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Marine Salvage in the United States

MEMORANDUM

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MARINE SALVAGE IN THE UNITED STATES

Committee on the National Salvage Posture

Marine Board
Commission on Engineering and Technical Systems
National Research Council

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PREFACE

Origin of the Study

Safe maritime commerce is essential to the intercourse of nations, and shipowners, governments, and international organizations strive to prevent shipping accidents. The same interests and organizations take action against marine pollution, one aftermath of shipping casualties. The middle ground between preventing casualties and cleaning up after them encompasses operations undertaken to save all or part of an imperiled ship or cargo. These operations fall within the realm of marine salvage, the subject of this report.

In response to a request from the Department of the Navy, the Assembly of Engineering of the National Research Council convened the Committee on the National Salvage Posture under its Marine Board.*/ Members of the committee were selected for their experience in salvage and towing operations, ship command and shipping management, naval architecture, marine salvage engineering, admiralty law, risk analysis, marine insurance, and naval and marine systems development. Members also provided experience in public law and environmental concerns. The principle guiding the constitution of the committee and its work, consistent with the policy of the National Research Council, was not to exclude the bias that might accompany expertise vital to the study, but to seek balance and fair treatment.

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*/In a reorganization of the National Research Council in the Spring of 1982, the Assembly of Engineering was subsumed into the newly created Commission on Engineering and Technical Systems.

Scope of the Study

The charge to the committee was "to assess the present national posture for coping with ship rescue salvage and towing situations and for time-critical offshore salvage in general." The committee was also asked to recommend courses of action to assure that our rescue salvage resources are sufficient to meet our national needs.

The committee set certain limits on its investigation. The time period studied was the present through the year 2000. The spatial coverage of the study encompassed all bodies of water surrounding the United States, including the Great Lakes and the Caribbean and Pacific possessions, from the ports of call of deep-draft (23 ft or greater) ocean-going vessels out to 200 miles.

The committee was concerned with the salvage of all merchant shipping; however, it concentrated on the salvage of the ships and barges as they constitute the majority of commercial vessels. It did not examine in detail the salvage of specialized craft such as submarines or offshore oil rigs, although much of the committee's work is applicable to these special situations. It emphasized those forms of shipping, where casualties are likely to involve large-scale release of pollutants or very valuable cargoes.

Consideration of military requirements for salvage of military vessels was excluded from the study. The committee was neither asked nor constituted to undertake such an evaluation. Although the subject of the potential national mobilization base provided by commercial tugs was raised in committee discussions, it was not addressed.

The separate objectives of saving lives, salving vessels or cargoes (which is the saving of property), and the mitigation of marine pollution are often complementary, but occasionally in conflict. The interaction of these pursuits is a topic of this report. However, the technical assessment of capability presented pertains only to salvage capability. The committee did not assess capability for search and rescue and other methods of saving life in the marine environment, nor did it provide a detailed assessment of pollution containment and cleanup capability.

In assessing salvage capability, the committee considered it necessary not only to evaluate the salvage forces but also the self-help ability of stricken ships to be salved. This evaluation included consideration of the design and outfitting of ships, the training and experience of vessel crews in salvage, and the readiness of ship operators to respond to marine casualties.

Study Organization

At the outset, the committee compiled information on the risks of marine casualties within 200 miles of the United States and forecast the occurrence of casualties, and, hence, the need for salvage, through the year 2000. Salvage assets in the United States were also surveyed.

Three regional working groups were then convened to evaluate the regional salvage capability along the Atlantic coast (plus the Great Lakes and the Caribbean), in the Gulf of Mexico, and along the Pacific coast and in Alaska and Hawaii. The membership of the regional working groups is listed in Appendix A. The members of the working groups comprised committee members and also outside experts who provided a cross-section of regional experience, including salvors, shipping company executives, risk and operations analysts, environmental policy analysts, marine firefighters, offshore supply vessel operators, and Navy and Coast Guard representatives. In addition to considering background information on risks and salvage capabilities in making their assessments, the regional groups conducted a number of site visits to centers of salvage activity in order to gain a first hand appreciation of salvage capability and readiness for marine casualties. A list of site visits is provided in Appendix A. They also developed a set of scenarios of casualties and salvage responses to test the salvage capability of each region. The regional evaluations are summarized on pages 44 to 62. The complete reports of the working groups are available on request from the Marine Board.*/

Other working groups of the committee examined roles and responsibilities for salvage, and developed alternate salvage postures for the United States.

The committee's findings, conclusions, and recommendations are based on analysis of data, site visits to centers of salvage activity, development and analysis of scenarios of the occurrence of marine casualties and salvage responses to them, and the professional experience of committee members.

*/Marine Board, National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C. 20418

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LIST OF ACRONYMS

CLC	International Convention on Civil Liability for Oil Pollution Damage, 1969
CMI	Comité Maritime International
CVS	U.S. Coast Guard Commercial Vessel Safety
EOD	U.S. Navy Explosive Ordnance Demolition Team
Fund Convention	International Convention on Establishment of an International Fund for Compensation for Oil Pollution Damage, 1971
H&M	Hull and machinery
IMO	International Maritime Organization
ISU	International Salvage Union
LNG	Liquefied natural gas
LPG	Liquefied petroleum gas
MARPOL	International Convention for the Prevention of Pollution from Ships, 1973
NRT	National Response Team
NSF	National Strike Force
OCIMF	Oil Companies International Marine Forum
OJT	On-the-job training
OSC	On-scene coordinator
P&I	Protection and indemnity
RRT	Regional Response Team
TAPs	Trans-Alaska Pipeline
VOT	Valdez Oil Terminal

LIST OF SHIP CASUALTIES CITED

Aikaterini	Tanker in ballast caught fire off Norfolk, Virginia. After delays, fire extinguished by commercial firefighters and salvors, who had been contacted initially by the Coast Guard, but were, in the end, contracted for by the owners. March 1981.
Amoco Cadiz	Following a steering system breakdown, the supertanker drifted off the coast of France for a number of hours until she stranded. The ship and 223 thousand tons of crude oil and bunker fuel were lost. March 1978.
Argo Merchant	A laden tanker off course stranded on Nantucket Shoals. The ship broke up in heavy weather a few days later. Some salvors believe that the ship could have been freed if a small amount of cargo had been jettisoned soon after stranding. December 1976.
Atlantic Empress/ Aegean Captain	After colliding off Tobago, salvors were denied permission by neighboring countries to bring the ships into protected waters for emergency repairs. The Atlantic Empress sank under tow 2 weeks later. The salvor has not been reimbursed for expenses of $1.2 million because the work was contracted on a no cure-no pay basis. 1979.
Blue Hawk	A freighter carrying Honda automobiles caught fire 700 miles off the California Coast (September 1981). A Coast Guard high-endurance cutter rushed to the scene and extinguished the fire at no cost to the shipowner.
Burmah Agate	Laden tanker caught fire off Galveston. Extinguishing the burning cargo proved to be beyond the capability of firefighters. 1980.
Dae Rim	Fishing vessel stranded near Attu Islands in an area that was soon to be occupied by returning migratory waterfowl and marine mammals. Coast Guard, using Navy EOD team destroyed the ship to eliminate long-term pollution threat. 1981.

LIST OF SHIP CASUALTIES CITED
(continued)

El Paso Paul Keyser	Fully laden ship carrying liquefied natural gas struck a rock in the Strait of Gibraltar. Ship was refloated, towed to protected waters and lightered without incident. The smooth salvage operation was the result of the ship operator's careful contingency planning and high state of readiness. 1979.
Mary Ellen	Tanker stranded on the Texas coast in a storm. Local tugs were unable to go to her assistance during the storm. After the weather improved, and after some delay in negotiating a contract, she was lightered and refloated. 1980.
Prince William Sound	A loaded supertanker lost power in Prince William Sound. She drifted for 16 hours before regaining power. When power was restored, she was less than half an hour off the rocks. Although a tug was dispatched, a rescue tow was never completed. 1980.
Prinsendam	A cruise ship with 900 aboard caught fire and sank in the Gulf of Alaska. All hands and passengers were saved in a large rescue operation which took place at the outside limit of helicopter range. Salvage of the vessel was not undertaken. 1980.
Ryuyo Maru No. 2	A stranded fuel barge threatened the seal rookery on St. Paul Island, Alaska, with long-term pollution. The Coast Guard destroyed the barge, eliminating the pollution threat, with the assistance of a Navy EOD team. 1981.
Torrey Canyon	A supertanker stranded off the coast of England and broke up in the ensuing days, causing widespread pollution. The wreck was bombed by the British Air Force to end the pollution threat. The Torrey Canyon brought the issue of tanker safety, accidents, and pollution to world-wide public attention. 1967.

LIST OF SHIP CASUALTIES CITED
(continued)

Zoe Colocotroni	A tanker stranded on the southwest shore of Puerto Rico. Minutes after stranding, the captain freed the ship by jettisoning a small amount of cargo. This action may have prevented a larger pollution incident. In subsequent court actions, the operator of the vessel was assessed stiff penalties. 1973.

SUMMARY

Great changes have taken place in the past three decades in maritime transportation: ships have grown tremendously in size, greater quantities of hazardous cargoes are being carried, shipboard cargo handling and operating systems are becoming much more complex and specialized, and public interest in pollution of all types has increased. Whereas the incidence of shipping accidents along our coasts is not great in number, the potential consequences -- damages and losses amounting sometimes to a hundred million dollars or more, and massive polluting spills -- are large and increasing. When casualties occur or are threatened, it is under certain conditions possible that timely or emergency measures can save the ship and her cargo from further harm, and control pollution by preventing or minimizing spills at the source. Such time-critical operations are called salvage, and include offshore salvage (e.g., firefighting, prevention of foundering, refloating stranded ships, emergency cargo handling, and correcting structural and stability problems of ships) and rescue towage.*/

The Committee on the National Salvage Posture of the National Research Council has completed an assessment of the salvage capability of the United States in order to determine the extent to which we have

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*/Salvage is conducted by salvors who salve ships.

the capability to salve ships. The study focused on the needs of commercial ships for time-critical assistance in the ocean waters of the United States out to 200 miles. Military and national emergency requirements were excluded from the study.

The committee concluded that it has been possible, so far, to meet our salvage needs with current capabilities. There has been no pattern of failure to cope with casualties due, in part, to the flexibility and ability to improvise, and also to luck, especially in that a catastrophe such as the Amoco Cadiz has not yet occurred in the United States. That the Prince William Sound did not become a negative statistic was luck. The incident is, nevertheless, indicative of the committee's concerns with our current salvage posture.

The current state of readiness to provide effective salvage services has evolved into a dynamic equilibrium. However, trends towards fewer commercial casualties requiring salvage (only two or three major salvage jobs per year are conducted in the United States), a more difficult business climate for salvors, and lower governmental priority for salvage will cause the nation's salvage readiness posture to decline, if these trends are not checked. Also, some foreseeable accidents are beyond the nation's current and anticipated capability. A single casualty of national interest could cause the current level of salvage capability to be sharply questioned.

The committee did not consider the mere existence of these trends and the threat of an incident of national interest sufficient to justify major new initiatives, such as crash programs to develop technology or acquire rescue tugs, or major shifts in federal responsibilities. It did conclude, however, that these trends jeopardize the continued availability of commercial salvage services in the United States.

Few domestic companies actually provide salvage services, yet a commercially viable, private domestic salvage capability offers the potential of reducing shipping and cargo losses from maritime perils and controlling spills from ship casualties. A stronger commercial salvage base in addition would provide a nucleus of equipment and expertise in the event of war. In any case, were commercial salvage services to become unavailable, the Federal Government would have to provide protection, and undoubtedly at greater cost.

The few domestic companies that provide salvage services have strived in recent years to improve their business prospects. Faced with declining return on investment in the operation of ships dedicated to salvage, they embraced advances in logistics and communications, and have developed an entirely new method of operation. Whereas in the past salvage was conducted from ships that were continuously manned, outfitted, and kept on station for the purpose, U.S. salvors now usually assemble equipment and personnel for each and every job. Containerization and rapid transport is depended

on to move all to the scene as rapidly as possible. A tug or other suitable ad hoc floating operations base is hired locally. No salvor, in these days of infrequent casualties and huge and sophisicated vessels, can carry in inventory all that may be needed.

Concurrent with these technological advances, salvors have to face the public's increasing concern with pollution. This has resulted in questions of liability when the salvage effort is complicated by a spill (or the threat of one), and constant government surveillance of salvage operations and sometimes intervention. Salvage, the former sole concern of salvors, shipowners, operators, and underwriters, is now often subordinated to avoidance of pollution.

To an extent, the salvage industry has suffered from external business and policy trends. Without attention, these trends will leave U.S. shipping vulnerable to large casualty losses and our coasts at risk of major spills.

The Salvage World

The salvage world involves all those with financial interests in marine commerce -- shipowners, operators, cargo owners, underwriters, and salvors themselves -- and in addition the Federal Government as represented by the Navy, the Coast Guard, and the Maritime Administration.

Salvage Companies

Most of the few companies that conduct marine salvage in the United States see salvage operations as supplements to their primary operations of marine transportation, point-to-point towing, or marine engineering. Time-critical salvage incidents occur too infrequently and sporadically, and remuneration is too low, to justify single-purpose salvage companies or maintaining specialized vessels for salvage as in the past. Modern salvage operations therefore are largely matters of improvisation, requiring the rapid assembly of suitable vessels, equipment, and personnel when the needs arise. Advance logistic arrangements and careful planning are vital. Investments must be made in advance for specialized equipment and trained personnel so that all can be rapidly marshalled and deployed in emergencies. Vessels, equipment, and personnel not on hand must be located and cataloged, and arrangements made for their immediate acquisition when needed.

These efforts require substantial investments, and the sporadic commercial salvage opportunities must promise sufficient remuneration to make them worthwhile. Such investments are difficult to make or justify with the low rate of return that salvors have realized in recent years. Potential liabilities for pollution further discourage interest in salvage and decrease companies' expectations of awards. The committee recommends that arbitrators and the courts make more

generous salvage awards taking into account the value of salvage in pollution prevention, and the higher investments made by companies that endeavor to maintain and improve their salvage capabilities.

When the Coast Guard provides rescue or oil spill control services to ships -- however justified -- it sometimes takes away already scarce business from salvors who would be able to handle it. The Navy does likewise when it undertakes salvage as clearance with fleet forces.

Another source of frustration for salvors stems from the Public Vessels Act (46 USC 781-790). This law has been interpreted as forbidding the commercial salvage of publicly owned ships and cargoes under the terms of the Lloyd's Open Form, a widely used salvage contract, because the pro forma contract commits the United States, as owner, to binding arbitration under foreign jurisdiction. The committee recommends that the U.S. Government take steps to eliminate this obstacle and to make it easier for the commanders of naval ships, and the masters of public vessels and vessels carrying government-owned cargo to contract for commercial salvage services.

Because of the increased potential for liability and therefore costs of salvors for pollution, the committee further recommends that Congress consider amending domestic laws to absolve salvors from civil liability for pollution that occurs incident to prudent professional salvage activities. The international conventions governing similar liabilities should also be similarly amended. Although the United States has not yet ratified these conventions, it should do so.

Shipowners and Operators

Shipowners and operators bear the primary responsibilities for recognizing and responding to marine casualties. Many have established emergency procedures, ranging from simple telephone notification arrangements to formal contingency plans and stockpiling of emergency equipment. At present, however, few operators have equipped their ships with sufficient casualty control plans and equipment. Explicit planning for salvage is necessary in view of the fact that every ship is likely to need some kind of externally provided emergency assistance at least once. Therefore, the committee recommends that ships be provided with casualty manuals, engineering drawings, and information on the behavior and characteristics of the ship when disabled. They should be equipped also with equipment that will enhance the ability of the vessel to avert a potential casualty, either through its own efforts or when assistance is offered. Such equipment might include emergency equipment fore and aft, such as auxiliary power, and towing points and bridles. It is desirable that the master and crew be versed in salvage procedures and the actions

required of them in an emergency. Shipping companies should consider establishing with salvage companies general terms and conditions for salvage services. Such arrangements made in advance of their need could minimize delays due to contract negotiations.

U.S. Navy

At the end of the Second World War, the Navy deemed it desirable, in the face of the postwar decline in marine casualties, to ensure the continued existence of a U.S. commercial salvage capability as a basis for mobilization, and to involve naval salvors in operations where commercial companies were unavailable (thus maintaining the Navy's salvage competence in case of war). Legislation was passed that established a framework for this. The Salvage Act of 1948 (10 USC 7361-7367) authorizes the Navy to operate as a salvor, and to assist private salvage companies, but it does not require the Navy to maintain salvage facilities in excess of its own needs or to render assistance in all cases. At present, the Navy makes available to private companies its advice and its salvage equipment and vessels as needed (for a fee) and assists in salvage operations when necessary (usually at the request of the Coast Guard). The Navy has, in the past, subsidized the operation of a leased naval salvage vessel by a private firm. More recently it has set up (and maintains) a series of contracts for salvage services with companies, on a regional basis. The Navy's paramount functions under the act in support of commercial salvage readiness are monitoring the nation's salvage readiness; training naval salvage personnel, some of whom leave the Navy to take jobs in the private salvage industry; and developing, testing, and stockpiling improved salvage systems, equipment, and components.

Despite its charge of monitoring national salvage readiness, the Navy is not required to formally assess commercial casualty risks and salvage capability; and, until it commissioned this study, it had not done so.

The Federal Government has not yet taken best advantage of the possibilities for developing salvage policies or programs (as an element of a national pollution control strategy, for example). It would find it very difficult to establish such programs since there is no formal or informal advisory group to serve as liaison between the government and the commercial salvors. The committee recommends that a subcommittee on salvage be established under the Naval Research Advisory Committee, to encourage improvements in the national salvage posture.

U.S. Coast Guard

The Coast Guard's long held authority "to perform any and all acts necessary to rescue and aid persons and property and save property," although permissive and not mandatory, is broad enough to cover salvage operations. The Coast Guard has in the past relied on the Navy to maintain the government's salvage capacity. The Coast Guard has no substantial salvage capability of its own. Yet the line between saving lives and property and the conduct of salvage operations is difficult to define, and adhere to especially in emergencies. Under its more recent pollution control authorities, the Coast Guard conducts activities necessary to prevent or mitigate the effects of spills of oil or hazardous substances. It can even destroy vessels or cargoes that present substantial threats of pollution hazards (and has done so on occasion). Whether for reasons of saving lives or countering marine pollution, Coast Guard vessels are often the first on the scene of casualties and not infrequently give some assistance. Because almost every marine casualty involves the threat of pollution, the Coast Guard monitors the majority of salvage operations. Therefore, there is a potential for unintentional involvement with salvage operations. The committee recommends that the Coast Guard develop and administer policies that recognize and take into account the nature of salvage operations and, in particular, the role of commercial salvors. The Coast Guard could further assist commercial salvors by informing them of potential salvage cases in a timely manner.

Maritime Administration

The Maritime Administration is authorized to design and support the construction and operation of vessels. In this, they work closely with the Navy to ensure that the U.S fleet provides a basis for mobilization.

Salvage Technology and Planning

Without regard to their different purposes, actual use, cost, or cost-effectiveness, there is a difference in the installed capabilities of the American-design commercial ocean tugs that currently perform the majority of salvage work offshore the U.S. and European-design tugs. The additional installed salvage capability of European-design tugs, which are not currently available in the U.S., could play a critical role in the success of salvage operations, especially in high-risk situations, such as those involving large ships, remote areas, hazardous cargoes, and bad weather. The committee recommends that the Maritime Administration and the Navy investigate the commercial feasibility of European-design tugs, with and without government support, and develop designs if appropriate.

The improvised assemblies of equipment and employment of vessels of opportunity upon which domestic salvage today largely rely may not always match the capabilities of specialized salvage vessels and equipment. Yet the application of available sophisticated logistics systems is cost-effective and permits quick and effective responses to casualties. Nevertheless, assets needed for a short-term assignment may not always be available if they are otherwise engaged. In bad weather (when most casualties occur), aircraft, helicopters, and vessels of opportunity are all vulnerable to reductions in speed, range, and payload; in very bad weather they may be unable to operate. The reduction of capabilities caused by weather increases with the remoteness of the casualty.

Given sufficient planning and coordination between salvors and ship operators, improvised assemblies of equipment and employment of vessels of opportunity provides an adequate response for most marine casualties, though it is easy to develop scenarios of casualties and conditions that would be difficult to handle. One feature of this mode of operation is the requirement for the consideration of salvage in design, contingency plans, and emergency equipment by all concerned. This integral component of the salvage effort can make the difference between success and failure. Some shipowners' and other associations, like the International Maritime Organization, are promoting the use of such contingency planning and preparations. This kind of planning should be widespread among ship operators and also the operators of major port complexes. The committee recommends that the Coast Guard encourage such planning wherever possible, and require it (under the Ports and Waterways Safety Act of 1972 [33 USC 1221-1227]) where voluntary efforts are inadequate. One other aspect of advance planning is the province of the Federal Government: the designation of safe havens, where disabled vessels can be towed for emergency repairs. The committee recommends that the Coast Guard identify candidate havens and establish, under the National Oil and Hazardous Substances Contingency Plan, procedures for making safe havens available.

While salvage technology generally is considered by the committee to be adequate (even though it cannot cope with all risks), one element of salvage, marine firefighting (assistance external to the ship), would benefit from the development of effective portable systems and techniques for fighting fires in cargoes such as coal and petrochemicals. The committee recommends that the Navy, under its authority to monitor and strengthen salvage readiness, initiate the development of improved firefighting technology.

Authority at the Scene of a Casualty

Salvage, before the advent of modern telecommunications and a strong federal interest in marine casualty management, was a matter for agreement between the salvor and the master of the stricken ship.

The ship's master, totally on his own and exercising his traditional full authority over his vessel, typically contracted with the first salvor to reach the scene, turning over operational authority to the salvor while remaining in nominal command of the ship. Today, however, the situation has changed. The master is anything but "on his own." He is likely to be in direct radio contact with the ship's owner and operators and their underwriters, and will likely be reluctant to enter into contractual arrangements with salvors without higher authorization. Furthermore, the Coast Guard is more likely to be involved because of the pollution threat attendant to most casualties. Coast Guard vessels may precede salvors to the scene and may find it necessary to initiate pollution control operations which may be similar to or impinge on salvage operations.

In the event that salvors capable of acting for the owner of a distressed ship arrive at a casualty after the Coast Guard has initiated salvage operations, the Coast Guard policy is to turn the operations over to commercial salvors. However, in practice the transfer of responsibilities is very difficult.

Under these changed conditions, salvors have a more complex task than they otherwise would, and their authority to act is not always clear. The committee recommends that the Coast Guard, as well as other federal agencies, clearly and consistently follow a policy of not undertaking salvage operations that can be handled competently by private companies; when it does conduct salvage operations it should charge fees at least marginally higher than those charged by private salvors, rather than performing such services free. The Coast Guard should continue to oversee the salvage of commercial vessels in those rare instances in which salvage contributes to environmental or public safety and in which effective private salvage efforts are not likely to be forthcoming.

The Business Environment for Salvage Companies

The current business environment for salvage companies -- characterized by low demand, high costs, uncertain returns, and potential legal liabilities -- is such that it is difficult to justify the expense of maintaining salvage readiness. Some companies, notably those that operate fleets of tugs, justify their involvement in salvage as an investment in protecting their own fleets and those of their customers.

In view of the small number of salvage incidents and despite the innovations in salvage logistics and technology, the future for the commercial salvage industry is uncertain, and steps to maintain current U.S. capabilities are necessary. Possible alternatives include reducing or shifting the costs of salvage, increasing the rate of return on salvage investments, and mitigating government competition.

Cost reduction is commonly sought in the salvage business by minimizing the stocks of specialized salvage equipment. Some salvors do not operate their own vessels, for example, preferring instead to depend on ships or platforms of opportunity and to use whatever tugs or work boats are available. Other companies add certain salvage-specific design features to vessels designed for other tasks. The establishment of salvage cooperatives by shipowners may offer another useful way to share the costs of salvage with those who need coverage.

The committee concludes that increasing the returns on salvors' investments may improve the business environment. Salvage awards by courts or arbitrators as percentages of values saved have declined from about 7.3 percent between 1960 and 1970 to about 5.7 percent between 1970 and 1980. Part of this decline is attributable to the past decade's sharp rise in the values of cargoes, without a corresponding rise in awards. There is concern that awards have not kept pace with the rising costs of salvage readiness and salvage operations. The committee recommends that salvors receive more generous remuneration in recognition of the value of salvage in pollution prevention, to encourage prompt and meritorious service, and to provide adequate incentive for commercial salvors to maintain and improve their capability.

Many of the difficulties that salvors face can be traced to lack of understanding on the part of federal agencies, shipowners, and underwriters concerning marine salvage and the important contribution that effective salvage can make to safer shipping and cleaner seas. Timely action is necessary to ensure adequate commercial salvage capability in the United States in the future. The Federal Government and shipowners and operators should acknowledge this potential contribution and their responsibilities, and should make every effort to improve the nation's salvage readiness.

Alternate Salvage Postures for the United States

With large ships carrying larger cargoes, shipping accidents of major proportions will occur in the future. Recognizing that improvements in the nation's readiness to respond to shipping accidents can be made, the committee considered several general models of salvage posture. At one end of the spectrum, salvage could be made exclusively a federal responsibility; an opposite approach would call for salvage to be conducted solely on a business basis. The approach adopted by the committee is a compromise. It calls for incremental measures to improve the national response to marine casualties by improving the commercial attractiveness of salvage while maintaining certain government responsibilities and involvement in salvage.

INTRODUCTION

The shipping world uses the term salvage to describe all services rendered to save maritime property. To an admiralty lawyer or a salvor, however, the term has a much more specific meaning. The admiralty definition of salvage is "a voluntary response to a maritime peril by other than the ship's own crew, and from which the ship or property could not have been saved without the effort of the salvor."[1] The Comité Maritime International (CMI) further defines salvage as "any act or activity undertaken to assist a vessel or any property in danger in whatever waters the act or activity takes place."[2]

Salvage operations include the two subsets of offshore salvage and rescue towage. Offshore salvage includes providing external (to the ship) firefighting assistance at sea; refloating stranded ships; off-loading cargo or water to prevent foundering; lightering cargo at sea to restore stability or to remove cargo from harm's way; and shoring, patching, and making temporary repairs to correct structural, stability, or mechanical problems. Rescue towage involves taking an incapacitated vessel under tow at sea and towing it out of harm's way, generally to a safe haven or port, but sometimes for beaching.

Salvage operations are time-critical, in that success depends on timely action.[3] Actual operations are ad hoc as they relate to the organization of forces assigned, and their execution. The application of engineering and management in salvage situations may stem from prior contingency planning or the inherent skill of the salvors, or both, because time is not available to develop tailored engineering and management schemes or detailed analyses of alternatives.

An important consideration when undertaking salvage is the prevention or reduction of marine pollution, especially the uncontrolled release of polluting substances or hazardous cargoes.

For the purposes of this study, salvage does not include harbor clearance or wreck removal.

Not all salvage is undertaken by professional salvors. In addition to the towing and construction firms that occasionally secure a salvage contract, ships often aid other ships in distress and perform services in the nature of salvage, for which they are rewarded. In one instance a supertanker even took another supertanker in tow.*/

The committee used certain terms frequently. The terms ships and vessels are used interchangeably in this report, and include barges in their meaning. Salvage capability denotes the equipment, vessels, supporting operations, personnel, organization, and management to conduct effective salvage, and connotes fitness to meet the challenge of time-critical marine casualties with favorable odds of success. Salvage capability also connotes geographical coverage sufficient to deal with the probable occurrence of marine casualties in the waters of the United States. The nation's salvage posture includes its judgment of the risk of marine casualties and their consequences, policies addressing the mitigation of such casualties and consequences, and readiness to take effective action in the face of threatened or actual marine casualties. Salvage posture is the nation's readiness to provide effective salvage services.

Salvage has traditionally encompassed the saving of hulls and cargoes. This is the legitimate concern of ship and cargo owners, salvors, and their underwriters, both property and liability. Yet some shipping accidents have, in the past, resulted in large spills -- for example, the Torrey Canyon, the Argo Merchant, and the Amoco Cadiz. These incidents have contributed to a change in public attitude towards and concern for environmental quality and specifically marine pollution. At the same time, ships have become larger and tanker traffic (with its pollution potential) a larger component of marine commerce. Control of the public consequences of casualties, especially pollution, has increasingly overshadowed the private concerns of saving hulls and cargoes in the response to marine accidents. This public concern is evidenced in international actions and domestic legislation and regulations restricting or forbidding pollution of the marine environment.

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*/Hugh Williams (Mobil Oil Corporation) 1981, personal communication.

The public concern and stricter rules carry the potential of interference with the operations of private salvors. However, since salvage encompasses the saving of cargoes, in most cases successful salvage operations can mitigate the severity of shipping casualties or prevent them from becoming polluting casualties. Thus salvage can be a timely tool to combat marine pollution.

In the event of a national emergency, the nation's salvage assets would be mobilized. As in past national emergencies, our domestic salvors would form a core of domestic salvage expertise, and would provide as many salvage-capable vessels and as much equipment as possible to meet the emergency.

In time of war the need for salvage increases due to increased traffic, operation of ships with perhaps fewer navigation aids available in the ports being used, and operation in a more hazardous environment due to the use of smaller harbors, marginal facilities, less competent people to operate the ships, and enemy actions.

The average hull used to carry cargo in a war during the next 20 years may be significantly larger -- more than twice the size -- of the standard hull used during World War II. The cargoes of war material will be significantly more valuable. For example, the increased size and complexity of the Army's current main battle tank over that of a World War II tank has raised the price in man-days of manufacture by several orders of magnitude. The same can be said for field artillery, radar, communications equipment, and many other items. The pressure to prevent the loss of or recover such equipment will be significantly greater than it was in World War II.

The high cost of military hardware, including the cost of ships and the difficulty of replacement, adds an important economic incentive to the necessity of maintaining salvage capability as a basis for mobilizing in time of war.

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THE RISK OF CASUALTIES AND THE NEED FOR SALVAGE

The demand for salvage services depends on the frequency and the public and private consequences of marine casualties.

Consequences of Marine Casualties

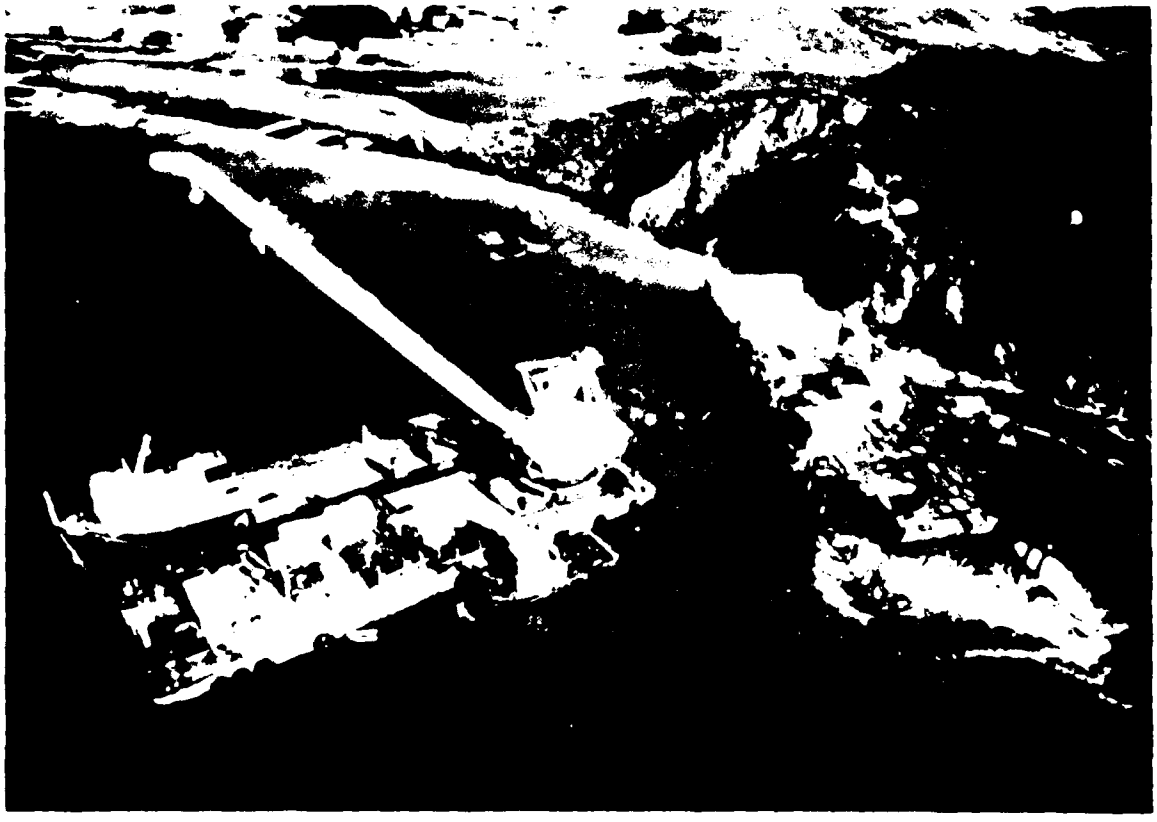
Damage or Loss of Vessels and Cargoes

Successful salvage represents a savings in the total cost of marine casualties. Costs may be estimated narrowly, in terms of cargo lost and direct damage to the ship and other property, or broadly to include total economic losses, cost of pollution clean up, and environmental damage. For many of these costs it is very difficult to estimate a dollar value.

The values of vessels and their cargoes provide the traditional motivation for marine salvage. The hull value of a new ship such as a container ship or bulk carrier ranges from $50 million to $90 million.[1] The equipment on these ships may add an additional $1 million to $7 million to the value. The values of cargoes carried in these vessels range from nil (in ballast) to upward of $200 million.

PHOTO 1 Refloating of the San Juan, San Juan, Puerto Rico, February 1980. Photo supplied by Crowley Maritime Corporation.

PHOTO 2 Floating crane removing cargo from the stranded barge Agattu, Marin County Headlands, California, December 1979. Photo supplied by Crowley Maritime Corporation.



Environmental Damage

Marine casualties involving large cargo releases to the environment, such as those of the Argo Merchant and the Burmah Agate, have attracted public attention. Similar accidents are likely to occur in the future. While tanker accidents account for only about 3 percent of marine oil pollution,[2] such an incident may be catastrophic if the oil contaminates a biologically productive or otherwise sensitive coastal area. A 1973 study on tanker oil pollution found that every tanker, on the average, is likely to be involved in an accident once every 8 years during its 20-year lifetime.[3] About one in four of these casualties results in pollution.

The environmental concerns about marine casualties and their polluting aftermath include damage to coastal amenities and tourism; damage to fisheries; modification of marine and coastal ecosystems, resulting in possible human health hazards involving contaminated seafood and impaired aesthetic values.

Estuaries and polar regions are particularly vulnerable to oil spills. Estuaries play a key role in the ecosystem because they serve as spawning and nursery areas, waterfowl habitats, and sites of much diverse biological productivity. Because of their proximities to population centers, many estuaries carry heavy maritime traffic. The effects of an oil spill in the polar regions might also be very serious, as well as long lasting. Arctic temperatures do not permit rapid evaporation of aromatics in oil, allowing more of these toxic hydrocarbons to enter solution in sea water even though the solubility of these compounds is lower at low temperatures. Bacterial degradation and other weathering processes are slower at very cold temperatures. In addition, many arctic marine biota are long-lived, have low reproductive potentials, and do not have wide-ranging dispersal stages. Furthermore, spill prevention and control techniques for these difficult environments are nonexistent or relatively inefficient.[4]

Worst Case Example

While the United States has in recent years been spared the polluting effects of a large shipping accident, lessons are to be learned from elsewhere. The wreck of the supertanker Amoco Cadiz off the coast of Brittany, France in March 1978 resulted in the loss of 223,000 tons of crude oil and bunker fuel. About 64,000 tons (29 percent of the total spilled) reached the beach. Another 245,000 tons of "mousse" (a weathered mix of oil and sea water) were eventually deposited along approximately 250 miles of coastline, an area equivalent in size to the Atlantic coast from Provincetown, Massachusetts to New Haven, Connecticut. The spill damaged fisheries and disrupted the 1978 tourist season. Cost estimates range upward of $100 million.[5]

In 1972, Congress enacted the Federal Water Pollution Control Act (33 USC 1251) establishing a national goal of maintaining and restoring the "chemical, physical, and biological integrity of the nation's waters," and eliminating vessel-source pollution. The popularity of coastal recreation and the economic importance of tourism were among the motivating factors.

Exposure to Marine Casualties

The character and volume of maritime traffic and cargoes determine the nature and geographic distribution of casualties. The committee compiled information on the vessels that ply U.S. waters and their cargoes sufficient to identify regional differences and trends through the year 2000.

A 14-year study on world-wide ship casualties concludes that major factors affecting the frequency of ship casualties are the nature of vessel ownership and the country of registry.[6] Owners govern the condition of the vessel and the character and qualification of the crew. Ships registered and operated under the laws of countries that do not impose extensive safety rules as a condition of registry tend to have poorer accident records than ships registered in countries that impose more effective standards for crew qualifications and vessel conditions.

A representative measure of exposure to the probability of casualty is a count of vessel traffic, derived from records of ship passages.[7,8] An analysis of tanker accidents shows that ship passages correlate more highly than other criteria with exposure to casualties.[9]

Ship passage data were developed by the committee for vessels with drafts of at least 23 ft, approximately the loaded draft of a vessel of 5,000 gross registered tons (grt). The measure of ship passages is termed port calls. The annual number of port calls for a port is the average of the total inbound and outbound ship passages. Port calls were counted for the years 1975 to 1978. Data for 1978, the most recent year for which data were available, appear to be in the midrange of year-to-year fluctuations and consistent with growth trends. The year 1978 was therefore selected as the base year for casualty analysis.

In 1978, an estimated 123,927 port calls were made in the United States, Puerto Rico, and U.S. trust territories. Table 1 presents the data by region.

TABLE 1 Port Calls in the United States, 1978

Ship Type	Atlantic	Pacific	Gulf	Great Lakes	All U.S.
Tanker	13,926	3,675	14,789	58	32,448
Cargo	41,600	17,790	26,308	5,821	91,519
Total	55,526	21,465	41,097	5,879	123,967

Source: U.S. Army Corps of Engineers Water Resources Support Center, Department of the Army. 1979. Waterborne Commerce of the United States: 1978. New Orleans, LA: U.S. Government Printing Office.

Table 2 compares total U.S. port calls and tonnages for the years 1973 and 1978. While regional patterns vary, the annual growth in U.S. port calls appears to be about 4 percent; for purposes of comparison, annual growth in tonnage handled has been about 7 percent. This indicates that the tonnage of cargo carried per ship, and hence the per unit exposure of cargo, is increasing.

TABLE 2: Comparison of 1973 passages and tonnages with 1978 passages and tonnages

AREA	PASSAGES[1]	TONNAGE[2]
GREAT LAKES	+ 0.2%	- 6.6%
NEW ENGLAND	-23.2%	-13.4%
MID-ATLANTIC	- 7.6%	-14.7%
SOUTHEAST	+14.5%	+25.0%
ANTILLIES	-13.7%	- 2.0%
EASTERN GULF	+ 9.4%	+35.4%
WESTERN GULF	+26.2%	+40.4%
HAWAII	-58.3%	+22.7%
CALIFORNIA	- 8.0%	+12.7%
NORTHWEST	+ 2.2%	+28.9%
ALASKA	+41.7%	+840.6%

[1] Data from U.S. Army Corps of Engineers Water Resources Support Center, Department of the Army. Annual Publication. Waterborne Commerce of the United States. New Orleans, La: U.S. Government Printing Office.

[2] Data from U.S. Maritime Administration.

Incidence of Marine Casualties

This section addresses the probability of occurrence of marine casualties, and thus the need for salvage, by presenting and analyzing data on the occurrence of marine casualties and the conduct of salvage operations, and projecting trends in the occurrence of casualties through the year 2000.

Casualty Data

Only two casualty data bases -- the U.S. Coast Guard Commercial Vessel Safety (CVS) file and Lloyd's Statistical Information Service -- are compiled from direct field reports. The Lloyd's data are global in scope. The CVS data base is derived from reports of U.S. Coast Guard officers, and covers all U.S. ships and U.S. waters, reporting all incidents in which the Coast Guard was involved. The committee considered both data sets to be useful, but relied in its analysis on the CVS file, which deals specifically with casualties occurring close to the United States.

Coast Guard casualty data indicate 2,857 casualties to vessels of 5,000 grt and over in U.S. coastal and offshore waters during the 4 year period 1976 through 1979, an average of 672 casualties per year. Not all of these incidents required or elicited a salvage response. About 10 percent of them, or 285, involved total loss of the vessel, over $100,000 per event in total damages or loss, or major pollution. The committee considers these 10 percent to be serious casualties, indicative of the demand for salvage. Table 3 allocates serious casualties by region and type, and describes their severity.

An analysis of the data shows that there are about six serious casualties per month. The Atlantic region sustains the greatest number of serious casualties (nearly half of the total); this is expected since the Atlantic accounts for nearly half of U.S. port calls. The most common type of serious casualty in the Atlantic is stranding (31 percent); the Pacific, ramming (the striking of fixed objects by ships) (30 percent); the Gulf, collision (46 percent); and the Great Lakes, stranding (48 percent). Table 4 estimates the frequency of serious casualties in the United States as related to port calls.

Data on Salvage Operations

While abundant information on marine casualties is available, there are no comparable data on salvage operations. Compiling salvage statistics is especially difficult because some time-critical salvage needs, such as rescue towing, are often handled on a nonemergency basis and thus are never identified as salvage. Furthermore, many salvage operations -- perhaps half, according to experts -- are

TABLE 3 Serious Casualties by Region[a], 1976 to 1979

	Atlantic	Pacific	Gulf	Great Lakes	Total
Serious Casualties	130	44	76	35	285
Collisions	26	4	35	1	66
Rammings	21	13	11	9	54
Strandings	40	8	11	17	76
Fire or Explosion	11	4	6	2	23
Structural or Material Failure	16	7	13	5	41
Other[b]	16	8	0	1	25
Over $1 Million Loss	23	8	11	4	46
Total Loss of Vessel	4	2	3	3	12
Cause of Major Pollution	6	0	3	0	9

[a] Serious casualties are defined as total loss, pollution incident, or over $100,000 damage or loss as reported to the U.S. Coast Guard.

[b] Other includes foundering, capsizing, and flooding.

Source: Based on data obtained from the U.S. Coast Guard Commercial Vessel Safety Data System.

conducted by companies that only rarely engage in such business. Nevertheless, the committee considered it useful to establish some measure of the number of time-critical salvage operations undertaken in the United States.

TABLE 4 Serious Casualties[a] per Thousand Port Calls, 1978

Region	Ship Type	Collision	Ramming	Grounding	Fire or Explosion	Structural or Material	Other	Total
All Atlantic	- Tanker	.25	.19	.41	.12	.13	.03	1.13
	Cargo	.06	.06	.09	.02	.04	.08	.36
	Average	.11	.09	.17	.05	.07	.07	.55
Gulf	- Tanker	.22	.08	.09	.02	.14	0	.56
	Cargo	.19	.05	.04	.05	.05	0	.39
	Average	.20	.06	.06	.04	.09	0	.45
All Pacific	- Tanker	.06	.32	.06	.19	.25	.32	1.20
	Cargo	.04	.11	.09	.01	.04	.04	.33
	Average	.04	.14	.09	.04	.08	.09	.48
Great Lakes[b] -	Tanker	0	0	0	0	4.14	0	4.14
	Cargo	.04	.36	.69	.08	.16	.08	1.41
	Average	.04	.36	.68	.08	.20	.08	1.44
All U.S.	- Tanker	.22	.15	.22	.08	.16	.05	.84
	Cargo	.09	.08	.12	.03	.05	.05	.43
	Average	.12	.10	.14	.05	.08	.05	.55

[a] Serious casualties (total loss, pollution incident, or over $100,000 damage) reported to the U.S. Coast Guard 1976 to 1979.

[b] The calculated rates for the Great Lakes may be artificially high because of difficulties in calculating the number of port calls.

Therefore, the committee obtained from several U.S. companies, which provide(d) salvage services, a list of their operations conducted from 1973 to 1980 that they considered time-critical salvage.*/ The data collected are presented in Table 5. Of a total of 204 salvage operations, 26 were cases of national interest, involving hazardous cargoes, channel blockage, potential threat to human life or the environment, or requirements for time-critical near-shore rescue towing. The locations of these incidents are shown in Figure 1. Most of the remaining incidents were towage well offshore, assistance to small vessels in distress, or pulling vessels from ground in nonprecarious situations.

*/Crowley Maritime Corporation, Fred Devine Diving and Salvage Company, Moran Towing and Transportation Company, Murphy Pacific Company, and Ocean Salvors Company.

TABLE 5 Time-Critical Salvage Incidents Responded to by U.S. Salvage Companies, 1973 to 1980[1]

	Rescue Tow	Strand Removal	Firefighting[2]	Prevention or Response to Foundering	Unknown Response	National Interest[3]	TOTAL[4]
Atlantic	42	28	0	8	7	12	85
Gulf of Mexico	11	13	2	5	2	9	32
Pacific	39	25	3	16	6	5	87

1 Crowley Maritime Corporation, Fred Devine Diving and Salvage Co., Moran Towing and Transportation Co., Murphy Pacific Co., Ocean Salvors Co.

2 No firefighting was reported in the Atlantic because the companies reporting in that region do not have significant firefighting capability and ordinarily contract for such expertise.

3 Cases involving hazardous cargoes, channel blockage, potential threat to human life or the environment, or time-critical near-shore rescue towing.

4 Total number of incidents in each region. "National Interest" column not included in total.

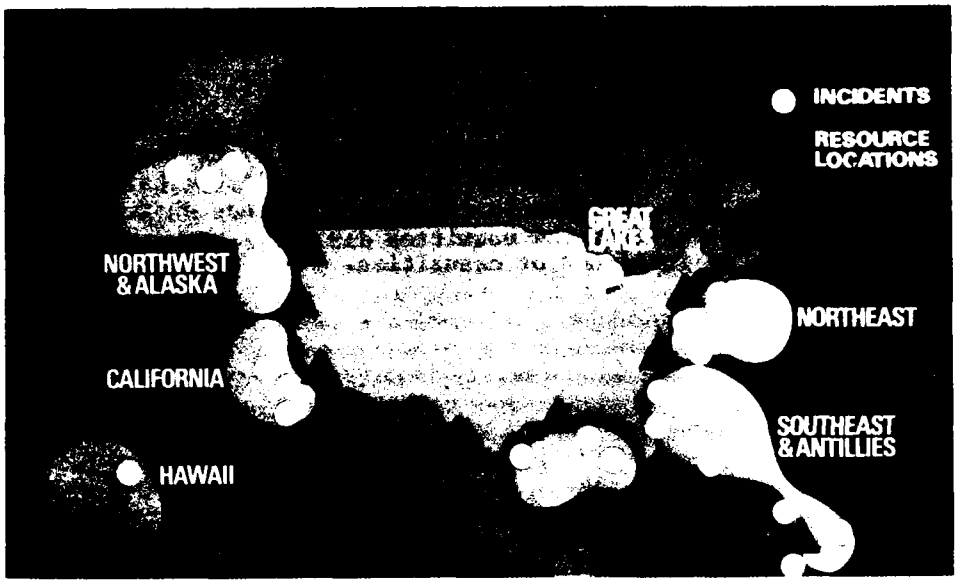


FIGURE 1 Salvage-related incidents, 1973 to 1980, and major locations of salvage resources

Marine Casualties in the Year 2000

The major change between now and 2000 that will alter the nature of casualties and influence required salvage capabilities will be a continued increase in the size of the average ship. The mean size of ships is expected to increase about 65 percent for tankers, 37 percent for dry bulk carriers, and 20 percent for container vessels and cargo ships.[10] However, it should be noted, especially for tankers, that while the mean size is projected to increase, the size of the largest ships is likely to remain about the same.

Regarding the other influences -- in shipping technologies or trade patterns, for example -- on the need for salvage, the committee found no evidence for anything other than marginal changes in casualty rates. Technological improvements in shipping or navigation are not likely to eliminate the need for salvage.

The forecast method and numerical results of the committee's forecast of probable casualties in the year 2000 are presented in Appendix B. The total number of serious casualties is estimated to

change little in the next 20 years, decreasing slightly from 68 to 61 per year. Within this generally stable overall pattern, the incidence of some particular types of casualties (strandings off the East Coast, for example) are halved while others (rammings in the Gulf) nearly double. Regardless of these fluctuations, the numbers of casualties and therefore the ranges of fluctuations are small.

The committee's projections are consistent with other recent work on maritime casualties, which shows that the incidence of casualties continues to decline but at a lessening rate.[11] Since the need to maintain salvage capability depends on the probability that casualties requiring salvage will continue to occur, rather than on the precise numbers of such casualties, the committee did not analyze more deeply the distribution or incidence of casualties.

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COMMERCIAL SALVAGE

The saving of ships and cargoes from loss and the recovery of equipment and cargo from wrecked ships are commercial pursuits as old as the shipping industry. Until the mid-nineteenth century, however, the overwhelming majority of salvage activity was carried on by what today would be called "casual salvors": passing mariners and amateurs. Just prior to the Civil War, in 1860, there were as many as 4,000 itinerant wreckers along the Atlantic coast of the United States. The business that came their way was sizable. In that year, with U.S. annual exports totaling about $300 million, shipping losses ran at about $14 million per year for an annual loss of about 5 percent.

Faced with rapid advances in shipping technology -- the advent of steam-powered, iron-hulled vessels, for example -- and consequent steep rises in values afloat and at risk, underwriters placed the salvage business on a more organized and secure basis by establishing professional salvage companies. The motivation for salvage has always been the remuneration salvors receive from the owners of salved property. Because of the dangers -- both personal and business -- to which salvors voluntarily expose themselves, the general maritime law considers their services deserving of a reward, rather than merely a fee-for-service (quantum meruit) business activity. Salvage awards are based on values saved and on the degree of danger involved in the operation, but there are other considerations.

Salvors, shipowners, and underwriters all have a very direct interest in the conduct of salvage, and are likely to participate directly in the operation. The shipowner or his designated operator may be a substantial organization, and the owner's presence during a salvage operation depends on the owner's practices and responses. The largest and most reputable shipowners have established contingency plans for emergency response and will direct substantial resources to the scenes of casualties. Through the master or otherwise, the shipowner contracts for salvage services with one or more salvage companies after a casualty occurs. The contractor (often called "salvor") provides a project manager, a salvage master, or both, along with the necessary vessels and equipment. The salvor may call in various experts and subcontractors. The shipowner may also secure the services of salvage consultants and other experts for independent advice. In most instances, the underwriters send a surveyor to assess the situation on their behalf. Whenever values at risk are large and legal complications likely, the shipowner usually engages admiralty counsel.

The Contractual Basis of Salvage

Voluntary, time-critical salvage has traditionally been conducted pursuant to the terms of the Brussels Convention of 1910, which provides that voluntary acts of assistance at sea that have a useful result shall be rewarded equitable remuneration.[1*/] Conversely, no remuneration is due if the services rendered have no beneficial result. A pro forma contract embodying these principles is Lloyd's Standard Form of Salvage Agreement (Lloyd's Open Form). This contract, and others like it, provide that the salvor will extend his best endeavors to save vessel and cargo in peril in exchange for an award. The amount of the award is arrived at through negotiation or arbitration after the salvage operations. The contract type is termed "no cure-no pay" in that the salvor receives an award only if the job has been successfully completed. Unsuccessful salvage attempts are deemed undeserving of salvage awards. This performance arrangement requires the salvor to assume financial risk (sometimes quite substantial) with the uncertain expectation that satisfactory financial compensation will follow.

Since the amount of remuneration for salvage services is usually arrived at after the fact, most salvage awards are settled privately, either by negotiation between the shipowner (generally joined by the cargo owner) and the salvor, or by an arbitrator. (The Lloyd's Open Form provides for the appointment of an arbitrator by the Committee of

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*/Alternatively a salvor may provide services according to the terms of a fixed-price or cost-plus contract, or daily hire.

Lloyd's.) The parties may also request the Salvage Awards Committee of the American Institute of Marine Underwriters to recommend an award amount. Occasionally a salvage claim is decided by the courts. This occurs if there is no contract (such as Lloyd's Open Form) and the parties cannot negotiate an amicable settlement. It also occurs in cases in which the owner of the salved property -- whether the vessel or the cargo -- is the United States Government and the salvor chooses not to accept the award set unilaterally by the U.S. Government or through government arbitration. Such cases must originate in federal courts because the Suits in Admiralty Act (46 USC 741-752) and the Public Vessels Act (46 USC 781-790) prescribe that the only tribunals that have the power to make awards against the United States Government in maritime cases are the U.S. federal courts. Thus, commanding officers of U.S. Government vessels do not have the authority to agree to the arbitration clause contained in pro forma salvage contracts such as Lloyd's Open Form;[2] and the master of a private vessel, although he has the power to bind his owner and the owners of private cargo aboard his vessel to the arbitration clause, does not have the power to agree on behalf of the U.S. Government to assign arbitration.[3] The consequence of this is that a salvor of a private vessel carrying U.S. Government cargo may be required to settle the question of the quantum of the award in two tribunals -- the arbitrator specified in the salvage contract and the U.S. federal courts. This is, quite naturally, a potential disincentive for salvors to respond to salvage incidents involving government ships and cargoes. So far as can be ascertained, no other government has such a requirement.

The factors weighed in U.S. admiralty courts in determining a salvage award are:[4]

- The degree of danger from which the property was rescued.
- The value of the property saved.
- The risk incurred by the salvors in securing the property from the impending peril.
- The value of the property employed by the salvors in rendering the service, and the danger to which such property was exposed.
- The promptness, skill, and energy displayed in rendering the service and saving property.
- The time and labor expended by the salvors in rendering the salvage service.

U.S. companies that provide salvage services tend to be more willing than foreign salvage companies to provide salvage services on a daily rate or other contractual basis that is less open-ended than

the no cure-no pay Lloyd's Open Form. Because the majority of U.S. salvors are in the towing business, their historical attitude has been that a mariner in distress is likely to be a customer or future customer; customers deserve less open-ended financial terms.*/ In contrast, in Europe and elsewhere, no cure-no pay arrangements are used more frequently, even in straightforward rescue towing situations.

Salvage Companies

Most companies that conduct marine salvage operations are general marine industrial firms engaged in towing, marine construction or offshore support services. Salvage business for these companies is "the jam on the everyday bread-and-butter business of a towage and salvage company,"[5] because time-critical salvage incidents occur infrequently and irregularly. The sporadic nature of the business makes it particularly important that the managements of these companies be interested in and committed to salvage work. The commitment of effort, in terms of organization and planning, required to respond effectively to time-critical salvage situations can be substantial. A useful guide to salvage states, "Organized facilities are most necessary for efficient offshore salvage work. Improvised facilities sometimes may be successful for some particular situation but improvised facilities could not be relied upon to be successful very often over an extended period."[6] Investments must be made in specialized equipment and trained personnel, and the necessary resources must be marshalled in advance. Vessels, equipment, and personnel not in the possession or employ of the company must be located and cataloged, and arrangements made for their immediate acquisition or employment when needed. To justify these contingency efforts, in the face of business opportunities that are irregular at best, the expected remuneration must be substantial.

The International Salvage Union (ISU), the international trade association of salvage companies headquartered in the United Kingdom, has about 25 members in 15 countries, including the U.S. Among several activities, the ISU has documented and publicized the long-term decline in salvage awards as a percentage of salved values.

Shipowners and Operators

A ship afloat represents a financial investment ranging to hundreds of millions of dollars. Shipowners therefore share with underwriters a substantial concern for minimizing losses due to casualties. Shipowners or operators bear the primary responsibility for responding to emergencies.

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*/Pieter Kleyn van Willigen (SMIT International) 1981, personal communication.

Most shipowners or operators have established procedures to be followed in the event of a casualty. The extent of such contingency arrangements ranges from simple telephone notification procedures to formal policy and guidance, and stockpiling of emergency equipment. A company engaged in the transport of cryogenic liquid cargoes, for example, designed and built a ship-to-ship emergency cargo lightering manifold before the need for one arose. The item was first used in an emergency salvage situation within months of its fabrication.*/ It need hardly be stated that contingency planning for marine emergencies contributes directly and materially to effective emergency response.

Shipowners and others have established various professional associations that engage in a number of research and policy activities. Two of these organizations have demonstrated serious interest in salvage. For example, the Oil Companies International Marine Forum (OCIMF) is a technical organization of the operators of oil company tanker fleets. Its membership in 1978 comprised 45 groups of companies representing approximately 80 percent of the total volume of oil shipped by sea. OCIMF recently published and distributed widely a booklet, Peril at Sea and Salvage--A Guide to Masters,[7] designed as a handy reference for a ship's bridge. It provides specific information on the actions facing the master of a ship in peril. The OCIMF also has sponsored research on the handling characteristics of disabled tankers and basic engineering studies of the emergency towing equipment available on tankers and tugs.

The Comité Maritime Internationale (CMI), which consists of national maritime law associations, is concerned with all legal aspects of shipping. The CMI is often called upon by the International Maritime Organization (IMO) for guidance with respect to the formulation of international conventions that govern world shipping. The CMI recently drafted a salvage convention to update the Salvage Convention of 1910 (U.S.T.S. No. 576), which establishes the international legal framework for salvage. The CMI draft will be submitted to IMO for formal diplomatic consideration.

The Master

A ship's master oversees and directs the operation of the vessel at sea and in port. His authority is vested in him by the shipowner, and can be withdrawn. Notwithstanding the shipowner's rights and interests in this regard, a fundamental principle of maritime law is that the master exercises authority over his ship. The master's responsibility for the safety of the ship applies regardless of jurisdiction or the condition of the ship, whether it is engaged in routine commerce or is in peril on the seas. Unless the master

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*/Warren Leback, Department of Transportation (Maritime Administration), 1981, personal communication.

abandons ship, he is directly responsible for her safety, including compliance with international, national, and corporate safety requirements, and conducting or contracting for salvage as may be necessary.

In certain instances the master delegates his authority, most commonly when he takes a pilot aboard. Even when the safety of the ship is in the pilot's hands, however, the master, except in certain places such as the Panama Canal, retains the ultimate authority and responsibility for the safety of his ship.[8] When salvage is contracted for, the owner or the master ordinarily agrees to the services of a salvage master. The salvage master commands the salvage operation, while the master remains in command of his ship (unless he has abandoned it). (See pages 70 - 73 for a more complete analysis of this relationship.)

Before the advent of modern telecommunications, it was necessary for the master to exercise sole authority over his ship. Today, however, masters often choose to enter into major contracts, such as salvage contracts, only after clearing such actions with their owners. Owners in turn may feel obliged to consult with attorneys and underwriters before entering into substantial contracts. Thus, telecommunications affect the master's actions in two ways. First, whereas in earlier times the salvor nearly always contracted with the master, today the salvor may have the choice of contracting with the master or directly with the owner. (In some cases ships' masters have contracted with salvors, and owners have tried to renegotiate or even renege on the contract.)[9*/] Second, since a cautious master or owner may think his best interests require consultation with advisers and concerned parties, the conclusion of a salvage contract may become protracted. Observers have attributed some salvage failures to the delays caused by protracted negotiations.[10]

Another influence on the master is that while he has authority over his ship, he is not immune from penalties and lawsuits in the wake of his actions. For example, in 1973 the master of the Zoe Colocotroni jettisoned a small amount of cargo to lighten his ship and free it from a strand off Puerto Rico. While this action saved the ship, and may have prevented much more severe pollution that was threatened by the situation, it resulted in protracted litigation and substantial fines.[11]

Insurance

Without insurance coverage for the risks of maritime enterprise, ships would not sail. Thus, insurance is a pervasive influence in the development of the international legal regime within which ships operate and salvage is conducted.[12]

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*/W. Don McLean (Crowley Maritime Corporation) 1981, personal communication.

A fundamental requirement for marine insurance coverage is that a ship be "classed" with one of the world's nine major classification societies. The American Bureau of Shipping is the one domiciled in the United States; Lloyd's Register of Shipping, the largest, is domiciled in London. The original and still the primary function of the societies in support of marine insurance is to establish technical standards for seaworthiness and to ensure that these standards are met during construction and maintained during service. To that end, the societies employ staffs of marine surveyors throughout the world to carry out ship inspections.

Every commercial vessel afloat is involved with several forms of insurance. A hull and machinery (H&M) policy covers damage to the ship caused by perils of the sea (such as heavy weather, grounding, striking objects, and collision), as well as damage caused by fire, explosion, and crew negligence. It also covers salvage awards, and includes coverage for the shipowner's liability for collision damage caused to other vessels and their property (primarily cargo) should the vessel be found at fault.

If a ship were to suffer damage so severe that the estimated costs of salvage and repair would exceed the insured value stipulated in the policy, or if such damage reduced the vessel to a wreck, the owner would recover from his underwriter an amount equal to the insured value. The former instance is termed constructive total loss, and the latter actual total loss. A major exclusion from H&M policies is loss or damage from war or warlike perils. Separate hull war risk insurance is available.

Aside from collision, the shipowner must also be concerned about potential legal liabilities and statutory obligations to third parties incurred in the normal operation of the vessel. The principal risks giving rise to shipowners' legal liability claims are death or injury of crew members; damage to docks and other harbor installations; pollution damage and clean up expenses (including the owner's obligation under the Tanker Owners Voluntary Agreement Concerning Liability for Oil Pollution and the Civil Liability Convention of 1969); and cargo shortage or contamination. Protection and indemnity (P&I) insurance is available to cover these risks. The vast majority of P&I coverage is obtained through mutual associations, customarily referred to as "clubs". A P&I club is a nonprofit association formed by a group of shipowners to provide protection against each other's legal liabilities. P&I clubs usually provide unlimited coverage to their members for all forms of shipowners' legal liability except pollution liability. Existing insurable limits for pollution liability are currently higher than that presently provided for under international agreements, domestic law, and cooperative industry arrangements.

Another major form of marine insurance covers loss of or damage to cargo. Cargo insurance is arranged for by the shippers or consignees of cargo.

Once a casualty has occurred, hull underwriters employ the services of marine surveyors to assess the extent of damage to the vessel and the cost of making repairs. In general, U.S. hull

underwriters are represented at damage surveys by surveyors of the U.S. Salvage Association, whereas London underwriters use the services of The Salvage Association, London. Marine surveyors or consultants also provide damage assessment and repair estimation services directly to shipowners and their admiralty lawyers. The P&I clubs generally call on specialist salvage consultants or local attorneys to advise and assist.

"Average adjusters" allocate expenses to those who should rightfully pay them. Partial loss or damage sustained as a result of an accident (for example, hull damage as the result of stranding) is referred to as "Particular Average" and is borne by the shipowner's hull underwriters. Damages or expenses deliberately incurred in efforts to avert imminent perils to vessels and cargoes (for example, damage to the vessel's machinery caused by working her engines in efforts to refloat) are referred to as "General Average" and apportioned over vessel and cargo on the basis of the values saved.

It is important to point out the very direct relationship between insurance and salvors: the underwriters pay the bills. However, the different kinds of insurance the owner carries can bring conflicting interests to bear in the event of a casualty. The award for salvage services is covered by hull and cargo insurance, while the bill for pollution clean up and third party damages is covered by P&I insurance. The hull insuror may consider a casualty a constructive total loss, and, if this prompts the shipowner to cease recovery efforts, the resulting increase in the pollution risk would run counter to P&I interests.

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NATIONAL POLICIES AND RESPONSIBILITIES

The policies of the United States that address marine casualties concentrate on marine safety and preventing or mitigating pollution. Their expression in statutes, regulations, and actions varies in comprehensiveness and detail, as do the interpretations of those responsible for executing them. Appendix C is a compendium of these U.S. statutes.

The principal domestic laws of the United States that underlie policies pertaining to salvage are the following:*/

- The Cabotage Law (Act of 11 June 1940) restricts the operation of foreign salvage vessels in U.S. coastal waters (within 3 miles of shore) by requiring the approval of a high customs official. Agreements attending treaties are exempt from the act's provisions.

- The Salvage Facilities Furnished by Navy Act of 4 May 1948 (10 USC 7361-7367) designates the U.S. Navy as the government's agent for salvage. It authorizes the Secretary of the Navy to

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*/The policies authorizing the U.S. Army Corps of Engineers to remove wrecks and other hazards to navigation are omitted as specifically excluded from the committee's definition of salvage.

provide salvage facilities by contract or otherwise; to transfer or charter salvage vessels and equipment for operation by private salvage companies; to advance funds to such companies; and to finance salvage operations; to collect and adjust claims for services rendered.

- The Saving Life and Property Act of 4 August 1949 (14 USC 88) authorizes the U.S. Coast Guard, without limitation as to method or place, to "perform any and all acts necessary to rescue and aid persons and property and save property."

- The Clean Water Act of 1972 (33 USC 466 et seq.) establishes federal policy that there shall be no discharges of oil or hazardous substances in waters under U.S. jurisdiction, including the Fisheries Conservation Zone (which extends to 200 miles from shore). The act provides basic operating authority for the Coast Guard's activities in marine environmental protection and in administering the National Oil and Hazardous Substances Pollution Contingency Plan.

- The Intervention on the High Seas Act of 5 February 1974 (33 USC 1471-1487) authorizes the Coast Guard to take whatever measures are necessary to prevent pollution from a marine casualty on the high seas, or to eliminate the danger to the coastline of such pollution. Authority under the act permits the Coast Guard to remove or destroy the ship or cargo that presents such a danger.

Salvage has traditionally been a commercial activity. The growth of federal responsibilities for related activities, notably pollution control, raises questions with regard to the division of responsibilities between the government agencies involved and between the Federal Government and the commercial salvage industry. Internal Coast Guard instructions, for example, require Coast Guard field operating forces to defer to commercial salvage operators if they are on the scene of a casualty; but the appropriate division of responsibilities may not always be clear in such a case (especially when the threat of substantial pollution or loss of life exists). The Navy, similarly, will not provide salvage services if commercial salvage services are available.

Navy Responsibilities

To safeguard its fleet and operations, the Navy maintains and deploys salvage vessels, equipment, and personnel and operates a training school. The Office of the Supervisor of Salvage, U.S. Navy has technical responsibility for these activities. A major concern of this office is the identification and mobilization of commercial salvage assets in case of war or other hostilities.

The Supervisor of Salvage is the delegate representative of the Secretary of the Navy as relates to the various authorities under the Salvage Act of 1948 (10 USC 7361-7367). One of the authorities under

the act is the assessment of the nation's salvage capability. The committee is not aware of any formal assessments of U.S. salvage posture that have been conducted other than this report, and a Navy letter that transmitted the (then proposed) Salvage Act of 1948 to Congress (see Appendix D). The 34-year-old letter makes a strong case for the authorities in the Salvage Act of 1948, and provides interesting background for considering the modern situation.

In the period after 1955, the number and frequency of marine casualties declined world-wide. Acting under the intent of the Salvage Act of 1948 of maintaining domestic commercial salvage capability, the Navy attempted to encourage domestic salvage companies by leasing ships being retired from the fleet and with free wharfage and other subsidies. More recently, the Navy has developed a series of salvage support contracts. For each coast of the United States, a maritime company is under contract to the Navy to provide salvage services as needed and requested. The contracts are essentially sets of prearranged conditions agreed to for the provision of services.

The Navy maintains extensive inventories of salvage equipment in depots around the world for national emergencies. The Navy leases its services or equipment on request to augment private salvage efforts, but only if these assets are unavailable from other sources. The Navy undertakes the salvage of commercial vessels only rarely; from 1976 to 1981, it salvaged just 11 commercial ships, generally working closely with the Coast Guard. The Navy also occasionally leases equipment to commercial salvors. The Navy charges for rescue towing and salvage services and for the use of its equipment; its policy is to charge slightly in excess of commercial rates.[1]

Coast Guard Responsibilities

The Coast Guard's marine safety missions include search and rescue, commercial vessel safety, and marine environmental protection. Search and rescue activities are administered by operations personnel in the Coast Guard districts, where rescue coordination centers are located. Whenever the Coast Guard learns of a casualty that threatens the crew or passengers of a ship, an officer of the Coast Guard takes charge. The Coast Guard Search and Rescue Policy Manual directs this on-scene commander to provide whatever services are necessary to protect life, property, and the public, including rescue towing to the nearest port in which emergency repairs can be made.

Commercial vessel safety and marine environmental protection activities are the responsibility of Coast Guard district marine safety officers. In cases of threatened or actual pollution, a regional pollution-response contingency plan is activated, and the pollution response is supervised or monitored by a predesignated on-scene coordinator, who is a Coast Guard officer (usually the Captain of the Port).

The on-scene coordinator is the project manager for the pollution emergency. He directs federal pollution control efforts and coordinates all other federal efforts at the scene of a discharge or potential discharge. At the outset, the on-scene coordinator determines the nature of the threat posed by the discharge, and whether the person responsible is taking proper action to remove the threat. If so, the on-scene coordinator monitors that action. If not, or if the person responsible is unknown, the on-scene coordinator may take further actions specified in the regional plan, coordinating all public and private efforts for eliminating the threat. In such cases, the on-scene coordinator may remove or destroy the vessel if necessary.

Implementation of the National Oil and Hazardous Substances Pollution Contingency Plan (National Contingency Plan)[2] is overseen by the National Response Team (NRT), which consists of members of all participating federal agencies. The NRT evaluates the effectiveness of regional plans for responding to pollution discharges and for training and equipping response teams. The NRT is activated as an emergency response team when a discharge exceeds the response capability of the region in which it occurs, when a discharge transcends regional boundaries, or when a discharge involves unique hazards.

Regional Response Teams (RRT) prepare for discharges of oil or other hazardous substances and provide coordination and advice during discharges. RRT's consist of regional representatives of the participating federal agencies, and representatives of state and local governments. Affected states are encouraged to participate in all RRT activities. RRT's review regional preparedness to respond to pollution incidents. The RRT is activated automatically in the event of a major or potential major discharge. When activated, it monitors and evaluates reports from the on-scene coordinator, advises the on-scene coordinator, requests other governmental or private aid, and helps the on-scene coordinator with media and public relations.

The Coast Guard has established National Strike Force teams to assist the on-scene coordinator. They are field operations teams capable of providing communications support, as well as other advice and assistance regarding oil and hazardous substance removal, ship salvage, and casualty control. Environmental Response Teams established by the Environmental Protection Agency (EPA), are also available to provide scientific advice to the on-scene coordinator. Finally, a Scientific Support Coordinator is available to provide scientific support.

The discharger of the pollution is liable for the costs of federal removals. Actions undertaken by participating agencies must be carried out under existing programs and authorities as practicable. The Coast Guard administers a revolving fund to cover the costs of pollution clean up operations.[3]

The Coast Guard occasionally takes direct action (under the intervention authority) to avert or control pollution. Most frequently, it takes steps to respond in the early hours after a

casualty has occurred in order to get some kind of a response under way. Later when the owner is on scene and ready to act in a manner considered adequate to the situation, the Coast Guard relinquishes direct control. For example, after the Aikaterini caught fire off Norfolk, Virginia, in February 1981, the Coast Guard made the initial attempts to put together a salvage response. When the owner was ready to act, he employed the salvor that the Coast Guard had arranged for.[4]

Because of their sophisticated network of communications, the Coast Guard often is the first to hear of ships in peril. The Coast Guard is not under any obligation to relay such information to commercial salvors, and in fact, does not regularly do so. For example, when the Blue Hawk, carrying a load of automobiles, caught fire off the California coast, the Coast Guard was promptly notified (and provided assistance). Commercial salvors learned of the fire some 7 hours after the Coast Guard through the news media.

International Perspective

Since marine salvage is a sub-set within the world-wide maritime industry, the rules and practices of salvage do not vary a great deal from one country to another. The international organization with the most direct interest in salvage is the IMO. This deliberative body within the United Nations system has as its sole interest the safety of maritime commerce, including the protection of the oceans from pollution from ships. Under the sponsorship of the IMO, a number of international conventions have been concluded to improve the safety of ships and shipping, and the control of marine pollution from ships. Currently, the IMO is considering draft standards that would require that large tankers be capable of receiving a towing hawser and making up a rescue tow, even in loss-of-power situations. Another topic under consideration is the limiting of a salvor's liability for pollution that may attend or be caused by salvage activities. U.S. participation in IMO deliberations is led by the Coast Guard. The U.S. Navy Supervisor of Salvage has not been extensively involved in IMO deliberations.

A great determinant of a country's interest in its readiness for marine salvage is its recent marine casualty history. The wreck and record spill of the Amoco Cadiz in 1978 motivated the French Government to contract for the services of stand-by rescue tugs at a cost of $5 million per year. After 10 years of maritime accidents, from the Torrey Canyon to the Amoco Cadiz, the United Kingdom apportioned its surrounding ocean area into a series of eight zones for the purposes of salvage and pollution control. Within each zone, the government tries to ensure the ability to respond to marine casualties. As the result of close calls off the Cape of Good Hope, the Government of South Africa has contracted with a private salvor for "preferential call" on the services of rescue tugs when the government deems it necessary to take prompt action to prevent or

mitigate a marine casualty. The United States is not immune from this phenomenon. A series of tanker accidents in the severe winter of 1976 to 1977 precipitated a presidential order to strengthen vessel design, operating and personnel standards, and to improve U.S. capability to respond to marine casualties.[5]

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A REGIONAL EVALUATION OF SALVAGE CAPABILITY

To establish the extent to which the United States has adequate salvage coverage, the committee considered it necessary to conduct a regional assessment, including an appraisal of the risk of ship casualties, a review of salvage capability, and an analysis of the capability to respond to the casualties that are likely to happen through the year 2000.

The committee established separate regional working groups for the eastern seaboard (including the Great Lakes and Puerto Rico and the Virgin Islands), the Gulf of Mexico, and the Pacific coast (including Alaska and Hawaii) for the regional assessment. The regional groups comprised shippers, salvors, and other experts. All were knowledgeable about the special conditions that prevail in their region. The regional groups based their assessments on the data on maritime risks and information on salvage assets compiled by the committee, on site visits to the major centers of salvage activity in the region, and on their considerable salvage expertise and experience. The membership of the regional groups and a list of site visits are given in Appendix A.

The regional groups found it necessary to consider the risks and types of salvage response required and to assess the adequacy of capability for each type of response in the regions. For this, they postulated a series of tests in the form of ship casualty and salvage response scenarios. The scenarios are summarized in Appendix E.

Since the risk of casualties already has been presented (pages 14-25), this section will review available salvage capability and analyze its adequacy.

Eastern United States

The eastern United States includes the Great Lakes, the Atlantic Ocean from ocean-going ports out to 200 miles, and the ocean surrounding Puerto Rico and the Virgin Islands.

Salvage Assets

About 100 offshore-capable tugs and other vessels that may be useful in some salvage situations are home-ported in the eastern region. In June 1981, there were 38 tugs of 3,000 horsepower or greater north of Norfolk, Virginia, and 28 to the south. All were primarily used in open ocean towing. None was built or crewed specifically for offshore salvage or rescue towing, and most have design limitations that hinder their salvage performance. No commercial vessels in service on the East Coast are designed or operated specifically for complex salvage operations such as laying mooring systems in the surf, underwater patching or dewatering, or marine firefighting. These operations are currently handled by placing specialized gear and expert personnel on platforms of convenience or opportunity.

Thus, while all can be considered salvage assets, the available vessels' actual utility must be established on each salvage job. A marginally suitable vessel may be able to perform salvage work under the direction of a salvage master, providing it has been suitably outfitted and crewed prior to its sortie. However, such a vessel is likely to require more time to complete an operation than a more capable vessel, and delays may be critical in many situations.

In addition to these U.S. vessels, fully equipped, modern foreign offshore tugs with substantial salvage capability occasionally transit the East Coast en route between Europe and the Gulf of Mexico or the Caribbean. These ships are permitted under U.S. law to conduct salvage operations to within 3 miles of the U.S. coast. Some salvage jobs are also undertaken by itinerant vessels.

The volume of maritime commerce in the eastern region ensures the availability of many other vessels useful in salvage operations. Barges and itinerant vessels can be used for lightering or as platforms for specialized operations. Offshore supply boats can carry heavy equipment and be used as work platforms. Specialized craft with lifting devices are widely available, though they rarely go offshore and can conduct operations only in fair weather. A few firefighting vessels operate in conjunction with city fire departments, but offshore firefighting increasingly is accomplished with portable pump systems mounted on vessels of convenience.

The Navy salvage vessels in the region are all home-ported in Norfolk, Virginia. In October 1981, three vessels, including one combat salvage ship and two fleet tugs, were in the area. At present, the only fully equipped dedicated salvage ships in the eastern region are the U.S. Navy salvage vessels. The Navy salvage ships represent the only comprehensive salvage capability continually maintained afloat. It is Navy policy that these ships are not to be used in commercial work where adequate commercial assets are available.

The Coast Guard tries to keep at least one large cutter in each Coast Guard district. These cutters are capable of limited towing and can be outfitted with salvage gear. In July 1981, six of these vessels were on the East Coast.

Transportation facilities can be as critical as vessels to the conduct of salvage operations. The eastern region has an extensive and sophisticated transportation network. Any point in the eastern region can be reached by truck from Norfolk, a major port and center of salvage equipment, in 18 hours, and by air in 6 hours. Airports capable of receiving cargo aircraft are numerous. One weakness in the eastern region is the scarcity of commercial helicopters fitted for offshore operations, for lifting, and for exterior cargo operations. Few of the region's helicopter pilots, in addition, are familiar, competent, and confident in conducting such operations. All aircraft operations are vulnerable to bad weather, and helicopters are especially susceptible to weather-induced limitations on range and payload. Furthermore, most helicopters are not equipped with marine frequency radios and thus are poorly equipped to communicate with ships. With the projected growth of offshore oil development in the eastern region, the numbers of helicopters and pilots can be expected to increase.

General purpose marine equipment, such as air compressors, generators, fenders, and hoses, is available to salvors in ports throughout the eastern region. More specialized salvage equipment such as beach gear or high-capacity marine pumps can be found only where it has been specifically stockpiled. Two commercial depots are located in the New York area; two government depots and a commercial depot are situated in the vicinity of Norfolk; and Jacksonville and Miami each have a commercial depot.

Specialized equipment that may occasionally be needed is found in very few other locations. The major repository of portable firefighting equipment in the United States is in Houston, Texas. The only portable gas inerting system in the U.S. is stockpiled for air transport in Galveston, Texas. Back-up capability must come from overseas. Cryogenic hoses for ship-to-ship tranfer of liquefied natural gas (LNG) or liquefied petroleum gas (LPG) are normally stored in Norfolk, but the owner is abandoning the marine business and its availability is not assured.

Adequate numbers of project managers, salvage masters, and salvage engineers are employed by or available to the salvage companies. There are no independent (external to individual salvage companies) standards or qualifications for commercial salvage personnel and no training program other than a basic Navy program directed at covering the Navy's needs. The number of people capable of planning, organizing, and running a salvage operation can be expected to decrease with time.

Salvage personnel other than vessel crews need not be located in the vicinity of a casualty; they can be transported where needed by air within hours. The crews of the tugs or other vessels that undertake salvage assignments are ordinarily drawn from the ranks of

local mariners and may not be experienced at salvage. Their familiarity with salvage operations depends on the local incidence of salvage operations. Probably more mariners with some salvage experience are available in the ports of New York, Norfolk, and Miami (south Florida), which are nodes of salvage activity, than elsewhere in the eastern region.

Companies that engage in salvage in the eastern region are of three types: dedicated salvors, towing companies that maintain some salvage capability (for their regular customers if for no other reason), and other marine companies that occasionally perform salvage or rescue towing on an itinerant basis. The latter type of firm can be found in nearly every major eastern port. The specialist salvage companies in the region are Ocean Salvors Company, (a joint venture of Crowley Maritime Corporation and Moran Towing and Transportation Company, which maintains salvage crews and equipment depots, while relying on its corporate sponsors and other tug operators for salvage vessels); Don Jon Marine Company of New Jersey; Tracor Marine Corp. of Norfolk and Ft. Lauderdale; and SMIT America Salvage, Inc. of New York City (a U.S. affiliate of a foreign salvage company).

The larger salvage companies in the region operate out of New York, Norfolk, and south Florida. Smaller operations are based in New Bedford, Massachusetts, south Florida, Puerto Rico, and elsewhere. While these smaller firms are not equipped to salvage supertankers, ore ships and colliers, or roll on/roll off ships, they can assist coastal freighters and tankers and the like, which experience most of the marine accidents in the eastern region. In addition, a limited rescue towing capability may exist wherever tugs operate -- that is, in every commercial port.

Two of the Coast Guard's strike teams cover the eastern region (Florida is covered by the Gulf Strike Team). They are specially prepared to respond to marine pollution incidents, especially tanker incidents. They maintain full complements of pollution-control equipment, as well as diving, dewatering, and other equipment useful in salvage operations.

The National Contingency Plan governs the federal response to marine pollution in the eastern region, as it does elsewhere. A treaty between Canada and the United States provides that the salvors of each country can respond to casualties of its own flag that occur in the jurisdiction of the other. Marine pollution response is viewed as in each country's interest. In the Great Lakes, for example, a joint contingency plan is in effect and a joint rescue coordination and marine pollution response center is maintained.

There are no designated "safe havens" into which a damaged ship may be towed in the eastern region.

Analysis of Capability

During a recent 8-year period (1973 to 1980), five U.S. salvors responded to 85 time-critical incidents in the eastern region. Forty-two of the responses involved rescue towing and another

28 required removal from strand. Of the remaining 15 incidents, 8 required assistance to vessels in danger of foundering.*/ Approximately 12 of the 85 incidents were categorized as cases of national interest, involving hazardous cargoes, obstruction of navigation channels, potential threats to human life or the environment, or the need for time-critical near-shore rescue towing.

Major salvage incidents in the eastern region are too infrequent to justify a dedicated commercial salvage ship. Salvage in the eastern region will, therefore, probably continue to involve improvised assemblies of assets on an incident-by-incident basis. Such arrangements have so far served the eastern region satisfactorily.

For many tasks, such as control of flooding, dewatering, and other actions taken to stabilize distressed vessels, state-of-the-art technology and equipment are in regular use.

Marine firefighting, however, is another matter. Today's firefighting technology and systems and the level of training are not adequate for most shipboard fires, especially fires involving a breached hull, crude oil, coal, or chemical cargoes. Furthermore, the eastern region has few specialized firefighting systems or crews. Shipboard fires should be fought by trained crews with specially outfitted ships or special portable equipment. The major ports in the eastern region have vessels with some firefighting capability, but most have only water monitors, and little or no foam or chemical equipment. In addition, these harbor firefighting ships can go offshore only in good weather. On the scenes of casualties, only specialized ships equipped with powerful raised monitors are capable of reaching the main decks and superstructures of high-freeboard ships, such as automobile carriers, and LNG carriers.

Given enough time, money, and good weather, anything can be accomplished in a salvage operation. Unfortunately, time-critical situations do not afford that luxury. In salvage situations, the initial actions taken can strongly determine the outcome. This dictates early notification of the owner, government authorities, and other concerned parties; the use of contingency plans; and the institution of efficient communication among the interested parties. Early acquisition and dissemination of specific details pertaining to the vessel and its cargo are particularly important. Casualty management planning for tankers and some other carriers of dangerous goods has increased. This type of planning should be widespread in the shipping industry and should include specific instructions to masters on recognizing casualty situations, assessing damage, and promptly requesting assistance.

In the Great Lakes, because of the low frequency of salvage incidents, few salvage assets are available. Great Lakes tugs normally are not outfitted with towing winches or specialized salvage

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*/The absence of firefighting in the reporting is an artifact of the data. None of the companies have much firefighting capability; thus the data they provided do not include marine fires.

gear. Some specialized salvage gear is available from points throughout the Great Lakes area, but must be assembled and deployed on an ad hoc basis. Perhaps the most significant lack is that of experienced salvage masters and personnel.

Other points of note are the lack of specialized commercial pulling vessels for strand removal operations in the surf and the limited commercial helicopter support services for offshore salvage operations. Offshore-capable commercial helicopters are located in Cape Cod, Massachusetts; Atlantic City, New Jersey; Norfolk, Virginia; and Brunswick, Georgia. These aircraft can transport personnel offshore but are severely limited in their lifting capability. The availability of pilots experienced offshore in marginal weather conditions is also limited.

Gulf of Mexico

Salvage Assets

The Gulf of Mexico has many vessels and much specialized marine logistics and offshore construction equipment because of the extensive offshore oil and gas development in the region. Some of this equipment, and the expertise of the people who employ it, is useful in marine salvage.

The primary area of such operations has been the central Gulf coast extending roughly from Houston, Texas to Gulfport, Mississippi. During the last 10 years, operations have extended west and south of Houston almost to the mouth of the Rio Grande, and some lesser operations have occurred in the northeastern Gulf between Pensacola and Tampa, Florida.

There are about 100 tugs or tug-supply boats in the Gulf of 3,000 hp or greater, and 28 fireboats or tugs equipped with one or more fire monitors. Their concentration is heaviest in the north central and northwestern Gulf, around New Orleans and Houston, and near the major concentration of offshore oil and gas operations. This count of tugs may be low, as a 1981 trade survey showed an additional 40 tug or tug-supply boats.[2] Most of the tugs in the region are equipped with towing gear consisting of winches with hawsers, stern rollers, and stud-link chain and wire rope pendants.

In addition to these commercial assets, the U.S. Coast Guard stations four 210-ft cutters in the region, one each in Brownsville, Galveston, Gulfport, and Tampa. These cutters can be used for rescue towing in some cases. The Coast Guard also operates several 180-ft buoy tenders out of Galveston. These tenders have large (40-ft long by 30- to 35-ft wide) deck work spaces and booms with a maximum lift capacity of 25 tons (at least on the newer boats).

Most of the tug-mounted fire monitors appear to have capacities of about 1,000 gallons of water per minute (gpm) and many have foam firefighting equipment installed. The Gulf region also has a number of dredges with pumps that can handle 15,000 to 20,000 gpm of water. These pumps are potentially useful for structural cooling rather than firefighting itself.

There is little precise information on derrick barges or other heavy-lift crane-carrying ships. However, the offshore oil and gas construction industry in the Gulf is known to have large amounts of such equipment. A survey of this equipment in the Gulf region lists eight construction derrick barges with lift capacities up to 500 tons, ten with capacities from 500 to 999 tons, and five with capacities of 1,000 tons or more.[3] However, the availability and usefulness of these assets in time-critical situations is problematical.

The large number of supply and work boats in the Gulf can accommodate portable diving (and other) equipment.

Supplies of equipment useful in salvage are found throughout the Gulf. Major locations of this equipment, in addition to the centers of oil and gas activity, include recently established commercial salvage logistics depots in New Orleans, Houston, and Galveston, and the U.S. Coast Guard strike team base in Mississippi.

The major sources of specialized firefighting equipment are the oil well firefighting companies. Typically, portable equipment used to fight shipboard fires includes 4,000-gpm water pumps, foam equipment, and other related packages. At least one oil well firefighting company, Boots & Coots Company, has some shipboard firefighting experience and markets its services in this area. Since the marine, oil-drilling, and oil production industries use many high-volume, high-pressure pumps, fairly large commercial inventories of such gear are maintained in the Gulf region.

Pumps, hoses, and other equipment for use in lightering and dewatering operations are similar in type and availability to the firefighting equipment. The heavy concentration of petroleum production and transportation industry in the Gulf region assures the ready availability of tank barges and small tankers for receiving off-loaded liquid cargoes. Supply boats and offshore construction barges in the Gulf offer similar receptacles for off-loaded dry cargo.

The Gulf region is a major center of the diving industry and therefore contains several concentrations of diving and diving-support equipment. At least 48 firms offer diving services along the Gulf coast.[4] Much of the diving equipment is portable and can be readily transported and mounted on vessels of opportunity.

As noted before, the Gulf area enjoys a concentration of all types of marine personnel. The region's experienced salvage personnel are difficult to inventory, however, because no standards or lists have been established. In any event, the ready availability of air transport makes salvage personnel from other regions almost as readily available to the Gulf coast as the local personnel.

In the general field of maritime transportation, the LNG transport industry has probably been the most conscious of the advisability and benefits of contingency planning as related to marine casualties. The petroleum exploration and production industry has, however, also become more appreciative of contingency planning benefits during the last decade. As a result of this fact and of the large role that petroleum plays in maritime traffic in the Gulf, it is believed that there will be a trend toward increased contingency planning, at least in the petroleum transport field, in the Gulf region.

Response times to any point in the Gulf region range from 1 to 2 hours for helicopters on personnel-rescue flights and 10 to 20 hours for vessels on rescue towing, firefighting, or pollution-prevention actions. With helicopter speeds of 100 kn or more and rescue vessel speeds of 10 kn or more, such response times can be achieved out to 200 miles offshore.

Proximity to Cuba and Mexico have not created risk or response problems in the past. The U.S. maintains a reciprocal treaty with Mexico concerning salvage. In addition, a U.S.-Mexican marine pollution contingency plan is in effect, and contributes to readiness and rapid response.

Analysis of Capability

The Gulf region is responsible for almost half of U.S. tanker traffic and almost one-third of the dry cargo ship traffic. Projected changes in trade, traffic, and the number of offshore structures will not significantly alter the risks of shipping casualties in the region. However, the character of maritime trade in the Gulf of Mexico will change in the future so as to affect the salvage assets that may be needed. These changes include:

- An increase in coal export trans-shipments from river barges to sea-going colliers in Gulf ports.
- A shift in the character of tanker traffic from crude oil imports and exports to exports of refined products and petrochemicals, which are generally more toxic and hazardous than crude oil.
- An increase in the traffic of hazardous materials, including spent nuclear reactor fuels and nuclear wastes.
- Possible increases in the traffic of toxic wastes destined for offshore incineration or other disposal.
- Continued extension of offshore oil and gas operations to deeper waters, and an increase in the number of offshore structures.
- Construction of a limited number of additional offshore ports, and probable increases in large tug and barge traffic.

The salvage capability of the Gulf region is adequate for the current and projected future situation, even with specific management and technological deficiencies.

Management Deficiencies As in other regions, the incidence of marine casualties in the Gulf is not sufficient to sustain commercial interest in salvage. The operational readiness and responsiveness of the companies in the Gulf region that have some salvage capability might be high as a result of their long and close association with the relatively dynamic offshore oil and gas industry. Their effectiveness is not established, however, because of their possible lack of availability for emergencies. Furthermore, the assets (including personnel) that have been described are controlled, developed, and used by organizations whose primary business interests are other than the salvage of ships. The operational readiness of salvors is also hampered by the absence of centralized locators or directories for salvage personnel and equipment.

Many ships do not carry drawings and casualty-control manuals. Ready access to these kinds of information can assist rapid response to an emergency. Operational plans for marine emergencies also assist emergency management. These should clearly explain the decisions that must be made and the responsibilities of the master and government authorities. Outside of major oil company fleets, such planning is the exception, not the rule. Ship operators also do not appear to have discussed with companies that provide salvage services possible contractual terms in advance of need.

While the Coast Guard has a great deal of experience in managing the government response to marine pollution, their management of situations involving salvage is hampered by a lack of specific experience. Salvage is not directly addressed in the National Contingency Plan. There are no guidelines to assist a Captain of the Port in deciding whether to allow a ship in peril to enter U.S. waters, or where to anchor for emergency repairs.

The National Contingency Plan provides an adequate mechanism for contact and coordination with scientific experts. However, those responsible for responding to an impending marine casualty need ready access to detailed information about the major characteristics of the ecosystems which might be adversely affected by either the salvage strategy adopted or by a futile salvage effort. Little of real value is available for emergencies in this regard.

Technical Deficiencies First and foremost is a lack of either dedicated or purpose-built rescue tugs, shore-side stores of salvage gear, and special craft such as pulling vessels, heavy-lift vessels or lightering barges. However, general purpose tugs, special craft, and stores of salvage gear are abundant in the Gulf region, and some may be available at any time.

Firefighting technology is more advanced in the Gulf than elsewhere, but recent technological advances require adaptation for use in shipboard fires. Shipboard firefighting equipment is not standardized. Ships, including rescue tugs, offshore supply boats and large ships, are in the main not equipped with state-of-the-art equipment and supplies. Portable inerting systems are not readily available. Few personnel have shipboard firefighting experience (especially with coal fires).

There are no standards of qualifications for training and evaluating salvage personnel. A shortage of competent, trained salvage personnel may surface in the future.

While the Gulf is well endowed with helicopters, the majority of commercial helicopters do not carry marine radio frequencies. Thus communications with ships is difficult.

The tugs that operate in the Gulf do not often experience heavy weather and therefore may be less prepared for it (equipment and manning) than tugs that operate elsewhere. Also, most large ships do not carry emergency towing gear; nor are they equipped for emergencies with redundant auxiliary power fore and aft.

Pacific Region

The Pacific region encompasses Alaska, the Pacific coast of the United States, Hawaii, and the U.S. Pacific territories. The area of coverage is vast. Local shortages, distances to be covered in providing salvage services, and severe weather could act against some salvage operations. Recently, however, the salvage companies have made sizable investments in ships and equipment.

Alaska

The question of remoteness and its implications for the adequacy of available salvage capability looms large in Alaska because of the vastness of the state (Figure 2), the harsh physical conditions that prevail, the sensitivity of its environment, and the importance of the development of Alaskan resources to the nation and the probable increases in maritime traffic that will accompany that development.

Ammonia, LNG, and oil are cargoes of particular interest exported from Alaska. The oil terminal at Valdez is the terminus of the Trans-Alaska Pipeline (TAPs) that traverses 800 miles from Prudhoe Bay to the ice-free port of Valdez. The pipeline is designed to handle 2 million bbl per day but currently handles 1.5 million. The terminal can accommodate four tankers at once and turns them around in about a day. During 1981, a total of 547 million bbls of oil were loaded

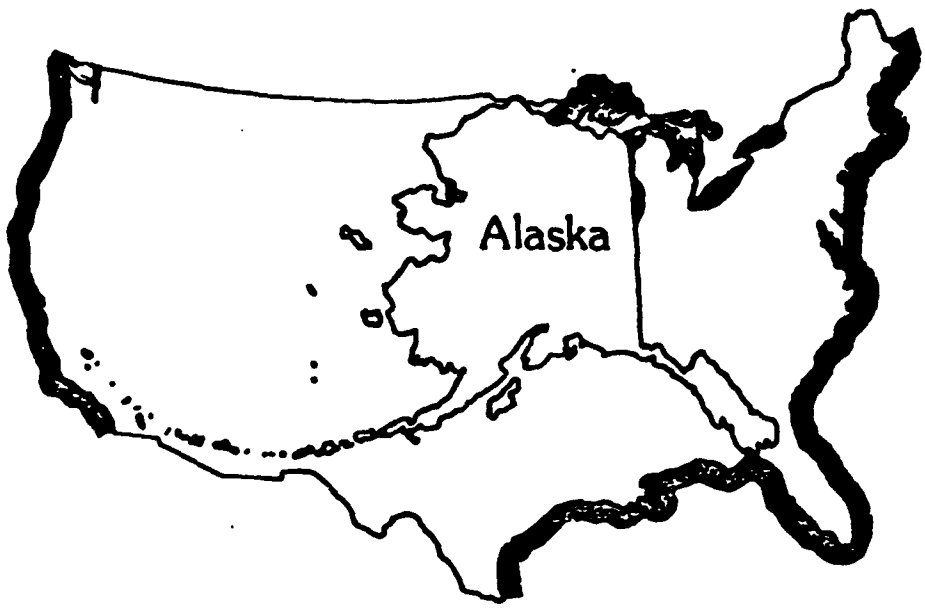

Figure 2 A comparison of the State of Alaska with the conterminous United States. Adapted from Alaska Geographic, 1980. Reston, Virginia: Rogers, Golden and Halpern, Incorporated, 1981.

during 735 tanker visits. This represents about 10 percent of U.S. domestic oil production. The National Petroleum Council has cited the Valdez Oil Terminal (VOT) as a model for future marine terminals.[5] Except for the presence of seasonal ice and large tides and tidal currents in Cook Inlet and elsewhere, the environmental conditions that prevail in the region are not dissimilar to those elsewhere in the Pacific Northwest.

In the far north, the presence of ice has precluded the operation of year-round ports, although year-round transportation of petroleum in ice-breaking tankers has been shown to be technically feasible and is being considered. Commercial fishing in large ships is restricted

PHOTO 3 The question of remoteness and its implications for the adequacy of available salvage capability looms large in Alaska. Cook Inlet, Alaska, March 1982

to the short navigation season, approximately July through October. A nationally significant trade in the north is the annual run of barges carrying oil field supplies to the North Slope and resupplying military installations and local villages and towns. This seasonal traffic is substantial. To date, more than 700,000 tons of oil field supplies have been barged to the Far North.

Alaska's bountiful resources are only beginning to be tapped. Rapid development is anticipated. Even so, the volume of maritime traffic is not large. Alaska's distinction is more directly related to its diverse nature, and the extraordinary risks due to weather and remoteness, than to the volume of maritime traffic.

PHOTO 4 The supertanker Arco Fairbanks (122,000 dwt) transitting the Narrows, Valdez, Alaska, March 1982

Salvage Assets

In June 1981, 75 tugs of 3,000 hp or greater and about 167 large American barges were operating in the Pacific region. Helicopter and air logistics services are found throughout Alaska, in the Pacific Northwest, and elsewhere in the region. The Pacific region, unlike the other two regions, has two specially designed salvage vessels, both are primarily pulling ships specially fitted to cope with strandings. The Salvage Chief, operated by Fred Devine Diving and Salvage Company, is a converted Navy LSM and is home-ported in Astoria, Oregon. The Arctic Salvor, an ice-strengthened former offshore supply boat, was refitted by the Crowley Maritime Corporation to accompany the annual convoy of barges that carry supplies to the oil and gas operations on Alaska's North Slope.

Five companies that operate salvage-capable vessels or employ salvage masters are located in the Pacific region. Of the approximately 50 salvage masters in the United States, 18 live and work in

the Pacific region. These may be assisted by one of the region's six firms with salvage engineering experience; for many of today's ships, assistance from a salvage engineer or naval architect experienced in salvage assessments may be vital. The Pacific region also has 11 marine chemists or firms, one company able to offer advice on the handling of LNG (in addition to the LNG company itself, should one be involved in a casualty), two water-damage experts, eight heavy-lift marine contractors, and two companies specializing in explosives.

The U.S. Navy operates 5 salvage ships in the Pacific region, all based in Hawaii, and maintains a depot of salvage equipment and supplies in Stockton, California.

The U.S. Coast Guard has one ship with true rescue towing capability, which is also fitted and manned for limited salvage work -- the Yocona, home-ported in Astoria, Oregon. The Yocona, a Navy ARS transferred to the Coast Guard, is outfitted with a self-tensioning towing winch. High-endurance cutters operate in the region; one or two are usually off Alaska. These and other Coast Guard vessels, including ice breakers and buoy tenders, have very limited salvage capability. The Coast Guard Pacific Strike Team is based in central California. Their modular equipment includes portable high-capacity pumping systems, including a system capable of handling viscous oil at low temperatures.

Analysis of Capability

The Pacific region suffered 32 serious marine casualties in the period 1976 to 1979, according to records of the U.S. Coast Guard, and over the period 1973 to 1980, salvage and towing companies report responding to 87 incidents requiring rescue salvage. Of the latter number, 45 percent necessitated rescue towing, 29 percent removal from a strand, 18 percent response to foundering, and 3 percent firefighting. Although none of the casualties in the Coast Guard records is accounted an incident of pollution, the risks of pollution are of serious concern in all areas of the Pacific.

Physical salvage assets and capability are generally adequate in the Pacific region, with two exceptions: trained personnel for fighting major shipboard fires; and technology for dealing with some hazardous cargoes. As awareness of the problems of hazardous cargoes continues to grow, the latter situation may improve.

Rescue towage coverage of U.S. waters in the Pacific is generally adequate. Some local shortages may affect the time-criticality of certain types of salvage operations or operations in certain locations. While maritime activity in Alaskan waters will experience the greatest percentage increase in this region, real growth will be small; commercial salvage coverage is expected to keep pace.

The limited number of trained and experienced salvage masters now available is considered adequate, as is the number of tug masters experienced in rescue towing in the Pacific. A sufficient number of motivated and committed salvage companies is operating in the Pacific region; nevertheless, attention must be given to the replacement of today's salvage masters, in times of declining marine casualties.

Ice conditions present unique difficulties (and occasionally opportunities) in salvage operations (as do other severe environmental conditions). The commercial salvage companies in the Pacific region appear prepared for salvage in the locations where they operate in Alaska, with the exceptions noted earlier in firefighting and contingency planning.

Experience in the Pacific region with salvage incidents requiring international cooperation has shown that existing international and bilateral agreements with Canada and Mexico have worked well, and have not inhibited any necessary response. Cabotage laws have also not adversely affected any necessary response.

Suitable ports of refuge exist in the Pacific region where damaged ships can be taken for repairs. However, since the Coast Guard grants access to protected waters on a case-by-case basis, a damaged or leaking ship might have difficulty obtaining approval to enter these waters. For example, Puget Sound remains closed to loaded, intact tankers over 125,000 dwt, let alone damaged ships. Thus, the availability of safe havens is questioned.

Institutional arrangements are generally satisfactory, but shipboard, local, and regional contingency planning for marine emergencies should be improved.

Salvage Capability in Alaska More often than not, when a ship of marginal value gets into trouble in the remote regions of Alaska, it is not salvaged because of the difficulty of conducting salvage operations in heavy weather, the time involved in getting assets to a remote location, or, most important, the high cost of salvage operations under these conditions.*/ When a casualty poses a substantial pollution threat to the marine environment, the Coast Guard, under its intervention authority, has on occasion destroyed it.**/ The Coast Guard has used the U.S. Navy Explosive Ordnance

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*/Two recent incidents are the destruction of the Ryuyo Maru No. 2 and burning of its jet fuel cargo after it stranded near St. Paul Island, in order to keep long-term pollution from a nearby seal rookery; and, in 1981, the burning of the fishing vessel Dae Rim and its diesel fuel cargo after it stranded near Attu Island in an area that was soon to be occupied by returning migratory waterfowl and marine mammals.

**/Captain Ray Spoltman (Captain of the Port of Anchorage) 1982, personal communication.

Demolition (EOD) team based at Adak, Alaska, in the Aleutians, in these operations. This pattern of no salvage or government elimination of a pollution threat is reinforced by the lack of salvage assets in the region. When (infrequently) a salvage operation is conducted, it is likely to be undertaken by one of the companies that conducts salvage in the Pacific Northwest, and which may have a tug operating in the region (more likely in summer than in winter).

With the exception of itinerant tugs (usually with barges in tow), and a few pumps and other salvage gear at Anchorage and Valdez, there are, with certain specific exceptions, virtually no salvage assets in Alaska. Other exceptions include the annual barge convoy to the North Slope, the Navy EOD team at Adak, Alaska, in the Aleutians, and the tugs and portable pumps at the Valdez, Alaska, oil terminal.

- North Slope The Arctic Salvor accompanies the annual movement of barges to the North Slope. The services of the Arctic Salvor are contracted for by the owners of the cargo shipped. Thus, at present, there is some dedicated, but generally committed or obligated commercial salvage capability in the Far North during the short navigation season.

- Adak, Alaska From the Second World War until 1974, the Navy stationed a salvage ship at Adak, Alaska to provide salvage coverage for Military Sealift Command vessels plying the great circle route to the Far East. Since the Navy salvage ship departed, no commercial salvor has filled the breach. Recently, several West Coast salvage companies have considered stationing a rescue tug at Dutch Harbor, at least during the busy fishing season.

- Valdez, Alaska The committee was especially interested in auditing the salvage posture at Valdez because of the importance of the oil terminal to national security, the extraordinary environmental sensitivity of Prince William Sound, the fact that the Valdez Oil Terminal (VOT) and tanker operation will be cited as a model for future maritime developments in Alaska, and because in 1980 a fully laden supertanker, the Prince William Sound, nearly drifted upon the rocks after losing power. The Prince William Sound mishap was, in part, caused by the inability of those involved to complete a rescue tow hook-up in adverse weather conditions with available expertise, equipment, and vessels.[6]

  Difficult navigating conditions -- wind, rain, snow, or other heavy weather or low visibility -- occur more than 6 days out of 7 year-round in Prince William Sound. The passage itself is fjord-like and constricts to less than 900-yd wide at its narrowest. Small icebergs are another hazard. The Coast

Guard operates a vessel traffic system which provides navigation and communications assistance. Nevertheless, it is especially important that the ship's plant and navigation equipment be maintained properly so that risk of accidents can be kept to a minimum.

Steps have been taken to improve salvage capability in the area since (and as a result of) the failed rescue tow in 1980. A Coast Guard investigation of the 1980 incident recommended that the tankers calling at Valdez be equipped with emergency towing equipment. The tanker operators have established a voluntary program for this and, 2 years later, about one-fourth of the tankers have been fully equipped and three-fourths of the vessels have been at least partially equipped. The pre-rigged towing package provides additional "insurance" throughout the voyage and is perhaps most helpful in the restricted waters of Prince William Sound where the chances of having the time to hook up a tow are minimal.

The towing capability at Valdez has been upgraded. At the time of the failed rescue tow in 1980, the tugs at Valdez were manned and equipped for the berthing services in which they were regularly engaged, and not for towing work, not to mention rescue towing work.*/ The 1980 experience caused the operators of the tugs and those who contract for their services to recognize the importance of also having towing capability at this location, and an effort has been made to upgrade the capability.

The question arises as to whether these tugs comprise a regional salvage asset or are dedicated to the Valdez service. In the event that the tug operator wants to proceed to a salvage (or other) assignment elsewhere, he must secure the permission of the operators of the VOT. Terminal managers have indicated that they will make the decision on the basis of the need for tug services at the terminal. That a tug would be made available where life is at stake is virtually assured, according to terminal managers. The freeing of tugs for the saving of property would be on a case-by-case basis. In practice, tugs from Valdez have been released for short-term salvage work elsewhere in Alaska on at least two occasions.

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*/ The operators of the VOT have contracted for three tugs to engage in firefighting and pollution cleanup, as necessary. Under separate contracts, the three tugs provide berthing services to the ships that call at the port, and also escort them through the narrows (a Coast Guard requirement). The escort tug is available to give a ship a nudge to keep her in the traffic lane, should such assistance be necessary.

There is a pattern in Alaska of industry providing its own salvage planning and coverage. As oil exploration and development gets under way in western Alaska, additional commercial salvage assets will possibly move to the area, perhaps Dutch Harbor.

All Pacific The Pacific region's capabilities in the four types of salvage operations can be ranked as follows: (1) rescue towing, (2) removal from strand, (3) prevention of foundering, and (4) firefighting. This order parallels the incidence of types of salvage operations cited earlier.

Rescue towing capability in the region is good. While a salvage-capable tug may be difficult to find, a tug of marginal capability may be available, and it might keep the situation from worsening until a more powerful tug arrives.

The salvage industry and the Navy together display adequate capability to remove ships from strands in the Pacific region, though the conditions of some strandings may obviate any salvage response. Strandings are few and their frequency is declining.

Pumping capacity and the availability of equipment for preventing ships from foundering are adequate. The ability to helicopter equipment and people to the scenes of casualties enhances this capability, but in particular cases transportation delays and those owing to weather and other causes may present problems. The advantages of a salvage ship in dealing with offshore founderings are considerable. The Pacific region has two such vessels.

Firefighting capability for major tanker and cargo-fed fires at sea is limited, although capability is adequate for engine room and other shipboard fires.

The importance of fisheries, marine mammals and rookeries, and recreational uses of coastal areas in the Pacific region emphasizes the need for time-critical responses to marine casualties. Public concern about the prevention of marine pollution is especially strong in the Pacific region. Industry and government are aware of this concern, and sensitive to it.

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THE NATION'S SALVAGE POSTURE

The nation's readiness to provide effective salvage services — that is, its posture for salvage -- is shaped by the conditions of the marketplace; the state of technology; the planning and readiness of ship operators, salvors, and the Federal Government; the health of the salvage industry; and national policy. These molding forces are assessed in this chapter.

Winds of Change

The winds of change have blown for more than three decades since the end of World War II and have drastically altered the way commercial salvage is conducted. Navigation has improved, and accidents at sea are relatively fewer. There are fewer cases for salvors today than in the past. On the simple basis of numbers of casualties it is no longer profitable to keep even a salvage-capable vessel on station, ready to respond immediately to ships in peril, let alone to build and maintain on station a purpose-built salvage tug. Also, without regular work it is difficult to train salvors, to retain experienced personnel and vital assets, and to maintain corporate interest in salvage as a profit center. Two U.S. companies that engage in salvage cite protection of their own fleets (and those of customers) as a major motivating factor for their salvage

readiness.*/ But while there are relatively fewer casualties, the sizes and complexities of the vessels and cargoes at risk have risen dramatically. Thirty years ago the supertanker, the bulk ore ship, the container ship, and the RO/RO were beyond the dreams of most mariners. The larger and more complex the ship, the greater the values afloat and the more cargo likely to be at risk; thus, the consequences of particular accidents are likely more than ever to be severe. One might think responding to incidents involving larger ships, more complex cargo handling systems, and so forth, would result in higher awards to salvors. However, salvage awards, as percentages of values saved, have actually decreased in the past decades.[1] Furthermore, the salvor's award normally depends on successful completion of the job. The larger and more complex the ship in peril, the larger and more complex the salvage job is likely to be. The costs that the salvor incurs on these jobs are likely to be higher, while the chances of success may be lower. Also, until 1980, the actions of salvors against oil pollution have not figured in the calculation of the salvor's award, although salvors are liable for pollution that occurs as a result of their actions.

Dramatic improvements in communications have also had profound effects on the salvage world. In the days before radio, and especially before satellite communications, the master of a ship exercised independent authority over his ship. Today most masters are able to communicate directly and instantaneously with their owners. As a result, salvors today are hired by owners as well as by ships' masters. The owner, with the advice of lawyers, comptrollers, and underwriters, often considers himself more able than the master to negotiate a good deal with the salvor. The master, who may be eyeing a fast-approaching lee shore, is likely to recognize the gravity of the situation more quickly and to hire the first salvor on scene. Thus, the salvor's situation has gotten more complicated. Contracting with the highest authority willing to do so is in the salvor's interest. In addition, his hiring and operations are prone to the interruptions and delays consequent on securing the commercial or government approvals or advice that were not necessary in the past.

Innovations in logistics have facilitated changes in salvage operations. The use of purpose-built and dedicated ships equipped with all manner of specialized equipment used to be the only way that salvage could be conducted. Such ships have become too expensive to build, and possibly to maintain, crew, and operate for the amount of income they can produce (see Appendix F). Salvors have found it necessary to explore alternative means of storing assets and moving them to the scenes of casualties. Today awkward and bulky salvage gear such as anchors, pumps, hoses, patching and diving equipment and so on are most often kept in depots ashore, stored in container

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*/Admiral Edmund J. Moran (Moran Towing and Transportation Company) 1981, personal communication. Leo Collar (Crowley Maritime Corporation) 1981, personal communication.

PHOTO 5 Today awkward and bulky salvage gear is kept in depots ashore. Salvage pumps stored on pallets ready for rapid deployment at Fred Devine Diving and Salvage Company, Portland, Oregon, September 1981. Photo by B. Glenn Ledbetter.

modules ready for transport to the scenes of casualties by truck, plane, helicopter, or vessel (sometimes all four). When the call comes for salvage, the salvor is likely to locate a suitable tug or other available working platform of opportunity in proximity to the casualty. He will then assemble his salvage teams and needed equipment and transport all to the casualty. In many cases the assets that are assembled in this way arrive at the casualty in advance of the tug, which is indispensable, but whose arrival is limited by its speed and sea conditions.

Significant marine pollution has come to be regarded as unacceptable by the public, and the objective of minimizing pollution is addressed by national laws and international treaties. Nearly every ship afloat can pollute the oceans if it is severely damaged or lost. Should that pollution occur close to shore or near valuable

resources, it may have severe consequences even in instances involving the spillage of small quantities of hazardous substances. In many cases the prevention or clean up of pollution becomes the overriding concern when a casualty occurs. This is a far cry from the traditional situation, in which the motivation for salvage was solely the saving of property. This new situation poses a very real and troubling predicament in cases of casualties that threaten devastating pollution, but in which the ship and cargo are not valuable enough to motivate commercial salvors to respond on traditional terms.

Salvage Technology and Planning

While most voyages are routine, a number of circumstances can demand the saving of property by rescue towage or offshore salvage.

- Machinery failure Machinery failures include loss of propulsion, loss of steering, and breakdowns in cargo or habitability systems. If a vessel loses propulsion it will, after losing headway, drift under the influence of wind, waves, and currents. In coastal waters if the drifting vessel is set toward shore and is unable to anchor, a rescue tow may be urgently needed. A barge whose tow is lost or broken will suffer a similar fate.

  A loss of steering in restricted waters or near a weather shore may put a vessel in imminent danger. Vessels equipped with multiple screws can often minimize the danger by using the engines to accomplish some steering. If repairs cannot be made in time, then a rescue tow is needed.

- Loss of Buoyancy Structural failure, collision damage, groundings and strandings may cause a vessel to take on water through holes in the hull. Hull patching and other casualty control measures then need to be taken, and the ship needs to be dewatered and/or lightened by the removal of cargo.

- Fire One of the most dangerous and difficult threats to a vessel's security is shipboard fire. Any kind of fire can require externally-provided firefighting assistance. Cargo fires, because of the many different kinds of cargoes, presenting different hazards, and because of their volumes and inaccessibility, may be very difficult to control. Fires in accommodation spaces or the engine rooms can also destroy ships.

- Cargo A vessel may require salvage assistance because its cargo has been improperly loaded and is consequently unduly stressing the vessel, or because the cargo has shifted in heavy weather. In either case, the stability or structural integrity of the

vessel may be threatened or damaged. Cargo can also be damaged by sun, wind, seawater, fire, or contamination or even hazard to the ship's own structure. Liquid cargoes can leak, resulting in cargo or water contamination. Such situations can lead to more serious casualties and pollution. Offshore salvage may prevent the worsening of such casualties.

- o Other Other threats to a ship's security include human failure, mutiny, barratry, piracy, insurrection, hijacking, and damage inflicted through hostile action. Any of these situations could conceivably result in a requirement for rescue towage or offshore salvage.

Rescue Towage

A rescue tow is initiated by a tug's establishing communications with a distressed ship and transitting to (and locating) her. Next, the rescue tug will maneuver, rig, and pass appropriate connections to make up the tow. Then the rescue tug will apply engine power and attempt to maneuver the distressed ship out of harm's way. Proper equipment together with the skills of rigging and towing are necessary.

Rescue towage is invariably an ad hoc operation. Thus, the readiness of the tug and crew and the planning for contingencies are paramount. The more ad hoc the operation, the more imperative is detailed advance planning.

Rescue Tugs Tugs can be purpose-built for rescue towing; however, any vessel capable of passing and rigging an appropriate towline can attempt a rescue. The following are some design considerations for rescue towage.

- o Power and Seaworthiness A rescue tug should have sufficient pulling capability to accommodate the casualties it is likely to encounter and the seaworthiness to function in high sea states. The power of the tug may be expressed as horsepower or bollard pull. Horsepower may be described in several ways.[2] Static bollard pull is an actual measurement of a tug's pulling power following prescribed procedures. Classification societies issue bollard pull certificates, but this practice has not been common in the United States. The use of too much power can be as dangerous as too little in towing. The power applied to any tow must be commensurate with the strength of the towing system, and weather and sea state, as well as the size and general condition of the tow.

PHOTO 6 Working the towline in rough seas aboard the Abeille 45. Photo by Les Abeilles Company.

- Towing Arrangements The dynamic forces of the ocean environment impose variable loads on the towing assembly. Point-to-point towing assemblies usually have newly rated safe working load at least double the tug's rated static bollard pull.[3] Towing assemblies designed specifically for rescue may have rated breaking strengths as much as five times the tug's static bollard pull. Dynamic or shock loading may be damped by four means: a towline long enough to form a catenary, addition of a synthetic hawser, addition of a length of so-called "surge chain," or a constant tension (sometimes called automatic) towing machine. In open-ocean towing, it is nearly always possible to stream a long towline and form a catenary. In close-in and heavy weather situations, this method of damping dynamic loads is rarely feasible.

To make up tows on short notice, a rescue tug must be of suitable design and be able to carry a generous and varied mix of gear. The rigging of tows in adverse circumstances is facilitated if the open work spaces, especially the after-deck or fantail, are reasonably dry. Rescue tugs should also be highly maneuverable. Twin screws and bow thrusters can be useful features. A rescue tug needs to be fitted with winches, capstans, and so forth for manipulating messenger lines and controlling the towline, particularly at short scope and in rough seas. Any vessel which engages in rescuing vessels in distress should be equipped with heavy-duty line-throwing gear. It also needs to carry a generous supply of equipment and hardware, such as pendants and shackles, that it might need because in rescue situations opportunities to obtain additional supplies from a shore base after the tug has departed are few.

Personnel The personnel that undertake a rescue tow are nearly always the regular crew of the rescue tug. Thus, the success of the operation depends largely on the master's experience with these specialized operations and with offshore towing in general. The number of deckhands available for rigging, their skill, and their enthusiasm for a possibly difficult and dangerous task are also important. The comments on personnel in the following section on offshore salvage are also pertinent to rescue towage personnel.

Offshore Salvage

Offshore salvage operations call for diverse capabilities on the parts of ships, equipment, and personnel.

Offshore Salvage Ships and Equipment While ships intended for offshore salvage should be self-contained, a full complement of equipment would require a larger hull than is otherwise commercially practicable. A basic and realistic operational concept in designing and outfitting a ship for offshore salvage service is to provide a reasonable allowance of equipment for the most common casualties, with other equipment kept in readiness at a shore support base.*/

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*/This concept is distinct from the classical commercial salvage ship and also from U.S. Navy combat salvage vessels. The classical commercial salvage ship is a vessel whose primary design features maximize workshop capabilities and pulling. Because of the necessity of operating in remote areas for extended periods, Navy combat salvage ships (ARS and ATS) contain a plethora of equipment and capabilities not required of commercial vessels.

Following is an outline of the kinds of equipment that one may find on a ship intended for offshore salvage work, and also at an operating base on shore.

- o Firefighting equipment Pumps and monitors capable of handling water and aqueous firefighting foam should be sized to handle a large fire on a large ship.

- o Pulling gear Ships intended for offshore salvage may be rigged to refloat stranded vessels by pulling with winches and the ship's engines. This operation may be assisted with beach gear (a system of embedment anchors, wire rope, and purchases).

- o Hull patching, structural repair, and dewatering equipment Ships intended for offshore salvage need to carry an assortment of portable salvage equipment, including pumps, generators, compressors, welding machines, and so forth. Equipment should be rugged, self-contained, and packaged for transport by work boat or helicopter. Salvage ships also need to carry work boats, and should be capable of supporting shallow diving operations incident to hull survey and underwater repair operations.

- o Weight handling A ship intended for offshore salvage service may be equipped with cranes for handling equipment onboard and over the side, or for handling cargo on a distressed vessel.

- o Lifting gear In some situations, the ship is used to apply lift to a heavy object, such as a sunken ship. Bow or stern rollers may be useful in rigging this type of lift This capability is usually associated with military salvage and is not ordinarily included in commercial salvage.

Personnel The team that undertakes salvage operations is constituted especially for the job at hand. Often, a project manager, a salvage master, a salvage engineer, a salvage foreman, the salvage crew, divers, and consulting experts comprise the salvage team.

The salvage master has traditionally been the operations manager. A salvage master should have enough salvage experience that masters, owners, operators, and underwriters entrust the conduct of salvage operations to him. In the classical sense the salvage master served as project manager; in modern practice, especially on complex cases, a senior salvor is assigned as project manager.

The relationship between the salvage master and the master of a ship in peril depends on the type of contract that has been agreed to. In the case of a no cure-no pay contract, the salvage master or project manager is nominally in total charge of the operation. While the ship's master may remain on board and continue in command of his ship, he is inhibited from controlling the salvage operation lest

he jeopardize the salvor's plan and overtake the no cure-no pay situation. When salvage services are contracted for at a predetermined rate, the master (or his management) will likely exercise more affirmative control over salvage operations.

Often, salvage operations must be initiated before all the facts necessary to an engineering solution are in hand. To be able to read the signs and signals of lost buoyancy, hull buckling, flooding, scouring, and other facts, the project manager or salvage master needs a great deal of both knowledge and intuition that can only come from years of experience.

Salvage masters are judged by the quality and success of the salvage jobs they have worked on. An individual can call himself a salvage master (or be called one by his employer) but will not be considered one by salvage professionals until he has considerable experience. No set of standards or certification program assures one salvage master will be more fit than another.

Salvage masters are assisted by a salvage crew. The experience, training, attitude, and motivation of the crew is critical to successful salvage operations. Salvage requires skills in all nautical trades. One explanation of salvage states:

> The salvage crew...must consist of very highly trained personnel...[the] men must be most versatile in order that they all can be employed usefully...They should be good men in small boats, for they will be required often to boat salvage gear to wrecks located too close in for the salvage vessel to go alongside. They must be riggers, for they will be required to rig beach gear and to make up improvised arrangements for handling heavy equipment and cargo...Some of the men will have to be divers; others will have to know enough about diving to be useful as divers' tenders. Most of them should be good carpenters...motor mechanics...proficient in metal work...able to rig pump sections as well as miscellaneous piping systems...know something about the use of explosives and about the dangers existing in salvage work. All should be in good physical condition, for when offshore operations commence, there is little time to rest until the work is completed.[4]

There are few training opportunities for salvage personnel. Many of the current population of salvage masters and project managers (the committee has identified about 50 in the U.S.) gained their experience in the Navy. The Navy runs a diving and salvage training center in Panama City, Florida. The salvage training at the center encompasses diving, removing a vessel from a strand, refloating, and damaged ship stability. Participation in the course is restricted at present to Department of Defense personnel. Related Navy training activities taught elsewhere include shipboard firefighting and damage control, and underwater construction techniques.

The supply of Navy-trained salvage personnel depends upon the Navy's own needs. Since the end of the Vietnam era, the annual number of individuals who have received diving and salvage training have decreased. Even so, there are more Navy personnel with some training or experience in salvage released every year than there are commercial opportunities to employ that experience.

In the commercial world, salvage skills are learned or honed through on-the-job (OJT) training. OJT is perhaps an ideal way to learn a trade that requires as much improvising and intuition as does salvage. However, there are two weaknesses to heavy reliance on OJT. While OJT enables the acquiring of hands-on experience, it is usually difficult to find time for training in the stressful conditions surrounding a salvage operation. Moreover, OJT does not provide the opportunity to develop trained responses independent of the risk of catastrophic early errors.

The success of OJT is directly related to the opportunities for training that arise. The committee found in its regional evaluation of salvage capability that, even along the eastern seaboard where ship casualties occur most frequently, salvage operations are conducted too infrequently to provide sufficient opportunities for OJT, much less for acquiring experience.

Alternative means of gaining experience have not been extensively pursued by salvors; for example, the simulation of the management of marine emergencies. Nor have parallel training opportunities, such as firefighting schools, been taken advantage of.

The low level of activity also affects the experience level of salvors. Without the opportunity to practice their trade, salvors turn to other tasks. When the call does come, their skills may be rusty; or, the trained salvors may be committed to some other enterprise and not available to help with the emergency. This is especially the case in rescue towing, where a different crew may be involved in nearly every operation.

Salvage companies are aware of this training and experience predicament. Most companies have one or more individuals "coming up through the hawsepipe," and management will endeavor to give these individuals as wide an exposure to salvage operations as possible.*/

A salvor often needs outside expertise in completing his task. He may need to call on salvage engineers, divers, cargo and cargo-handling experts, and others knowledgeable in the type of ship being salvaged. Experts in the environmental conditions of the locale will ordinarily be brought onto the salvage team.

Because of the complexity of operations, salvage companies now usually assign overall charge of a salvage operation to a senior salvor who is designated as project manager. Subcontractors and consultants report to the project manager, as do the salvage master

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*/Robert Loftus (Ocean Salvors Company) 1981, personal communication.

and salvage engineer. A field business manager responsible for ordering supplies, renting equipment, arranging logistics, negotiating subcontracts, maintaining records, also assists the project manager. This management technique frees the salvage master for on-scene control involving operational decisions.

Logistics A variety of unique specialists and equipment may be urgently needed for a particular salvage operation. Thirty years ago it was necessary for ships engaged in offshore salvage to be equipped with everything that conceivably might be needed in remote offshore operations. It was impractical to make timely transport of specialized tools or personnel to a remote or offshore location in the time available. Today jet air transport, helicopters and modern logistic services are essential elements of planning and conducting salvage operations. The worldwide dimensions of salvage logistics are demonstrated in Figure 3.

Today all companies engaged in offshore salvage use air logistics to rush a project manager, a salvage master, an entire crew and other specialists to the scene. Equipment is packaged and stored in depots in modular units designed to fit a variety of transport modes -- jet aircraft, helicopters, and trucks. Handling and travel times from depots to likely points of debarkation are calculated and determined in advance. In adverse conditions air dropping salvage equipment, such as pumps, is sometimes attempted.

Reliance on sophisticated logistics pays off in cost-effectiveness and quick response so long as good weather holds, but it is important to know the physical limitations of this approach. As the weather worsens, the range and payload of aircraft are reduced; in truly bad weather, they do not fly. Helicopters are especially vulnerable. The transit of a rescue tug or salvage ship to a casualty is also vulnerable to weather delays. A particular source of concern is that the breakdown of logistics is likely to coincide with the need for salvage -- both are most likely to occur during bad weather.

The problem increases with the remoteness of the casualty. The rescue of the passengers from the burning Prinsendam in the Gulf of Alaska in 1980 was conducted at the maximum range of available helicopters.[5] The rescue craft could not fly with full loads, and they needed to refuel at sea. These constraints prolonged the operation and increased the risk.

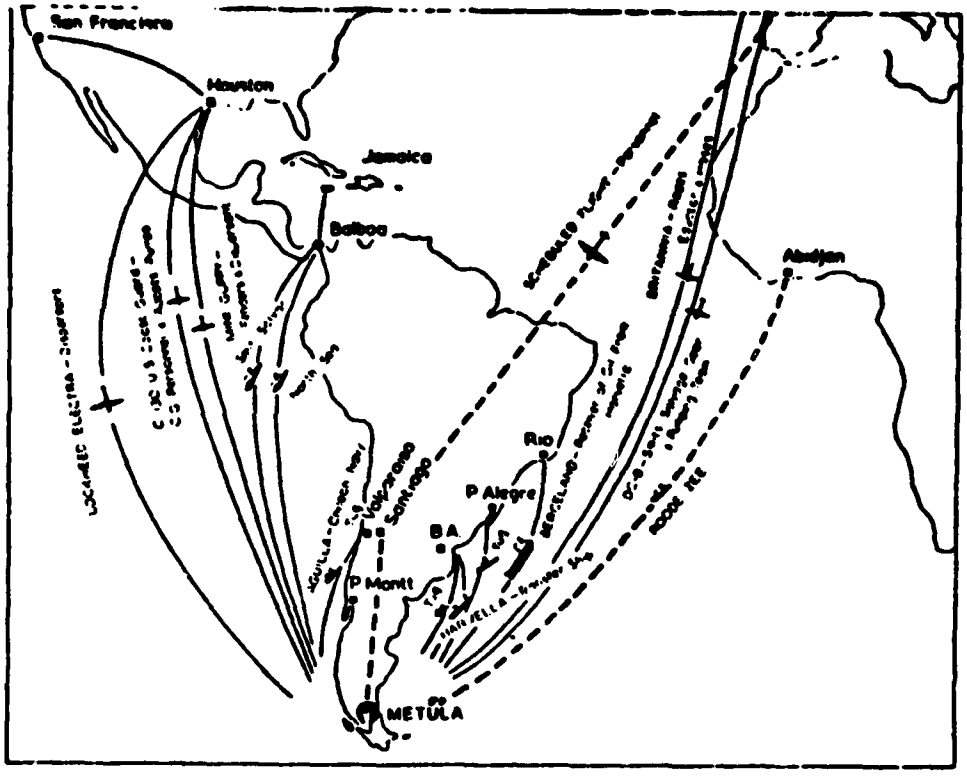

Figure 3 Salvage Supply Routes to the Site of the Metula Grounding

Source: A. F. Dickson, "Environmental Pollution--The New Dimension in Salvage," International Symposium on Marine Salvage, Marine Technology Society, Washington, D.C., 1980, p. 78.

But logistical constraints are not limited to air operations. Removing the Mary Ellen from her strand off Corpus Christi, Texas, (1980) was prolonged in part because local berthing tugs could not leave port in the heavy seas that were running. Later, an ocean-going tug was engaged and improvised to set legs of ground tackle (used to stabilize and then pull the ship off) but it could handle just one of the heavy Eells salvage anchors at a time. After each leg was set, the tug had to return to port to load the next leg. In contrast, a vessel designed for this work would be able to carry and set as many as six legs of ground tackle without returning to port for additional gear.

PHOTO 7 Lightering the Mary Ellen, Corpus Christi, Texas, August 1980. Photo by Ocean Salvors Company.

The modular packaging of equipment for rapid deployment, reliance on air transport to obtain equipment and personnel, and the use of tugs of opportunity rather than dedicated on-station salvage ships cost less and enable the salvor to bring to bear on the casualty appropriate equipment and experts. However, there are limits to this approach that affect the availability of assets. These limits must be taken into account.

The ever-present physical constraints imposed by weather and sea on air and other transport already have been discussed. The greater the reliance on such logistics, the more vulnerable the operation is to interruptions on these accounts.

Matching Salvage Assets to the Case at Hand Another constraint on the availability of salvage assets stems from the impracticality of making assets that are otherwise engaged available for short-term, ad hoc salvage assignments. This is especially the case with tugs that might

have to drop a tow in order to proceed to a salvage job. Some towing contracts, especially those involving high value tows, actually proscribe the tug operator from interrupting a tow to take on another assignment. This is an understandable business practice on the part of owners. Even when the salvor is not proscribed by the terms of a contract from temporarily abandoning one kind of customer in favor of another, he is likely to think twice about doing so, since the customer whose service is interrupted is not likely to view this favorably. As one participant in the committee's regional evaluation of salvage capability put it, he would be disinclined to drop a regular customer in favor of a short-term salvage assignment even if it paid more because "Customers have long memories." One major tugboat company indicated that it would only drop a tow if it were company-owned and even then they would be inclined to check with the cargo owner prior to doing so.*/

It is especially critical for the salvor to match the available assets with the requirements of the emergency. The attributes of the salvage platform -- tug or otherwise -- need to be considered to ensure that they are adequate for the casualty at hand. The dimensions, weight, and operating requirements of portable equipment must be reviewed to ensure that they can be transported to the operations site and employed when they get there. The familiarity of the team that is assembled with the platform and equipment to be used must also be established for every job. While the matching of salvage assets with the requirements of a casualty is necessary in every salvage operation, it is a particularly important task when operations are assembled from diverse elements from different depots and bases.

These physical and management considerations limit the availability of salvage assets, especially when they are assembled from diverse sources for particular jobs rather than being continuously on station and dedicated to salvage work.

This modular approach to salvage is increasing, but it has not been tested enough (on large ships, in remote regions, with hazardous cargoes) to ensure that it provides adequate coverage. Furthermore, the extent of experience gained could be insufficient for years to come, so long as casualties requiring salvage occur infrequently.

In the absence of adequate experience, it is still possible to simulate the availability of salvage assets and thereby gauge whether salvage coverage by available assets, as opposed to dedicated assets, is adequate. Such a simulation would involve establishing computer data bases on ship casualties and salvage assets and then utilize a Monte Carlo technique (employing a random number generator) to distribute and then match casualties and assets.

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*/Leonard Goodwin (Moran Towing Company) 1981, personal communication.

Planning and Readiness

Ship casualties requiring salvage are never planned. They can occur at any time; in any location -- often remote and dangerous; and in any weather -- especially foul. The damage or threat is always one-of-a-kind, and the salvage operation has to be specially tailored to the situation.

Salvage operations are, by their very nature, ad hoc. The more ad hoc the salvage case, the more dependent an effective salvage response is on prior comprehensive contingency planning.

While the salvage situation is unique, it is possible, and indeed necessary for success, to plan for the eventuality of conducting a salvage operation. The requirement for planning encompasses ships and shipping management, salvage companies, ships and systems, and also government agencies that can render assistance.

The Ship Operator's Readiness Ships can be designed and equipped for ease of salvage (so that the ship, should it ever be in distress, will be amenable to salvage). In addition to analyzing a design for the ship's stability, the survival of the hull, machinery and cargo spaces, the prudent ship operator will consider towability and the ability to survive fire and strand. These analyses will lead to the designing and equipping, and possibly even manning of the ship for these special purposes. At this time, he may prepare a casualty control manual and emergency response procedures for ready reference in the event of a casualty.

In preparation for ship operations, salvage-conscious management will develop plans for responding to and making decisions in emergencies.[6] An example of the contribution that the owner's planning can make to successful salvage is the stranding of the loaded LNG carrier El Paso Paul Keyser in the Straits of Gibraltar.*/ The ship operator considered salvage in the design of the vessel, and when salvage was necessary, the ship had the strong points, fittings, and other features that aided the salvage operations. Special equipment needed for cargo salvage had been developed by the operator and was kept ready for rapid depl yment. Casualty-control manuals containing minute details had been developed and were available on the ship's bridge and in the corporate office. A corporate contingency plan for marine emergencies established a crisis management team trained and empowered to respond efficiently. The masters of all company ships were briefed on actions that would be expected of them in an emergency, and specifically on initiating salvage. These preparations enabled the company to efficiently react in the emergency with a minimum of delay.

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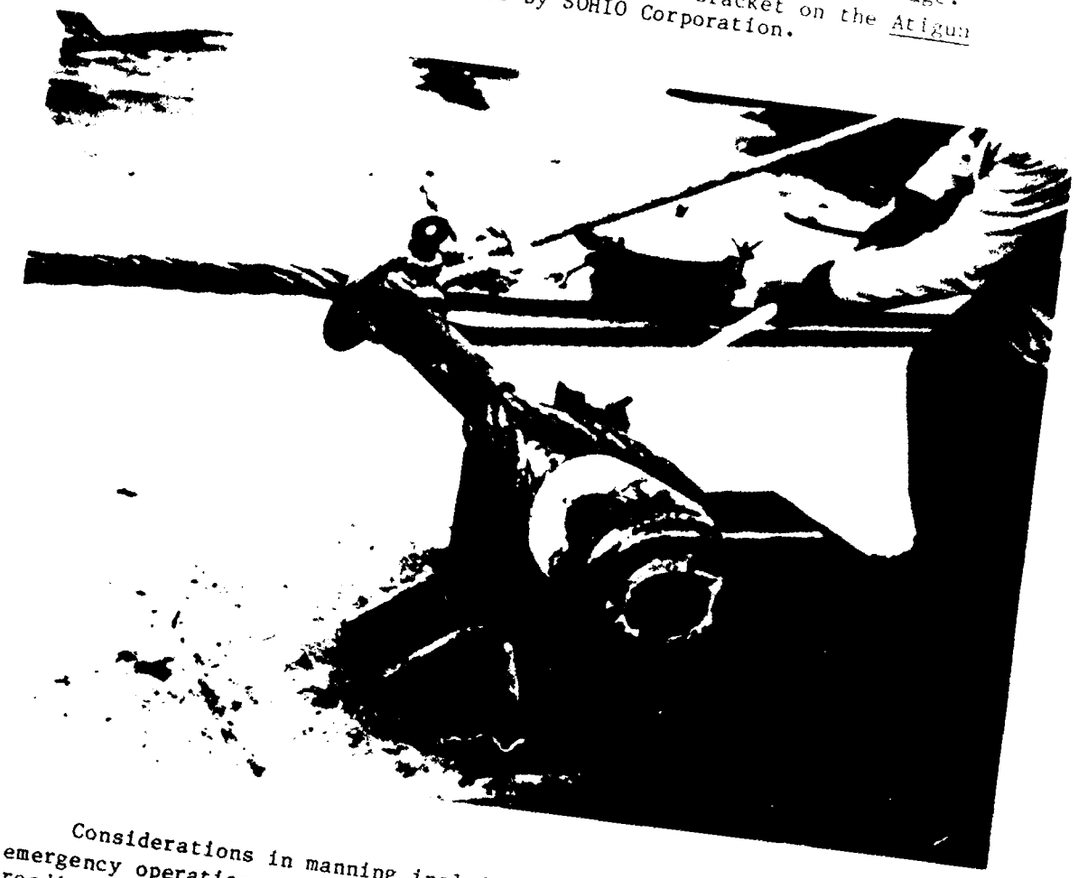
*/Warren Leback (Maritime Administration) 1981, personal communication.

PHOTO 8 Ships can be designed and equipped for ease of salvage. Making up a rescue tow with a SMIT bracket on the Atigun Pass. Photo supplied by SOHIO Corporation.



Considerations in manning include adequate numbers of crew for emergency operations, and their skills, including their training and readiness for emergencies. A related matter is the degree to which the crew is polyglot, and whether there would be difficulties in communicating in emergencies.

In the planning and operation of major maritime complexes it is constructive to identify salvage requirements, to provide adequate salvage capability, and to plan for the conduct of marine salvage. An example of an analysis of salvage requirements and the kinds of improvements that might ensue may be found at the Amerada Hess Oil Refinery at St. Croix, Virgin Islands. Here, ordinary berthing tugs were designed (horsepower, towing equipment, salvage-capable crew,

contingency planning, and other features) so that the tugs in the immediate vicinity of the refinery have the capability (albeit fair weather) for front-line salvage response for the tankers that put into the refinery port.

A number of U.S. ports would benefit from similar analysis and preparations. These include LNG terminals, the Houston Ship Channel, other busy waterways and choke points of marine traffic, and frontier offshore oil fields utilizing tanker transportation (a future development). The oil spill cooperatives formed in a number of areas[7] provide a useful organizational model for this. In certain situations companies that occasionally have the need for oil spill clean up capability have formed cooperative organizations to provide protection. The burden of purchasing and maintaining equipment stockpiles is shared by the members. The cooperative normally contracts with a technical contractor for day-to-day management and operations. This contractor obtains, maintains, and operates response assets and conducts contingency planning on behalf of the cooperative. It should be noted that the majority of oil spill cooperatives were established in direct response to federal laws prohibiting oil spills and requiring that spills be cleaned up. The Coast Guard has the authority under the Ports and Waterways Safety Act of 1972 (33 USC 1221-1227) to require analysis of salvage requirements and preparations for salvage contingencies.

Salvage Companies Salvage work rarely allows second chances. The degree to which a salvage or towage company identifies with and commits itself to salvage work determines the company's readiness, assets, and performance.

Company commitment will be manifested in the attitude of top management. Management is likely to understand and be amenable to operating on a no cure-no pay basis and tolerating negative cash flow in the maintenance of salvage capability.

A company committed to salvage work is likely to be able to mount a salvage response faster and more professionally than other companies. The extent to which tug companies have tugs available for salvage work has to be considered in light of the overall regional situation. There may be sufficient numbers of tugs in a particular coastal region that companies committed to salvage need not endeavor specifically to always keep a rescue tug available and ready.

Companies interested in salvage actively seek salvage work. Some maintain salvage stations in the sense that they confine their operations to an area or section of a trade route. With the assistance of communications, modern tugs have the capability to steam towards potential salvage work before the real crisis occurs.

Salvage companies have available or have ready access to the specialized equipment that is useful in salvage work. This does not necessarily mean that the equipment is kept aboard tugs (this practice would allow the equipment to be available only if a particular tug were in the right place at the right time). To a greater extent today, the equipment is maintained ashore at a place where it can be quickly transported to almost anywhere. Regardless of where equipment is kept, it is necessary to match the salvage assets that are available to the requirements of each job.

Companies interested in salvage employ people with salvage skills and experience. An experienced salvor is essential because he not only has a practical working knowledge of the techniques used in salvage work but he has the intuition, ingenuity, and ability to improvise. As with salvage equipment, specialized salvage personnel may be employed on other work so they may not always be available.

Companies that try to maintain an active interest in or commitment to salvage face a conflict between tolerating negative costs consequent to holding costly resources available to meet salvage emergencies and maintaining positive cash flow. Because the demand and nature of salvage work is so irregular and unpredictable, it is important for salvage companies to have ample other work to keep them in business.

Federal Salvage Capability The Federal Government needs and seeks to maintain a salvage capability to salvage public vessels, to counter marine pollution or its threat as the result of ship casualties (when the responsible private party does not do so), and to provide a basis for mobilization in the event of a national emergency. The Navy and Coast Guard maintain salvage assets and have access to additional assets by contract.

Need for Salvage Systems Engineering

The engineering of salvage systems is particularly important since, when an accident is threatened, there is little time to design or redesign available emergency response systems. The "salvage system" comprises the design, onboard equipment, and personnel of ships that may be in distress and also the tugs, equipment, and personnel used by salvors. The rigging of a rescue tow illustrates this. The salvage system encompasses the distressed ship including its towline attachment point and towing chock, the towline linkage between the tanker and the tug, and the attachment point and special line handling fittings and machinery on the tug. The smooth interfacing of these three subsystems in a salvage situation is dependent on engineering in advance of need.

The operators of tanker fleets and other shipping organizations show evidence of improving the engineering of the salvage systems over which they exercise control. The OCIMF research program on the behavior of disabled tankers, and the development by IMO of guidance on the rescue towing readiness of large ships (which is being implemented in some places in advance of international approval) support this view.

Salvors, on the other hand, (although there are some exceptions) have in general not pursued systems engineering to a similar extent. This is probably due to the fact that there are few incentives (other than superior performance) for salvors to do so, i.e., salvage services are neither especially profitable nor in great demand. The isolated instances of field tests and other evidence of systems engineering have generally been undertaken at the behest of and in conjunction with ship operators. The need for systems engineering of those elements of salvage systems that are maintained or supported by salvors is particularly evident in firefighting technology.

Firefighting Technology In providing external firefighting assistance to ships, techniques developed for the offshore oil fields have potential in salvage situations. The portable systems that have been developed are of limited application in salvage at present, however, for several reasons. Necessary engineering has not been undertaken to integrate the portable systems with the in-place firefighting equipment found on ships. The techniques apply principally to LNG/LPG, crude oil, and refined petroleum products, and are being extended to other products, such as chemicals and coal, only when the occasion arises to fight such a fire. Furthermore, the techniques are well known to, and understood by, only a relatively few people associated with a few specialized firefighting firms in the Gulf of Mexico region.

It is imperative in salvage situations for these firefighters to work under the direction of a salvor, who has the experience to safeguard the stability and structural integrity of the imperiled ship. Some steps available to salvage companies that would improve the engineering of marine firefighting and their preparedness include increased training in firefighting, and the development of a modular package of adapters to facilitate integrating portable systems with shipboard systems. The extension of present oil fire techniques to a wider variety of cargoes and to ships would be a fruitful area for technological development. National and international requirements for shipboard firefighting equipment and training may eventually have to be reviewed to encourage taking advantage of the major advances that have been made in this area, and the opportunities for advancing technology that are still available.

Status of Commercial Rescue Tug and Salvage Ship Design in the United States A number of U.S. tugs and other vessels have design features which make them suitable for some salvage operations. However, with

PHOTO 9 It is imperative for firefighters to work under a salvor who has the experience to safeguard the ship. The Burmah Agate afire off Galveston, Texas, November 1979. Photo supplied by James Hayes II, Office of Supervisor of Salvage, U.S. Navy.

the possible exception of the pulling salvage vessels Salvage Chief and Arctic Salvor, no U.S. vessels have had their designs optimized (from an engineering standpoint) for either offshore salvage or rescue towage. Instead, the designs of American commercial ocean tugs have most often been optimized for point-to-point towing.[8] This has been noted by naval architects and others in the past and it has been suggested that the Maritime Administration (with Navy assistance) undertake to design a multipurpose tug with many salvage features suited to the exigencies of current commercial conditions.[9,10]

Other ocean-going tugs, notably those of European-design, have greater installed rescue towage and salvage capability than U.S. tugs. The differing installed capabilities of European- and American-design tugs, shown in Table 6, reflect differing management philosophies.

TABLE 6: Comparison of Tugs

	American-Design Ocean Tugs[1]	European-design Ocean Tugs[2]
Power/Maneuverability	9000 hp 90 tons bollard pull No bow thruster	16,000 hp 135 tons bollard pull Bow thruster
Operating and Arrangements Characteristics	30 days endurance running free	42 days endurance running free
	110 m^2 workspace on afterdeck	About 60 m^2 open work space
	Interior storage in lazarette Access from afterdeck	Ample storage
	Line handling features: one capstan winch one gypsey winch	Line handling features: 2 capstan winches 2 gypsey winches
Towing Capability	Double drum towing engine, each with 2800 ft of 2-1/4 in wire Breaking strength of 223 short tons (2.5:1 safety factor) Other lines and make-up gear: 1400 ft -2 in wire 800 ft - 15 in nylon 2 shots - 3 in chain Ample shackles, pulleys, deck-lines, hardware, etc.	2 towing engines, each with 4,950 ft of 2 1/4 in wire Breaking strength of 300 metric tons (2.2:1 safety factor) Other lines and make-up gear: 1 spare tow wire of similar characteristics to main wire Pendants and shackles sufficient for a fourth towing wire Ample supply of nylon hawsers, shackles, chains, etc. Wide variety of padeyes, fairleads, bollards, snatch blocks, etc.
Auxiliary Salvage Equipment	Obtained as necessary by air or surface delivery 2 firefighting pumps (3500 gpm), telescoping remote-controlled monitor, foam	One crane: 1.5-ton capacity, 6-7 m. 2 firefighting pumps, 3 monitors and foam Two derricks: 1-ton capacity, 6.9-m reach One heavy-lift derrick: 10-ton capacity, 20-m reach Portable submersible pumps, hoses, etc. 2 sets beach gear Air compressors for direct diver supply, scuba resupply, and compressed air delivery Electric generators for external power supply Extensive machinery/repair shop Over/underwater cutting and and welding gear Patching material carried on board
Manning	8-10 Salvage crew on call	20 Salvage crew on call

1 Based on Stalwart, operated by Crowley Maritime Corp.

2 Based on Simson, operated by Bugsier Company

The table indicates that European-design tugs have greater pulling capability than American-design ocean tugs, some additional line-handling features, more deck loading equipment, and more space for shops and dry storage. They also carry a larger inventory of salvage equipment and are more generously manned.

American-design ocean tugs do not have as complete a range of installed capabilities. They obtain equipment and personnel from shore bases as necessary. Yet they adequately perform in many salvage situations, and where they have utilized shore-based assistance, the time delay has not hindered an effective and successful response.

The greater installed capability of European-design ocean tugs as compared to American-design ocean tugs can be critical to success. European-designed tugs were successful in refloating the grounded LNG tanker El Paso Paul Keyser in the Straits of Gibraltar in 1979. The installed pumps, repair shops, and available crew played a critical role in refloating the ship quickly. Similar performance from an American-design tug in the time available would have been problematical. Indeed, the owners of the stricken ship would not have assigned primary responsibility for the salvage job to an American-design tug because they believed that the magnitude and time-criticality of the required work effort exceeded the capabilities of the ad hoc response that likely would have been forthcoming.*/ On the other hand, the capabilities of European-design ocean tugs do not guarantee success. While the Pacific, a European-design tug, was on hand within minutes to assist the Amoco Cadiz in 1978 prior to her breakup, she was unable, for a variety of reasons, to execute the rescue tow under the time-critical circumstances.[11]

The Health of the Salvage Industry

More and more, salvage companies are operated as subsidiaries of integrated marine transportation companies. These larger corporations justify their involvement in salvage on the basis of providing protection to their own corporate fleet and to their far-flung customers in addition to earning profits. Other companies that consider themselves to be in the salvage business have diversified into other endeavors such as offshore towing or marine construction. No independent company in the United States confines its business to responding to time-critical offshore casualties. If they did, they would face bankruptcy.

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*/W. Leback, personal communication, 2 July 1982. Capt. Leback was the Vice-president in charge of ship operations of the shipowner, and the senior on-scene manager of the casualty response.

Despite the innovations that have occurred in recent years, problems persist that affect the health of the salvage industry. Innovations to solve them are needed. These concern reducing, sharing, or shifting the costs of salvage operations, encouraging investment in salvage, and increasing the rate of return on salvage investments; and eliminating government competition.

Salvage Costs, Investment, and Rate of Return

So long as salvage is a high risk/low return enterprise, it will be difficult to attract investment and general corporate interest in salvage. The task is made more difficult by the fact that organizing and maintaining salvage assets is an expensive proposition. The three strikes of high risk, low return, and high cash requirement to maintain salvage readiness make the salvage business an easily dispensable item in most corporate long-range plans.

The most expensive salvage asset is the ship. To reduce the cost of maintaining salvage readiness, most salvage companies, subsidiaries, or associates of tugboat companies, do not operate their own seagoing platforms but use whatever tugs or work boats happen to be available -- from a parent company or elsewhere. Other salvage companies have added some design features for salvage to vessels in the company fleet, rather than operate dedicated salvage vessels. One approach to providing dedicated salvage capability that has not been pursued is the fitting out of barges for use as salvage platforms. A salvage barge would be a dedicated self-contained platform that could be towed to a job site by an available tug. It could be constructed and operated at a much lower cost than a ship.

The problem of reducing the cost of salvage is related to the issues of sharing the cost and shifting costs. One strategy for sharing costs (or providing salvage protection where it otherwise might not be available) is the formation of salvage cooperatives along the lines of the earlier mentioned oil spill cooperatives.

Some salvage companies have been successful in getting those who may require their services to share the cost of salvage readiness.*/

In spite of innovations to bring down, share, or shift the cost of salvage readiness, the problem remains -- attract investment to a business that has been plagued with a low return on investment.**/ The only ways to do this are to artificially create investment incentives or to increase the real rate of return in the salvage business.

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*/Leo Collar (Crowley Maritime Corp.), July 1981, personal communication.

**/Hector Pazos (Ocean Oil International Engineering Corporation), 1981, personal communication.

Increasing the real rate of return to salvors can be accomplished by reducing the salvors' costs -- the few opportunities for this have been discussed -- or paying salvors more generously for their readiness and their work. When salvors work on a daily rate, time and materials or other bid price arrangement, they are solely responsible for charging sufficient overhead to cover the cost of maintaining company readiness for salvage. Given the on-call nature of the business,
however, there is no absolute way of calculating the amount of time that a salvage company is likely to work in any one year. By way of example, the Salvage Chief, operated by Fred Devine Diving and Salvage Company is on station available for work about 80-85 percent of the time.*/ Some years are diamonds and others are stones, however. In any single year the ship may be unemployed and thus available as little as 60 percent of the time or as much as 90-95 percent of the time.

The on-call nature of the business is one reason why salvors have traditionally been paid an award rather than a fee. The salvor's foresight, preparation, and planning is a factor in determining the amount of the award.[12] Salvage awards as a percentage of value saved have been declining for some years. From 1960-1970 the average award was about 7.3 percent of the value saved. From 1970-1980, this slipped to 5.7 percent. The reason for the net decrease is an increase in the value of property saved, especially cargo, without a corresponding increase in salvage awards. The lack of growth in salvage awards during a period when operating costs have risen has affected the rate of return on salvage investments. Salvors claim that the result may be a significant decline in the availability of salvage services.[13]

In 1982, the U.S. Navy Supervisor of Salvage publicly expressed concern that inadequate salvage awards may adversely affect the availability of commercial salvage services. In a memorandum to the committee he stated that, "The salvage awards currently being determined by both the courts and other processes are inadequate to compensate the salvor for his risks and costs. This situation must be turned around if both we in this country and the maritime industry worldwide are going to have an adequate commercial salvage posture to respond to emergencies."[14]

Government Competition in the Salvage Business

The Coast Guard does not charge for saving lives. Nor does the Coast Guard charge for preventing pollution, unless and until there has been a spill. However, it competes with commercial salvors on

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*/ Reino Mattila (Fred Devine Diving and Towing Company) 1982, personal communication.

terms that cannot be matched when it provides commercially available salvage services at no cost or below market cost. While the incidence of this situation is unknown, observers charge that it occurs frequently,[15] and some incidents are known to the committee.

The Coast Guard's enthusiasm to conduct rescue towage or other salvage operations is probably due, in part, to the limited number of opportunities for true rescue work and the desire for operational organizations to "show their stuff." The difference between these endeavors and the rightful work of salvage companies can quite understandably be hazy in the heat of an emergency when rescuing people and hundreds of thousands of dollars worth of property, as well as preventing pollution, hinges on immediate action.

This problem cannot be solved easily, but constructive steps can be taken. These include modifying Coast Guard policies to include salvage as an element of incident response and to relate salvage to the various Coast Guard marine safety missions, including search and rescue, marine environmental protection, and intervention. In those rare instances when, for lack of an adequate commercial response, the Coast Guard must provide salvage services, it would be appropriate to levy charges at commercial rates or higher (the Navy does this and publishes a schedule of rates for its assets).[16] Over the long term the Coast Guard would be able to dispel the impression that it competes with commercial salvors by relying more on commercial resources, and providing monetary incentives for their use.

In the implementation of its responsibilities for marine environmental protection under the National Contingency Plan, and when it intervenes, the Coast Guard encounters situations that call for dexterous project management to avoid interfering with commercial salvage. When the Coast Guard intervenes, for example, the salvor may be operating under contract to the owner, but the Coast Guard has the authority to take over from the owner, or to monitor and revise operating decisions. The salvor, who conducts the operation, may be left asking "Who's in Charge?" or "Who's Paying the Bills?"

In one instance in particular, the salvor is particularly vulnerable. Sometimes a salvor may not be owed an award under a no cure-no pay salvage contract until the stricken vessel has been brought into a safe haven (usually where emergency repairs can be made), or the vessel is declared a constructive total loss. Often, a stricken vessel is taken in tow to sheltered water where temporary repairs or offloading can be completed prior to the ship's being taken to permanent repair facilities. The Coast Guard Captain of the Port is charged with deciding whether, where, and under what conditions a stricken vessel may enter the waters of the United States. These sensitive decisions may be made on a case-by-case basis between the owner, the salvor, and the Coast Guard, generally without the benefit of policy or technical guidance. Damaged ships in the care of salvors have been denied entry privileges in a number of instances both in and outside the U.S. and these actions have severely constrained the successful conclusion of salvage operations.

For example, after colliding with the Aegean Captain north of Tobago in 1979, the Atlantic Empress was denied entry by neighboring countries. She was kept in tow by the salvor (who continued to fight fires and undertake other damage control measures) for 2 weeks until the unfortunate ship finally sank. Unable to complete the job on the terms of no cure-no pay, the salvor did not receive a reward and sustained a loss of $1.2 million in expenses for loss of equipment, hire for six tugs, and so forth. Compensation to the salvor for oil pollution prevention or removing the threat has been denied by shipowners and insurors.*/

The committee found in its regional evaluations that suitable harbors of refuge exist along the coasts. However, damaged ships need specific Coast Guard permission to enter U.S. waters, and it is conceivable that such a ship would have difficulty obtaining approval to enter protected waters. Indeed this happened with the Burmah Agate at Galveston.

If the salvor foresees difficulty in finding a safe haven, he may conclude that he is not be able to afford to undertake the job in the first place. Conversely, the lack of a readily identifiable safe haven may cause an owner to abandon a ship in distress, rather than to salvage it.

National Strike Force (NSF) capabilities directly duplicate those of commercial salvors and oil pollution-control experts.**/ The extent to which the NSF competes or interferes with commercial salvors is a function of how it is used. If it is used along with naval forces to respond to incidents for which there truly is no commercial response of similar competence, timeliness, and safety, then there will be no competition or interference. If, on the other hand, it is used in situations where comparable commercial assets are available, then commercial salvors have a legitimate grievance, especially if services are provided at no cost.

Liability for the Cost of Salvage and for Marine Pollution

The salvor's world is fraught with uncertainties concerning who pays for salvage and the extent of liability of the working salvor for marine pollution. On occasion, a situation arises in which a salvor's

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*/A recent revision of Lloyd's Open Form provides for the reimbursement of salvors for preventing pollution or removing the threat.

**/Similarly the Coast Guard has occasionally turned to foreign salvors in situations where U.S. salvage companies have comparable expertise.

best technical decision is to jettison a small amount of bunkers or cargo in order to lighten a stranded ship, thereby hoping to free the vessel and prevent a more serious pollution incident. Some salvors think that such expedient action could have saved the Argo Merchant. This important and traditional course of action by salvors in the event of strandings is seldom employed because of the legal constraints that exist. The Clean Water Act and the Deepwater Port Act prescribe civil penalties for the discharge of oil and other pollutants into the ocean.

Civil penalties are designed to deter and punish unsound actions. They are a form of punishment and public condemnation as well. The jettisoning of cargo to free a vessel from a strand and prevent a more serious pollution incident is environmentally sound. Presumably we do not want to punish, condemn, or deter salvors who make environmentally sound decisions. There is no logical reason to assess civil penalties in cases where pollutants are discharged in an effort to prevent more serious pollution.

Existing law must be changed to better deal with this situation. In removing penalties, it will still be prudent to charge the Coast Guard with ensuring that action to jettison is indeed a prudent professional action, and to assign the person who jettisons the burden of proof since the natural presumption is that a polluting discharge is not environmentally sound and since he has the best information about the incident.

Paying for Salvage Services

During the 1970s underwriters (and salvors) became concerned lest salvors decline to undertake the salvage of large ships because of lack of financial inducement compounded by increased pollution liability. In individual cases, salvors could foresee large expenditures on their part with potential salved values insufficent to support an award to cover such expenses. Discussions were initiated to revise Lloyd's Standard Form of Salvage Agreement to provide the salvor additional financial inducements. In the revised form, "LOF-80," the salvor "agrees to use his best endeavors to prevent the escape of oil from the vessel." This provision permits the arbitrator to enhance the salvage award to reflect the salvor's success in this. Insofar as laden tankers are concerned, P&I clubs agreed to reimburse salvors for expenses plus up to 15 percent even if the salvage of property is not successful. The implications of "LOF-80" for salvors have been reviewed.[17] These innovative concepts also have been incorporated in the draft salvage convention which will be submitted to IMO to replace the Brussels Convention of 1910.

Other international agreements bear on the matter of who pays for salvage. The International Convention on Civil Liability for Oil Pollution Damage, 1969 (CLC) and the International Convention on Establishment of an International Fund for Compensation for Oil Pollution Damage, 1971 (Fund Convention) provide the legal framework for a uniform comprehensive system of recovery for pollution clean up and damage resulting from marine transportation of bulk oil cargoes.

These conventions include some provisions (relatively low limits of liability, for example) which to date have kept the U.S. from ratifying them. The U.S., as a non-party, has pressed for changes in the conventions, but with limited success. This suggests that the conventions can best be strengthened if the U.S. were to ratify them, and then work for improvements as a condition to remaining a signatory.

National Cognizance of Salvage Posture

The national policy is to rely on the commercial salvage industry insofar as possible for responding to commercial shipping accidents.[18] The wisdom of this policy will remain in doubt so long as the salvage industry remains unorganized, and the government does not monitor salvage posture or initiate actions to improve the posture that may be indicated.

Salvage Industry Organization

The number of companies who consider themselves to be in the salvage business is small. The number for which salvage is a major profit center is smaller. It is quite common for the companies that comprise an industry or for the professionals in the industry to establish a trade association or professional organization. Several technical societies and trade organizations have professional activities concerning salvage, but there is no trade or professional association devoted primarily to salvage. Without such focused attention, it is difficult for salvage companies to promote the development of technology and professional standards of performance, especially as they relate to the contribution of commercial salvage companies to the salvage posture of the United States.

Government Cognizance

The Navy operates several fully equipped salvage ships and rescue tugs and has stand-by contracts with various marine companies for salvage services. The Navy is authorized to make its expertise, equipment, and services available to commercial salvors and to undertake salvage of private vessels although Navy policy is not to provide these services if a commercial alternative is available.

The Coast Guard conducts marine search and rescue operations, and also marine pollution response operations. The Coast Guard has at its disposal the necessary assets, including logistics support, to mount these operations. Many of these assets, such as pumps, aircraft, and support vessels may be useful in salvage situations.

The Coast Guard's job is especially complex. The dividing lines between personnel rescue, standing by stricken vessels, pollution response and salvage are often not clear-cut. While personnel rescue,

standing by stricken vessels awaiting commercial assistance, and marine pollution response are Coast Guard responsibilities, the conduct of salvage operations is not (unless the exercise of other responsibilities requires that such action be taken). In potential pollution situations, the Coast Guard is authorized to take immediate action, but the policy is not to assume command of a situation so long as a vessel owner is acting responsibly. Further, in salvage and rescue towing situations Coast Guard instructions call for deferring in favor of commercial operators, when they are present. Implementing these complex authorities and policies in the glare of the public eye and in the heat of emergency response can be extremely difficult, especially if the Coast Guard happens to be the first to arrive at a casualty. While the Coast Guard may not be in the salvage or towing business, its attitude towards that work, its willingness or unwillingness to relinquish an operational role to a commercial salvor, and whether or not it charges for services rendered, directly affect the viability of commercial salvage in the U.S.

The Coast Guard's potential for unintentional interference with salvage operations is real. It can be guarded against by careful development and administration of policies that recognize and take into account the nature of salvage operations and, in particular, the role of commercial salvors.

The Navy has the authority under the Salvage Act of 1948 to monitor the national salvage posture and take whatever actions are indicated to improve salvage posture, especially by working with commercial salvage companies. Acknowledging that there is a difference between being authorized to act and being required to act, from 1948 until the Navy's request to the National Research Council for this study, the Navy had no organized program of evaluating salvage risks or of promoting the advancement of commercial salvage capability. Nor has the Navy ever reported to Congress on the adequacy of U.S. salvage capability. Indeed the Navy probably would find it difficult to work more actively with commercial salvors to improve capability because there is no mechanism, such as a formal or informal advisory group, for doing so.

Planning and Readiness

National Contingency Plan The National Contingency Plan guides the Coast Guard's management of the federal response to potential pollution emergencies at sea. However, its implementation in marine emergencies has, in the past, caused confusion and delay in operations. As more experience has been gained conducting operations under the plan, the performance of all concerned has improved, and the plan and its administrative and decision making structure function reasonably smoothly today, although performance could be improved by providing greater guidance in the plan to on-scene coordinators and others. The whole apparatus is necessary, sound, and constructive,

and has proved to be capable of producing coordinated and timely decisions. The implementation of the plan and the success of operations conducted under it are, of course, limited by the circumstances of particular incidents and the management capabilities and technical resources of those in charge. The implementation of the plan, and particularly the decisions of the on-scene coordinator, can limit the courses of action available to the master of a ship in peril, or to a salvor. This is a potential area of concern that can only be ameliorated by ensuring that the government on-scene coordinators have adequate experience and resources, as well as authority and independence to make tough decisions in the field with full command support.

Safe Havens The need for safe havens, places of refuge where conditions are suitable for the conduct of surveys and emergency repairs, has been presented above. Physically, a safe haven should be a protected anchorage, shielded from wind and waves, with good holding ground for mooring.

Since the ships that require safe havens are crippled, they may be safety or pollution hazards or actively leaking. A crippled ship may leak oil or carry dangerous or hazardous chemicals whose release to the environment would be devastating. The safe haven should be situated to minimize interference of the casualty, the salvage operation, and any untoward consequences such as spills or explosions, with other human activities such as fishing, shipping, and recreation. The location of the safe haven also should be chosen with a view towards minimizing environmental degradation.

There is no isolated bay, inlet, or lee anywhere on earth that is without some degree of environmental value. Yet the environmental value of coastal regions can be ranked.[19]

The designation of safe haven means that a small (and possibly less sensitive) area will be placed at risk repeatedly so that the risk to a more widespread area will be reduced. The risk to the larger area is further reduced by a safe haven because the safe haven provides a place where emergency measures can be performed. Without the safe haven, necessary steps to save stricken ships would likely not be able to be undertaken. Thus safe havens reduce the risk of environmental degradation and other negative consequences in two ways. They increase the likelihood that ships will be saved and deleterious consequences avoided by providing a safe place for rendering emergency assistance; and, they increase the likelihood that a large (or very sensitive) area will be spared the ill effects of marine catastrophes by concentrating the risk in a predesignated area.

Environmental Information Those responsible for responding to an impending maritime casualty need prompt access to detailed information about how the environment might be adversely affected by either the salvage strategy adopted or by a futile salvage effort. While

literature on ecosystem characteristics and values is abundant, good environmental aids to assist in pollution response and salvage are few. An example of a useful approach is the Northern Land Use Information Series, a series of maps that depict the environmental values of the Canadian coast.*/ Of particular value in the Canadian map series is the appearance on each map of a considerable narrative describing the environment and its values The strategic planning activities of the National Oceanic and Atmospheric Administration's Office of Ocean Resources Coordination and Assessment provide a starting point for developing such aids in the U.S.

Alternative Salvage Postures for the United States

With larger ships carrying larger cargoes, shipping accidents of major proportions will occur in the future. When those accidents occur, the nation's ability to respond will be directly related to the amount of planning and preparedness that have been undertaken, and resources that have been committed to salvage readiness. The committee's data, analysis, and investigations indicate that although an urgent problem of major proportions does not exist, improvements in the current salvage posture can be made.

To accommodate this situation, the committee considered several alternate salvage postures for the nation. Conceptually, there are three general models that could be pursued.

The first model is based on a national policy that would make salvage a federal responsibility. In response to this policy, a federal agent, such as the Navy or the Coast Guard, would organize and manage a salvage system. An analogous system is that now undertaken by the French Government through contracts of commercial salvage vessels on station. The establishment of such a system could not provide total assurance that all casualties could be adequately salvaged or that the level of risk would be substantially reduced.

The second model assigns all commercial salvage responsibilities to the private sector. In this model, salvage would be conducted on an economic and business basis. But as the committee's data and analysis indicate, without government incentives and involvement the continued availability of timely response to major casualties is questionable.

The third model, the approach adopted by the committee, calls for taking incremental measures to improve the national response to marine casualties by improving the commercial attractiveness of salvage while maintaining certain government responsibilities and involvement in

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*/Available from the Canada Map Office, Surveys and Mapping Branch, Department of Energy, Mines, and Resources, Ottawa, Canada KIA0E9. Each of the 200 or more maps costs about $2.00.

salvage. This approach is a compromise between the other two; it seeks to improve the availability of timely response to casualties while avoiding additional expense which is not currently justified by the relatively low incidence of serious shipping accidents.

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CONCLUSIONS AND RECOMMENDATIONS

Level of Risk

There are approximately 60 to 70 marine salvage operations in U.S. offshore waters annually with little change expected in the next two decades. Of these, two or three have potentially serious public consequences -- cases involving hazardous cargoes or imminent threat to human life or the environment. Despite the low incidence of shipping accidents, greater quantities of more hazardous cargoes are being carried in larger ships than ever before, and the potential consequences of individual accidents are increasing. The need to maintain the capability to conduct salvage operations relates more to the potential consequences that can ensue if a casualty requiring salvage occurs and no salvage is conducted, than to the number of casualties that require a salvage response. Given current or foreseeable capability, some easily conceivable maritime accidents cannot be salved at all.

Salvage Posture Adequacy

The committee concluded that it has been possible, so far, to meet our salvage needs with current capability. There has been no pattern of failure to cope with casualties. This is due, in part, to the flexibility and ability to improvise, and to luck, especially in that a catastrophe such as the Amoco Cadiz has not yet occurred in the

United States. That the Prince William Sound did not become a negative statistic was luck, the incident is nevertheless indicative of the committee's concerns with our current salvage posture.

The current state of readiness to provide effective salvage service by industry and government has evolved into a dynamic equilibrium. However, trends (should they continue) toward fewer commercial casualties requiring salvage, a more difficult business climate for salvors, and lower governmental priority for salvage may cause the nation's salvage posture to decline, if these trends are not checked. Also, (especially since some foreseeable accidents are beyond the nation's current and expected capability) a single casualty of national interest could cause the present level of salvage capability to come under sharp scrutiny. The existence of these trends and the possibility of an incident of national interest, are not considered sufficient to justify major investments to improve the U.S. salvage posture.

The public interest is best served by a strong, commercially viable, domestic salvage industry, but this industry currently suffers from: inadequate remuneration; government competition; legal obstacles to providing salvage services, especially to public ships and cargoes; and the threat of large liabilities.

RECOMMENDATION: Arbitrators and the courts should make more generous salvage awards to recognize the value of salvage in pollution prevention, to encourage prompt and meritorious service, and to provide adequate incentive for commercial salvors to maintain and improve their capability. Companies that maintain reasonable professional salvage competence and readiness as demonstrated by their personnel, equipment, and management, should receive enhanced awards.

RECOMMENDATION: The Coast Guard and other agencies should refrain from undertaking salvage operations on commercial vessels that can be accomplished with equal competence, timeliness, and safety by the private sector. Whenever the Federal Government conducts salvage operations, it should charge for services at rates that are at least marginally higher than commercial rates.

RECOMMENDATION: The Coast Guard should develop criteria for safe havens where distressed vessels constituting a pollution hazard can be taken for emergency repairs, and should identify candidate safe havens. The Regional Response Teams under the National Contingency Plan should establish procedures for making safe havens available when they are needed.

RECOMMENDATION: The U.S. Government should take steps to make it easier for commanding officers of naval vessels and masters of public vessels and vessels carrying government-owned cargo to contract for time-critical salvage assistance.

RECOMMENDATION: The United States should amend domestic laws to absolve salvors from civil penalties for pollution that occurs as the result of prudent professional salvage activities. The language for the provision might be patterned from Annex I, Regulation 11(c) of The International Convention for the Prevention of Pollution from Ships, 1973 (MARPOL)*/ so that discharges which are "for the purpose of combating specific pollution incidents in order to minimize the damage from pollution" will not result in a civil penalty.

RECOMMENDATION: The U.S. should ratify the International Convention on Civil Liability for Oil Pollution Damage, 1969 (CLC) and the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage, 1971 (Fund Convention). When it notifies the parties to the conventions of its ratification, it should also file a memorandum suggesting desirable amendments including, but not limited to, the following:

- o The CLC should be amended to exempt from liability any persor performing salvage operations who discharges oil cargo or bunkers in the prevention of a more serious pollution incident.

- o The liability limits should be substantially increased both for shipowners under Article V of the CLC and for the fund under Article 4 of the Fund Convention.

Should such amendments not be forthcoming after a reasonable period of time, the U.S. should renounce the treaty.

In order to protect the environment and the public, the U.S. Government has clear authority to take over and salve marine casualties or threatened accidents when the operator of the vessel does not do so. The implementation of this authority most appropriately lies with the Coast Guard, since its missions of saving lives and controlling marine pollution require it to maintain marine operational capability throughout U.S. offshore waters. The Coast Guard should maintain an oversight interest in responding to marine casualties.

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*/Annex I, Regulation 11(c) of MARPOL provides that penalty requirements concerning the control of discharge of oil, in general (Regulation 9), and in special areas (Regulation 10) "shall not apply to: . . . (c) the discharge of substances containing oil, approved by the Administration [the Government of the State unde whose authority the ship is operating], when being used for the purpose of combating specific pollution incidents in order to minimize the damage from pollution. Any such discharge shall be subject to the approval of any Government in whose jurisdiction it is contemplated that the discharge will occur."

RECOMMENDATION: In those instances where salvage will contribute to environmental or public safety, but private salvage efforts are not likely to materialize soon enough to be successful, the Coast Guard should oversee the conduct of salvage operations. In taking action, the Coast Guard should favor employment of commercial salvage companies. Only when the commercial response or expertise is unavailable or inadequate should the Coast Guard act directly, using Navy forces or its own National Strike Force or other government expertise. In those instances where the Coast Guard initiates action, but competent commercial capability becomes available later, the Coast Guard should transfer the operations to commercial salvors at the earliest practical time. When the Coast Guard conducts salvage operations directly, it should charge rates that are at least marginally higher than commercial rates.

Planning and Readiness

Without regard to their different purposes, actual use, cost, or cost-effectiveness, there is a difference in the installed capabilities of the American-design commercial ocean tugs that currently perform the majority of salvage work offshore the U.S. and European-design tugs. The additional installed salvage capability of European-design tugs, which are not currently available in the U.S., could play a critical role in the success of salvage operations, especially in high risk situations, such as those involving large ships, hazardous cargoes and bad weather. Current Federal maritime and naval statutes provide potential means for investigating the commercial feasibility of salvage tugs, for designing them, and for supporting their operation.

RECOMMENDATION: To provide greater flexibility in responding to marine casualties, the Maritime Administration and the Navy should investigate the commercial feasibility of European-design tugs, with and without government support, and should develop designs if appropriate.

Marine salvage is an emergency service that, to be effective, must be provided quickly. Experience shows that precious response time is occasionally lost and effectiveness compromised because salvage may not have been explicitly planned for by the company undertaking the salvage, by ship operators, or by the government.

RECOMMENDATION: Companies engaged in salvage should, with the assistance of ship operators, improve the planning and development of salvage systems to ensure adequate salvage response to protect crews, ships, cargoes, and the public interest. For the management of complex salvage operations, a team approach wherein the person in charge of operations functions as a project manager, with the salvage master, salvage engineer, consulting experts, and administrative staff reporting to him.

RECOMMENDATION: Ship operators should develop corporate contingency plans for marine emergencies that include explicit planning for salvage. They should establish general terms and conditions with salvors in advance of need in order to minimize hiring delays due to contract negotiations. Ships should be provided with onboard casualty control manuals, engineering drawings, actual cargo load data, and information on the behavior and characteristics of the ship when disabled. They should be equipped with emergency equipment such as redundant auxiliary power, towing points and pendants, each fore and aft. The master and crew should be conversant with salvage and the actions required of them in an emergency.

Although it could provide clearer operational guidance to on-scene coordinators and others, the National Contingency Plan functions reasonably well in dealing with the control, containment, and cleanup of pollutants following marine casualties. However, the success of operations conducted under it is determined by the circumstances of particular incidents and the management capabilities and technical resources of those in charge. The implementation of the plan, and particularly the decisions of the on-scene coordinator, can limit the courses of action open either to the master of a ship in peril or to a salvor.

RECOMMENDATION: The National Contingency Plan should be amended so as to address salvage. Under it, up-to-date information should be maintained on the availability of salvage assets. The National Contingency Plan should provide field personnel with clear guidance on when and how to initiate salvage operations. The Coast Guard should arrange for talented people to serve as on-scene coordinators, support them with adequate resources, and support them in the making of tough decisions in the field, with full command support.

Those responsible for responding to a maritime casualty must have prompt access to detailed information about the environment that could adversely affect (or be affected by) the salvage operation.

RECOMMENDATION: The Coast Guard should establish a system to gather, store, and provide environmental information in support of pollution-response planning, which includes potential salvage operations.

In the planning and operation of new ships, trade routes, and major maritime complexes, salvage requirements must be indentified in order to provide adequate salvage coverage and to plan for the conduct of marine salvage.

RECOMMENDATION: The Navy and the Coast Guard should encourage ship and terminal operators to plan and prepare for salvage operations.

The Coast Guard should (under the Ports and Waterways Safety Act of 1972) require them to do so in those instances where voluntary efforts are inadequate.

National Policy

The national policy is that the public interest is served by maintaining salvage capability to provide for the national defense, especially to ensure readiness for war mobilization. The additional function of salvage in minimizing marine pollution and providing for public safety is not currently addressed in national policy.

RECOMMENDATION: The Congress should update the national statement of salvage policy (10 USC 7361-7367) to recognize the vital role that salvage plays in minimizing the public consequences of maritime casualties, and to harmonize the Salvage Act with the laws on intervention and pollution response.

The U.S. Government needs to lead and act as a catalyst developing and maintaining U.S. salvage capability.

RECOMMENDATION: The Navy should continue to oversee the national salvage posture, and should periodically audit and report on U.S. salvage capability -- perhaps once a decade.

RECOMMENDATION: With the assistance of the Coast Guard, the Maritime Administration, and U.S. industry (as appropriate), the U.S. Navy should:

- o Continue to train and educate the next generation of project managers, salvage masters, salvage engineers, divers, and workers.
- o Develop, test and stockpile improved salvage systems, equipment, and components, taking full advantage of new deployment means. External (to the ship) firefighting technology and operations require immediate attention.

There is no forum for enhancing cooperation among the government, commercial salvors, and ship operators in making improvements in the national salvage posture.

RECOMMENDATION: The Navy should, with the participation of the Coast Guard and the Maritime Administration, establish a subcommittee on marine salvage under its Naval Research Advisory Committee to encourage improvements in the national salvage posture and to oversee their implementation. Subcommittee membership should include representatives of U.S. salvage companies, ship operators, underwriters, admiralty lawyers, salvage consultants, and interested members of the public.

APPENDIX A

REGIONAL EVALUATIONS OF SALVAGE CAPABILITY: WORKING GROUP MEMBERSHIP AND LIST OF SITE VISITS

Eastern Region

Membership

J. D. Porricelli,*/ Leader, ECO, Inc.
Richard Fredericks, SMIT International (Americas) Inc.
Leonard Goodwin, Moran Towing
Raymond Hicks, Jr.,*/ American Hull Insurance Syndicate
Donald Jensen, U.S. Coast Guard
Charles S. Maclin, U.S. Navy
Leonard C. Meeker, Center for Law and Social Policy
William Milwee, Searle Consortium, Ltd.
Hugh Williams, Mobil Oil Corporation

Site Visits:

South Florida, October 1981
Norfolk, VA, October 1981
New York City, NY, November 1981
Cleveland, OH, October 1981

Gulf Region

Membership

Warren Leback,*/ Leader, Consultant
Wayne H. Christensen, Consultant
John E. Flipse,*/, Texas A&M University
James W. Greely, Consultant
William Mayberry, Offshore Marine Services Association
Ned Middleton, Jackson Marine Corporation
Hyla Napadensky, IIT Research Institute
Harley Oein, Naval Sea Systems Command
Hector Pazos, Ocean Oil International Engineering Corp.
Hal Scott, ECO/Interface Evaluations
James Tanner, U.S. Coast Guard
Dwight Williams, Boots & Coots, Inc.

Site Visits:

Corpus Christi, TX, September 1981
New Orleans, LA, September 1981
Houston, TX, November 1981
South Florida, September 1981
Tampa, FL, September 1981

Western Region

Membership

B. Glenn Ledbetter,*/ Leader, President, Oceanographic Institute of Washington
Sidney D. Campbell, Foss Launch & Tug Company
Clifton E. Curtis,*/ Center for Law and Social Policy
Richard E. Tolhurst, SEASPAN International
Anthony C. Horton, Chevron Shipping Company
Colin Jones, U.S. Navy
Reino Mattila, Fred Devine Diving & Salvage, Inc.
Charles McAuliffe, U.S. Salvage Association
W. Don McLean, Crowley Maritime Corporation
James O'Brien, U.S. Coast Guard
William F. Whitmore, Lockheed Missiles & Space Company

Site Visits:**/

San Francisco, CA, September 1981
Stockton, CA, September 1981
Astoria, OR, November 1981
Seattle, WA, November 1981

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*/Member of the Committee on the National Salvage Posture

**/An additional visit to Cook Inlet and Prince William Sound, Alaska was made by the leader of the Pacific Team in conjunction with other committee activities, subsequent to the completion of the team's work.

APPENDIX B

MARINE CASUALTIES IN THE YEAR 2000

The committee considered the projection of casualties to be necessary in the study, but, as described in the report, not determinative of the study's outcome. A forecast was made based on the growth in shipping tonnages estimated by the U.S. Army Corps of Engineers[1] and changes in vessel sizes and numbers estimated by the U.S. Maritime Administration.[2]

The projections assume that the frequency of casualties relative to port calls will remain unchanged, except as influenced by changes in the density of vessel traffic and number of offshore structures. The consideration of these latter factors is confined to projecting collisions and rammings, where the other ships and structures are "targets."

The projection method is summarized below (subscripts indicate years):

(1) $C: E_{2000} \times R_{2000}$

C = The Incidence of Casualties
E = Exposure
R = Frequency of Casualties

(2) E: PC

PC = Port Calls

(3) $$PC_{2000} = PC_{1980} \frac{X\ T_{2000} X\ S_{1980}}{T_{1980}\quad S_{2000}}$$

T = Cargo Tonnage
S = Average Ship Size

(4) $$R_{2000} = K\ (R_1 + c \cdot R_2)$$

k = a factor accounting for changes in casualty frequency as a result of changes in technologies (automation, navigation, operating practices, weather prediction, and so forth). "k" is assumed to be 1. Even should such advances halve the numbers of serious casualties requiring a salvage response, it would not appreciably change the size of the salvageable universe; i.e., the number of casualties would not change by more than an order of magnitude, and they would still be distributed throughout the region.

R_1 = frequency of occurrence of all casualties except collisions and rammings.

c = a factor representing the changes in exposure in the year 2000 caused by the numbers of other ships and structures that might be collided with or rammed.

R_2 = frequency of occurrence of collisions and rammings.

Table B-1 estimates serious casualties by region in 1980 and 2000. Table B-2 presents similar information in the form of ratios -- $\frac{2000}{1980}$ -- and also provides ratios for a number of related factors.

The committee considers its projections to be tentative and strictly preliminary. Certain problems, especially with the exposure base, detract from the usefulness of the projections.

- The projections are based on growth in shipping tonnages, while the exposure variable used in the casualty calculations is port calls. Thus it was necessary to translate tonnage growth into port calls, utilizing very preliminary, possibly even superficial, estimates of future ship populations and ship tonnages.

- This weakness in projecting exposure is compounded in projecting collisions and rammings where other ships and structures are targets; thus any errors in the estimated exposures are multiplied.

- Rammings involve the striking of fixed objects (including offshore platforms) by ships. An acceptable estimate of the regional population of fixed offshore structures in the year 2000 was not available for use in the projections. Lacking that information, the question was looked at in two ways: a tentative national offshore structure estimate[3] was allocated equally to the three coasts; and, the allocation was made on the basis of estimates of undiscovered offshore oil and gas resources.[4] While neither approach proved satisfactory, allocation on the basis of undiscovered resources produced projections that seemed to be more reasonable.

- Some regions of the country, particularly the Great Lakes and the Pacific coast, do not have especially extensive maritime commerce and thus the exposure base for casualty analysis and projection is low. Occurrence of isolated incidents in the data base can produce totally artificial estimates and projections.

With these problems in mind, the committee cautions against reliance on either the Great Lakes or Pacific projections, and on the projection of collisions and rammings in all regions.

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2. Maritime Administration, U.S. Department of Commerce, 1978. Merchant Fleet Forecast of Vessels in U.S.-Foreign Trade. Washington, D.C.: U.S. Government Printing Office.

3. Maritime Administration, U.S. Department of Commerce, 1977. A Technology Assessment of Offshore Industry. Washington, D.C.: U.S. Government Printing Office.

4. Edgar, N. Terence. 1981. "Oil and Gas Resources of the U.S. Continental Margin." Prepared for the Conference on the Future of Gas and Oil from the Sea, Center for the Study of Marine Policy, University of Delaware, Newark, Del., June 1981.

TABLE B-1: Serious Casualties 1980 and 2000 (Estimated)

Region/Ship Type		Type of Casualty													
		Collision		Ramming		Stranding		Fire/ Explosion		Structure/ Material		Other		Total	
		1980	2000	1980	2000	1980	2000	1980	2000	1980	2000	1980	2000	1980	2000
Atlantic	Tanker	3.5	1.5	2.6	1.8	5.7	3.0	1.7	0.9	1.9	1.0	.5	0.3	15.8	8.5
	Cargo	2.6	1.7	2.3	2.3	3.8	2.9	.9	.7	1.9	1.5	3.3	2.5	14.8	11.6
	Total	6.1	3.2	4.9	4.1	9.4	5.9	2.6	1.6	3.8	2.5	3.8	2.8	30.6	20.1
Gulf	Tanker	3.3	3.2	1.2	1.9	1.4	1.2	.2	.2	2.1	1.8	0	0	8.2	8.3
	Cargo	4.9	4.9	1.4	2.2	1.2	1.1	1.4	1.3	1.4	1.3	0	0	10.4	10.8
	Total	8.2	8.1	2.6	4.1	2.6	2.3	1.7	1.5	3.5	3.1	0	0	18.6	19.1
Pacific	Tanker	.2	0.2	1.2	1.7	.2	0.1	.7	.4	.9	0.6	1.2	0.8	4.5	3.8
	Cargo	.7	1.1	1.9	4.2	1.7	1.7	.2	.2	.7	.7	.7	.7	5.9	8.6
	Total	.9	1.3	3.1	5.9	1.9	1.8	.9	.6	1.7	1.3	1.9	1.5	10.4	12.4
Great Lakes	Tanker	0	0	0	0	0	0	0	0	.2	.4	0	0	.2	0.4
	Cargo	.2	.2	2.1	2.4	4.0	4.6	.5	.6	.9	1.0	.5	.6	8.2	9.4
	Total	.2	.2	2.1	2.4	4.0	4.6	.5	.6	1.2	1.4	.5	.6	8.5	9.8
All U.S.	Tanker	7.1	4.9	4.9	5.4	7.3	4.3	2.6	1.5	5.2	3.8	1.7	1.1	28.7	21.0
	Cargo	8.5	7.9	7.8	11.1	10.6	10.3	3.1	2.8	4.9	4.5	4.5	3.8	39.3	40.4
	Total	15.5	12.8	12.7	16.5	17.9	14.6	5.7	4.3	10.1	8.3	6.1	4.9	68.0	61.4

Note: Some columns and rows do not add exactly due to rounding-off individual entries.

Table B-2 A Comparison Between the Years 2000 and 1980[1]

Region/Ship Type		Type of Casualty[2]						Total Cargo Carried	No. of Ships	Average Ship, dwt	No. Ships + Structures	Port Calls
		Collision	Ramming	Grounding	Fire/ Explosion	Structural/ Material	Other					
All Atlantic	Tanker	0.43	0.69	0.52	0.52	0.51	0.51	.80	0.63	1.54	1.33	0.52
	Cargo	.64	1.02	.77	.77	.77	.77	1.07	.92	1.39	1.33	.77
	Average							.94	.83	1.35	1.33	.71
Gulf	Tanker	.98	1.55	.88	.88	.88	.88	1.11	1.07	1.27	1.76	.8
	Cargo	1.01	1.60	.91	.91	.91	.91	1.23	1.11	1.35	1.76	.91
	Average							1.19	1.11	1.32	1.76	.90
All Pacific	Tanker	.98	1.40	.63	.63	.63	.63	.85	1.02	1.35	2.22	.63
	Cargo	1.55	2.22	1.00	1.00	1.00	1.00	1.35	1.66	1.35	2.22	1.00
	Average							1.13	1.55	1.19	2.22	.94
Great Lakes	Tanker	1.87	1.87	1.93	1.93	1.93	1.93	5.14	2.00	2.67	.97	1.93
	Cargo	1.12	1.12	1.15	1.15	1.15	1.15	1.47	.96	1.28	.97	1.15
	Average							1.48	.97	1.28	.97	1.16

[1] The casualty and port call ratios are actually based on 1978 values.

[2] These apply to numbers of casualties, not to their frequency of occurrence.

APPENDIX C

SALVAGE-RELATED STATUTES OF THE U.S. GOVERNMENT

AUTHORITY	PURPOSE	COMMENT
Salvage Facilities furnished by Navy P.L. 513, 4 May 1948 10 USC 7361-7367	The Act authorizes the Secretary of the Navy: to provide salvage facilities by contract or otherwise; to transfer or charter salvage vessels and equipment for operation by private salvage companies; to advance funds to private salvage companies; to finance *salvage operations*; to collect fees for salvage services.	Having given the Secretary of the Navy authority to act in the salvage field, it may be inferred that Congress expected him to use that authority. It has been so used over the years in support of commercial salvage activities. However, it may not be inferred that the Salvage Act requires the Secretary of the Navy to act. Nor does it require the maintenance of a certain level of salvage capability or type of posture. The statutory authority does not obligate the Navy to maintain salvage facilities in excess of its own needs, nor to render assistance on all occasions. Such a position may be necessary to avoid open-ended liability and exposure to claims from shipowners who were not salved. (See 32 CFR 754.2 (g)).

AUTHORITY	PURPOSE	COMMENT
Salvage Facilities Furnished by Navy (Continued)		The Act was passed shortly after World War II. The Navy Department was designated as the logical salvage agency for the following reasons: o The Navy already had a (military) salvage organization and therefore understood all phases of the problem. o It was deemed necessary to continue Navy interest in salvage in times of peace so that sufficient personnel and equipment would be available in the event of war. o The Navy had sufficient public salvage vessels to cover waters where private salvage enterprises were not prone to operate. o The Navy was the primary source of mariners and engineers trained in salvage operations.
Saving Life and Property Act of 4 August 1949 14 USC 88	Complete revision of Coast Guard authorities. Authorizes the Coast Guard, in the broadest possible terms without limitation as to method or place, to save lives and property.	The language, "to perform any and all acts necessary to rescue and aid persons and protect and save property" is broad enough to encompass salvage questions.

AUTHORITY	PURPOSE	COMMENT
Saving Life and Property Act (continued)		However, the Coast Guard has consistently maintained that it is not in the salvage business. The Coast Guard does not have any substantial salvage capability in the sense of conducting a major offshore salvage operation. (Recently, it called upon the Navy for assistance in raising two sunken cutters, the Cuyahoga and the Blackthorn.) The Coast Guard's emergency response capability is largely in the area of search and rescue (saving of life) and marine environmental protection (oil spill response). Related to these are their major activities in safety of navigation.
Clean Water Act (33 USC 1251 et. seq.), including Sec. 1321 "Oil and Hazardous Substance Liability"	Establishes U.S. policy that there shall be no discharges of oil or hazardous substances in waters under U.S. jurisdiction (including the Fisheries Conservation Zone (200 miles)), and authorizes executive actions to that end.	Authority extends throughout 200-mile zone. Provides basic operating authority for Coast Guard's marine environmental protection activities and for the National Contingency Plan. President authorized to direct all public and private efforts to prevent marine pollution whenever a marine disaster has created a substantial threat of a pollution hazard. Efforts may include removal or destruction of the vessel posing the threat.

AUTHORITY	PURPOSE	COMMENT
Clean Water Act (33 USC 1251 et. seq.), including Sec. 1321 "Oil and Hazardous Substance Liability" (continued)		Authority extends throughout 200-mile zone. Provides basic operating authority for Coast Guard's marine environmental protection activities. President authorized to exercise similar authority to clean up spills, unless, pursuant to the National Contingency Plan, the owner or operator is taking proper action. The difference between the two authorities noted above is that the President does not have to take account of the owner or operator's actions if there has been a maritime disaster.
Intervention on the High Seas Act 5 February 1974 33 USC 1471-1487		Incorporates into U.S. law the International Convention relating to intervention on the high seas in case of oil pollution casualties. Authorizes the Coast Guard to take whatever measures are necessary to prevent or eliminate danger to the coastline of the U.S. from pollution from a marine casualty on the high seas. Range of possible actions includes removal or destruction of the ship or cargo which is the source of the danger.

AUTHORITY	PURPOSE	COMMENT
33 USC 409, 414, 415, Wreck Statute	These three statutes provide the U.S. Army Corps of Engineers with authority to remove wrecks from the navigable waters of the U.S. o 33 USC 409 makes it unlawful to obstruct navigable channels. It sets forth the duty of the owner of a sunken craft to mark and remove it. Failure to do so is considered an abandonment of such craft, subjecting it to removal by the United States. o 33 USC 414 provides for removal by the Secretary of the Army of sunken wreck obstructing navigation. It contains provisions for notice to the owner and authorizes the Secretary of the Army to contract for removal. o 33 USC 415 provides for summary removal in emergency cases. When an obstructing vessel or craft seriously interferes with or especially endangers navigation, the Secretary of the Army may take immediate possession of such craft and remove or destroy it and clear the waters of the obstruction.	The Corps of Engineers, U.S. Army, has been successfully operating under the Wreck Statute for over 80 years in clearing the navigable waters of the United States of obstructions caused by sunken vessels. Removal of wrecks by the Corps of Engineers is generally confined to those considered obstructive to general navigation. The Corps of Engineers has its own contracting authority and some in-house capability for wreck removal. In time-critical situations, the Corps may request Navy assistance and/or obtain assistance under an existing Navy salvage contract.

AUTHORITY	PURPOSE	COMMENT
P.L. 96-387 (94 Stat. 1545) National Defense Features	Authorizes the Secretary of Commerce to equip certain U.S. vessels with national defense features.*/	A possible federal assistance mechanism for improving the salvageability of U.S. ships.
Merchant Marine Act of 1936 46 USC 1192 (Construction, Reconstruction, Remodeling)	Authorizes the Maritime Administration to construct, recondition, or remodel vessels in private or public shipyards.	A possible mechanism for strengthening the U.S. salvage fleet.
46 USC 1273 (Obligations, Guaranteed Payment)	Authorizes the Secretary of Commerce to guarantee private financing of vessels.*	A possible mechanism for strengthening the U.S. salvage fleet.

*/Authority recently transferred to Secretary of Transportation.

STATUTES RELATING GENERALLY TO SALVAGE IN THE U.S.

AUTHORITY	PURPOSE	COMMENT
"Cabotage Law," (Act of 11 June 1940) 46 USC 316	Restricts the activities of foreign tugs and salvage vessels in U.S. navigable waters.	Approval of a high customs official is required in order for foreign salvage vessels to work in coastal waters of the U.S. The effect of the law is to make it very difficult to utilize foreign salvage vessels on a timely basis, even though such assistance may be the only kind available in an emergency. Coverage may not apply to Alaska or Hawaii.
46 USC 725 Canadian Vessels Aiding Vessels Wrecked or Disabled in U.S. Waters	Authorizes Canadian vessels to render aid or assistance to Canadian or other vessels wrecked or disabled in the waters of the United States continguous to Canada, and vice versa.	This statute, together with a 1908 treaty, allows Canadian salvors to operate in waters of the United States continguous to Canada, in return for reciprocal privileges for United States salvors. The Cabotage Law excepts salvage operations authorized by treaty or by 46 USC 725.
Salvage Act of 1912 46 USC 727-731	To harmonize U.S. law with the Salvage Convention of 1910 (Brussels Convention). The Convention establishes arrangements	Public vessels not included. There is some feeling that the Salvage Convention of 1910 is inadequate

AUTHORITY	PURPOSE	COMMENT
Salvage Act of 1912 (Continued)	governing the conduct of salvage operations and the obtaining of compensation for them.	to cope with present conditions. Particular points at issue: o The effect of the Convention is to segregate salvage by public vessels from salvage by private vessels. As a consequence, different legal and compensatory regimes have arisen for public and private salvage. o The terms of the Convention do not address the modern problem of pollution hazards, which often attend salvage incidents. There is no consideration of salvage of liability or at least remuneration for preventive measures against pollution. A modern revision of the 1910 treaty is currently under way under IMO sponsorship.
Suits in Admiralty Act 46 USC 741-752	The intent of the Act is to subject the U.S. to the same liabilities, apart from seizure, as are imposed by law on the private shipowner. Sec. 10 of the Act authorizes the U.S. and the crew of any merchant vessel owned or operated by the U.S. to sue for compensation for salvage services rendered by such vessel and crew.	This Act, together with Public Vessels Act, constitutes a broad, consistent and complete waiver of the government's sovereign immunity, with the exception that public vessels cannot be seized or attacked through court action. This exemption from seizure is relevant to salvage because salvage

AUTHORITY	PURPOSE	COMMENT
Suits in Admiralty Act (Continued)		awards are determined after the fact. However, it can be argued that it is unnecessary to seize a U.S. vessel in order to achieve payment on a salvage award.
Public Vessels Act 46 USC 781-790	Grants a right of action for damages caused by government vessels of the United States. Affords claimants a legal remedy for damages by public vessels including salvage claims against public vessels.	The Public Vessels Act deals only with suits against the United States, including actions for compensation for towing and salvage services rendered to public vessels. This Act has nothing to do with affirmative Navy claims for salvage services rendered by the Navy, which are the usual situations where Navy salvage forces are involved. In a recent court case (JULIUS A. FURER litigation) it was held that suits against the U.S. must conform strictly to this statute. It follows that a commanding officer lacks the authority to sign a Lloyd's open form salvage agreement, which would commit the U.S. to arbitration in London and give the salvor a maritime lien.
Act of 3 July 1944, amended by Act of 10 August 1956 10 USC 7721-7730 10 USC 7622	Provides the Navy with authority to stay judicial proceedings under the Public Vessels Act in time of war. Also provides the Navy	Enables claimants against the Navy to settle admiralty claims without having to resort to litigation. However, should satisfactory settlement

AUTHORITY	PURPOSE	COMMENT
Act of 3 July 1944 (Continued)	authority to settle claims for damages caused by Naval vessels without litigation. These include claims for compensation for towage and salvage service, including contract salvage, rendered to a vessel in the naval service or to other property under the jurisdiction of the Navy.	prove to be impossible, the necessary authority to sue is provided by the Public Vessels Act.
33 USC 1221-1227 Ports and Waterways Safety Act of 1972	Authorizes the U.S. Coast Guard to establish Vessel Traffic Services and Systems for ports, harbors, and other congested waters.	The Coast Guard may require that vessels use or otherwise comply with established port and waterway safety procedures. *Special procedures*, such as restricting vessel operations, may be applied in particular circumstances, such as in the movement of hazardous cargoes or in adverse environmental conditions.
P.L. 96-510 Comprehensive Environmental Response, Compensation, and Liability Act of 1980	Provides for response to hazardous substances emergencies.	Establishes a tax on hazardous substances and a Hazardous Response Trust Fund. Provides that the National Contingency Plan authorized under Sec. 311(c)(2) of the Federal Water Pollution Control Act of 1972 shall include a National Hazardous Substances Response Plan. Requires that the National

AUTHORITY	PURPOSE	COMMENT
P.L. 96-510 (Continued)		Response Center be notified of all unauthorized releases of hazardous substances. Authorizes the President to act, consistent with the National Contingency Plan, to respond to hazardous substances emergencies unless the President determines that a responsible party is responding satisfactorily. Authorizes the President to initiate abatement actions in response to the threat of a hazardous substance emergency; assigns liabilities and establishes rules of financial responsibility.

OTHER SALVAGE-RELATED STATUTES

AUTHORITY	PURPOSE	COMMENT
Recaptures: Award of Salvage Costs, and Expenses 10 USC 7672	Applies in the event that the Navy recaptures, before condemnation as a prize, a vessel which has been seized by the the enemy. States the duty of the Court, the disposition to be made of the recaptured property, and provides that the amounts awarded as salvage shall be paid to the U.S.	When a vessel is captured by the enemy in time of war the question of her seizure and subsequent condemnation or release is for the courts of the captor. The purpose of bringing in a captured ship or cargo for adjudication is to have a sentence of condemnation pronounced by a proper tribunal, a Prize Court, declaring the capture to have been properly made. Such a decree is necessary to vest the property in the captor. The proceedings are in rem, and they transfer a title to the property which should be universally recognized, if the Prize Court has jurisdiction. However, if the ship is recaptured before condemnation as prize, she has no such status. The situation then is of a captured ship which has been recaptured, with no change in her original status. Recapture of a vessel or property from an enemy, pirate, or privateer has long been recognized as a salvage service and the subject of a salvage award. Since possession of the

AUTHORITY	PURPOSE	COMMENT
Recaptures: A Ward of Salvage, Costs, and Expenses 10 USC 7672 (cont'd.)		owner was displaced by the capture, restoration of the property to him is a beneficial service, resulting in a salvage award.
Seamen's Suits 28 USC 1916	Relieves seamen from prepayment of court fees, costs, or security in suits that they bring concerning wages or salvage or the enforcement of health and safety laws enacted for their benefit.	This statute looks back to former times when seamen were believed to be impecunious, improvident, and imposed upon by their employers. As such, they were considered wards of the admiralty.
Tariff Act of 1930 Provisions Regarding Cargo of Wrecked Vessels 19 USC 1483 19 USC 1310	19 USC 1310 allows free importation of merchandise recovered from sunken and abandoned vessels. 19 USC 1483 allows the wrecked merchandise to be entered and cleared through customs, leaving the rights of ownership and other claims to be determined by court order or other proceedings.	The procedures for entering and clearing cargo from a wrecked vessel are as follows: o The vessel must have been sunk in U.S. waters for 2 years or more. o The vessel must have been abandoned by the owner. o The salvor must raise such vessel (or, presumably, retrieve the cargo). o The salvor must enter the merchandise in the applicable customs district. The salvor of the cargo is regarded as the consignee for customs purposes.

AUTHORITY	PURPOSE	COMMENT
Wrecked Vessels Act of 24 February 1915 46 USC 14	Authorizes the U.S. registration of foreign-built vessels which have been wrecked in U.S. waters; purchased by U.S. citizens (such as U.S. salvors); and repaired in U.S. shipyards (at the expense of U.S. owners), so long as the value of repairs equals three times the appraised salved value of the vessel.	It is not believed that vessels qualifying for documentation under these provisions represent a significant addition to the U.S. Merchant Marine.
Agreement as to Loss of Lien or Right to Wages 46 USC 600	Protects the seamen's lien for wages. Provides that any stipulation by which a master or seaman consents to abandon his or her right to wages, or to abandon any right to salvage, is wholly inoperative.	Crew members of ships regularly engaged in salvage are not entitled to salvage awards. This is because the crew members perform work that they may have been hired to do. As such, they are not volunteers, and voluntarism has traditionally been an essential element for a salvor to qualify for a salvage award. Since this element of voluntarism is absent in the case of professional salvage crews, they do not have any rights in the nature of salvage, and thus are not within the purview of the statute.
Attachment or Arrestment of Wages 46 USC 601	Protect seamen's wages and salvage awards from seizure.	This statute protects the sailor against signing away his potential <u>future</u> salvage rights.

AUTHORITY	PURPOSE	COMMENT
Plunder of Distressed Vessel 18 USC 1658	Prohibits and punishes: plundering a distressed or wrecked vessel within the jurisdiction of the U.S.; obstructing the escape of any person trying to save his life from such a vessel; or rigging false lights or extinguishing true lights with intent to bring a vessel into danger.	This is the only section of the U.S. Criminal Code directly related to salvage. It is in the chapter dealing with piracy and privateering.
46 USC 721 Vessels Stranded on Foreign Coasts	Provides that the U.S. Government, through its consuls, will assist U.S. vessels that are in extremis on foreign shores for the purpose of saving the vessel, its cargo, and other effects and delivering them to the owners. When the master, owner, or consignee is present or otherwise capable of taking possession, the consul shall not exercise such authority.	The settlement of salvage liens takes precedence over such consular actions.
46 USC 722-724 Wrecks on the Coast of Florida	Regulates the disposition of salved property on the coast of Florida by licensing vessels and masters regularly employed in wrecking.	These statutes hark back to the days when there was considerable salvage and wrecking activity on the Florida Keys and coasts. These sections were lucrative business for American salvors. The U.S. Cabotage laws, especially 46 USC 316(d), treat similar matters in a more broadly applicable way.

APPENDIX D

LETTER TRANSMITTING A PROPOSED SALVAGE BILL
(SALVAGE ACT OF 1948) TO CONGRESS

Navy Department
Washington, 8 August 1947

Honorable Chan Gurney
Chairman of the Committee on Armed Services,
United States Senate

My Dear Mr. Chairman:

There is transmitted herewith a draft of a proposed bill to authorize the Secretary of the Navy to provide salvage facilities, and for other purposes.

The purpose of the proposed legislation is to authorize the Secretary of the Navy to provide, by contract or otherwise, necessary salvage facilities for public and private vessels; to acquire or transfer such vessels and equipment as may be necessary for operation by private salvage companies, and, if and when necessary, to advance funds to private companies so as to provide for the immediate financing of salvage operations under such terms and conditions as the Secretary of the Navy may deem adequate for the protection of the Government. The proposed bill contains a provision that proposed contracts for salvage facilities which affect the interests of the United States Maritime Commission would be submitted to the Maritime Commission for recommendation and comment.

In addition, the bill would authorize the Secretary of the Navy to adjust and settle claims for salvage services rendered by facilities operated by the Navy. Moneys received as a result of adjustment and settlement would be credited to the appropriation made for the Navy Department for the purpose of maintaining salvage facilities, and all moneys in excess of the actual cost incurred by the Navy in rendering salvage services would be covered into the Treasury as "Miscellaneous receipts." The proposed bill also authorizes the appropriation of such sums, not in excess of $3,000,000 annually, as may be necessary to effectuate the purposes of the act.

It is of vital interest to the United States that there be in existence in peacetime adequate facilities for salvaging United States ships, public and private, and that such facilities be capable of expansion in wartime as part of the national defense. In order to insure the availability of adequate offshore salvage facilities for all ships, the responsibility should be vested in one agency of the Government. The Navy Department is the logical agency for this task, for the following reasons: (1) The Navy already has a salvage organization which thoroughly understands all phases of the problem; (2) the Navy must continue in time of peace a sufficient interest in the matter of salvage to be certain that sufficient personnel in the Navy and commercial salvage companies are maintained in a high state of training and readiness for war service; (3) the Navy has sufficient salvage vessels manned by naval personnel to cover any areas of the waters controlled by the United States where no private salvage enterprises will undertake to engage in offshore operations; and (4) the Navy has and will continue to operate a training school for divers, salvage mechanics, and salvage officers.

The United States Government is now the largest owner and operator of ships in the world. With the return of normal times more and more merchant ships will be transferred to private ownership, but the United States will still have a vast financial interest in shipping. In addition to the financial interest, there is a potential naval value to the Government in these ships arising out of the fact that they would be converted to war use upon the occasion of the outbreak of war. The Navy is retiring to an inactive status, or otherwise disposing of, a large portion of its wartime fleet, but the number of ships that will remain in commission will be considerable. The original cost of many of the individual naval ships exceeded $50,000,000, and some of the capital ships exceeded $100,000,000 in cost. The saving of such a ship would compensate many times over the cost of maintaining the most elaborate salvage facilities.

The amount of salvage work required by the Navy in normal times is so small that if naval salvage facilities are to be used only for the salvage of naval craft, it is likely that the personnel will be too infrequently employed to be kept in a satisfactory state of training and readiness. The proposed bill would overcome this difficulty by authorizing the Secretary of the Navy to enter into contracts with private companies to encourage them to provide adequate salvage facilities in various areas for all vessels and by authorizing the Navy to undertake with its own salvage vessels the salvage of other than naval ships in those areas where salvage facilities are not provided by private enterprise. This will eliminate the attendant unwarranted cost of maintaining naval salvage facilities in areas where adequate private facilities are in existence. If advantage cannot be taken of available commercial facilities, it will be

necessary to maintain an uneconomically large Navy salvage organization to afford adequate protection throughout the extensive areas which are now, and for many years will be, of interest to the United States.

Between World Wars I and II, the Navy had an annual contract with a private concern to provide salvage services to all units of the Navy along with Atlantic Coast and in the Caribbean area. This arrangement was found to be very satisfactory from the operational standpoint, as the private concern was well equipped and highly capable of doing all types of salvage work. It was also found to be economical since the Navy was relatively small and the need for salvage service was infrequent.

Shortly before our entrance into the recent war, legislation, similar to that which is now proposed, was enacted and was effective during the time of war or national emergency. Under the provisions of that law, the Secretary of the Navy was authorized to provide salvage facilities for all vessels and to contract with private companies to provide salvage facilities. Pursuant to that authority, the Navy availed itself of the services of an established private concern to conduct salvage work for all vessels on the Atlantic Coast and in the Caribbean area. This company, with Navy assistance, also established salvage facilities on the Pacific Coast, where no private salvage companies had operated since 1937. As a result of this arrangement, the Navy was able to concentrate its efforts in the war zones. It is a well known fact that during the war the Navy salvage forces rendered invaluable service in Africa, France, and Italy in clearing ports and harbors of derelicts, barriers, and sunken vessels, which is as much an important a part of salvage work as the saving of a ship and her cargo from the perils of the sea.

To provide adequate salvage facilities for all ships and equipment of the United States, private and public, it will be necessary that salvage ships and facilities be strategically located along the Atlantic and Pacific Coasts, the Caribbean area, Alaska, the Aleutians, in the Hawaiian, mid-Pacific, South Sea, and Philippine Islands, and in Chinese and Japanese waters. The Navy Departmnet proposes to allow private companies to operate offshore salvage facilities at locations where the prospects for such operations at a profit appear good. Where conditions are less favorable, it would be to the advantage of the Government to finance private salvage companies, by charter or contract, to operate and maintain salvage ships and equipment. In other areas where there would be substantial need for salvage service by United States ships, the offshore facilities would be provided by the Navy. In areas such as Alaska, the Hawaiian, mid-Pacific, and South Sea Islands, there is little chance of any commercial contractor being able to provide suitable salvage protection for shipping operating in these areas. Some protection will be needed in these waters especially for the many

naval ships that will be operating there for the next several years. Salvage facilities in these areas should be furnished by Navy salvage vessels manned by Navy crews. The same situation exists in Chinese and Japanese waters, where there are at present large numbers of American ships and no salvage facilities except those provided by naval crews and vessels. It will in all probability be many years before any Chinese or Japanese salvage vessels with trained crews and sufficient equipment will be available. In the meantime, it is of utmost importance that the United States furnish salvage protection for the American vessels, public and private, that will be operating in these waters.

The proposed bill authorizes the appropriation of such sums, not in excess of $3,000,000 annually, as may be necessary to carry out the provisions of the act. Since the bill authorizes the Secretary of the Navy to adjust and settle claims for salvage services rendered by the Navy, it is possible that the operations of this service will not result in any appreciable cost to the Government. Earnings would be credited to the appropriate naval appropriation, and earnings in excess of the expense of maintaining the salvage service would be covered into the Treasury as "Miscellaneous receipts." During the recent war, vessels and cargo exceeding $700,000,000 in value were salvaged by the contract salvage service which the Navy operated in the coastal waters of the United States and the Caribbean. The Government levied salvage claims against vessels and cargo which were privately owned, and the moneys so collected were deposited into the Treasury to the credit of "Miscellaneous receipts." No salvage claims were made against ships and cargo which were owned by the United States Government or by certain of its allies. The net cost to the United States Treasury of maintaining this salvage service was approximately $7,000,000, or about 1 percent of the salved values. Should a large unit of the Navy or of the merchant marine become in need of salvage, the salved value of such a ship would exceed considerably the total net cost of maintaining a salvage service on the coast for a considerable period.

The facilities which the Navy desires to have provided under the terms of the proposed legislation are for offshore salvage facilities. Nothing in this bill conflicts with the responsibility of the Army engineers in the removal of menaces to navigation from navigable waters nor with the responsibility of the United States Coast Guard in the performance of rescue work at sea. Under the terms of the bill, any proposed contracts for salvage facilities which would affect the interest of the United States Maritime Commission would be submitted to that agency for recommendation and comment.

For the foregoing reasons, the Navy Department recommends enactment of the proposed legislation.

An identical report has been transmitted to the Speaker of the House of Representatives this date.

The Navy Department has been advised by the Bureau of the Budget that there would be no objection to the submission of this report to the Congress.

Sincerely yours,

John L. Sullivan
Acting Secretary of the Navy

APPENDIX E

SCENARIOS OF SHIP CASUALTIES AND SALVAGE RESPONSE

The regional working groups used a series of tests to ensure that the adequacy of salvage capability was assessed from the standpoint of severe, but credible risks, including:

- Location, type, and consequences of the most frequent casualties.
- Worst accidents (worst consequences and also most difficult response).
- Ship types, traffic patterns, density, and cargoes through the year 2000.
- Interrelationships between probability of occurrence and consequences; time-criticality and consequences; and salvage and accident severity.

The tests were formulated as casualty scenarios against which the adequacy of salvage capability could be measured. The scenarios touched on all aspects of salvage response in the regional context. For example:

- Type of Casualty -- collision, stranding, ramming, fire, structural failure, other.
- Salvage Operations -- rescue towing, removal from strand, firefighting, prevention of foundering, other.
- Conditions -- visibility, sea state, wind, accessibility of location, time-criticality, other.
- Considerations -- environmental concerns, threats to public, population centers, international bounderies, other.

The tests enabled the assessment of salvage capability throughout the regions.

Figure E-1 shows the locations of the posited casualties. Table E-1 summarizes the scenarios. The nature of the casualties, the salvage operations, and the results are described.

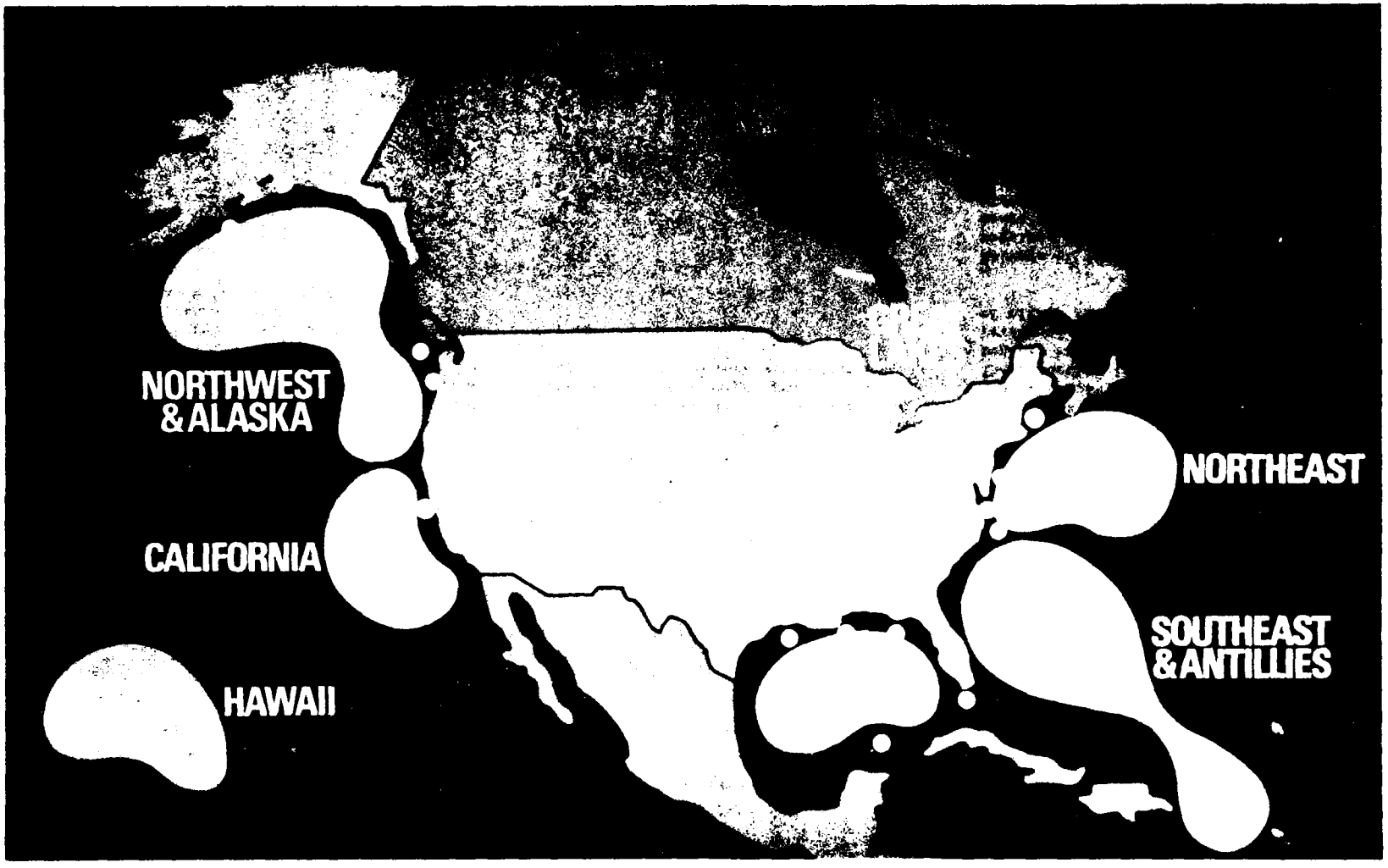

Figure E-1. Location of posited casualties.

TABLE E-1

SUMMARY OF SALVAGE SCENARIOS

	NATURE OF CASUALTY	TECHNICAL OBJECTIVES OF THE TEST	RESULTS
1.	Collision at the entrance to Delaware Bay. An inbound fully laden crude oil tanker is struck within the cargo length by an outbound laden break bulk cargo vessel. The situation unfolds at three levels of complexity: o Collision, no strand, no fire. o Collision, followed by both vessels stranding. o Collision, strand, fire.	Assess the availability of assets in the Mid-Atlantic for damage control, removal from strand, and fire-fighting.	The situation with no fire and no stranded ships is easily handled. The salvage response to the strand is adequate but ad hoc and less than optimum. With the fire, the ability to deal with the casualty breaks down because of fire-fighting equipment limitations. The success of the salvage operation is dependent on the experience, knowledge, and ability of the salvors to assemble and employ the assets that are available.
2.	Stranded Chemical Barge off Puerto Rico. A A chemical barge, fully laden with a hazardous polluting substance, inbound to San Juan, Puerto Rico, breaks away from its tow. The situation unfolds at two levels of complexity. The barge strands on a pinnacle with the cargo tanks intact; and, the barge is extensively holed and sinks.	Assess the availability of damage control and vessel refloating assets in the Carribbean; the ability to salvage a barge; and also, the ability of salvors to work with hazardous cargoes.	The strand calls for basic seamanship evolutions and equipment that is local and also obtained by air from South Florida. The expertise is within the competency of tugboat crews augmented with salvage personnel and working under the direction of either the tug or salvage master. Salvage of the foundering situation requires the discharging of the cargo by means of a specialized underwater pipefitting technique called "hot tap." Hot tap systems are available in New York and Miami and are air-deployable. The refloating operation in the scenario not complicated and has been accompliahed before. Beyond the complicating factors of sea conditions and the availability of a barge for offloading that is compatible with the hazardous cargo, the operation would be routine for a professional salvor.

TABLE E-1 Summary of Salvage Scenarios

	NATURE OF CASUALTY	TECHNICAL OBJECTIVES OF THE TEST	RESULTS
3.	Stranded Supertanker in the Florida Straits. A fully laden supertanker loses power in the Florida Straits. The situation unfolds at two levels of complexity. The supertanker drifts and requires a rescue tow; and, she strands on coral.	Assess the availability of rescue tugs in South Florida that are capable of making up to and towing a supertanker. Test the ability of salvors to refloat a stranded, fully laden supertanker, including cargo offloading.	The Florida Straits are not, at present, heavily trafficked by VLCC's, and a change in this situation is not foreseen. Once the tanker is adrift, the master can take a number of measures to slow the drift rate, thereby increasing the amount of time available for rescue. In the scenario a tug capable of the rescue arrives in time, but there is no guarantee that this would be the case on another day. Furthemore, while the tug that was available was able to handle the VLCC in good weather, the additional forces generated in bad weather might result in a different outcome. The strand is adequately handled by experienced salvors. A potentially major determinant of the outcome of the scenario is the responsibility of the owner, especially his readiness to recognize the severity of the situation and then to act accordingly to locate and contract for salvage assets. A casualty of this nature would likely attract a great deal of public attention.
4.	Tanker Stranding in Casco Bay, Maine. A fully laden petroleum products tanker strands on rock in deteriorating weather. The situation unfolds at two levels of complexity: the ship is capable of navigation and comes off at high tide; and the ship is not capable of navigation.	Assess the ability to remove a vessel from a strand and to rescue tow in an unforgiving environment where there is little time available.	The environment is not forgiving. In the instance where the vessel is not capable of navigation, it is possible that the ship and cargo could be saved if a small amount of cargo were jettisoned to refloat the ship soon after the strand.

TABLE E-1 Summary of Salvage Scenarios

	NATURE OF CASUALTY	TECHNICAL OBJECTIVES OF THE TEST	RESULTS
5.	Collier Stranding Off Norfolk, Virginia. Two situations are assessed: a light coal collier drags anchor in a squall and strands; and, a loaded collier strands on the side of the channel.	Assess salvage capability in the mid-Atlantic, region and also the ability to offload dry bulk cargoes.	The salvage of the light ship is straightforward and easily handled by experienced salvors. The salvage of the loaded ship is also straightforward provided a floating crane and barges for offloading are available.
6.	Cargo Shift in a Roll On/Roll Off Vessel. The scenario involves a shift of cargo in heavy weather that threatens to capsize the ship.	Assess the capability to salvage a Roll On/Roll Off Ship; and also the ability to stage and conduct a complex, time-critical salvage operation in the open ocean in marginal conditions.	Heavy weather precludes air operations to provide pumps or experts at the scene. The owner's actions are key. He needs to secure a rescue tug and a competent salvor *as soon as possible. Any delay may cost* him his ship. The chances of successful salvage improve with proximity to shore and decrease as distances increase.
7.	Stranded Great Lakes Ore Carrier.	Assess salvage capability in the Great Lakes.	*There are only limited salvage assets in* the region, but needed assets can be brought in less than a day. Great Lakes weather can be severe in late Fall, and the tugs in the region occasionally cannot transit safely on the lakes. Thus, the *availability of a rescue depends on the* weather.
8.	Collision of Tanker and Grain Carrier off Galveston, TX. The grain carrier's bow penetrates the tanker amidship. There is considerable structural damage on both ships and fires ensue.	Assess damage control and fire-fighting capability.	Overall response is adequate, partly from lessons learned from a similar casualty in the past and from improved availability of liquid cargo receiving tankers drawn from Galveston lightering zone traffic. Problems were encountered due to lack of equipment and information aboard stricken ships and from delays in contracting tanker owner ı Far East. Response would be improved by ready avai'ability of locators or directories for personnel and equipment.

TABLE E-1 Summary of Salvage Scenarios

NATURE OF CASUALTY	TECHNICAL OBJECTIVES OF THE TEST	RESULTS
9. VLCC Breakdown in Open Sea. A laden VLCC loses propulsion in the Yucatan Straits. An approaching hurricane threatens to drive the ship into Mexican jurisdiction.	Assess the capability for rescue towing in the Gulf.	The response is marginal. Wind and sea conditions are close to the operating limits of tugs in the area. The tugs are not well matched (in terms of towing capability) to the task of towing a VLCC.
10. Ramming of Unmanned Platform. A loaded petroleum products tanker rams an unmanned oil and gas production platform. A fire ensues.	Assess fire-fighting and damage control capabilities.	Overall response is reasonably adequate due to extensive facilities, equipment, and experience in the Gulf Region. The situation would be improved with better fire-fighting equipment onboard the tanker and also training.
11. Collision of Benzene Tanker and Container Ship. A "drug store" tanker is struck by a container ship carrying, among other cargo, an oversize container of spent nuclear fuel.	Assess the capability to salvage these kinds of ships, to make heavy lifts, and to conduct operations involving hazardous materials.	The response is marginally adequate, partly because the casualty occurs near helicopter operating range limits and there is, at present, no strong assurance that an offloading tanker and derrick barge will be released from other assignments for emergency work. Additional concerns are the relative risks of the derrick barge (or other offloading receiver) approaching the container ship before the fire is extinguished versus the risks of the fire reaching the nuclear container or the nuclear container being jettisoned in over 6,000 feet of water (or in any water depth). The adequacy of the onboard protective clothing, breathing gear, and monitoring equipment is also questionable along with the adequacy of the onboard fire-fighting equipment. While it is desirable to take the ship to a safe haven for emergency repairs, the presence of toxic products or radioactive material increases concern as to the likelihood of obtaining permission to enter a safe haven.
12. Stranding of Ammonia Tanker off Florida. An ammonia tanker suffers a steering failure and is driven aground.	Assess the capability to refloat the ship and to salvage a hazardous cargo.	The response is adequate, though that might not be the case for a larger ship in the northeastern Gulf area. The only questionable aspect is the availability of NH_3-compatible tankers for offloading. Other concerns are adequacy of onboard protective clothing, etc.

TABLE E-1 Summary of Salvage Scenarios

NATURE OF CASUALTY	TECHNICAL OBJECTIVES OF THE TEST	RESULTS
13. Tanker Rams Jack-Up Drilling Rig Off Louisiana. The tanker bow goes beneath the jack-up deck and damages the legs of the drilling rig.	Assess the capability to stem the flow of oil from all sources, save the cargo, separate and repair the tanker and drill rig.	The response is adequate because of the lessons learned and experience and equipment built up during many years of offshore oil and gas activities. A key item of equipment is a large crane barge. These are found in the offshore oil fields, but would be much harder to find elsewhere.
14. Stranding Off Oahu, Hawaii. A tanker breaks from a mooring and strands before rescue tugs can reach her.	Assess salvage capability in Hawaii.	This area seems to be well equipped with salvage equipment and skilled personnel able to conduct salvage operations; however, the commercial marine community is not organized for salvage at this time, owing to the infrequency of casualties requiring salvage.
15. A Roll On/Roll Off (RO/RO) Ship Rams an Oil Production Platform in Cook Inlet, Alaska. A RO/RO ship is caught by ice and swept into an oil platform. The ship is severely holed and threatens to capsize.	Assess the capability to control the damage, offload cargo, and tow in south-central Alaska under ice conditions.	There are ample resources to respond to the casualty. Tugs capable of the rescue operate locally, and the necessary equipment is found in the area. The salvage personnel are flown in from Seattle.
16. Collision at the Entrance to Juan de Fuca Straits, Washington. A container ship collides with a crude oil tanker. An engine room fire starts on the tanker and the crew abandons ship.	Assess the capability to offload cargo and to rescue tow in the Pacific Northwest. Also determine whether there are potential jurisdictional problems with Canada.	Rigorous seas and weather complicate the operation, but the offloading is successful. Equipment and experienced personnel are available for lightering and towing tankers to any port on the West Coast.
17. Collision Between LNG Ship and Fish Processing Ship off Kodiak Island, Alaska. A loaded LNG ship rams a fish processing ship on station. The ammonia system on the fish processor is damaged and leaks; the ship is holed; the LNG ship incurs bow damage, but its cargo tanks are intact.	Assess capability for making emergency repairs and removing ships from strands in the presence of hazardous cargoes.	Salvage assets are obtained from Portland, Oregon and therefore their availability and time of arrival are dependent on the weather. An unresolved issue is whether U.S. authorities would allow the venting of LNG at sea.

TABLE E-1 Summary of Salvage Scenarios

	NATURE OF CASUALTY	TECHNICAL OBJECTIVES OF THE TEST	RESULTS
18.	Stranding of Ammonia Tanker off the Coast of Oregon. The ship strands on an offshore bar and suffers structural failure.	Assess the capability to prevent foundering and to remove from strand in the presence of a hazardous cargo.	The success of the salvage response in this scenario critically depends on the availability of the proper platform--one with sufficient bollard pull and station-keeping ability, as well as serviceability as swells break over it. Offloading equipment for the ammonia cargo is not available, so the cargo would have to be jettisoned or gravitated if the ship cannot be pulled quickly off the strand. In the conditions described, it would be almost impossible to fog or spray the cargo, and it would be difficult to prevent the release of an ammonia cloud. The scenario is extremely time-critical. Scouring will occur with the ebb current, and the ship cannot lie on the bar more than 36 hours without breaking up.
19.	Structural Failure off San Francisco, California. A chemical tanker carrying benzene is improperly loaded, cracks and breaks in two. The stern section sinks while the bow remains adrift.	Assess the capability for cargo shifting, emergency repair, refloating and rescue towing along the central Pacific coast.	The execution of the salvage operation is controlled by weather. Retrieval of the stern section would require four work weeks. The status of local plans for evacuation, as well as their achieveability, and who would take responsibility are serious matters in this scenario, but outside the salvor's control.
20.	Stranded tanker and fire, Long Beach, California. A petroleum products tanker grounds on the breakwater, catches fire, and explodes.	Assess firefighting, vessel stabilization capability in Southern California.	There is inadequate local fire-fighting capability. A minimum of twelve hours would be required to obtain specialized mobile fire-fighting expertise and equipment. The adequacy of this equipment is not established. Jurisdictional problems and public concerns could hamper emergency response.

TABLE E-1 Summary of Salvage Scenarios

NATURE OF CASUALTY	TECHNICAL OBJECTIVES OF THE TEST	RESULTS
21. Tanker Fire, Prince William Sound, Alaska. Fire breaks out in the engine room forcing loss of control and power systems.	Assess firefighting and rescue towing capability in Prince William Sound, Alaska.	This scenario is a credible worst case for the given conditions. Intensive study has been made of the risks associated with tanker traffic entering and leaving Valdez. Equipment is available in the area with a view to the occurrence of this type of casualty. A stranding would probably be averted under more severe conditions than those postulated. Equipment and trained fire-fighting crews are available. All vessels entering Valdez are required to be equipped with specific emergency towing gear, and tug escort procedures are strictly followed, so that the likelihood is high of reaching a distressed vessel in time to avert grounding. Since the assist vessels are under contract to the terminal operator for ship assist, fire-fighting, and rescue towing service, little time would be lost in making contractual agreements.

APPENDIX F

COST OF A DEDICATED SALVAGE VESSEL

The manning of dedicated ships on salvage station became unprofitable during the 1960s and 1970s as the frequency of shipping accidents declined and the expense of maintaining a ship and crew on station climbed.

The committee developed preliminary information on the cost of building and operating dedicated salvage vessels on station.*/ The financial estimate was based on experience with ships of similar size and class, and on the limited information available. Certain assumptions were made in order to calculate costs. The ship would be continuously manned by a minimum ship crew (in other words the crew would need to be augmented with a dozen or more for salvage work). The ship would either be in port or at sea on paying salvage jobs. The ship would respond to about twenty emergencies a year and operate on a paying basis 140 days a year.

Costs were figured for two designs. The minimum design was based on the offshore supply vessel. The custom design was modeled after commercial salvage ships. The characteristics of the designs are presented in Table F-1. The cost data are summarized in Table F-2.

To calculate required annual earnings (Table F-3), it is necessary to assume the cost of money (50 percent of capital borrowed at 15 percent); profit objective (two times the real cost of money); and tax schedule depreciation (straight line over 12 years).

For a profitable commercial venture, a daily rate of $30,000 or $65,000 is required. If the ships were operated commercially by civilian crews but built by the government at taxpayer's expense, the daily rate would have to be $15,000 or $19,000 to break even. For purposes of comparison, a daily rate of $20,000 or more for modern tugs in rescue service is considered high but not unheard of.

*/This material was developed for the committee by Mr. Benjamin V. Andrews, transportation consultant, Menlo Park, California, September 1981.

TABLE F-1 Salvage Ship Design Characteristics

ITEM	MINIMUM[1]	CUSTOM[2]
Length overall	200 ft	210 ft
Beam	42 ft	38 ft
Depth	20 ft	22 ft
Design Draft	15 ft	15 ft
Deadweight	800 long tons	900 long tons
Brake Horsepower	6,000	10,000
Speed	15.5 kn	19-20 kn
Bollard Pull	85 tons	120 tons
Range	Medium	Long
Crane Capacity	10 tons	20 tons
Chain	50 shots (4500 ft)	100 shots
Anchors	4 medium	8 heavy
Buoys	4	8
Shops	Very limited	Limited
Excess Electrical Power	100 percent	150 percent
Dynamic Positioning	Sea State 4	Sea State 6
Stern	Non-snag	Roller
Air Compressors	Diver Only	Diver and Inflation
Towing Winch	Yes	Yes
Work Boats	2 @ 30 ft	3 @ 36 ft
Fire Monitors	2	3
Auxiliary Controls	After Deck, Open	After Deck, Enclosed

1 Based on an offshore supply ship design.
2 Based on a commercial salvage ship design.

TABLE F-2 The Cost of a Salvage Tug[a]

Cost Item	Minimum Ship	Custom Ship
Capital Cost (U.S. Construction)	$ 7.00	$12.00
Annual Operating Cost		
Fuel	.58	1.00
Crew	1.01	1.14
Other	.41	.48
Shore base	.08	.08
	2.10	2.70

[a] Millions of 1981 U.S. Dollars

Table F-3 Required Earnings for a Dedicated Salvage Vessel

Cost Item	Minimum Ship	Custom Ship
Operating costs	$ 2.10	$ 2.7
Depreciation	.58	1.0
Interest	.52	1.8
Profit	1.05	3.6
Total Required Earnings	$ 4.25	$ 9.12

[a] Millions of 1981 U.S. Dollars