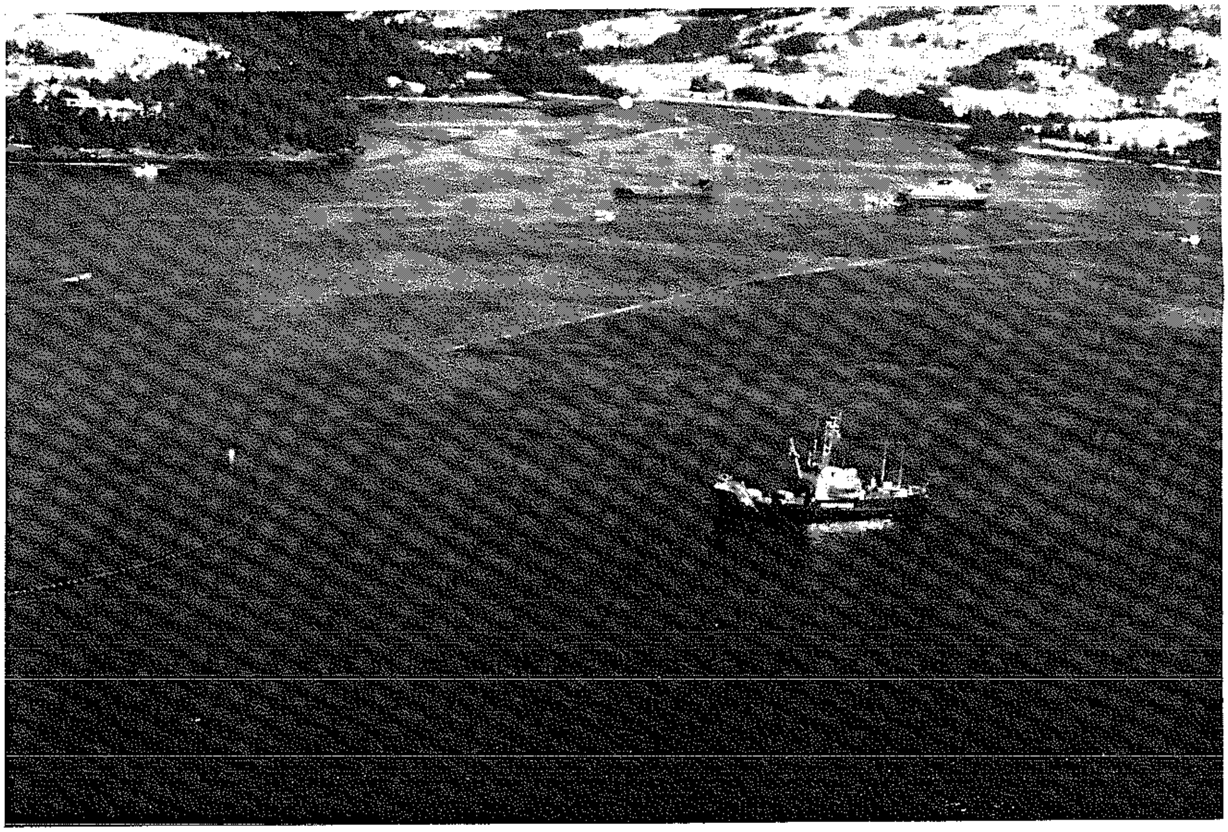

Figure 3-14. Deflection Boom at Sawmill Bay.

The entrance to Sawmill Bay was already protected by a variety of boom. Exxon tasked SUPSALV to provide a deflection boom outboard of that was already in place. It was estimated that as much as 20,000 feet of 42" boom, along with 16 anchoring systems, would be needed for this task. Judicious arrangement reduced the requirement to just 7,600 feet of boom. The deflection boom deployed was a cascading system consisting of three long segments, with each section overlapping the other and sufficient space between them to permit skimmers and support vessels to navigate inside. The longest section was 2,700 feet while the two others were each approximately 2,200 feet in length. The three arrays constituted the longest deflection boom arrays SUPSALV has deployed to date.

Moorings were laid by IRONWOOD while boom was streamed from the stern of BLUE FIN. Crews of the fishing vessels MALAGA and MYRIAH towed the boom into place and connected fittings.

Mooring operations were complicated because normal navigational charts contain insufficient bottom topography detail needed to thoroughly plan such operations. The major earthquake that struck Prince William Sound in 1964 made major changes in bottom topography. These changes have not been defined in a fine-grained bottom survey. The lack of detailed information about the seafloor was particularly vexing in operations to deploy the boom mooring system in waters that turned out to be far deeper than the 200 feet for which the standard mooring systems are intended.

The booms were moored initially with the standard mooring systems, in water depths to 300 feet. Strong tidal currents, a relatively great tidal range, and the short scope of the ground legs, all exerted enough force on the moors to cause them to drag, making the boom system ineffective. IRONWOOD retrieved and reset the ineffective moorings, using 1,000-pound Stato anchors in the array shown in Figure 3-15.

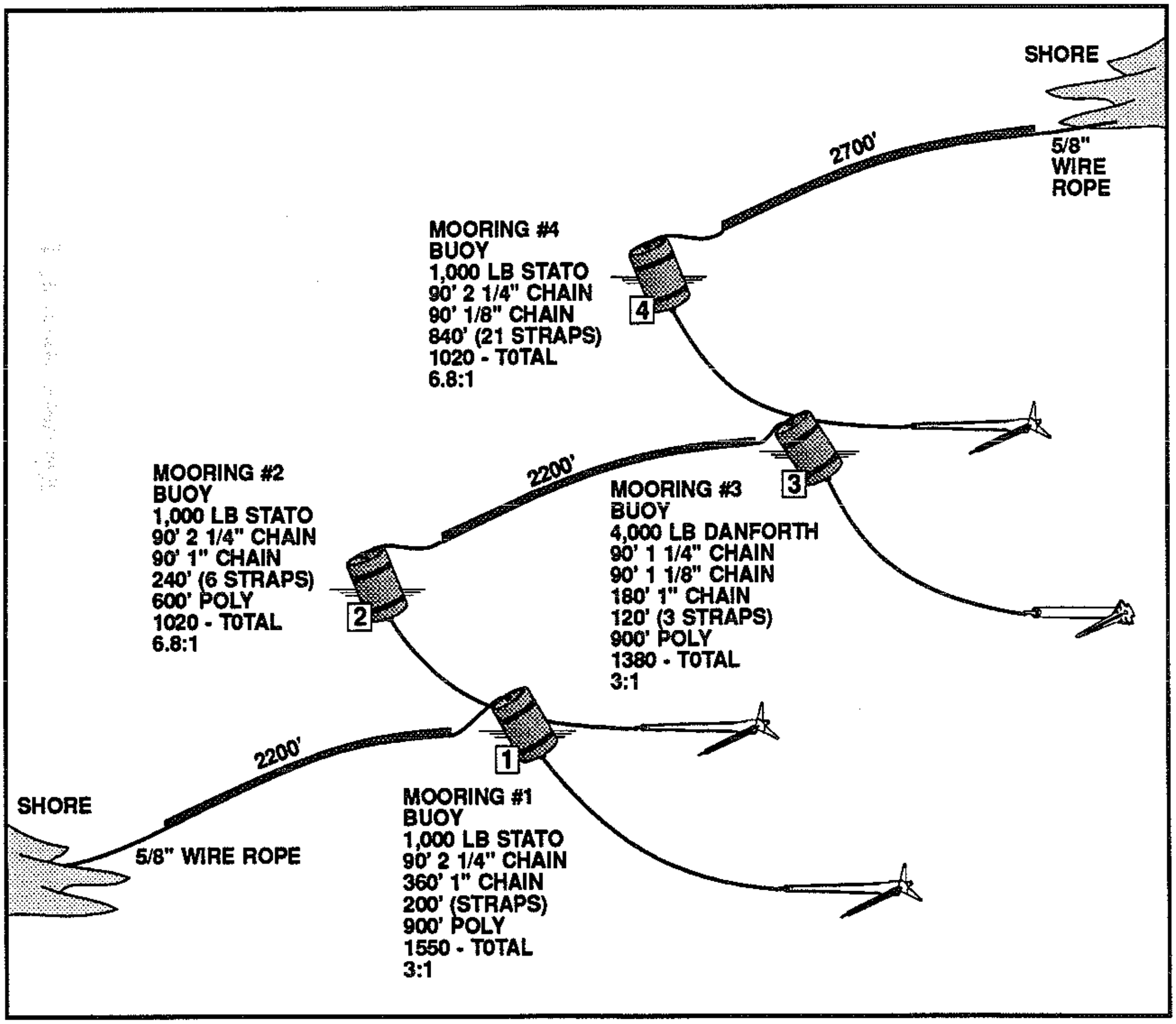

Figure 3-15. Schematic of Boom Moorings at Sawmill Bay.

3-6 COMMUNICATIONS

Imperfect radio communications frustrated managers' efforts to track skimmer locations and logistical needs. The first SUPSALV representatives and GPC project managers soon realized that they would benefit from the flexibility of more reliable communications, instead of depending on VHF and other line-of-sight means. To improve the communications situation a satellite communications (SATCOM) equipped command van was requested with the third increment of equipment ordered to Prince William Sound, 10 days into the spill response. After the vans arrived, through their standard and added equipment, personnel could perform their duties aided by satellite and land telephone lines, radios, a local-area computer network, and a facsimile (FAX) machine.

Satellite communications initially were with the land-based (suitcase model) SATCOM System. Surrounding mountains blocked transmissions to the low-altitude satellite—a result of being in a northern latitude—so the equipment was of little use. Later, a SATCOM unit was placed aboard the chartered skimmer maintenance support vessel ARCTIC TUKTU and her successors. This unit, housed in a small van and featuring a tracking antenna, worked very well and was the primary means of communicating between shore land lines and the support vessel.

The following SUPSALV communications equipment was used during the EXXON VALDEZ spill response:

SATCOM Van (aboard the maintenance support vessel in Prince William Sound):

(1) SATCOM

(2) VHF-FM

(3) CB

(4) FAX.

Workboats

(1) VHF-FM

(2) CB.

Command Van/Trailer (2 vans, 1 trailer, Valdez):

(1) VHF-FM

(2) CB

(3) FAX

(4) Land-line telephone hookup.

Skimmers (20 Marco Class V, 2 Marco Class XI, roving skimming operations):

(1) VHF-FM

(2) CB.

Figure 3-16 depicts communications options available to the shore-based and afloat units.

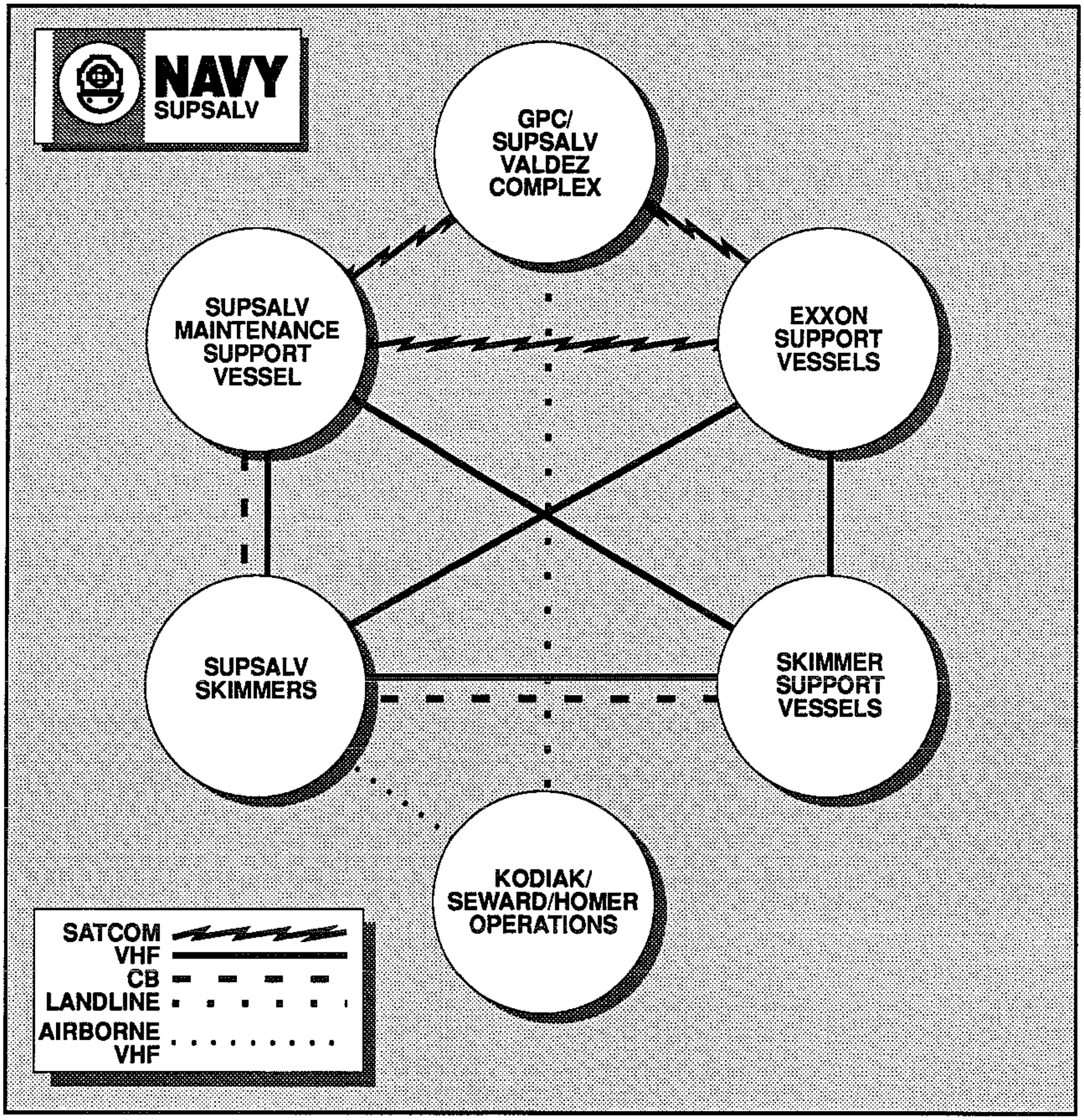

Figure 3-16. Communications Capabilities of Response Participants.

Mainstays of SUPSALV communications were SATCOM and VHF. VHF linked the skimmers to each other and to logistic support aircraft. SATCOM linked the Exxon command barges to the Exxon command complex in Valdez; to the roving maintenance support vessel; and to the command vans, in conjunction with the vans' land-line telephone hookup.

SUPSALV personnel occasionally used the UHF radio lent by Exxon as an alternative to congested VHF channels. The UHF net incorporated Exxon mountain relay stations. CB was used to communicate between skimmers and their mother vessels as a means of directing channel changes to different VHF frequencies. Switching permitted clear communications over the 70-mile distance from Herring Bay, off Knight Island, to Valdez.

VHF and the less frequently used UHF—both line-of-sight communications—were unreliable due to the mountainous topography of the operating area and relative scarcity of radio repeaters. A combination of microwave facilities with local UHF repeaters on Montague, Chenaga and Naked Islands enabled UHF communications between the Valdez Joint Communications Center (JCC) and the command units in Prince William Sound. With VHF, a skimmer coordinator operating in Herring Bay had better success communicating with Valdez, 70 miles away, than with his skimmer located only one mile away in the shadow of a mountain. Figure 3-17 shows the impact of local topography on communications during the response.

Weather permitting, SUPSALV conducted daily reconnaissance flights by aircraft equipped with dash-mounted VHF radios to communicate with operating skimmers. Inclement flying weather could prevent communications with skimmers until either weather improved or the boats could be contacted via shore-based Very High Frequency-Frequency Modulation (VHF-FM) communications with their support vessels.

Because contractor personnel carried out skimmer operations at the direction of Exxon command vessels, SUPSALV/GPC shore-based managers sometimes were out of the communications loop. The communications failure was sometimes hardware-dependent, and at other times a management issue. Skimmers often nested with their mother vessels at night, frequently receiving Exxon requests to shift locations during hours of darkness. Despite VHF and SATCOM communications between the Exxon command complex in Valdez and Exxon command barges afloat, on at least two occasions, skimmer tow vessels received and executed orders for overnight shifts without the knowledge of the Exxon field operations manager aboard one of the command barges. In both cases, the skimmers were out of sight and control of their mother vessels, with their whereabouts unknown for several hours. Interrupted communications have clear safety implications for small craft.

One skimmer coordinator was based on Kodiak Island, remote from the main spill cleanup area. He had to rely on "hitching" rides with reconnaissance planes and using their dash-mounted VHF radios to communicate with his four skimmers. This coordinator had reliable land-line telephone connection with the command vans 300 miles away, but no convenient VHF link to his skimmers that operated between 85 and 200 miles away from him.

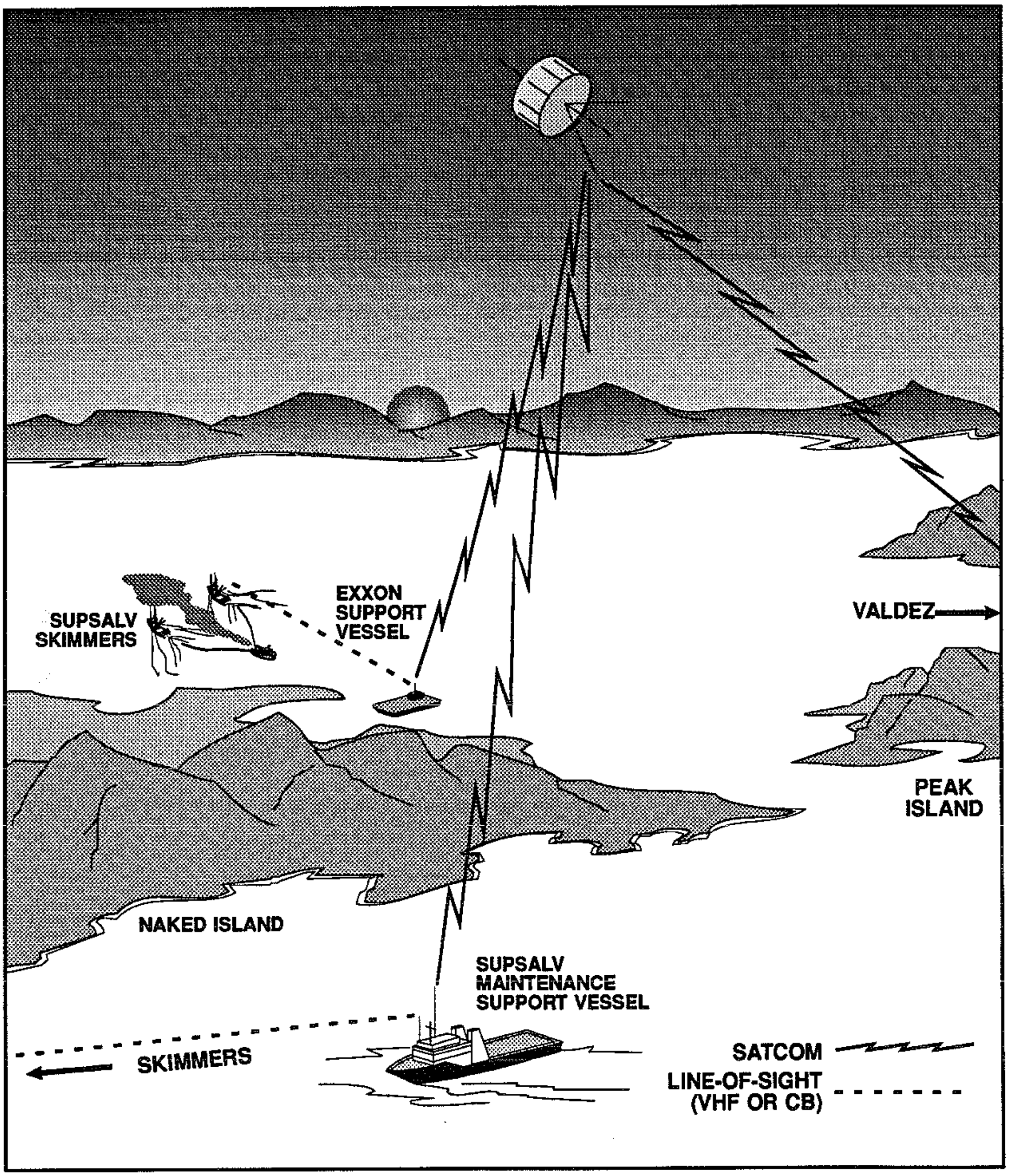

Figure 3-17. Line-of-Sight Communications Among Skimmers, Support Vessels, and Valdez were made Difficult and Sometimes Impossible Due To the Elevations of Some Islands in Prince William Sound and Forced Participants to Use SATCOM Communications.

The unreliability of VHF communications and lack of additional SATCOM units often frustrated efforts of shore-based managers to stay abreast of skimmer operations and locations. There was only one functioning SUPSALV SATCOM on-scene—fitted aboard the chartered maintenance support vessel.

The JCC established in Valdez in April was manned by Exxon, Coast Guard, and State of Alaska personnel, providing round-the-clock service. This center, together with its remote sites, improved the flow of information among operating units. For example, a remote VHF marine transceiver was placed on Naked Island and connected to the JCC by a microwave link. It enabled communications between southwest Prince William Sound and the JCC via switching capability from channel 16 to other channels.

Similarly, the JCC had UHF, HF and satellite communications capabilities. Exxon, the Coast Guard, FAA, U.S. Forest Service, and various Alaska State agencies also maintained separate communications facilities for various dedicated services, such as ship and aircraft control.

3-7 EVALUATION

Skimmer effectiveness varied with the condition and weight of the oil. Skimmers worked well in oil of moderate viscosity, but they were less effective in light sheen and with very high viscosity oils.

Skimmers filled their installed tanks after a few minutes of skimming areas in areas of heavy oil concentration, and then had to wait inordinately long periods to offload. Early in the operation skimmers sometimes had to transit great distances to rendezvous with barges for offloading. This cumbersome procedure required skimmers to wait in line for their turn to offload oil, and was both extremely inefficient and demoralizing to skimmer operators. Later in the operation, portable tankage on other support vessels was used effectively to shuttle the oil between the skimmers and barges.

The Marco Class V skimmers are most effective in calm water. In seas higher than two feet, oily water splashes and blows onto the decks, making them slippery. When seas reach three feet, the skimmers' bows lift and oil flows under the skimmer rather than onto the belt. On several days, seas were too rough for skimmer operations.

After the fourth day of the spill, increasing winds and sea heights caused the oil to weather from a relatively low-viscosity fluid to the high-viscosity oil-water emulsion, called mousse, that presented greater cleanup problems. As oil viscosity increased, transfer pumps installed in the Class V skimmers took much longer to empty the skimmer sumps. The Desmi DOP-250 pump was used to complete this work. This hydraulically driven submersible pump proved so successful in pumping weathered crude oil that it also saw service pumping out Dracones and the holds of two Corps of Engineers dredges that had been filled with recovered oil, presenting a monumental discharge problem. Other schemes included heating the oil before pumping, and using a variety of positive-displacement pumps and vacuum devices. The most common device was a vacuum truck. Figure 3-18 shows such a truck.

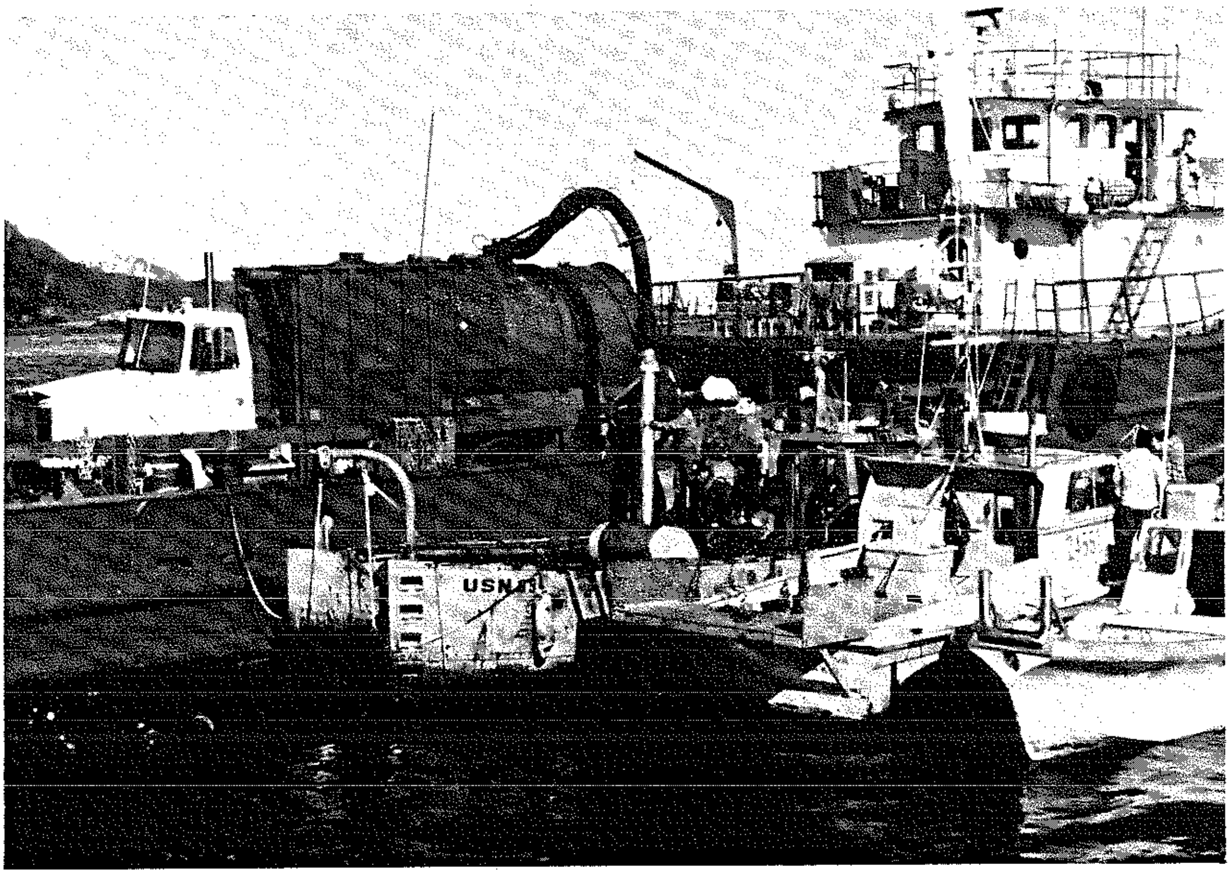

Figure 3-18. Vacuum Truck Mounted on an Offshore Supply Vessel.

Dracones demonstrated their potential value as transportable tankage for oil storage. They were not as effective as they have been when operating with sufficient discharging assets available. Further testing should broaden their applications. If it is feasible to fit gages and vents to the Dracones, they would be more useful in the field. Offloading the dracones was a major problem. Not only were offloading equipment and procedures not in place, but environmental concerns prevented them from being towed to the Alaskan ports.

3-8 DEMOBILIZATION

Planning for demobilization of some SUPSALV assets began in May, when the cleaning operation became increasingly one of beach cleanup, rather than open-water skimming. The FOSC and SUPSALV agreed upon a staggered demobilization schedule. It took into account both real and perceived needs for the continued presence of some skimmers in the Kodiak region, as well as the availability of deck cargo space aboard departing U.S. Navy ships returning to the U.S. West Coast. Skimmers and vans that could not be accommodated aboard ships of opportunity were transported by barge and/or truck to their home ESSM bases.

SUPSALV established a cleaning station aboard an Exxon-leased 40 x 120-foot barge, moored for a time in Outside Bay, to clean skimmers and related equipment. Subsequently, at Exxon's request, SUPSALV equipment was taken to a central cleaning site at McPhearson Passage, off Naked Island. Facilities included two small floating drydocks and two offshore supply vessels, fitted with cranes to hoist skimmers and other vessels clear of the water for cleaning. Figure 3-19 shows two offshore supply vessels supporting skimmer cleaning. Approved solvents and steam were used, and resulting runoff was collected in containment pools on the drydocks.

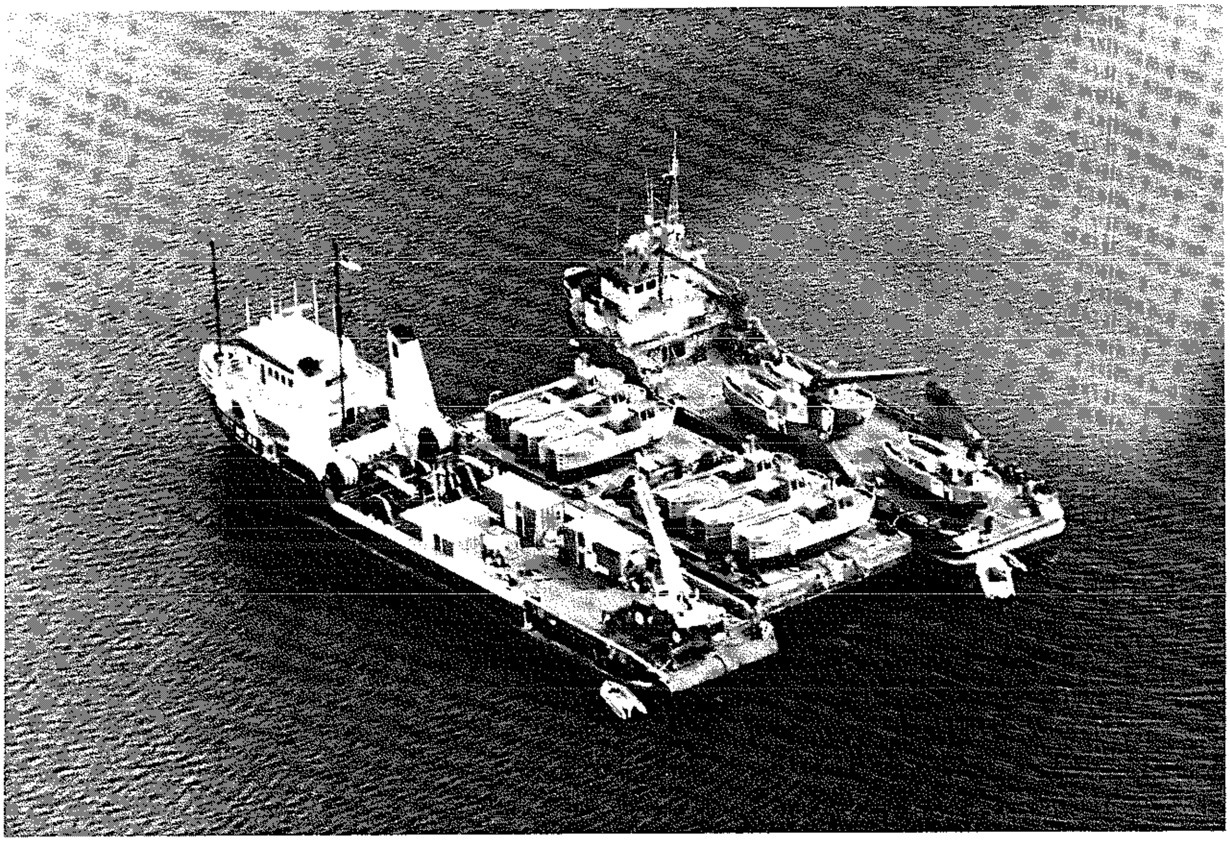

Figure 3-19. Offshore Supply Vessels as Floating Skimmer Maintenance and Cleaning Facilities.

The entire area surrounding the drydocks and adjacent "dirty" equipment was boomed to prevent their fouling the waters nearby. As stated above, skimmers and other equipment were cleaned and returned to CONUS by one of three means. Five COMPHIBRON-3 LPDs and LSDs transported 13 skimmers to San Francisco and 4 to Long Beach. Three skimmers were trucked from Valdez to Anchorage by commercial carriers and towed by barge to Seattle. All skimmers were trucked from their CONUS ports of arrival to their respective ESSM bases. Two skimmers were trucked from Valdez to their Williamsburg, Virginia base.

3-9 AMOUNT OF OIL RECOVERED

Both Exxon and the Coast Guard attempted to calculate the amount of oil recovered from the daily Coast Guard Pollution Reports and internal Exxon records. It was difficult to deduce the amount of free oil recovered, as opposed to the oil cleaned from rocks along the shoreline. The difficulty stemmed from the fact that oil from both sources often ended up in the same collection barges. Furthermore, much of the oil was emulsified with large quantities of seawater. A reasonable, if conservative, estimate of the amount of free oil recovered was 10 percent of the amount spilled, or approximately 25,000 barrels (10,500,000 gallons). Of this, the U.S. Navy was generally credited with recovering half, or approximately 5,250,000 gallons of free oil.

CHAPTER 4

LESSONS LEARNED AND RECOMMENDATIONS

4-1 INTRODUCTION

This nationally significant pollution incident resulted in the **largest oil spill response ever conducted in the United States**, and perhaps in the world. As a consequence, lessons learned should be documented and incorporated into planning for future oil spill response operations. In some cases, these lessons indicate work recommended to improve future response evolutions. In others, they indicate where the response system works very well.

4-2 INITIAL DEPLOYMENT

Requests for equipment should be timely. In this case, calls for **NAVSEA's Emergency Ship Salvage Material (ESSM) resources** were made in increments. Had procedures for requesting equipment been more widely known by U.S. Coast Guard and National Response Team/Regional Response Team (NRT/RRT) personnel, some ESSM resources could have been deployed sooner. The **ESSM inventory description**, procedures for accessing the system, and funding requirements should be disseminated at frequent intervals to the predesignated **Federal On-Scene Coordinators (FOSC)**, to **National and Regional Response Teams**, and to other potential spill responders.

4-3 TRANSPORTATION

The effectiveness of this response effort depended upon personnel and equipment being delivered to the scene quickly. Transportation was particularly critical. For a timely response, air transportation of men and equipment was imperative, although equipment had to be handled repeatedly during modal changes. **C-5A and C-141 aircraft** are best suited to move multiple shipments of large items such as skimmer systems and vans. Staging and landing sites are limited to those that can handle and support these large aircraft. Successful transport requires that trained personnel and sufficient **material handling equipment** (MHE) of the correct type and capacity be available at appropriate locations. As the **13-ton command van** is the heaviest piece of equipment to be handled, a large mobile crane capable of lifting that weight is satisfactory for most situations. However, if the van is to be placed at the center of the support vessel, the **mobile crane** must be capable of lifting its weight at a **35- to 40-foot reach**. In addition, one or more **5- to 6-ton forklifts** are required at the staging area and any other material handling location.

It may be necessary for contractors to rent trucks, fork lifts, cranes and other MHE at each site where materials are to be handled. The effort to determine availability of MHE where the equipment will arrive should begin early in the mobilization process. The SUPSALV Contingency Planning Guide includes MHE requirements so that they may be incorporated into local contingency plans.

Early establishment of a SUPSALV command post is critical to both effective mobilization and operations. However, shipment of booms and skimmers must take priority over shipping and setting up command vans. An interim command post should be established in a hotel or other convenient location.

The **SUPSALV command van** should arrive on the earliest flight that does not interfere with transportation of operational equipment. To facilitate establishment of a proper command post, the command van office and communications equipment should be packaged so that it can be either transported in the command van or shipped separately.

The **interagency agreement** between the Navy and the Coast Guard, supplemented by **Special Assignment Airlift Mission (SAAM) requests** made directly to the Military Airlift Command **(MAC)**, have proved most effective and efficient in arranging air transportation. This method will continue to be the method of choice, and will be followed in the majority of oil spills to which SUPSALV responds. In those rare spills that are considered to be **"of national interest"** or when prearranged support agreements are not in place, the Director of Military Support (DOMS) may be activated, and it may become necessary for SUPSALV to deal with that organization. SUPSALV should be exempt from involvement with DOMS but should be familiar with DOMS procedures and mechanisms in the event such involvement is required by higher authority.

Planning for air transportation of ESSM equipment should be improved so that SUPSALV can move large quantities of equipment quickly, utilizing U.S. Air Force assets. Planners should review **requirements for loading aircraft** and treatment of fuels, compressed gases, lead-acid batteries, and other hazardous materials for air transport. All material shipped must be prepared in strict compliance with Air Force directive ***AFR* 71.4 Chapter 3**. The existing SAAM message format should be modified to include a statement that all material conforms to the applicable requirements. Where conformance is impractical, requests should include a request for waiver for shipment of **HAZMAT**.

4-4 OPERATIONS

Skimmers and other ESSM equipment **functioned exceptionally well**, with minimal downtime—only 14 full days of a total of nearly 3,000 skimmer operating days. Such reliability is attributed to good equipment, proper preventive maintenance, and people who are both highly skilled and highly motivated. Equipment in the field was well-supported with on-scene spare parts, proper field maintenance, and knowledgeable persons to keep it operating.

Response during a catastrophic spill, or when valuable resources are threatened, demands an **"operate at all costs" philosophy**, with the maximum amount of equipment in the field. In such operations, maintenance must be done at night or at other times when equipment is idle. Equipment will not be available for maintenance on the customary rotational basis.

Maintenance should not be limited to the minimum required to keep the equipment operating. As much essential preventive maintenance as possible must be performed; otherwise, the equipment will develop a "**maintenance debt**," which will contribute to decreasing reliability as the operation continues.

Skimmers are most effective when skimming **free oil**. In order to skim under the most favorable conditions, equipment should be placed in operation before wind and current move the oil ashore. Crude oil weathers quickly, leaving a highly viscous residue. Difficulty was experienced in pumping very viscous oil from the skimmer sumps. Because pumping with the installed pump became very slow, discharge was prolonged. To speed the process, the **Desmi DOP-250 pump** was transported from skimmer to skimmer for use in offloading. The **Class V skimmer** has limited effectiveness for skimming very light oils and sheens. This problem may be alleviated by "**diesel belts**" being procured for testing at the time of this writing.

Throughout the operation, **local fishing boats** towed skimmers and provided accommodation for skimmer crews. They were effective in this role. Suitable local fishing boats may be used in lieu of the **Boom-Handling Boats** (BHBs), or may supplement the limited supply of **BHBs** in large-scale skimming operations. Fishing boat crews are quite familiar with their boats and with local waters. They are easily trained to tow skimmers. The vessels extended the range of operation by providing accommodations for skimmer crews in remote areas of the geographically broad spill area.

Spotter aircraft were invaluable in directing skimmers to the areas of greatest oil concentration. From their altitude, spotters in the aircraft were able to see the location and extent of oil on the surface much better than personnel on board the skimmers. The aircraft could vector the skimmers to the areas and in the directions in which they could be most effective. Aircraft spotters were also able to determine whether skimmers were operating effectively, by observing the skimmers' wakes for oil. Skimmer numbers painted on the top of the pilot house and engine covers facilitated identification by aircraft.

Field cleaning of oil-fouled equipment was a continuing problem during this large operation. **Contingency planning** should ensure that appropriate cleaning facilities are operational and available as early in the response as possible. The benefit of this approach is a **continuous cleaning** effort from the outset, with concomitant minimization of delays while equipment awaits cleaning.

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A dedicated **maintenance vessel** is needed to support operating units, if the **operations area** extends **more than five miles from a shoreside support base** and is sustained for extended periods. In this response, use of an offshore supply vessel outfitted with SUPSALV support equipment worked extremely well. An open after deck, where the portable crane, support vans, boom vans, and other equipment can be staged, is a particularly desirable feature in any support vessel. The ability to lift the skimmers on deck is particularly desirable.

Anchoring systems from the ESSM inventory were modified in the field for deployment in water deeper than the equipment's design depths. These modifications included heavier Stato anchors and additional chain and polypropylene straps in the mooring legs. Additional **mooring system components** for **field modification** of **standard mooring systems** should be added for future operations. Standard design arrangements for deep water mooring of oil booms should be developed and promulgated to ESSM personnel. **Operations manuals** should be updated to include additional data on maximum allowable forces on **boom components and rigging**. The data should be easily accessible in charts and nomograms.

Dracones were used as a last resort for storage of recovered oil. These devices are intended as **short-term storage** facilities that can be used to collect oil from the limited-capacity skimmer and transport it to a larger disposal facility. Unfortunately, it was not possible to use Dracones in their design mode in Prince William Sound, because handling and discharge procedures and doctrine had not been developed and did not lend themselves to field improvisation. The basic concept of the Dracone is believed to be sound, but some **equipment modification** is required and appropriate **handling and discharge doctrine and procedures** must be developed. Their use outside their design mode as long-term oil storage facilities caused potential safety hazards because of the generation of toxic gases accompanying the decay of organic debris.

An investigation should be conducted into potential equipment degradation caused by long-term exposure to residual oil and oil by-products. Managers should consider **alternative means of offloading skimmers**, including design and construction of a tank. The tank would be approximately 20 feet long, could receive and store skimmer oil, and could double as a shipping container for dirty Dracones. A scenario for packaging Dracones in a "dirty" but empty condition and shipping them to their ESSM bases for cleaning could alleviate space and environmental/political problems associated with cleaning the Dracones in the field.

During the initial response, some of the oily waste was disposed of by on-site incineration. However, the majority of the oily waste was ultimately transported to Oregon where it was disposed of in an approved landfill facility. Planning for necessary state and other permits should be a high priority in the contingency planning process. Incident-specific planning should be initiated early in a response operation.

4-5 COMMUNICATIONS

Line-of-sight communications do not work well in mountainous regions, and **satellite communications** ultimately were necessary to overcome this difficulty. Exxon installed a microwave **UHF repeater system**. In this response, the satellite communications capability installed in ARCTIC TUKTU and her relief maintenance support vessels significantly enhanced command and control. A **FAX machine**, invaluable for sending and receiving hard copy, was installed in the SUPSALV satellite phone and command van and should be standard equipment in future operations.

A 100-channel **High Frequency (HF) base station** transceiver was installed in the Joint Communications Center (JCC), connected with a remote transceiver at Naked Island, enabling HF communications with Seward and Homer communications centers. Had skimmers been equipped with **HF Single Sideband (SSB)** communications, skimmer operators would have been able to communicate over long distances more easily. Utility of HF communications equipment should be included in future SUPSALV communications evaluations.

Communication among command vans was difficult, even though they were situated adjacent to each other. An intercom should be provided so that messages and phone calls may be routed without personnel having to shuttle between units.

SUPSALV should task the appropriate **U.S. Navy communications command to evaluate** Navy requirements for remote-operation communications, **and** to develop a **recommended** suite of **equipment to accompany skimmer systems into the field**. Important components of the overall need include aircraft-to-surface, ship-to-shore, ship-to-ship, boat-to-shore, boat-to-boat, and land-line communications. The evaluation should consider all types of state-of-the-art radio, satellite, and telephonic equipment.

4-6 PERSONNEL

The availability of a senior Naval **Reserve Officer** to act as **SUPSALVREP** was of great benefit because of his **seniority** and **the continuity of having one person** on scene while other SUPSALV managers rotated out periodically to resume their duties elsewhere.

An experienced SUPSALV operations specialist should be on scene initially to ensure timely setup of equipment and proper coordination. Guidance available to SUPSALVREPs in pollution response operations should be improved. The ***SUPSALV Operations Guide*** should be updated continually to ensure that SUPSALV's responsibilities vis-à-vis the contractor, USCG, NRT, National Oceanic and Atmospheric Administration (NOAA), and regional response organizations are up to date and explained clearly.

During the EXXON VALDEZ response operation, numerous situations arose where expediency would have been served by jury-rigging equipment or otherwise short-cutting established and approved procedures for equipment handling, rigging, and maintenance. The first SUPSALVREP, Eric Glaubitz, advocated the correct policy of **following established and proper procedures whenever possible**. While this policy seemed to cause delays, it proved to save time

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Personnel mobilized for a spill response must have appropriate **training**. As a consequence of this response, there are now many experienced SUPSALV and contractor personnel. This experience should be preserved by continuation of annual training exercises at each ESSM site when spills of opportunity do not satisfy this proficiency training requirement. These training exercises should be augmented by short training videos and pictorial training booklets for each piece of equipment.

Personnel support is difficult to sustain in remote areas and should be planned as thoroughly as is deployment of ESSM resources. **Berthing, messing, sanitary, and transportation facilities are critical to personnel support**, and thus to safe and efficient operations. These facilities must be established immediately. When response operations are stretched out with several miles between individual units, personnel support is particularly challenging. Class V skimmers have no berthing, messing, or sanitary facilities aboard; these facilities must be provided externally. A plan for meeting these requirements must be agreed to in advance by both SUPSALV and the customer.

4-7 SAFETY

Personnel must be made aware of hazards and provided with appropriate **protective clothing and equipment**. In Prince William Sound operations, personnel were exposed to foul weather, slippery walking conditions, and petroleum fumes, in addition to the usual risks associated with long hours of physical work in a marine environment. The four-hour safety course developed by Exxon and required of all hands was effective. There was only one safety-related incident involving SUPSALV or contractor personnel. This incident involved a contractor who developed respiratory problems from inhaling hydrocarbons. He was hospitalized briefly, then returned to CONUS.

From the internal SUPSALV perspective, ESSM personnel safety equipment and training were satisfactory but somewhat marginal for the harsh operating conditions and large-scale effort encountered in Alaska. The **ESSM organization** should continue to stress safety in operations and should develop **safety training videos** to enable subcontractor personnel and new-hires to be trained in the field.

4-8 DOCUMENTATION/FIELD ACCOUNTING

Computerized and manual field accounting **procedures** should be in place on the first day of an operation. The **field accounting activity** must enjoy a priority high enough to ensure meticulous accuracy from the outset. Aggregation of **daily cost** should be simple and uniform, and promulgated to all concerned with **equipment, manpower, and consumable expenditures.** Aggregated costs should be passed to the ESSM bases and the contractor's corporate offices daily. Customer audit procedures should be part of the field accounting process. The **ESSM field accounting manual** should be changed to a **field administrative manual**, with documentation requirements tailored to the scope of the operation. Management personnel should be trained in the documentation requirements for various magnitudes of response.

4-9 DEMOBILIZATION

Demobilization from an oil spill response requires considerable planning and coordination. Cleaning equipment to meet transportation requirements is a large part of demobilization, is expensive, and requires advance planning and logistical support.

A **cleaning plan** was implemented for **Dracones** using the same facility provided for cleaning skimmers and oil booms. This procedure required a crane to elevate one end of a Dracone so that recovered oil would drain to the low end for pumping. This effort, combined with rinsing and final cleaning, made Dracone cleaning an arduous procedure. Experiments were conducted in the drydock floor to determine the optimum temperature of cleaning water. The water had to be sufficiently hot to liquify the oil mousse, yet not so hot that the interior of the Dracones would be damaged. **Water at 190 to 212 degrees Fahrenheit** was found to be effective in performing both tasks. The interior of the Dracone was washed with water at this temperature while hot water was sprayed on the exterior to help maintain the interior temperature. The Dracone was pumped and the effluent dumped into a sludge barge. The Dracone was flushed until satisfactorily clean for transportation. Throughout the cleaning process, a marine chemist and industrial hygienist were in attendance to monitor the atmosphere in the Dracone and to provide safety guidance for personnel performing the work. The procedure was effective and should be used in future field cleaning operations.

Returning equipment to its base on board Navy vessels of opportunity reduces transportation costs, but requires advance planning. While it is not necessary to return equipment with the same speed at which it is mobilized, the unpredictable frequency of spill response operations dictates rapid re-warehousing and restoration to ready-for-issue status. Transportation cost savings must be balanced against loss of readiness if a slow transportation mode is chosen.

The capability of transporting equipment such as **booms and Dracones to their bases for cleaning** should be developed, so that they may be cleaned in a controlled and cost-effective manner at the base, rather than in a less efficient procedure at the field site.

CHAPTER 5

CONCLUSIONS

Management and *logistics*—rather than technology—were the factors that limited the success of the response to the EXXON VALDEZ oil spill. The size and relative remoteness of the spill, geographic area, number of organizations involved, *ad hoc* structure, and high level of public attention moved the response beyond the limits anticipated for spill response. The Supervisor of Salvage (SUPSALV) was integrated with Federal and state agencies and commercial organizations into a reasonable, workable, flexible, and effective operation.

While the response to the EXXON VALDEZ oil spill was the largest yet undertaken by SUPSALV, the proven deployment methods were again effective. The basic difference was scale. The scale of the deployment—over 90 percent of the Emergency Ship Salvage Material (ESSM) inventory of oil spill response equipment—and the difficulties encountered in moving equipment from the ESSM bases to the spill site underscore the importance of thorough *deployment planning*. Equipment must arrive at the site in the order in which it will be employed. Perhaps more importantly, the equipment must not arrive so quickly that the quantity overwhelms the handling capacity of the receiving activity or the ability of the operators to put it into service. The most efficient operation results when all the equipment is ordered at the outset, enabling total deployment planning. In the confusion that immediately follows a spill, it is often difficult to judge the quantity of equipment that will be required. It is far better to order all the equipment that might be needed than to be caught short because of an ill-advised attempt to save money.

Deployment of the *ESSM system* pollution response equipment and personnel, and operations in the field *are costly*. They cannot be supported, even on an interim basis, by the funds normally held and administered by SUPSALV. As a matter of policy in oil pollution response, SUPSALV works directly for Federal agencies only. *Funding* **must be** identified and provided by the Coast Guard or other customer agency before the contractor can be tasked and the equipment mobilized and deployed.

Even with the most thorough contingency planning, the most rapid response, and the state-of-the-art cleanup technology that SUPSALV employs, there will be **environmental damage** from oil coming ashore in nearly every spill. Broader acceptance of burning or *dispersal by chemical means* may have potential for getting rid of spilled oil. Until these methods are approved and tested on an actual spill, their effectiveness will not be realized.

The SUPSALV equipment worked well in skimming oil, and recovered the majority of all oil recovered. Equipment effectiveness was limited by the ability of the onboard pumps to pump oil that had become more viscous from weathering, and by the storage capacity of the skimmers. As weathering is a natural process that occurs on all spills, a pump capable of handling the entire range of viscosities likely to be encountered should be identified and programmed for skimmer installation. The support of locally hired craft—barges, support ships, fishing boats, and aircraft—was essential for skimmer teams in remote areas. The *Dracones*, extremely attractive as transportable tankage, were not used effectively because of poorly founded concern about the difficulty of offloading them. Further testing should be undertaken to prove and improve Dracone effectiveness.

The EXXON VALDEZ oil spill response demonstrated, albeit negatively, the importance of an effective public relations program to an oil spill response. Although Exxon spent large amounts of money, acted responsibly, and was reasonably effective, they received great media and public criticism. *The Navy received almost no credit for their rapid response* or their oil skimming efforts. A well-organized, technically accurate PAO effort is necessary to ensure that blame and criticism are not awarded unduly and that proper recognition is given those who deserve it. In retrospect, a dedicated Naval Public Affairs Officer should have been on site from the onset.

Oil transportation related spills can be expected to occur most often in areas around terminals where waters are restricted and the population of tankships is high. The location and frequency of such spills, like marine casualties, do not fall into any predictable pattern of size, location, or type. Equipment required to combat spills is capital-intensive; the required skills are highly specialized. Maintaining a high state of readiness is costly, but necessary if spill response is to be effective. Because of the costs and complexity of maintaining spill response readiness and the unpredictable occurrence of spills, central location of dedicated pollution response equipment and operators, such as in SUPSALV's ESSM system, is a logical, technically sound and cost-effective method of providing an oil spill response capability as a national asset. Equipment can be *deployed rapidly* to areas where it is needed rather than being warehoused awaiting a spill at a particular location. Responses occur often enough that ESSM personnel must maintain equipment in ready-for-issue condition. Regular exercise of the equipment contributes to its reliability and to the disclosure and correction of operational problems and deficiencies. Because of the frequency of operations operators, supervisors, and managers are practiced in the deployment and use of their equipment. When their skills are called upon often, *rapid-response-oriented, "can-do" personnel*, capable of the flexibility needed to adapt to the unique conditions of each response, remain motivated and available.

The ESSM system was responsive, but experience gained in the EXXON VALDEZ response identifies areas where improvements can be made. Judicious application of the lessons detailed in Chapter 4 can make the system function more smoothly and effectively in future operations. The logistics requirements of each job differ in detail. Care must be taken in analyzing each operation to ascertain which lessons fit conditions beyond the particular spill and can be generalized.

The SUPSALV equipment and deployment system worked, logistics proved manageable, and the organization made a significant contribution to the overall response. The *SUPSALV oil spill organization and equipment are demonstrably national assets* with the flexibility to be integrated easily into any type of organization.

APPENDIX A

REQUEST FOR POLLUTION CONTROL ASSETS

P 260439Z MAR 89
FM COGARD MSO VALDEZ AK
TO CCGDSEVENTEEN JUNEAU AK//M//
COMPACAREA COGARD ALAMEDA CA//PO//
COMNAVSEASYSCOM WASHINGTON DC//NAVSEA-00C//
COMNAVFACENGCOM ALEXANDRIA VA
CINCPACFLT PEARL HARBOR HI
COMDTCOGARD WASHINGTON DC//G-MER/NRC//

BT

UNCLAS //N16465//

SUBJ: REQUEST FOR POLLUTION CONTROL ASSETS

A. TELCON NRC/NAVSUPSALV 260100Z MAR 89

1. ON 24 MAR 89 T/V EXXON VALDEZ GROUNDED IN PRINCE WILLIAM SOUND RELEASING MORE THAN 250,000 BBLS OF CRUDE OIL. THE RESPONSIBLE PARTY HAS REQUESTED THE USE OF THE MARCO SKIMMER SYSTEM TO CLEAN OIL IN AREAS UNAVAILABLE TO ONSCENE EQUIPMENT.

2. REQUEST THAT ONE MARCO SKIMMING SYSTEM WITH OPERATING PERSONNEL AND SUPPORTING EQUIPMENT BE SHIPPED TO VALDEZ AS SOON AS POSSIBLE.

BT

O 312226Z MAR 89
FM COGARD MSO VALDEZ AK
TO OASD (P&I) L/TP PENTAGON WASHINGTON DC
INFO NAVMTO NORFOLK VA
COMDT COGARD WASHINGTON DC//G-MER//
COMCOGARD MLC PAC ALAMEDA CA
CCGDSEVENTEEN JUNEAU AK//M/O//

BT

UNCLAS //N04600//

SUBJ: SAM REQUEST

1. REQUEST TRANSPORTATION OF 5 NAVY SUPSALV MARCOS CLASS V SKIMMERS AND 42 INCH INFLATABLE VAN LOADS TO VALDEZ, AK. SKIMMERS ARE TO BE DEPLOYED IN THE T/V EXXON VALDEZ POLLUTION RESPONSE OPERATIONS IN PRINCE WILLIAM SOUND, AK. APPROX WEIGHT IS 66,000 LBS.

2. I CERTIFY THAT THIS TRANSPORTATION IS NEEDED IN THE NATIONAL INTEREST.

3. NO COMMERCIAL RESOURCES AVAILABLE TO PROVIDE.

4. DOD WILL BE REIMBURSED BY THE COAST GUARD.

5. POINT OF CONTACT IS MR. BEN HILLIKER CF ALYESKA CORP AND CAN BE REACHED AT (907) 265-8174.

6. FUNDS CITE: FPN 33-179007.

7. BILLING ADDRESS: COMMANDER (FCP-1) MAINTENANCE AND LOGISTICS COMMAND, PACIFIC, COAST GUARD ISLAND, ALAMEDA, CA 94501-5100.

8. RADM E. NELSON, JR, DISTRICT COMMANDER, SENDS.

BT

O 030314Z APR 89
FM CCGDSEVENTEEN JUNEAU AK//D//
TO DASD (P&L) L/TP PENTAGON WASHINGTON DC
INFO CNO WASHINGTON DC
COMDT COGARD WASHINGTON DC//G-MER//
COMCOGARD MLC PAC ALAMEDA CA//FCP//
COMNAVSEASYSCOM WASHINGTON DC//NAVSEA-00C//
COGARD NATIONAL RESPONSE CENTER WASHINGTON DC

BT

UNCLAS //N04600//

SUBJ: SAAM REQUEST

1. REQUEST TRANSPORTATION FOR 20,000 FEET OF 36 INCH OIL POLLUTION BOOM FROM NAVSUPSALV TO BE DEPLOYED IN THE T/V EXXON VALDEZ POLLUTION RESPONSE OPERATIONS IN PRINCE WILLIAM SOUND, AK. NAVSUPSALV POINT OF CONTACT FOR SHIPPING INFORMATION: BILL WALKER AT (202) 697-7403.

2. I CERTIFY THAT THIS TRANSPORTATION IS NEEDED IN THE NATIONAL INTEREST. IMMEDIATE RESPONSE REQUESTED TO PROVIDE GREATEST POSSIBLE RESOURCE PROTECTION.

3. NO COMMERCIAL RESOURCES ARE AVAILABLE.

4. DOD WILL BE REIMBURSED BY THE COAST GUARD.

5. POINT OF CONTACT IS CRAIG RASSINIER AT (907) 835-5551 OR (907) 835-4442. POINT OF CONTACT FOR COAST GUARD IS CDR ROME AT (907) 835-5551 OR AUTOVON 950-3861.

6. FUNDS CITE: FPN 33-179007.

7. BILLING ADDRESS: COMMANDER (FCP-1), MAINTENANCE AND LOGISTICS COMMAND PACIFIC, COAST GUARD ISLAND, ALAMEDA, CA 94501-5100.

8. RADM E. NELSON JR. DISTRICT COMMANDER SENDS.

BT

O R 042218Z APR 89
FM COGARD MSO VALDEZ AK
TO CNO WASHINGTON DC
INFO COMNAVSEASYSCOM WASHINGTON DC//NAVSEA-00C//
CCGDSEVENTEEN JUNEAU AK//M//
COMPACAREA COGARD ALAMEDA CA//PO//
CINCPACFLT PEARL HARBOR HI
COMNAVRFACENGCOM ALEXANDRIA VA
COMCOGARD MLC PAC ALAMEDA CA//MF//
COMDT COGARD WASHINGTON DC//G-MER//NRC//
DASD WASHINGTON DC//P&L/L/TP PENTAGON//

BT

UNCLAS //N16465//

SUBJ: REQUEST FOR POLLUTION CONTROL ASSETS

A. TELCON LT JANELLE (MSO)/BILL WALKER (NAVSUPSALV)

1. OIL SPILL RESPONSE FROM EXXON VALDEZ CONTINUES TO DEMAND ADDITIONAL RESOURCES. EXXON CORP HAS REQUESTED THE USE OF 13 ADDITIONAL MARCO CLASS V SKIMMING SYSTEMS AND TWO(2) CLASS II SKIMMING SYSTEMS TO CLEAN AREAS UNAVAILABLE TO PRESENT ONSCENE EQUIPMENT.

2. REQUEST THAT 13 MARCO CLASS V SKIMMING SYSTEMS AND TWO(2) CLASS II SYSTEMS AND SUPPORTING EQUIPMENT BE SHIPPED TO VALDEZ AS SOON AS POSSIBLE. EXXON WILL ARRANGE TRANSPORT FROM ANCHORAGE TO VALDEZ. EXXON HAS SUBMITTED LETTERS OF COMMITMENT FOR PROCUREMENT, TRANSPORTATION, OPERATION AND RETURN. POINT OF CONTACT FOR EXXON IS CRAIG RASSINIER AT 907-835-7700. POINT OF CONTACT FOR COAST GUARD IS CDR ROME OR LT RYERSON AT 907-835-4791 OR AUTOVON 950-3861.

BT

APPENDIX B

EQUIPMENT LISTING AND CHARACTERISTICS

TABLE B-1. 6-INCH POL SUBMERSIBLE PUMP (ESSM NUMBER A0207).

SPECIFICATION DATA

Model	CCN-150
Type	Centrifugal
Output	See performance charts
Hydraulic Service	Oil (Houghton 1192)
Connections:	
HP Supply	Aeroquip 5601-16 female coupler half
LP Return	Aeroquip 5602-16 male coupler half
Service Compatibility	Petroleum Products and Water

PHYSICAL CHARACTERISTICS

OPERATING			SHIPPING		
Length	–	41.25"	Length	–	55.00"
Diameter	–	11.88"	Diameter	–	14.00"
Weight	–	278.5 lbs.	Height	–	14.00"
Cube	–	2.7 cu. ft.	Weight	–	290 lbs.
			Cube	–	8.2 cu. ft.

TABLE B-1 (Continued). 6-INCH POL SUBMERSIBLE PUMP (ESSM NUMBER A0207).

HOSES AND ACCESSORIES

HOSE ASSEMBLIES

Dimensions	Weight	Working Pressure	Quantity
6" – 60' collapsible	135 lb/section	75 psi	1
6" – 20' suction	110 lb/section	55 psi	5
4" – 20' suction	72 lb/section	150 psi	5

ACCESSORIES

Dacron line – 3/4" dia., 50'	1
Shackles – Workload = 4,000 lbs.	2
Lifting Sling – Workload = 4,000 lbs.	1
Blocks – Workload = 2,000 lbs.	1
Beam Clamps – Workload = 4,000 lbs.	4
NAVSEA Hydraulic Power Supply, Model 6	1
Hose, 100' × 2, 3/4" I.D.	4
Hose Reel, Wt. 760 lbs., 3/4" I.D.	2

REFERENCE DATA

Technical Manual

NAVSEA S6225-DX-MMO-010 *Submersible Pump Subsystem CCN-150, Operations and Maintenance Instructions with Illustrated Parts Breakdown*

TABLE B-2. 6-INCH DIESEL PUMP (ESSM NUMBER P0208).

SPECIFICATION DATA

PUMP		ENGINE	
Manufacturer	Barnes Mfg. Co.	Manufacturer	Detroit Diesel, GMC
Model	NS 100 CCD	Model	2-53
Type	Centrifugal	Type	Water-cooled
Rotation	Clockwise-facing drive end	Displacement	106.2 cu. in.
		No. of cyliners	2
Duty cycle	Continuous	Fuel	Diesel
Service	Water	Compression ratio	17 to 1
Inlet port	6" NPT	Horsepower (nominal)	37 @ 2,200 rpm
Discharge port	6 x 11 - 125 lbs. standard	Bore	3.875"
Primary port	2" NPT	Stroke	4.5"
Drain port	1½" NPT	Duty cycle	Continuous
Rated output @ 2,000 rpm	1,540 gpm at 40' head	Hydrostart	3,000 psi (starting pressure)

PHYSICAL CHARACTERISTICS

OPERATING		SHIPPING		ANCILLARY EQUIPMENT	
Skid-mounted		Skid-mounted		Boxed	
Length -	65"	Length -	65"	Length -	149"
Width -	30"	Width -	30"	Width -	29"
Height -	48" (less muffler)	Height -	48"	Height -	29"
Weight -	2,360 lbs.	Weight -	3,543 lbs.	Weight -	1,258 lbs.
Cube -	54 cu. ft.	Cube -	80.25 cu. ft.	Cube -	73 cu. ft.

TABLE B-2 (Continued). 6-INCH DIESEL PUMP (ESSM NUMBER P0208).

ANCILLARY EQUIPMENT

ITEM		QUANTITY
Lightweight plastic suction or discharge hose, 6" x 10'	(Wt: 100 lbs.)	2
Lightweight plastic suction or discharge hose, 6" x 25'	(Wt: 250 lbs.)	3
Hose fittings, 6" (6" x 6" x 9")	(Wt: 2 lbs.)	3
Elbow, 90°, 6", female thread (9" x 10" x 6")	(Wt: 75 lbs.)	1
Nipple, 6' x 13", male thread	(Wt: 20 lbs.)	1
Foot Valve and Strainer 6" (6" x 10" x 24")	(Wt: 130 lbs.)	1
Fuel can, 5-gal. (14" x 6" x 19")	(Wt: 2 lbs.)	1

REFERENCE DATA

Technical Manuals

MAVSHIPS 0947-070-8010, *Service Manaul for Pump Assembly Model NS100CCD*

NAVSHIPS 0941-101-5010, *Technical Manual Series 2, 3, 4 and 6V-53 Industrial Engines and Power Units for U.S. Navy Salvage Equipment*

TABLE B-3. 24' RIGID BOOM HANDLING BOAT (ESSM NUMBER A0722).

SPECIFICATION DATA

BOAT		ENGINE	
Manufacturer	Mon Ark	Manufacturer	Detroit Diesel
Model	2408-1 modified removable bow	Model	6V-53TI
Sections	3	Gear ratio	3 to 1
Design draft	3'2"	Electrical	60-amp alternator
Freeboard fwd	2'8"	Cooling	Keel cooling
Freeboard aft	2'6"	Fuel capacity per tank	65 gal
Max load capacity	2,050 lbs.	No. of fuel tanks	2
Std cabin dimensions:		Steering	Mechanical
Length	8'3"		
Width	5'6"		
Headroom	6'0"		
Floor space	45 sq. ft.		
Seating accommodations	Four passengers plus operator		

PERFORMANCE DATA

ENGINE	BOLLARD (LBS)	OPEN THRUST (LBS)	PROP SIZE	SPEED (MPH)
6V-53TI	MAX(5,242)	5,142	28 × 32	2.2
280 SHP	3,500(3,566)	2,977	28 × 35	19.4
3:1 Gear	3,000(2,955)	2,349	28 × 42	26.6

PHYSICAL CHARACTERISTICS

OPERATING		SHIPPING	
Length	– 24'8"	Length	– 20'0"
Beam (including rubber molding)	– 8'0"	Beam (including rubber molding)	– 8'0"
Height	– 8'0"	Height (including cradle)	– 8'8"
Weight	– 7,400 lbs.	Weight (net)	– 8,195 lbs.
Cube	– 1,360 cu. ft.	Cube	– 1,120 cu. ft.

TABLE B-3 (Continued). 24' RIGID BOOM HANDLING BOAT (ESSM NUMBER A0722).

ANCILLARY EQUIPMENT

ITEM	QUANTITY
Lifting Sling	1 set
Shipping and Storage Cradle, 350 lbs.	1 ea.
Life Ring	1 ea.
Heaving Lines	2 ea.
VHF-FM Radio (MODAR)	1 ea.
Paddles	2 ea.
Tool Kit	1 ea.
Mooring Lines	3 ea.
Towing Lines	1 ea.
Life Jackets	5 ea.
Lifting Davit	1 ea.

REFERENCE DATA

Technical Manual

Detroit Diesel Engine Operators Manual – Series 53 General Operating and Maintenance Manual for Mon Ark – Model 2408-J Workboat

TABLE B-4. CLASS V OIL RECOVERY VESSEL (ESSM NUMBER A0721).

GENERAL OPERATION INFORMATION

The Class V Oil Recovery Vessel is especially designed to pick up oil spills from sea surfaces. To accomplish this mission, it is outfitted with the machinery necessary to draw spilled oil from the water, separate recovered oil from picked up water, store recovered oil, and transfer recovered oil to off-vessel storage facilities. The vessel is primarily designed to pick up oil while being towed by two support vessels. Towing is accomplished through the use of boom adapters which are also used to funnel the oil slick into the vessel pick-up well. However, the craft is self-propelled and as such, may be used to conduct oil skimming while under its own power.

Primary vessel power is obtained through the use of a diesel engine. This engine drives a series of hydraulic pumps, the output of which is used to drive various hydraulic motors and cylinders. All vessel functions are hydraulically actuated. This includes vessel propulsion, vessel steering, bilge pump operation, filterbelt module operation, induction pump, and offloading pump operation. The engine also drives an air compressor to provide pressurized air for operation of the filterbelt squeeze cylinders.

OPERATIONAL CAPABILITIES

The operator has complete control of the vessel's propulsion system with one lever for starting, stopping, forward motion, or reverse motion. The control level is stepless, therefore the direction and speed of the vessel is infinitely variable from zero to maximum (5 knots). The propulsion unit (thruster) is manufactured by MARCO, and final thrust is obtained through the use of a 16-inch, 3-bladed aluminum propeller.

The steering system works in conjunction with the propulsion system in that the steering torque generator is attached to the propulsion down drive assembly and through gearing rotates the thruster unit to provide 360 degrees of operation.

During oil recovery operations, the vessel is normally towed by two tow boats. To eliminate transit time required to offload fluid from the recovery vessel, an oil storage bladder (Dracone Barge) may in turn be towed by the recovery vessel for transfer of recovered oil.

TABLE B-4 (Continued). CLASS V OIL RECOVERY VESSEL (ESSM NUMBER A0721).

SPECIFICATION DATA

BOAT

Manufacturer	Marine Construction & Design Company (MARCO)	
	Single Hull	Modular
Draft (empty)	3'2"	3'2"
Draft (loaded)	4'0"	4'0"
Displacement (full load)	32,000 lbs.	32,000 lbs.
Hoisting weight	17,300 lbs.	20,000 lbs.
Construction	Welded aluminum	Welded aluminum
Capacities:		
Fuel tank	75 gal.	75 gal.
Hydraulic oil reservoir	75 gal.	75 gal.
Cooling system	5 gal.	5 gal.
Air tank	830 cu. in.	830 cu. in.
Sump tank	43 bbl.	32 bbl.

ENGINE

Manufacturer	Detroit Diesel
Model	4-53
Engine Type	Two cycle
Shaft horsepower and rpm	128 shp (95 kw) @ 2,800 rpm
Configuration	4 cylinder in line
Compression ratio	21 to 1
Marine gear	Warner 7'
Length	46"
Width	30"
Height	35"
Weight	1,350 lbs.

BELT DRIVE MODULE

Belt speed	0-8 fpm
Belt drive relief pressure	2,000 psi
Supply pump speed	2,400 rpm

TABLE B-4 (Continued). CLASS V OIL RECOVERY VESSEL (ESSM NUMBER A0721).

PHYSICAL CHARACTERISTICS

ITEM	DIMENSIONS (L W H)	UNIT WEIGHT (LBS)	UNIT CUBE (CU.FT.)
OFFSHORE SKIMMER (STANDARD)			
Hull	36' x 12' x 8'10"	16,800	3,802
Pilot house	4' x 3' x 7'6"	500	90
OFFSHORE SKIMMER (MODULAR)			
Hull	36' x 8' x 8'5"	15,500	2,448
2-side modules	32'5" x 4' x 5'8"	4,000	736
Pilot house	4' x 3' x 7'6"	500	90
FILTERBELT MODULE	15'9" x 52" x 38"	1,265	216

ANCILLARY EQUIPMENT SUPPLIED

ITEM	OVERALL DIMENSIONS				QUANTITY
	H	W	D/L	WEIGHT	
Protective cover	5"	18"	18"	15 lbs.	1
Filterbelt	42"	30"	30"	75 lbs.	1
Offloading pump				425 lbs.	1
Suction dip tube				40 lbs.	1
Suction hose	12"	12"	54"		1
Discharge hose	24"	32"	252"	530 lbs.	5
Induction pump	16"	16.5"		80 lbs.	1
Hydraulic control pump					1
Leg, sling, short					2
Leg, sling, long					1
Belt repair kit					1
Tool kit					1
Spare parts kit					1
Extinguisher, fire					3
Jacket, life					5

REFERENCE DATA

Technical Manual

NAVSEA 0994-LP-015-7010 Ch-1 Boat Information Book for Class V Oil Recovery System

Detroit Diesel-Allison *Series 53 Operators Manual*

TABLE B-5. CLASS XI SKIMMER (ESSM NUMBER A0733).

GENERAL INFORMATION

The Class XI Skimmer is a non-self-propelled, remote-operated ocean skimmer designed for use with a vessel of opportunity.

SPECIFICATION DATA

Manufacturer	Marine Construction and Design Company
Model	Class XI
Filterbelt	36" Wide
Induction Pump	(2) Hydraulically driven Propeller Type
Offload Pump	Destroil Model DS210 (Rated at 20 Tons per Hour)
Power Unit (Engine)	Detroit Diesel 4-53, 85 hp
	Starter – Hydraulic
	Hydraulic Pumps – Commercial Shearing, 3 Section
	Air Compressor – 12 SCFM
	Fuel Oil Tank – 31 Gal. Capacity
	Hydraulic Oil Tank – 100 Gal. Capacity
	Goodyear 12-24, 55' Long Each

PHYSICAL CHARACTERISTICS

SHIPPING

Length	–	229.5"
Beam	–	102.0"
Height	–	74.0"
Weight	–	3,050.0 lbs.
Cube	–	1,002.0 cu. ft

REFERENCE DATA

MARCO Condensed Specifications

TABLE B-6. GOODYEAR OIL CONTAINMENT BOOM (ESSM NUMBER A0702).

GENERAL INFORMATION

The Goodyear Oil Containment Boom is 990 feet long, consisting of 18 inflatable sections, towing chain, bridle chain and ropes, inflation kit, repair kit and spare parts, storage box, pallets, and storage container.

SPECIFICATION DATA

Manufacturer	Goodyear FSCM 73842
Model	FUG
Inflation pressure	2-3 psi
Test pressure	6 psi
Weight per foot	11.6 ± 0.5 lbs.
Freeboard	12.5"
Boom Strength	
Working	23,000 lbs.
Proof	45,000 lbs.
Ultimate	65,000 lbs.
Chamber buoyancy	630 lbs.
Lifting points	4 per boom section

PHYSICAL CHARACTERISTICS

OPERATING

Length (total)	–	990.1'
One Section	–	55.0'
Freeboard	–	12.5"
Draft	–	24.0"
Weight per foot	–	11.6 ± 0.5 lbs.

SHIPPING

Height	–	102.0"
Width	–	98.0"
Length	–	240.0"
Cube	–	1,380.0 cu. ft.
Weight (empty)	–	3,940 lbs.
Weight (shipping)	–	19,000 lbs.

TABLE B-6 (Continued). GOODYEAR OIL CONTAINMENT BOOM (ESSM NUMBER A0702).

ANCILLARY EQUIPMENT

ITEM	QUANTITY
Inflation/deflation kit	1
Standard nitrogen bottles	6
2-bottle manifold	1
Nitrogen pressure regulator	1
100' hose assembly	2
0-20 psi pressure gage	2
Valve inflater, with molded rubber tip	2
Repair parts kit, Goodyear Aerospace 2057-806	1
Boom pallets, 52" × 78" wood	4
Container, 20' × 8' × 8', weight – 3,940 lbs.	1
Two chains, 10'	2
Platform, aerial delivery, 20'	1

REFERENCE DATA

Technical Manual

NAVSEA S-5400-AA-OHB-00-00 *Operation and Maintenance Manual for Oil Containment Boom and Mooring System, 15 May 1977*

TABLE B-7. COMMAND TRAILER (ESSM NUMBER A0719).

SPECIFICATION DATA

Power systems	240 volts AC single-phase 12 volt emergency lighting system
Communications power	AC converter = 12 volts DC
Communication systems	VHF
	Single side band radio
	Walky-Talky
	Antenna – 65' max.
	Telephone jacks for commercial hookup
Office facilities	Space for three people
Human comforts	
Heat	Propane heater
Cooling	Air conditioner – 240 VAC
Berthing	One
Shower	One
Commode	One
Galley facilities	Butane range
	Microwave oven
	Refrigerator

PHYSICAL CHARACTERISTICS

Height – 13'4"
Width – 8'0"
Length – 42'0"
Weight – 24,130 lbs.
Cube – 4,480 cu. ft.

REFERENCE DATA

NAVSEA *Construction Drawing, NSWC Dahlgren #7730*

TABLE B-8. COMMAND VAN (ESSM NUMBER A0727).

SPECIFICATION DATA

Manufacturer	Fruehauf
Model	KB6-20
Power systems	Onan Gasoline 5kw Generator
Communications power	Converter 120V AC to 12V DC
Communication systems	Jarvis Telephone System
Office facilities	
Human comforts	
Heat	Heating Segment of Air Conditioner
Cooling	Air conditioner BTU
Galley facilities	

PHYSICAL CHARACTERISTICS

Containerized
Height – 96"
Width – 96"
Length – 240"
Weight – 7,500 lbs.
Cube – 1,280 cu. ft.

TABLE B-9. RIGGING VAN (ESSM NUMBER A0010).

GENERAL INFORMATION

The Rigging Van is a self-contained rigger's storeroom. It is equipped with lighting, heating, ventilation, and bins and racks for line, wire rope, rigging supplies, spare parts, and other items needed to support the rigging of the response equipment.

PHYSICAL CHARACTERISTICS

Containerized
Height – 96"
Width – 96"
Length – 240"
Weight – 10,200 lbs.
Cube – 1,280 cu. ft.

TABLE B-10. WORKSHOP VAN (ESSM NUMBER B0508).

GENERAL INFORMATION

The Shop Van is a complete self-contained workshop. It is equipped with a 5kw diesel generator, lighting, heating, ventilation, power tools, welder, spare parts, and other items needed to maintain the response equipment.

PHYSICAL CHARACTERISTICS

Containerized
Height – 96"
Width – 96"
Length – 240"
Weight – 11,000 lbs.
Cube – 1,280 cu. ft.

TABLE B-11. 13K OIL STORAGE BLADDER (ESSM NUMBER B0801).

SPECIFICATION DATA

Manufacturer	Trelleborg AB
Model	Trellcone 50
Shell material	Polyamide/PVC-coated
Buoyancy system	Two longitudinal flotation tanks (serve as fenders) Flotation chamber with towbar in forward end
Loading/Discharging	Inflatable hatch forward
Maximum tow speed	5 knots

PHYSICAL CHARACTERISTICS

SHIPPING

Length	–	94.0"
Width	–	32.0"
Height	–	27.0"
Weight	–	750.0 lbs.
Cube	–	47.0 cu. ft.

TOWING

Length	–	51.0'
Width	–	12.0'
Depth, loaded	–	5.0'
Volume	–	1,750.0 cu. ft.

ANCILLARY EQUIPMENT

ITEM	QUANTITY
Trellcone outrigger 5'L × 2'W × 2'H, 232 lbs.	1

REFERENCE DATA

Technical Manual

Trellcone Handling, Operating and Maintenance Manual, Trelleborg, Sweden

TABLE B-12. 136K OIL STORAGE BLADDER (ESSM NUMBER B0800).

SPECIFICATION DATA

Manufacturer	Dunlop General Rubber
Model	Dracone barge, type L
Shell material	Outer proofing – neoprene Skin – Nylon cord and woven nylon fabric Inner proofing – nitrile rubber for petroleum products
Buoyancy system	Two internal inflatable tubes
Towing hose bore	4" and 6"
Horsepower absorbed by barge at various speeds	4 knots – 32(80) 6 knots – 106(265) 8 knots – 254(635) (Figures in parentheses above are recommended reserve horsepower required in towing vessel, assuming a 40% efficiency.)
Drag (in pounds) fully loaded in seawater	4 knots – 2,620 6 knots – 5,750 8 knots – 10,340
Nose strength	30-ton pull
Formula for equivalent drag horsepower	$\frac{\text{Drag lbs} \times \text{speed (fps)}}{550}$

PHYSICAL CHARACTERISTICS

SHIPPING

Length	–	20.0'
Width	–	8.0'
Height	–	8.0'
Volume	–	960.0 cu. ft.
Weight	–	16,330.0 lbs.

TOWING

Length	–	221'0"
Diameter	–	10'9"
Empty Weight	–	8,930 lbs.

CAPACITIES

In-shore towing, 100%	–	137,000 gal 3,262 bbl.
Open-sea towing, 85%	–	116,450 gal 2,773 bbl.

TABLE B-12 (Continued). 136K OIL STORAGE BLADDER (ESSM NUMBER B0800).

ANCILLARY EQUIPMENT

ITEM	QUANTITY
*Quick-release hood	1
*Cargo net	1
*Gripper bar	1
*Nose cone and buoyancy tube	1
Crated hose, 16'9" × 1'5" × 1'9", 660 lbs.	1
Buoyancy tube air charging bottles, 72 cu. ft., 2,250 psi, 26 lbs. each	2
Charging hose with pressure gage, 4 lbs.	1
Air inflation blower, 40 lbs.	1
Navigation light float	1
Rolling bar	1
Tool kit	1

NOTE

Regulations may prohibit shipping charged air/N_2 inert gas cylinders.

*Shipped on same pallet with oil bladder.

REFERENCE DATA

Technical Manual

The Dracone Barge Handling, Operating, and Maintenance Manual, William Wood and Associates, New Orleans, Lousisiana

TABLE B-13. 26K OIL STORAGE BLADDER (REG. TYPE FAU).

SPECIFICATION DATA

100% Capacity	–	26,400 gal.
Length	–	126'0"
Diameter	–	6'2"
Empty Weight	–	2,200 lbs.

PHYSICAL CHARACTERISTICS

Nose and tail assemblies are of corrosion-resistant aluminum alloy and are bolted into position across the beaded ends of the nose and tail moldings respectively. They provide the cargo seal and, at the nose end, the means by which the towing loads are transmitted to the envelope.

The buoyant nose cone is of mild steel and is bolted to the nose end assembly.

The buoyant towing hose is bolted to the nose cone and is designed to have a high ultimate tensile strength and to be resistant to crippling under the severest conditions. At its forward end is a foam plastic recovery bend and the connection through which the Dracone barge is loaded and discharged. The foam buoyancy of the recovery bend is replaceable in the event of it becoming damaged.

The standard hoses fitted are 100mm (4-inch) Dracone hoses. All hoses are 15 feet in length and a number of these can be bolted together when required. The standard loading/discharge connection is a Class 150 ASA flange.

Towing gear consists of nylon rope of size and length appropriate to sea conditions and the size, power, and speed of the towing vessel.

TABLE B-14. BOOM MOORING LEG (ESSM NUMBER A0009).

GENERAL INFORMATION

The Mooring System consists of a number of moorings legs designed to anchor an oil boom in place in depths of water up to 200 feet. Each complete mooring leg is placed in a small container and consists of the following major components: anchor, anchor chain, wire ropes, polypropylene lines, and buoys. The major subassemblies of one mooring leg are described below.

Retrieving Assembly

The 350-pound buoyancy crown buoy is attached at the padeye to the crown end of the 500-pound Stato anchor by ¾-inch wire rope. Two 125-foot, ¾-inch, wire rope assemblies are supplied with each mooring leg.

Anchor Assembly

The 500-pound Stato anchor is an improved type of mooring anchor calculated to have holding power of 5,000 pounds in mud and 10,000 pounds in sand. Through the use of wedge-block inserts, the anchor is adjustable for maximum holding force in either mud or sand bottoms.

The anchor shank is connected to the shot of chain with a 1-inch safety shackle and a pear-shaped detachable link. The other end of the chain is secured to a 6-inch circumference polypropylene anchor line by another pear-shaped detachable link, a 1-inch safety shackle and a 6-inch coupling. Seven 40-foot lengths of polypropylene anchor line assemblies are supplied with each mooring leg. The line assembly has a soft eye spliced into each end to facilitate assembly into the mooring leg. Any number of line assemblies can be connected in series to obtain the desired scope for the particular depth and situation encountered. Another 6-inch coupling is used to connect the line to the 5,000-pound buoyancy mooring buoy.

A marker light with a photocell on/off switch can be mounted to the mooring buoy by using the light and buoy brackets supplied. The marker light provides 60 flashes of white light per minute.

Buoy to Boom Assembly

The major components of this assembly are two 25-foot lengths of 6-inch polypropylene line, a special pelican hook assembly, and associated hardware, couplings, etc.

TABLE B-15. INFLATABLE BOAT (23-FOOT) (ESSM NUMBER A0732).

SPECIFICATION DATA

BOAT HULL	
Manufacturer	Zodiac
Model	MK VI HD
Type	6662
Materials	Hypalon/Neoprene
Buoyancy	U-shaped with 7 conical air tight chambers and keel
Stern section (transom)	Laminated and varnished marine plywood
Bottom section	Glued to buoyancy chambers by means of angle fabric pieces
Keel section	Independent inflatable keel glued to the bottom throughout the boat
Floor section	Non-slip anodized corrosion free aluminum in five sections, 4 stringers and 1 bow floorboard
Buoyancy chamber working pressure	3 psi/240 millibars
Keel pressure	2.9 psi/200 millibars
Capacities	
Persons	20
Useful payload	6,615 lbs.
Max. buoyancy	13,930 lbs.
OUTBOARD ENGINES	
Min. horsepower for planing, 300 lbs.	35
Max. horsepower	175
Rec. Shaft Length	Long

FACTORY INSTALLED EQUIPMENT

ITEM	QUANTITY
Metalic bow handle	1
Towing rings	4
Hoisting rings	6
Paddle attachments	4
Large capacity self bailers	4
Launching wheel locating plates	2
Mooring line	1
Lifelines mounted on cuffs	4
Metalic outboard mounting plate	1

TABLE B-15 (Continued). INFLATABLE BOAT (23-FOOT) (ESSM NUMBER A0732)

PHYSICAL CHARACTERISTICS

OPERATING

Length overall	–	22'
Length inside	–	16'9"
Width overall	–	9'5"
Width inside	–	4'7"
Pontoon dia.	–	2'5"
Pontoon vol.	–	223.0 cu. ft.

SHIPPING

Folded hull in bag	–	8'2" x 3'3" x 1'8"
Floorboard in bag	–	5'7" x 3' x 1'
Weight	–	705 lbs.
ESSM Boxed		
Length	–	95"
Width	–	91.6"
Height	–	87.6"
Cube	–	440.16 cu. ft.

ENGINES

		70 horsepower
Length	–	55"
Width	–	28"
Depth	–	14"
Weight	–	250 lbs.
Shaft Length	–	16"

ANCILLARY EQUIPMENT

ITEM	QUANTITY
Carrying case for hull	1
Carrying case containing:	
Aluminum floorboard sections	5
Wooden blow board	1
Aluminum stringers	2
Paddles	4
Footpumps	2
Foredeck support	1
Pressure gage	1
Repair kit	1
Zodiac pennant and mast	1
Instruction manual	1
Launching wheels	2
Console Control Panel consisting of:	
Tachometer	2
Compass	1
Remote Engine Control Levers	2
Remote Steering Control	1
Fire Bottle	1

REFERENCE DATA

Technical Manual
ZODIAC Operation and Maintenance Manual for Inflatable Boats - MK III, MK IV, and MK V

TABLE B-16. HYDRAULIC POWER SUPPLY, MOD 7B (ESSM NUMBER PW0821).

GENERAL INFORMATION

This hydraulic power supply is designed to provide power for SUPSALV equipment. It is considerably smaller and lighter than the MOD 2 and MOD 6 units. It is mounted on wheels and can be handled with much greater ease than the two bigger models.

SPECIFICATION DATA

Engine	Lister, 2-cylinder air-cooled diesel
Output	15 gpm @ 2,000 psi
Hydraulic reservoir	7 gal

PHYSICAL CHARACTERISTICS

Length	–	48"
Width	–	36"
Height	–	36"
Weight	–	450 lbs

TABLE B-17. HYDRAULIC POWER SUPPLY, MOD 6 (ESSM NUMBER PW0230).

GENERAL INFORMATION

This hydraulic power supply is a major subsystem of the POL submersible pump system. It consists of a diesel engine, two hydraulic pumps, a hydraulic fluid reservoir, and a hydraulic fluid cooler. This unit is a dual system consisting of two gear pumps, each providing a flow rate of 26 gpm (total of 52 gpm) at 2,500 psi at an engine speed of 2,200 rpm. The power supply is mounted on skids and encased within a frame equipped with lifting eyes and forklift slots.

SPECIFICATION DATA

Engine	
Manufacturer	Detroit Diesel Allison
Model	Series 53
HP	67 (continuous)
Cylinders	4
Capacities	
Fuel tank	20 gal
Hydraulic reservoir	50 gal

PHYSICAL CHARACTERISTICS

Length	–	57.5"
Width	–	34"
Height	–	98"
Weight	–	3,840 lbs

TABLE B-18. PORTABLE CRANE (ESSM NUMBER CR0040).

GENERAL INFORMATION

This portable articulated hydraulic crane provides lifting services on ships or barges of opportunity during spill response operations. It is capable of loads up to 16,500 pounds at a reach of 9'1" and 1,600 pounds at a reach of 40'. Except for the power source, it is self-contained and consists of a base, a mast, two hydraulic and four manual extension booms, a winch, running rigging, controls and hydraulics. The crane is bolted to the base, which in turn is welded to the deck of the host ship. The crane requires a hydraulic power system capable of 2,500 psi and 16 gpm for operation. When used with the VOSS system, once secured to the host ship, it provides all the crane services necessary to deploy and recover the system and can be powered by the VOSS hydraulic power unit or the MOD 6 power supply.

SPECIFICATION DATA

Manufacturer	Iowa Mold Tooling Company
Model	18040
Rating	180,000 ft-lbs
Reach	40'
Lifting height	42'3"
Oil reservoir capacity	26 gal

PHYSICAL CHARACTERISTICS

Length	–	8'
Width	–	3'
Height	–	8'
Weight	–	9,240 lbs

TABLE B-19. SHIPBOARD SATCOM SYSTEM.

GENERAL INFORMATION

The shipboard satellite communications system (SATCOM) is a satellite communications station that can be taken aboard a ship and set up for telephone, telex, and telefacsimile transmissions.

The system is contained within an 8' x 8' transportable van. The van contains a satellite dish mounted inside a dome which is mounted on a gyro for automatically maintaining the dish pointed at the satellite during ship movement. The dome is mounted either on top of the van or somewhere on the ship to facilitate satellite signal transmission/reception. The van also contains a telefacsimile machine, a printer, and a keyboard.

The system contains one phone line that can be used in the van and also at a remote location aboard the ship. The system also has an uninterrupted power supply which is fed by the ship's 120 vac single-phase power source.

The SATCOM van will soon be equipped with VHF radio equipment.

TABLE B-20. AUGER 150 PUMP.

GENERAL INFORMATION

The Auger 150 pump is a hydraulically operated positive displacement pump. Its purpose is to catch oil and debris as it rolls off the filter belt of a skimmer and discharge it to a receiving facility such as a barge.

The advantage of using this pump over the skimmer sump pump is transferring the heavy oil directly from the skimmer belt to the receiving facility such as a barge or Dracone saves time.

This pump is similar to the ones that are built into the Class XI skimmers.

TABLE B-21. DOP 250 PUMP.

GENERAL INFORMATION

The DOP 250 pump is a specially adapted hydraulic submersible pump operated by a Mod 6 or Mod 7 hydraulic power supply.

Its purpose is to offload heavy oil from a Dracone, skimmer, or barge. It has an auger which allows the pump to remove the heavy oil from the collecting unit (a centrifugal pump would encounter difficulty pumping the heavy oil to the discharge lines).

TABLE B-22. CLEANING VAN.

GENERAL INFORMATION

The cleaning van is an 8' x 20' van which contains the necessary cleaning equipment to degrease the skimming systems and other oil pollution equipment in preparation for return shipment to the ESSM bases.

Examples of some items stored in the vans for use at the response site are:

- Absorbent boom, 4 - 12' sections
- Absorbent wipes, 4 packs
- Boots, brushes, and buckets
- Degreaser, 35 gal
- Fire hose, flashlights, and scrub brushes
- Cleaning pool to place equipment into
- Pressure washer
- Rain gear
- Assorted tools

APPENDIX C

OIL CHARACTERISTICS
PRUDHOE BAY CRUDE OIL

C-1 INTRODUCTION

This Prudhoe Bay Crude Oil Assay is of Sadlerochit crude, originally the only component of North Slope crude. Kuparuk crude is now blended at a rate of about 120,000 b/d with Sadlerochit at pumpstation No. 1 Total ANS stream is about 1.6 million b/d.

TABLE C-1. CRUDE OIL – RELATIVE PROPERTIES.

	U.S. Alaska North Slope (ANS, Sadlerochit) Trans Alaska Pipeline to Valdez Terminal	**KUPARUK,* ALASKA** Trans Alaska Pipeline to Valdez Terminal
Gravity, °API	26.4	23.0
Sulphur, wt %	1.06	1.76
Pour pt, °F	0	-55.0
Rvp, psi	3.55	2.6
Kin. vis @ 60 °F	42.42	79.98
H_2S, lb/1,000 bbl	0.35	<5
Salt, lb/1,000 bbl	32.7	-----
Carbon residue, wt %	4.40	7.37
Neut. no (D974)	1.12	-----
Ni/V, ppm	11/26	19/57
Nitrogen, ppm	2,090	1,980
C_4 & lighter, yield, vol %	1.17	-----
C_5 & lighter, vol %	-----	2.12
Source: *Oil & Gas Journal Data Book, 1988 Edition*, "Crude Oil Assays"		*Note: About 120,000 b/d of Kuparuk is blended with some 1.6 million b/d of Sadlerochit crude to produce North Slope crude. Kuparuk contribution is expected to double by early 1985.

APPENDIX D

PLAN FOR UNLOADING THREE "TYPE E" 26,400 GALLON DRACONES BY USN SUPERVISOR OF SALVAGE CONTRACTOR/GPC 15 JUNE 1989

D-1 PROBLEM

While Dracones have been in existence for about 20 years, experience utilizing them in an actual oil spill cleanup operation is minimal. Furthermore, experience offloading Dracones containing weathered Prudhoe Bay crude oil mixed with kelp and other debris is non-existent.

D-2 SOLUTION

As the offloading operation will provide valuable insight relevant to utilizing Dracones in other spills, it is essential that it be conducted in a manner such that no further oil pollution of the environment will occur and the health and safety of the offloading personnel can be assured. The operation will be conducted when the water is calm and winds are minimal, in a cautious, deliberate manner.

D-3 CURRENT STATUS

All three Dracones are located in Lewis Bay, a sheltered cove of Herring Bay, adjacent to Knight Island. This location is ideally suited, adjacent to Exxon's boat cleaning facility and Deck Barge 300 with a 300-ton crane that will be utilized for the offload. The Dracones are marked with lighted buoys to prevent boats [from] running over them during low-light conditions.

OFFLOADING PLAN 1 – TAIL OFFLOAD

PLAN ELEMENTS

- The Dracones will be positioned one at a time, adjacent to DB-300 with Exxon support vessel GULF FLEET #69 alongside. The Model 6 Hydraulic Power Unit will be set up and positioned on GULF FLEET #69.
- All Dracones have to be fitted with the modified tailpiece with the knife valve. This tailpiece was modified with a wide port knife valve at the tail for offload. This approach is preferred to the normal procedure of offloading through the Dracone nose, since the trash and heavy oil conditions can be anticipated to clog at the butterfly valve at the nose. Lift the Dracone tail by the wing.

- Four pumps have been selected for the offload:

  (1) DOP250 pump

  (2) MOYNO skimmer pump (both the spare pump and an installed pump on a skimmer should be tested)

  (3) MARCO 4" submersible trash pump

  (4) Thune-Eureka 6" CCN-150 submersible pump (Use new version, carbon seals only!).

  Each pump will be used to offload the Dracone under similar conditions for a period to be determined on-scene. After testing all pumps, the best pump for the offload will be selected based upon its performance. Observations and available performance data will be recorded for each pumping configuration. A reversing valve is available in the Dracone offload kit.

NOTE

After attaching the pump to the tail, drop the pump as low as possible into the water to begin offloading. Adjust the depth to prevent kinking of the Dracone.

- Dracone #1 will be positioned with the tail at the stem of GULF FLEET #69, and the nose under the hook of DB #300. The selected pump will be installed at the tail of the Dracone, requiring the tail initially to be lifted slightly from the eye of the tailpiece. The nose of the Dracone will be attached to the crane hook by the padeye towing point just forward of the nose. The nose will then be slowly lifted to achieve a head pressure on the tail section of 2 feet, with extreme care taken not to exceed the eight-ton working load on the padeye (See Paragraph D-5, "Environmental Concerns"). This will be accomplished by lifting the Dracone very slowly to shift the oil to the tail of the Dracone.

- Offloading will commence through the tail of the Dracone. The offload rate will be carefully monitored, as will the operation of the selected pump.

- As the oil shifts to the tail of the Dracone, it may be necessary to choke off the forward (empty) sections of the Dracone using soft, wide Kevlar slings. These slings will be carefully monitored and moved back towards the tail of the Dracone only as is necessary to maintain the head on the pump.

- If Dracone #1 is successfully offloaded in this fashion, Dracones #2 and #3 will also be fitted with the modified tail fitting and offloaded in a similar fashion.

- Problems can be anticipated maintaining sufficient head on the tail section to offload the Dracone enough for cleaning. This is particularly true as the Dracone nears empty where the tail section may collapse upon itself. It may be necessary at this point to reduce the pump flowrate or use the smaller pump. A second approach that may be considered is to lift the Dracone from the midsection and fit a second pump to the nose of the Dracone. After lengthy conversations with Allen Gamble, Chief Engineer for Dunlop in England, the recommended approach would be to use the roller bars or gripper bars to lift the center section of the Dracone to avoid fabric damage. Dunlop cautions against trying to lift the Dracone from the midsection using a strap sling due to the possibility of damaging the Dracone flotation.

D-4 HEALTH AND SAFETY FACTORS

Personnel health and safety will be of the utmost concern during the Dracone offloads. The Dracones have been holding crude oil for nearly two months now, and the health and safety of personnel will not be compromised to expedite or facilitate the offloading.

Exxon's Industrial Hygienist (IH) will be consulted prior to and on-scene for the offloading of Dracone #1. The Exxon IH will ensure the safety of the offload operations and direct all personnel monitoring as well. In particular, harmful or flammable quantities of methane which may have formed in the unvented Dracone due to decaying vegetation will be monitored, as will hydrogen sulfide gas from the crude oil. Should any flammable levels of gas concentrations or gas above the permissible exposure level (PEL) be detected, operations will cease immediately. Likewise, all safety precautions for operating on oily decks, in a cold water environment, and with overhead cranes and heavy loads will be strictly adhered to.

In addition to the Exxon IH, at all times during the offload of the three Dracones, GPC will provide a designated Safety Officer to oversee the operation. This individual will stop operations immediately for any unsafe act that is observed or suspected.

D-5 ENVIRONMENTAL CONCERNS

It is critical that the Dracone offloading operations do not reintroduce crude oil back into Prince William Sound. Thus, operations will proceed only at a pace that will ensure all preventive measures are taken. The area surrounding the Dracone offload will be boomed off and a skimmer with boom attached will remain on standby throughout the operations. A standing watch will be present at all times during the offload to observe for accidental release of the oil. To ensure the Dracone is not overloaded by lifting during offloading operations, a weak-link lifting line should be used with a breaking strength not to exceed 10,000 pounds on the tail or not to exceed the manufacturer's recommended working loads of the nose.

NOTE

Care must be taken to keep personnel from under the lift at all times.

D-6 DRACONE CLEANING

Suitable facilities have been identified by Exxon to thoroughly clean the inside of the Dracones once the oil has been offloaded. A draft cleaning plan is under development and will be submitted through SUPSALV and Dunlop's Allen Gamble for approval.

APPENDIX E

REPORT OF DRACONE CLEANING METHODS

E-1 PREFACE

Three Navy Dracones, Style E, that had been filled with weathered crude oil during the first days of the April '89 EXXON VALDEZ oil spill, were towed to the drydock facility at McPherson Pass on Naked Island. This facility can collect and contain all waste water produced in the cleaning process, plus it provides a flat, unobstructed surface for handling the 70×6-foot rubber bladder. This area is additionally favorable as it is protected from swell and wind that might endanger the integrity of the Dracone shell.

E-2 INTRODUCTION

The Navy Dracone is a flexible tube designed to carry petroleum and other liquids lighter than water. Its skin is made of nylon cord and woven nylon fabric, proofed with weather- and abrasion-resisting synthetic rubber on the outside, and an inner lining similar to latex rubber and resistant to petroleum products. The Dracone barge is a circular section envelope having a tapered nose section of special hydrodynamic form. The tail is blunt and has a circumferential skirt stabilizer to ensure directional stability. Its stabilizer eliminates any tendency to snake and due to its inherent flexibility, the Dracone barge conforms easily to the wave pattern, though some slight directional instability may be experienced in a following sea. The towing hose, through which the Dracone barge is also loaded and discharged, has been specially designed to accept the maximum towing loads with an ample safety factor.

Nylon, the strength member in the Dracone barge envelope, is an elastic material and suffers from fatigue when subjected to dynamic stresses, in common with any other structural material. When a Dracone barge is loaded with cargo and towed in a wave system, pressure waves cause the envelope to extend and contract continuously, giving rise to fatigue. If this condition persists over a long period, too high a stress value, a reduction in available strength, and considerable shortening of the life of the envelope would result. It has been found by careful measurement, with a specially developed high extension strain gage, that these extensions are reduced to negligible proportions if the loading fraction does not exceed 85%, regardless of wave height. It is therefore important that the loading fraction does not exceed 85% if wave heights exceeding half the design diameter of the barge are liable to be met.

E-3 OFFGASSING

When petroleum or any other low-flashpoint product has been, or is being, carried, full precautions appropriate to the handling of explosive or dangerous cargoes must be observed at all times. Even after discharge of the cargo, any vapor remaining inside the Dracone barge is highly dangerous. It is indicated that static charges do not build up in Dracone barges to the same extent as with conventional vessels. This is thought to be due to the absence of free surface and to the fact that the surface of the cargo and the surface of the water in which the barge is floating, are in proximity. However, during the cleaning process, the use of high-temperature steam, high-pressure hoses, water raised to 200 degrees and the use of detergents can produce static electricity. Grounding of the Dracone is therefore required. Grounding is also required during any offgassing prior to cleaning or repair. Gases present in the Dracone after collection of weathered crude oil from 1989 consisted of hydrogen sulfide at 476 ppm and methane that showed up on the explosive meter as 25% LEL. All hot work in the vicinity was terminated and all hot electrical receptacles were turned off to eliminate sources of ignition. No smoking rules were enforced and all unnecessary personnel were removed from the drydock location. Riggers proceeded to slowly lift one end of the Dracone under direction of SUPSALV personnel to the top of the drydock wingwall—approximately 20 feet. While the industrial hygienist stood by with the gas detect meter, SUPSALV personnel carefully opened the valve on the recovery bend. While the gasses were escaping, detection of the amounts were being monitored by the hygienist and the marine chemist. Offgassing lasted approximately 30 minutes. During that time, those that were caught downwind experienced a disagreeable odor that resembled sulfur and sewage. At this concentration in the open atmosphere, no personnel were in danger of being overcome by gas fumes. Once the chemist and the hygienist determined offgassing was complete, the valve was closed and the end of the Dracone was lowered to the deck. Data were recorded and procedures were planned for the next phase of the cleaning. The contents of these Dracones consisted of weathered crude (mousse), diesel oil, and sea water, along with kelp and decaying animal remains.

E-4 CLEANING

Prior to offgassing, the Dracone was brought aboard a floating drydock that was adapted to receive the particular shape and unique construction of the Dracone. Basically, a flat 12×100-foot platform was prepared and structured for the irregular loading that was anticipated. The projected total weight of the heaviest of three Dracones was to be 80,000 pounds and contain 15,000 gallons of mousse. Initially, the exterior surface in way of the end fittings gets a thorough washing with up to 230-degree water at pressure up to 3,000 psi. The exterior cleaning continues along the length of the exposed surface while the SUPSALV mechanics arrange the pump and hose hook-ups to the tail closure assembly. Four pumps were experimented with. The ones selected were a DOP250 pump, Mayno skimmer pump, Marco 4" submersible trash pump, and a Thune-Eureka 6" CCN-150 submersible pump. Each pump was used to offload the Dracone under similar conditions for a period to be determined on-scene. After testing all pumps, the best pump for the offload was selected based upon its performance. Hands down, the Thune-Eureka pump with carbon seals proved to be very effective in pumping the mousse through 3, 30-foot lengths of 6-inch discharge hose for circulation, while the DOP250 auger pump was found best used for pumping off liquid as it started to cool. This hose ran from the Dracone, along the drydock floor to the waste oil barge alongside. We used the TIDEWATER #7 barge for this purpose. This barge holds 600,000 gallons. Fortunately, we received only about 20,000 gallons of mousse. The consistency of the mousse resembles thick, elastic mud.

It is impossible to pump conventionally unless heated to around 190 degrees at which temperature the mousse breaks down to a runny liquid. In order to determine just how to best clean the Dracone interior of mousse, we decided to drop a pile of it on the deck of the drydock and work it with varying degrees of hot water to establish how to break up the congealed bulk. Workers with hot water, high-pressure wands were lined up to pass the mousse along the deck from the pile to the corner sumps. The mousse was repeatedly heated and kept hot, resulting in a steady flow of thin, oily water. The workers were about 10 feet apart and if only one stopped the heat application, the mousse returned to its jelled state and subsequently plugged the pump. That pile was ultimately loaded into an ore bin by shovel for future steam injection and dumping. Therefore, it became obvious that steam heat, greater that 190 degrees and less than 212 degrees (to avoid damage to the interior lining), was the solution. Consequently, 8 to 10 hot water hoses without the high-pressure wands were inserted into the head end of the Dracone, filling it about one-third. Externally, heat was applied with the wands to maintain internal temperature. Once the Dracone was ready, the hot water hoses were removed and a 6" suction hose was attached. This hose was also attached to the tail end of the Dracone with the pump in the middle. The pump was then turned on and the hot water, with a small amount of harbor master detergent, was circulated. The hot water wands maintained the internal temperature in the Dracone and the 6" hoses. This process continued for one hour successfully, breaking down the mousse from the Dracone walls. This allowed us to quickly close the valves, reconnect the pump to the discharge hose going to the waste water barge, and pump off the hot, thin liquid. Maintaining the heating process along the total length of the Dracone and the discharge was important during this process. The Dracone and hosing was successfully cleaned to 85% to 95% using this method. Once the Dracone was emptied of all debris and water, it was inflated with air from a small 110V blower. This blower was left on for one hour to allow the Dracone to grow to its full girth and be rolled for final exterior cleaning of oil, grass, and barnacles. During this time, the hot internal air blew most of the remaining moisture out of the exit opening. The Dracone was then lifted with a cross bar and folded into a cargo net for loading onto the vessel GULF FLEET 69 for transport to the vessel OGDEN which was to take the three Dracones to the ESSM bases.

E-5 SUMMARY

While the Dracones appear at first glance to be unwieldy and difficult to handle and seemingly impossible to clean, they can be effectively treated using this procedure. Additional circulation with clean water can ensure a high degree of cleaning in the field whether the material be heavy-weathered crude oil or lighter fuels oils. Careful handling and planning and proper assistance from support groups, such as marine chemists and industrial hygienists, crane crew, and attentive wash teams, along with strong supervision will result in the timely and thorough cleaning of Dracones of any length.

APPENDIX F

OIL CONTAINMENT BOOM RECOVERY PLAN
BY USN SUPERVISOR OF SALVAGE CONTRACTOR/GPC
16 AUGUST 1989

F-1 TASK

Recover 128 sections of boom from Sawmill Bay and 42 sections of boom from Esther Bay. The boom is to be disassembled on the deck of the recovery vessel and stacked onto pallets. This involves disassembly by 1,020 bolts and nuts and 340 clevis pins. Because of five months' immersion, some of the bolts might be seized and might require a nut cracker or burning off with an acetylene torch. The disassembled boom sections are then to be stacked on pallets and transported to the Alyeska Terminal for thorough cleaning and sorting for repair and proper stacking for shipment back to CONUS.

F-2 PLAN ELEMENTS

- Identify and obtain recovery vessel with capability to moor itself in 200 feet of water (or more) which has at least 100 feet of clear deck space, a stern roller or removable bulwark at transom and a crane with 5,000 pounds minimum lift capacity at a 30 foot radius.
- Drop vessel anchor or attach to boom mooring buoy near end of boom which will be recovered first, giving consideration to wind, seas, water depth.
- Attach recovery line from vessel to boom.
- Using bow picker, oil skimmer, or other low freeboard boat with a davit on it, lift boom out of water enough to release mooring lines, release all moors, and let boom stream behind recovery vessel.
- Using crane or winch aboard recovery vessel, haul one or two sections of boom on deck.
- Secure second section of boom to recovery vessel, enabling first section to be removed.
- Set up work platform to remove bolts and clevis to separate the first section.
- Loosen bolts with pneumatic wrenches.
- If torch is needed to free or cut bolts or clevis pins, <u>extreme care is to be taken to not burn the boom rubber or heat the metal end plate enough to burn the rubber</u>.

- Fire extinguisher is to be on deck when torch is being used and ship captain is to be alerted whenever torch is lit.
- When section is removed, lift with crane as high as possible and fake onto pallet.
- Arrange pallets so that enough clear deck space remains to complete boom recovery at both hatcheries without offloading.
- Secure load, recover ship's moor and steam for Alyeska Terminal for offloading, for cleaning, and packing.

F-3 PORTABLE EQUIPMENT REQUIREMENTS

- 125 CFM LP air compressor.
- Air hoses.
- Pneumatic impact wrenches with sockets.
- Nut cracker, hand wrenches, punches.
- Acetylene torches, fire extinguisher.
- Line, shackles, etc.

F-4 PERSONNEL REQUIREMENTS

- Supervisor.
- Two mechanics for breaking down boom sections.
- Two helpers for faking and stacking boom while suspended from crane.
- All personnel to wear hard hats, lifejackets, and safety glasses.

F-5 TIMEFRAME

Rough estimate of 25 sections a day if most bolts come loose for seven days total recovery time, followed by 10 sections per day (estimated) cleaning and packing for an additional 17 days at Alyeska (using existing setup). Total boom recovery and cleaning time estimate is 24 days (with no allowance for weather days) once vessel is assigned to job.

APPENDIX G

BOOM MOORING SYSTEM RECOVERY PLAN BY USN SUPERVISOR OF SALVAGE CONTRACTOR/GPC 16 AUGUST 1989

G-1 TASK

Recover seven boom mooring legs at Sawmill Bay and two at Esther Bay following recovery of the oil boom.

G-2 PLAN ELEMENTS

- Separate task not connected with oil boom recovery operation.
- Can be assigned to vessel and crew with only GPC supervisory personnel (i.e., USCG buoy tender).
- Vessel needs to be equipped (i.e., winch) to take a 15,000-pound or better pull on the crown buoy's ¾-inch wire rope (preferred method of recovery) or the 6-inch polypropylene mooring line if the crown buoy is sunk. In this case, ship's propulsion may be needed to break the anchor free of the bottom. Hawking for the sunk crown buoy/wire is also an alternative.
- If anchor cannot be broken free, leg needs to be cut as close to anchor as possible to save as much of the mooring leg as possible. If cutting the chain, a torch will be required.
- A ¾-inch carpenter stopper is needed to take a new pull on the wire. If recovery is via the mooring leg, soft eyes in line sections or chain sections will provide pull points.
- Vessel should have a crane with 15,000-pound lift capacity at the stern or side for recovery of the anchor(s) (500- or 1,000-pound STATO or others totalling 4,000- to 6,000-pound per leg), and mooring buoy. Use of a vessel with stern roller but no crane is possible, however, some damage to the mooring buoys are likely then, and the possibility exists that a cluster of anchor and chain won't be able to be recovered this way.
- Anchor legs should be packed separately and in their containers. Cleaning with HP water and repacking will be required at Alyeska Terminal.
- Care should be taken not to kink the wire, loose pieces of the mooring system, or tangle up the polypropylene line.

G-3 PORTABLE EQUIPMENT

- Pneumatic wrenches and tools to open shackles and clevises.
- Acetylene torches for cutting shackles and chain.

G-4 PERSONNEL REQUIREMENTS

- The wire and polypropylene line will have to be manhandled to be roughly packed into their containers and personnel will tire easily.
- Deck crew should consist of supervisor/bosun, two skilled personnel, and two helpers.

G-5 TIMEFRAME

- One day Esther Bay, two or three days Sawmill Bay, weather permitting.
- One week for cleaning and repacking at Alyeska.

APPENDIX H

COAST GUARD SPECIAL OPERATIONS SERVICE RIBBON

U.S. Department of Transportation
United States Coast Guard

Federal On Scene Coordinator
U.S. Coast Guard

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1650
6 Oct 89

FROM: Federal On Scene Coordinator, Anchorage, AK
TO: CAPT Charles A. Bartholomew, USN, Supervisor of Salvage
Commander, Naval Sea Systems Command, Washington, D.C.

SUBJ: COAST GUARD SPECIAL OPERATIONS SERVICE RIBBON

1. The Special Operations Service Ribbon has been authorized for all eligible Coast Guard and Department of Defense personnel involved in the cleanup operations following the 24 March 1989 T/V EXXON VALDEZ oil spill in the Prince William Sound, Alaska.

2. It is with distinct pleasure that I present this award to the Navy Supervisor of Salvage. I congratulate you and your entire emergency oil spill response team for a job well done. Their dedicated professionalism, enthusiasm, safety consciousness and, indeed, courage, throughout a most unfortunate disaster, bears great credit upon the Navy Supervisor of Salvage organization and its civilian contractor, Global Associates/Phillips Cartner & Co., Inc.

3. During the period 26 March to 27 September 1989, SUPSALV had deployed 90 percent of the Navy's entire emergency oil spill response inventory into the field. This included 22 skimmer systems, ten boom handling boats and four miles of oil containment boom—a total of 700 tons of equipment and over 200 operator, maintenance, and support personnel—on scene in the massive cleanup effort.

4. Commendably, of the Navy skimmers in operation, SUPSALV's highly effective and efficient systems of material maintenance and support held the number of craft out-of-service, at any given time, to an amazing maximum of only one. This was despite the seemingly never-ending-pace of 16-hour days, 7-day work weeks, and the inherent environmental harshness and uncertain hazards of numerous spells of sub-freezing temperatures and often sudden 30 - 40 knot winds and high, cold sea. Proudly there were no serious personnel injuries.

5. EXXON listed over 1,400 support vessels in addition to oil skimming vessels employed in the cleanup of Prince William Sound and the Alaskan coastal waters and shorelines as far west as Kodiak Island. Although the total amount of crude oil physically removed from the water by this flotilla may be debated, few will disagree that 22 "Navy skimmers" had collected as much as half of it. No one, however, can disagree that your skimmers were among the first to respond and the last to leave.

6. The magnitude of this oil spill—the largest, most complex in American history—demanded total commitment, unswerving dedication and a special "can-do" spirit. Your people reflected all of this and much more! SUPSALV's quick response, cooperative assistance and long-staying support is greatly appreciated and is in keeping with the finest traditions of our seagoing forces.

D. E. CIANCAGLINI