National and International Efforts to Prevent Traumatic Vessel Source Oil Pollution

Andrew W. Anderson

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NATIONAL AND INTERNATIONAL EFFORTS TO PREVENT TRAUMATIC VESSEL SOURCE OIL POLLUTION

ANDREW W. ANDERSON*

In this article, the author outlines the enormous economic, human, and ecological damage caused by traumatic vessel source oil pollution. After an examination of the technical context of the problem, he explores current international and national efforts to combat the problem such as construction standards, traffic regulation, and crew training. He concludes that effective prevention technology is currently available, but awaits implementation through international cooperation.

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I. INTRODUCTION: THE PROBLEM

A. Traumatic Vessel Source Oil Pollution

Within the past decade, the subject of oil has grown in importance until it seems to impinge on our consciousness during every moment and in relation to every area of thought and activity. We are constantly bombarded by discussions of oil as a scarce but vital commodity, oil as a tool of world power politics, oil as a target of world strategies, oil as inducing a world economic crisis and even oil as a world threatening pollutant. Given the crisis atmosphere

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generated by some of these problems, one might think that the pollution threat associated with oil spillage would receive short shrift in the allocation of world priorities and concerns. That this has not occurred is eloquent testimony to the growing world awareness of the severity of the oil pollution problem and the necessity for positive steps to protect the global marine ecosystem.

While the steps that have been taken have often been faltering and small, their very accomplishment in an era of increasing paralysis in the arena of multilateral, international cooperation is no small feat. One aspect of this continuing fight against oil pollution which has not received the attention it deserves is international and national efforts toward the prevention of traumatic vessel source oil pollution of the marine environment. While traumatic pollution, which arises primarily from collisions and groundings of vessels, originally generated much of the initial concern about marine oil pollution, the primary focus of world efforts to deal with the problem has shifted to other areas of oil pollution concern such as the imposition of greater legal liability for spills and discharges, compensation for oil pollution damage, and prevention of operational oil pollution.

Nevertheless, the analysis of traumatic vessel source oil pollution at this time presents a more useful approach to the problem of significantly reducing oil pollution than do these other methods. Potential liability for oil pollution damage has some deterrent or preventive effect, but it has been the subject of such exhaustive analysis, and so many statutory enactments and international co-

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1. The term "traumatic" oil pollution, as will be explained more fully, is applied to oil pollution that results from an unexpected and abnormal occurrence which causes damage to the physical containment system of the oil and results in spillage. The terms "marine environment" or "marine ecosystem" refer to the total life system of the world's oceans and coastal zones including neritic and oceanic biota, the hydrologic cycle, and biota of the coastal and littoral zones. These terms also take into account the extent to which marine and littoral life systems exercise a significant influence on one another (including influences concerning estuarine systems, coastal salt marshes, etc.).

2. The term "operational" oil pollution is generally used to refer to oil pollution that arises as part of the normal operations and procedures of oil storage, transfer, and transportation systems. Examples include bilge pumping, tank washing and de-ballasting.

3. For a detailed analysis of liability of oil pollution damage, see Bergman, No Fault Liability for Oil Pollution Damage, 5 J. MARITIME L. & COM. 1 (1973); Goldie, Liability for Oil Pollution, 6 J. MARITIME L. & COM. 303 (1975); Goria, Compensation for Oil Pollution at Sea: An Insurance Approach, 12 SAN DIEGO L. REV. 717 (1975); Meiklejohn, Liability for Oil Pollution Clean-up and the Water Quality Improvement Act of 1970, 55 CORNELL L. REV. 973 (1970); Mendelsohn, Maritime Liability for Oil Pollution - - - Domestic and International
operative efforts⁵ that it has little remaining potential for stimulating further reduction in vessel source oil pollution. The effectiveness of assessing liability for damage already incurred or providing compensation therefore as a means of protecting the environment is further limited by the fact that even when the questions of such liability and compensation have arisen, irreversible damage, for which there cannot be an adequate remedy, has already occurred.⁶ Ecologically, it is better to prevent the spill and damage in the first place than to worry about complicated compensation schemes which can do little to restore the natural balance once it has been altered.

Similarly, control of oil pollution after its escape through clean-up, restoration, and limitation of the actual spillage is of limited value in attempting to reduce total vessel source oil pollution. While invaluable in minimizing damage to the environment once the spill has occurred, the control of such spills does little to prevent the initial traumatic incident. This highly technical area has been largely left to the scientists and engineers⁷ with the exception of one

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⁷ See California v. S.S. Bournemouth, 307 F. Supp. 922 (C.D. Cal. 1969); accord, Maine v. M/V Tamano, 357 F. Supp. 1097 (S.D. Me. 1973), concerning the right of a State to recover, as parens patriae on behalf of its citizens, for oil pollution damages to the waters themselves. The assessment of a dollar value of ecological damage remains extremely difficult because of the aesthetic and societal values involved as well as the little understood complexities of the ecosystem. Quaere: May the United States bring an action as parens patriae for oil pollution damage to the living resources and fisheries of the Continental Shelf beyond the limits of State jurisdiction?

⁸ At least a minimal understanding of control techniques and difficulties is essential for a complete grasp of the problems of dealing with the oil pollution problem. For a presenta-
agreement on jurisdiction to take control measures.\footnote{Prevention of traumatic pollution, however, prevents the oil from entering the environment in the first place and not only obviates the need for litigation and its associated expense, but totally dispenses with costly clean-up operations and the capital investment in equipment and organization necessary for large scale clean-up. Another prime benefit of traumatic pollution prevention efforts is the avoidance of the traumatic incidents themselves. These incidents such as collisions and groundings not only cause pollution damage, but are costly in terms of lives lost, injuries, damage to ships and cargoes, lost time due to repairs, interference with commerce caused by wreckage and clean-up operations, as well as economic and personal suffering and related social costs. Moreover, with increasing energy costs and shortages, the saving of the oil itself becomes a desirable goal.}

\footnotetext{8. The Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, done Nov. 29, 1969, 9 INT'L LEG. MAT. 25 (1970), gives a coastal nation pollution control jurisdiction over foreign vessels on the high seas in limited circumstances where the state is threatened with oil pollution. Under domestic law, negligence in control efforts by the government can also result in liability to damaged third parties. See Burgess v. M/V Tamano, 373 F. Supp. 839 (S.D. Me. 1974).

9. Lloyd's Register of Shipping (1975) reports that the year 1974, saw an all-time high for vessel losses. A total of 71 vessels with a registered tonnage of 681,706 tons were lost at sea, resulting in an economic loss in ships and cargoes of $273 million. Every year, there are over 2,400 casualties of all types involving an average of 4,000 vessels. Of these, an average of 344 are total losses. Bates & Yost, Where Trends the Flow of Merchant Ships? in The Law of the Sea: The Emerging Regime of the Ocean, 249, 263 (J. Gamble ed. 1973) [hereinafter cited as Bates & Yost]. In the United States, losses from collisions, groundings and rammings are reported at the rate of $40 million per year, but actual losses are probably in excess of $200 million; the discrepancy is due to failure to file required reports. There are an estimated 56 people killed and 52 injured each year in the United States by such incidents and an estimated 2.35 million gallons of pollutants spilled. United States Coast Guard, 1 Vessel Traffic Issue, Study 4 (1973).}
Although the prevention of traumatic pollution has not attracted the world attention which has been afforded operational vessel source oil pollution, the attention to operational vessel source pollution prompted the adoption in 1973 of a comprehensive international convention dealing with that problem and, to a lesser extent, traumatic pollution. Since that time, the area of traumatic oil pollution prevention has been the subject of increased legislative and technical initiatives.

The chief areas of endeavor in traumatic pollution prevention are multilateral, international efforts and unilateral, or national efforts. World response to the threat of this age-old well recognized pollutant will be a test of the international ability to cooperate legislatively in coping with the pollution caused by other politi-

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10. Operational oil pollution not only includes that pollution which arises normally and predictably from routine operations associated with maritime transportation of oil, but also includes negligent discharges caused by human error and oversight, hose rupture, and other spills which are part of the normal risk associated with such operations.

11. The 1973 Convention on the Prevention of Pollution from Ships, done Nov. 2, 1973, 12 Int’l Leg. Mat. 1319 (1973) [hereinafter referred to as the 1973 Convention]. Ratification of the 1973 Convention has been postponed by many nations pending the outcome of the Third U.N. Conference on the Law of the Sea. The 1973 Convention creates an effective prevention and enforcement system accompanied by detailed technical annexes. It represents the culmination of over 50 years of effort and with full implementation will eliminate almost all operational pollution. The adoption of the 1973 Convention will effectively limit further advances until world reaction to the far reaching proposals of the 1973 Convention are measured.

12. Oil pollution first became a major problem just after the turn of the century. With the increased use of the automobile and airplane, and with the replacement of coal by oil as the major fuel for shipping and industry, maritime transport of oil increased. This increase was accompanied by a marked rise in the number of incidents of marine oil pollution. The United States called the first international conference on oil pollution in Washington, D.C. in 1926. All of the 73 nations present signed a convention banning oil discharges within 50 miles of a coast, but none ratified it. Resolution Noting Damage Done by Oil Pollution and Calling for an International Conference to Deal with the Problem, 42 Stat. 821 (1922); 4 Whitman, Digest of International Law 696 (1965). In 1930 subsequent attempts to deal with the problem at the Hague were also unsuccessful. Further attempts were interrupted by World War II when large scale torpedos of oil tankers brought the problem of traumatic oil pollution to world attention. See generally Wule, Contiguous Zones for Pollution Control, 3 J. Maritime L. & Com. 537 (1972).

13. It must be remembered that "the energy of economic exploitation seems far greater than the energy of community welfare on all levels of social organization." Only legislation, national or international, has been effective to control pollution. Economic controls do not exist. The implementation of complex environmental controls limiting industrial use of air and water is a major factor in diminishing profits, while unlimited use of air and water by industry is synonymous with higher profits. Ultimately, however, the costs of pollution, whether in the form of a ruined environment or in the form of increased costs due to controls, are borne by society. A. Koers, International Regulation of Marine Fisheries 221 (1973).
cally and strategically important commodities. Attempts to deal with vessel source oil pollution can provide a model for pollution control efforts generally. This contention is strengthened by several factors. First, since vessels are polluters of the sea, the technical aspects of vessel source oil pollution have received great attention.

Therefore, the lack of empirical data which hampers prevention efforts in other areas is not present here. Additionally, ships are true subjects of international law, constantly crossing international boundaries, and the world shipping industry is an important economic and strategic area of commerce. Finally, the problems of vessel source pollution have been the subject of historic as well as contemporary international cooperative efforts.

The presence of all these factors creates a situation ripe for

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15. Vessels of all types (military, freighters, tankers, etc.) are thought to account for about 95 percent of all maritime oil pollution. Hardy, Definition and Forms of Marine Pollution, in 3 NEW DIRECTIONS IN THE LAW OF THE SEA 73, 74 (S. Lay ed. 1973). Of this total, tanker and transfer operations account for about half of all pollution. Porricelli, Oil Spills: Causes, Quantities, Sources—The Magnitude of the Problem, in ASSESSING THE SOCIAL IMPACTS OF OIL SPILLS 3 (U.S. Environmental Protection Agency 1973).


17. Other factors not discussed, except peripherally, include the important role that oil
solution. A study of the success or lack thereof in this area can provide valuable lessons for other areas of pollution prevention.

Efforts by individual states of the United States to deal with the problem of traumatic spillage are growing and are an important aspect of the solution to the problem. The study of such efforts presents complex constitutional issues\(^8\) beyond the scope of this article. Likewise, private parties such as industrial or environmental groups also have a major effect, but their participation is so varied and differs so greatly in effect, that a comprehensive treatment must be left to others.

What is relevant, however, to any discussion of traumatic oil pollution prevention, is an examination of the nature and magnitude of the threat of oil pollution of the marine environment as well as an examination of the particular legal and technical problems associated with vessel source pollution.

B. Effects of Oil Pollution on the Marine Environment

Despite the political, social, and economic impacts of traumatic oil pollution, the main focus of concern remains on the great potential for ecological damage. Gallon for gallon, oil is one of the most persistent and destructive of pollutants found in the environment in large quantities.\(^18\) Oil discharged into the water disrupts the food chain by forming an oily slick which poisons and smothers its base of algae, plankton, and intertidal organisms.\(^20\) Since these small creatures are the initial source of food for larger creatures and eventually man, their absence has repercussions throughout the en-


\(^{19}\) This oil may take the form of dense, persistent fractions such as crude, heating or asphaltic oil or lighter, more volatile fractions such as gasoline and diesel oil. See generally Shin, supra, note 16 at 6; Schacter & Serwer, Maine Pollution Problems and Remedies, 65 Am. J. INT'L L. 84, 88-89 (1971).

tire ecosystem. Moreover, organisms which are not killed outright may absorb oil droplets, introducing the toxins into the food chain at other stages.\textsuperscript{21} These surviving organisms (themselves polluted) may be bioaccumulated by filter feeder organisms which are then consumed by other organisms. The toxic pollutants originally absorbed, move up the food chain in increasing concentration. Thus, man, highest on the food chain, is subject to the highest concentration of toxic materials.\textsuperscript{22}

Oil also settles on the ocean bottom and coats the seaweed causing it to be easily torn free by wave action, resulting in beach erosion. At the same time, some oil begins to biodegrade,\textsuperscript{23} reducing the life supporting dissolved oxygen in the water available to living organisms.\textsuperscript{24} Other effects may include tainting of food fish, interference with natural instincts, habitat changes, and disruption of life systems.\textsuperscript{25} The slick itself interferes with phytoplankton photosynthesis, the food source for much of the world's protein and a source of oxygen for the atmosphere.\textsuperscript{26} Interference with water evaporation

\textsuperscript{22} Waldichuk, \textit{supra} note 20, at 41. Filter feeders are organisms which pass huge quantities of water through their bodies, straining out food by the use of fine hair-like filters. Toxins which are present in the water in non-lethal quantities may be strained out by such creatures and concentrated at levels which are poisonous to man. The operation of the food chain and bio-accumulation are demonstrated as follows: 1,000 lbs. of phytoplankton are consumed by 100 lbs. of zooplankton or shellfish, which in turn feed 50 lbs. of anchovies or other small fish. These are consumed by 10 lbs. of small carnivores, which is eaten by one pound of large carnivore which is caught and eaten by man. The one pound of carnivore eaten by man contains essentially the same accumulated pollutants as the 1,000 lbs. of phytoplankton. M. Schwartz \& E. Rabin, \textit{The Pollution Crises: Official Documents} 120 (1972). See also Pomeroy, \textit{The Ocean's Food Web, A Changing Paradigm}, 24 Bio. Sci. 499 (1974).

\textsuperscript{23} Biodegradation is a process whereby the organic compounds contained in hydrocarbons or other pollutants are attacked by natural decaying processes such as bacteria. This process requires oxygen which is fact found dissolved in the water. In situations where natural conditions have already lowered the dissolved oxygen content of water, the addition of biodegradable materials may remove sufficient oxygen to reduce that available for fish and other organisms below the level necessary to sustain life.

\textsuperscript{24} See CEQ \textit{Report}, supra note 20, n.16 at 14; Waldichuk, supra note 20, at 41.
\textsuperscript{25} See CEQ \textit{Report}, supra note 20, at 12-17.

\textsuperscript{26} Id. at 12; \textit{Dying Oceans, Poisoned Seas}, Time, Nov. 8, 1971, at 74. This reduced output of oxygen leads to an increase in the carbon dioxide content of the atmosphere (phytoplankton also absorb carbon dioxide). Carbon dioxide inhibits re-radiation of solar heat and the increase could result in insolation or the "greenhouse" effect whereby the ambient temperature of the earth's atmosphere is sufficiently raised to melt the polar ice caps and raise sea level by 200 feet. See Hull \& Koers, \textit{A Regime for World Pollution Control}, in \textit{International Relations and the Future of Ocean Space} 83, 96 (R. Wirsing ed. 1974).
may cause reduced water vapor in the air with a proportionate decrease in rainfall.\textsuperscript{27}

In addition to genetic changes and deformities, observers have reported increasing cancerous lesions on fish in areas of high oil pollution,\textsuperscript{28} raising the specter that oil pollution may induce cancer in man. Although not conclusively established, studies have indicated a strong possibility of a connection between oil pollution and some forms of cancer, while the presence of known carcinogens in refined oils has been established.\textsuperscript{29}

The effects of oil pollution are perhaps most readily observable on the beaches. In addition to the sticky mess covering everything from bathers to boats, oil has proven an especially fatal attraction to birds and marine animals.\textsuperscript{30} The oil removes the protective waterproof coating from fur and feathers resulting in a loss of buoyancy and insulation, often resulting in death by drowning or exposure. An even slower death awaits those which die from ingested oil toxicosis or simple starvation from the loss of flight or swimming capability.\textsuperscript{31} Despite efforts to prevent these results, untold thousands of birds perish every year.\textsuperscript{32}
C. Patterns and Magnitude of Marine Oil Pollution

One of the most unfortunate aspects of oil pollution is that most pollution occurs in the areas which are of greatest ecological importance and which are most vulnerable to the harmful effects of pollution. The world's coastal and estuarine ecosystems are the most productive areas for organic matter; however, because of the delicately balanced life systems, they are also the most easily disrupted by the damaging nature of oil pollution. Since the great bulk of maritime activity occurs in the coastal zone, these systems are subjected to a constant bombardment of pollution. Nor is such damage confined to the coastal waters. As ocean currents spread the pollution far and wide, few areas of the world are left unmarked by the characteristic tar-like lumps of chronic oil pollution.

The international ramifications of the problem are easily understood when one realizes that today's spill of Arab oil, bound for England in an Italian manned tanker, owned by an American but registered in Liberia, resulting from a collision off West Africa with a Norwegian freighter, will eventually result in pollution of Caribbean and South Florida beaches. Such ramifications are particu-

33. An estimated 80 percent of spills occur within 10 miles off shore, 75 percent within 25 miles of a port, 85 percent off a coastal recreation area. Hardy, Definition and Forms of Marine Pollution, in 3 New Directions in the Law of the Sea 73, n.16 at 74 (S. Lay ed. 1973). An estimated 65-75 percent of collisions and groundings occur near a harbor entrance or within a harbor. Another 16-25 percent occur within the coastal zone. Porricelli, supra note 15, at 4-5.

34. While the average wheatfield produces about 1.5 tons per acre, a typical coastal marsh produces 10 tons of organic matter per acre. R. Wagner, Environment and Man 152 (1971). The Japanese have succeeded in producing 23 tons of oyster meat per acre per year in the coastal zone using advanced aquaculture techniques. Marx, The Oceans are Vastly Overrated as a Source of Food and Fuel, Smithsonian, June 1974, at 29.

35. After a few weeks exposure to air and sun, evaporation, absorption, biodegradation and auto-oxidation have reduced the oil to about 15 percent of its original volume in the form of a dense, asphalitic tar balls about the size of a softball. Pearson, Admiralty Remedies for Vessel Oil Pollution on Navigable Waters, 7 Tex. Int'l L.J. 121, n.14 at 123 (1971). The tar balls are found in great numbers throughout the world. A recent NOAA survey found vast areas of the Atlantic as well as 80 percent of the Caribbean and 90 percent of the Antilles polluted by such debris. Lyons, Chemical Debris Fouling Atlantic, N.Y. Times, Feb. 13, 1973, at 22, col. 1. An estimated 87,000 tons of these tar balls are added to the oceans each year. Knudsen, Ocean Pollution: Status and Prognostication, in The Law of the Sea: The Emerging Regime of the Oceans 313, 329 (J. Gamble ed. 1973). A 30-50 percent decrease during the past 20 years in the vitality of the ocean has already been estimated by Jacques Cousteau. Dying Oceans, Poisoned Seas, Time, Nov. 8, 1971, at 74.

36. This example is not as far-fetched as it seems. The infamous Torrey Canyon went aground in the English Channel in March 1967 spilling an estimated 15 million gallons of oil.
larly significant in international straits, such as the Straits of Malacca, which are travelled by thousands of foreign ships and tankers each year with many accidents and resulting pollution. While Malaysia and Indonesia, the coastal states bordering the Straits, are vitally concerned with protecting their fisheries and environment, states such as Japan, which receive most of their oil supply through such straits, are reluctant to recognize coastal state authority to impose prohibitory safety requirements. The situation is further complicated by United States and Russian strategic naval interests.

The solution to these vital international concerns has further been hampered by both a lack of accurate figures as to the actual amount of oil pollution taking place, and the failure to adopt a uniform system of reference terms, resulting in great confusion. While the United States is currently a leader in maintaining records on reported spills, a recent survey of world governments revealed widespread ignorance on the part of many nations as to exact quantities of oil spilled, damages caused, and resulting clean-up costs. The survey also indicated that clean-up efforts are relatively rare, while oil pollution of all kinds is widespread. Nevertheless, while the lack of a comprehensive international reporting system severely

and polluting thousands of miles of French and English beaches. It was owned by a Bermuda corporation which was controlled by an American oil company, registered in Liberia, on charter to a British oil company, crewed by Italians, salvaged by the Dutch and insured by United States and British underwriters. Comment, Post "Torrey Canyon": Toward a New Solution to the Problem of Traumatic Oil Spillage, 2 CONN. L. REV. 632, 637-38 (1970). See also E. COWAN, OIL, AND WATER—THE TORREY CANYON DISASTER (1968).

37. The problem was vividly illustrated in January, 1975 when the Japanese super-tanker, Showa Maru grounded in the Strait, spilling more than 3,300 tons of oil. Over the years, the Japanese have paid millions for pollution damage to the Straits and have offered to pay for the upgrading of navigational facilities and aids. N.Y. Times, Jan. 7, 1975, at 4, col. 1; id., Jan. 8, 1975, at 4, col. 4; Hartley, Troubled Waters: When is a Strait International? When Territorial?, The Wall Street Journal, Nov. 30, 1972, at 40, col. 1; Sterba, Two Nations Claim Malacca Strait, N.Y. Times, Mar. 13, 1972, at 9, col. 1.

38. The Coast Guard, as the nation’s primary agency for maritime law enforcement, shipping regulation and safety, aids to navigation, maritime search and rescue, and marine environmental protection, although an armed force, has found itself with overall responsibility for dealing with many phases of the oil pollution problem. Within the past few years the Coast Guard has attempted to locate and trace every oil spill in United States waters—a monumental task. Recently computerization has allowed instant analysis of reported spills by size, location, source, clean-up-cost etc. These figures are published annually by the Department of Transportation in POLLUTING INCIDENTS IN AND AROUND U.S. WATERS. It must be remembered that such figures represent only reported spills and do not include the literally thousands of small unreported spills. Further, trends in figures do not necessarily represent an increase or decrease in actual pollution since the reporting system is relatively new and increased reporting of actual decreasing pollution, etc. is a possibility.
hampers efforts to accurately deal with the problem, there can be no doubt that world traumatic oil pollution costs, measured in damage to vessels, fisheries, ecology, lost oil, and clean-up efforts, runs into tens of millions of dollars annually.\footnote{39} 

As long as reports of actual pollution remain sketchy and uncollated, it is necessary to rely on statistical estimates of pollution source contributions and quantities.\footnote{40} Only in this manner can figures for operational oil pollution resulting from bunker deballasting,\footnote{41} tank deballasting, washing,\footnote{42} or traumatic spillage be included in the calculation of the cost effectiveness of proposed preventive measures and the hard political and economic decisions made which

\footnotetext{39}{INTERGOVERNMENTAL MARITIME CONSULTATIVE ORGANIZATION, OFFICIAL RECORDS OF THE INTERNATIONAL LEGAL CONFERENCE ON MARINE POLLUTION DAMAGE, (1969).}

\footnotetext{40}{For this reason, all statistics on oil pollution should not be taken as absolutes, but merely as valuable estimates of relative contributions of various sources. Land sources, including industrial wastes and accidents, refinery activities, automobile emissions, urban and river runoff, as well as over 3.5 million gallons of waste automotive crankcase oil per year, are by far the greatest source of maritime oil pollution since all these spills, large and small, eventually find their way into the sea. Of maritime based pollution sources, ships are the greatest polluters. See note 15 supra. Operational vessel source pollution estimates vary from as low as 1.5 million metric tons per year to as high as 2.5 million metric tons per year. Figures on traumatic oil spill estimates are difficult to obtain. Some authorities state that traumatic incidents are responsible for as much as two-thirds of all vessel source oil pollution while others attribute only 18 percent to such casualties. Bates & Yost, supra note 9, at 249, 270, 280; J. Porricelli & V. Keith, AN ANALYSIS OF OIL OUTFLOWS DUE TO TANKER ACCIDENTS 5 (U.S. Coast Guard Report 1973); G. Wilson, MAN'S IMPACT ON THE GLOBAL ENVIRONMENT 266 (1970). See generally A. Anderson & W. Bissell, INTERNATIONAL COOPERATION FOR THE PREVENTION OF MARINE OIL POLLUTION 23-32, Table 2-1 at 26 (Sea Grant Technical Bulletin No. 33, 1975). One effort to control land based pollution sources, a politically sensitive international issue between developed and developing nations, is found in Annex III of the Convention on Protection of the Marine Environment of the Baltic Sea Area, done March 22, 1974, 13 INT'L LEG. MAT. 546, 556 (1974).}

\footnotetext{41}{De-ballasting is the removal of water ballast which is placed in empty fuel or cargo oil tanks to preserve vessel stability. When the water is placed in the tanks, it mixes with the "clingage", or the oil left clinging to the side of the tank. When the tank is de-ballasted, this oil and water mixture becomes a pollutant. SECRETARIES REPORT, supra note 31, at 6.}

\footnotetext{42}{The figures for tanker de-ballasting and tank washing are arrived at in a similar manner. Clingage is estimated at 0.4 percent of total cargo capacity in deadweight tons, approximately 33-50 percent of tonnage is ballasted and the percentage of oil discharged is 15 percent in de-ballasting and 100 percent in tank cleaning. Tanks are cleaned an average of twice a year and de-ballasted eight times a year. Using these figures, it is possible to estimate the total annual operational pollution generated by a tanker (or all tankers) by multiplying its deadweight tonnage by 1.4 percent or approximately 1,400 long tons of oil pollution per year for a vessel of 100,000 DWT. Hunter, Possibilities and Problems of Preventing Oil Pollution of the Oceans, 4 TRANS. L.J. 21, 40-43 (1972). See also Zachairiasen, OIL POLLUTION IN THE SEA: PROBLEMS FOR FUTURE WORK, in INSTITUTE FOR DEFENSE ANALYSES 4 (1968).}
OIL POLLUTION

affect traumatic pollution prevention.\textsuperscript{43}\ The lack of a uniform system of reference for measuring vessel size\textsuperscript{44} or the amounts of oil spilled\textsuperscript{45} has not only led to a lack of appreciation of the quantities

43. Traumatic spillage is easily calculated only when the amount of oil in the vessel prior to the casualty can be compared to that remaining afterward. The economic decisions which have to be made might include, for example, whether the ecological saving justifies the economic cost of requiring such systems as the Load-On-Top System (LOT), whereby oil is loaded and off-loaded from the top of the tank and the density difference between oil and water is utilized to minimize mixing. Approximately 80 percent of the world's tankers by tonnage are equipped with the system which is supposed to be 80 percent effective in reducing ballast discharge. The latter figure is probably high, however, due to the mixing action of the ship rolling in a seaway. Sea Hearings Before the Subcomm. on Coast Guard and Navigation of the House Comm. on Merchant Marine and Fisheries on Proposed Regulations Promulgated by the Coast Guard as Required by Title II of the "Ports and Waterways Safety Act of 1972", 93d Cong., 1st Sess., ser. 93-16, at 23-34 (1973) [hereinafter cited as Coast Guard Hearings]. Taking all the calculations discussed and applying them to the 1971 tonnage figures, it may be calculated that if the world's 50,000 non-tanker vessels de-ballast an average of six times a year, they generate 2,400,000 tons of oil pollution. Taking the estimated 155,100,000 DWT of LOT equipped tankers and the 38,800,000 DWT of non-LOT tankers, the following figures result:

<table>
<thead>
<tr>
<th></th>
<th>LOT equipped</th>
<th>Non-LOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deballasting</td>
<td>595,584</td>
<td>186,240</td>
</tr>
<tr>
<td>Tank Washing</td>
<td>992,640</td>
<td>310,400</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>1,588,224 tons</td>
<td>496,640 tons</td>
</tr>
</tbody>
</table>

A total of 20,084,864 tons of tanker operational pollution is yielded or 4,484,864 tons per year for vessels of all types. This is much higher than is generally reported particularly for non-tanker de-ballasting. See generally Hunter, supra note 42, at 40-43; OECD Study on Flags of Convenience, 4 J. MARITIME L. & COM. 231, 237 (1973); SUN OIL Co., ANALYSIS OF WORLD TANK SHIP FLEET 1 (1972).

44. One source of confusion has been that tanker size, and hence potential for pollution, may be expressed in traditional terms of gross registered tons (GRT or enclosed volume of the vessel in tons of 100 cubic feet) or in deadweight tons (DWT or weight in long tons of 2,280 lbs. of water displaced by vessel empty and loaded). The first is the measure of internal capacity by available cargo space, which was historically applied to freighters and other vessels before the advent of the huge tankers and bulk-carriers. The second actually measures the carrying capacity of the vessel in weight rather than volume and is therefore more accurate when dealing with cargoes such as ore and oil which have a relatively constant relationship between weight and volume occupied. The differences that may result by applying the two standards may be appreciated when one realizes that the ratio of carrying capacity (DWT) to internal volume (GRT) may vary from 1.5 or 2.7:1 (tankers of 100,000 GRT may actually be 150,000 to 170,000 DWT). See generally A. KNIGHT, MODERN SEAMANSHIP 42-43 (13th ed. 1960); Healy & Paulsen, Marine Oil Pollution and the Water Quality Improvement Act of 1970, 1 J. MARITIME L. & COM. 537, 566 n.165 (1970); Meiklejohn, Liability for Oil Pollution Clean-up and the Water Quality Improvement Act of 1970, 55 CORNELL L. REV. 973, 982 n.78 (1970).

45. Oil may be measured variously in short tons of 2,000 lbs., long tons of 2,240 lbs. or
II. TECHNICAL AND LEGAL CONTEXT OF MARINE OIL POLLUTION

A. The Rise of the Supertanker

In spite of the lack of accurate figures as to whether oil pollution is, in fact, on the increase, there has been growing concern in all areas of the world community over the oil pollution threat. This concern has been generated not only because of increasing sensitivity over ecological issues, but also by the boom in the maritime transportation of oil with which such pollution has always been associated. This maritime transport boom has been accompanied by an attendant jump in tanker sizes which has increased the potential environmental threat to staggering levels as well as further complicating the legal issues involved in preventing oil pollution.

The rise of the supertanker was largely the result of the 1967 closing of the Suez Canal by the Arab-Israeli conflict. While the size

metric tons of 2,204.6 lbs. The last measure is gaining wide acceptance. Oil is also frequently measured in barrels of 42 U.S. gallons. The number of barrels/gallons in a ton varies from 240 to 308 gallons or roughly six to seven barrels depending on the temperature and density of the particular oil and the ton measure employed. See Oil Pollution Clean-up, supra note 44, at 982 n.78.

46. An oil spill of 3,000 tons does not sound as terrible to the public as one of 21,400 barrels which does not sound nearly as traumatic as 900,000 gallons, although they all represent approximately the same quantity of oil. The 4,484,864 metric tons of oil pollution discussed in note 43 supra is certainly impressive even in those terms, but it also represents roughly 1.34 billion gallons of oil pollution and waste each year.

47. For example, although deadweight tonnage is a more accurate measure of a tanker's capacity to cause oil spillage or ecological damage, industry interests have succeeded in having their potential liability measured in the smaller terms of gross tonnage. See, e.g., Federal Water Pollution Control Act, 33 U.S.C. §§ 1251, 1321 (Supp. IV 1974) (limits clean-up liability to $100 per gross ton); Article V of the International Convention on Civil Liability of Oil Pollution Damage, done Nov. 29, 1969, 9 INT'L LEG. MAT. 45 (1970) (limits the liability of tanker owners to governments and private parties to 2,000 francs per ship's ton or an aggregate not to exceed 210 million francs).


<table>
<thead>
<tr>
<th>Year</th>
<th>length</th>
<th>cargo in tons</th>
<th>cargo in barrels</th>
<th>draft</th>
<th>relative shipping cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>650</td>
<td>30,000</td>
<td>225,000</td>
<td>35</td>
<td>100%</td>
</tr>
<tr>
<td>1960</td>
<td>750</td>
<td>50,000</td>
<td>375,000</td>
<td>38</td>
<td>88%</td>
</tr>
<tr>
<td>1970</td>
<td>1150</td>
<td>250,000</td>
<td>1,875,000</td>
<td>65</td>
<td>45%</td>
</tr>
<tr>
<td>1975</td>
<td>1300</td>
<td>500,000</td>
<td>3,750,000</td>
<td>95</td>
<td>38%</td>
</tr>
</tbody>
</table>
of tankers has grown steadily since World War II, as the demand for oil kept pace with the burgeoning Western economies, the long haul around the Cape of Good Hope from the Persian Gulf oil ports to the United States and Europe, necessitated by the Suez closing, made the use of supertankers an economic necessity. The economies of scale afforded by such large vessels, which had already led to the "jumboizing" of many older tankers, became the controlling factors in determining vessel size and virtually dictated the quantum leaps in size which followed. Spurred by major breakthroughs in shipbuilding technology and by a chronic tanker shortage, the Very Large Crude Carriers (VLCC's) and Ultra Large Crude Carriers (ULCC's) were soon being produced in ever increasing sizes with seemingly no technological limit on how large they might become. Indeed, the only controlling factor seemed to be the demand for oil, which then showed few signs of diminishing.

49. At the end of World War II, the T-2 tanker of 16,765 DWT was the mainstay of the world tanker fleet and has been used as the standard of reference. In 1972, the average deadweight tonnage of the world's tankers was 50,900 DWT or 3 T-2 equivalents. SUN OIL CO., ANALYSIS OF WORLD TANK SHIP FLEET 5, 10 (1973).

50. As vessel size increases, relative building costs decrease from $75/ton for a 100,000 DWT tanker to $61/ton for a 326,000 DWT Bantry class tanker or approximately $20 million. U.N. Doc. TD/B/C.4/66 at 87-96 (1969). At the same time cargo capacity is radically increased, operating costs increase only slightly and some expenses such as crew, quarters, etc., remain fixed. At the height of demand in the late 60's and early 70's a tanker could charge freight rates of $20/ton with operating costs of $2.40/ton. Gross profits on a single voyage could exceed $4.2 million. U.N. Doc. E/64/2/D.16 graph 1 (1966); see NEWSWEEK, Oct. 19, 1970, at 94-96.

51. This refers to the process by which a conventional sized tanker was cut in half and a large middle section attached between the two sections increasing its size and capacity by as much as a factor of two.

52. The term VLCC describes tankers over 200,000 DWT, but less than 400,000 DWT, while ULCC describes tankers in excess of 400,000 DWT. N. MOESTERT, SUPERSHIP 24 (1974).

53. A million ton tanker has been projected. Such a monster would be 1,640 feet long, 274 feet wide, and draw 100 feet of water. Anyone of her five main tanks could comfortably hold any of Europe's major cathedrals. Id. at 23.

54. The demand for tankers led to massive speculation and overbuilding, which ultimately caused a collapse of the tanker market in 1975 as the demand for oil dropped due to energy conservation, oil price increases and the inflation/recession of Western economies. The cost of a spot charter from the Persian Gulf to Western Europe fell from $8.8 million in October 1973, at $2.6 million in November 1974, to as little as $800,000 in March 1975. As hundreds of supertankers lay idle for want of cargoes, there was widespread cancellations of new ship orders, and 168 tankers totalling 11.3 million DWT, some just launched, were laid up to save operating and insurance costs. Some 90 million DWT or 30 percent of the fleet was estimated to be surplus. The long-term effects of this development on the future use of the supertanker and oil pollution is not yet known. Some experts predict a decrease in large tankers and a bright future for multi-purpose, 100-200,000 DWT vessels which can enter some
These same economies of scale were also responsible for the creation of other types of "superships" such as bulk carriers, Liquified Natural Gas Carriers (LNGC's), and combination function vessels, such as ore/oil or ore/bulk/oil (OBO) carriers.

While sharing the advantages of large tankers, such vessels also shared many of the potential disadvantages affecting their potential for traumatic pollution such as long stopping distances, large turning radii, and low shaft horsepower to tonnage ratios. Another major difficulty is that these large vessels have appeared in maritime commerce so suddenly that few officers have had the opportunity to become experienced with their handling, further increasing potential for traumatic pollution of epic proportions.56

B. Legal Context of International Maritime Commerce

Efforts to prevent traumatic pollution are also complicated by the very nature of international maritime commerce and the legal context in which it exists. Practical considerations dictate that a ship which visits many countries each year should not be subjected to conflicting requirements as to construction and equipment by each nation, but rather should be required to comply only with uniform international standards. While efforts to arrive at such standards have been going on for some time under the auspices of the Intergovernmental Maritime Consultative Organization (IMCO),57 the progress of multilateral negotiations on issues involv-
OIL POLLUTION

ing such vital economic and environmental issues is glacial at best.

Many nations, frustrated by the political squabbling restraining such efforts, have moved unilaterally to protect their coasts. Many nations, frustrated by the political squabbling restraining such efforts, have moved unilaterally to protect their coasts. However, even unilateral efforts are frequently frustrated by the complex legal rules which govern the ability of a coastal nation to regulate foreign vessels. The jurisdiction of a coastal state to prescribe regulations for traumatic pollution prevention and to apply them to foreign vessels is chiefly a function of the nature of the waters in which the foreign vessel is located.

In internal waters, the foreign vessel is subject to total regulation by the coastal state, subject only to certain principles of international comity involving purely domestic, internal matters of the ship’s management. A foreign vessel has no absolute right of entry into a nation’s internal waters, and the coastal state has the right to require compliance with special navigation and pollution prevention regulations as a condition of admission to internal waters.

As one proceeds seaward from internal waters, the jurisdiction of the coastal state progressively diminishes. In the territorial sea the coastal state has powers equivalent to full sovereignty, subject only to the international right of innocent passage. Foreign vessels engaged in innocent passage may be required to comply with rea-

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58. Iran, for example, in 1973 asserted the right to board all vessels within 50 miles of its coast for enforcement of pollution prevention regulations. Supership, supra note 52, at 303. Canada has unilaterally asserted broad jurisdiction both to proscribe certain polluting activities within the Arctic Circle and to ban certain vessels altogether as well as to establish construction and equipment requirements. Arctic Water Pollution Prevention Act of 1970, Canada has unilaterally asserted broad jurisdiction both to proscribe certain polluting activities within the Arctic Circle and to ban certain vessels altogether as well as to establish construction and equipment requirements. Arctic Water Pollution Prevention Act of 1970, CAN. REV. STAT. c.2 (1st Supp. 1970). See also Gold, Pollution of the Sea and International Law-A Canadian Perspective, 3 J. MARITIME L. & COM. 13 (1971).

59. The coastal state has plenary jurisdiction over its own vessels, and the persons aboard them, to enforce pollution prevention regulations wherever in the world they may be. United States v. Flores, 289 U.S. 137 (1933).


61. Generally, purely internal matters not affecting the peace of the coastal state are left to flag state authorities. Wildenhus’ Case, 120 U.S. 1 (1887).


63. Territorial Sea Convention, note 60 supra, art. 1.

64. Id., art. 14(1).
sonable safety and navigation regulations and measures to protect the security of the coastal state. Measures designed to reduce ship casualties and catastrophic traumatic pollution would certainly seem to be within the ambit of such jurisdiction. Unfortunately, the width of the territorial sea and thus the scope of such protective jurisdiction is not settled under international law. Claims range from 3 miles to as much as 200 miles, and the subject has great strategic, political, and economic implications. If international agreement is reached on a wider territorial sea, such as 12 miles, the ability of coastal states to take preventive measures and protect their coastlines will be greatly enhanced.

Beyond the territorial sea, the jurisdiction of the coastal state is greatly reduced. A special agreement under a treaty of friendship, commerce, and navigation with the flag-state of vessels frequently visiting its ports, or some other special arrangement would allow the coastal state to exercise special preventive jurisdiction over foreign vessels beyond the territorial sea. Barring such an arrangement, the coastal state enjoys only limited contiguous zone jurisdiction extending 12 miles off its coast. This jurisdiction is limited to the enforcement of violations of the coastal state's fiscal, immigration, customs, and sanitary laws within the territorial sea. The commentary of the International Law Commission reveals that the term “sanitary” was probably not intended to include anti-pollution regulations as part of the contiguous zone jurisdiction; however, a number of countries, including the United States, have adopted such a stance based on the need for limited protective jurisdiction.

65. Id., art. 17.
66. The first U.N. Conference on the Law of the Sea in 1958 failed to reach agreement on the breadth of the territorial sea. The Second U.N. Conference on the Law of the Sea also failed, narrowly, to arrive at an agreement. The Third U.N. Conference of the Sea, currently in intersession, has agreement on this point as one of its highest priorities.
67. The United States has expressed a willingness to recognize a 12 mile breadth of the territorial sea in exchange for agreement on the freedom of transit through international straits. See Address by Henry A. Kissinger, American Bar Association Annual Convention, Aug. 11, 1975.
68. An example is the series of so-called “Liquor Treaties,” whereby flag states agreed to United States enforcement jurisdiction for Prohibition over their vessels within one hour’s sailing time of the United States coast in exchange for the right to transit United States Waters with liquor cargoes under seal. See, e.g., Treaty with Great Britain for Prevention of Smuggling of Intoxicating Liquors, May 22, 1924, 43 Stat. 1761, T.S. No. 685, 27 L.N.T.S. 182.
69. Territorial Sea Convention, supra note 60, art. 24.
70. Id.
71. See N. Wulf, CONTIGUOUS ZONES FOR POLLUTION CONTROL: AN APPRAISAL UNDER INTER-
Beyond the contiguous zone the jurisdiction of the coastal state is even more limited. Aside from one international agreement which allows the coastal states to move, under narrowly defined circumstances, against a foreign vessel on the high seas which threatens the coastal state with imminent oil pollution, there is no jurisdiction on the part of a coastal state for pollution prevention over foreign vessels on the high seas under international law.

A vessel on the high seas is subject to the exclusive jurisdiction of its flag state, which is charged with drawing up and enforcing oil pollution prevention regulations for its vessels. Unfortunately, flag state high seas enforcement of oil pollution regulations is not only haphazard, but some countries, known as “Flag of Convenience nations,” have undertaken to attract foreign tonnage to their registry by a program of deliberate non-enforcement of international shipping regulations. These nations not only control almost a fifth of the world’s tonnage of ships of all kinds but also control nearly a third of tanker tonnage.

The existence of these so-called Flag of Convenience nations, coupled with the doctrine of exclusive flag state jurisdiction over vessels on the high seas, presents a tremendous obstacle to effective high seas pollution prevention measures. In addition to allowing large numbers of vessels to operate without effective controls, they limit the enforcement efforts of concerned flag states since owners faced with too stringent enforcement or requirements can simply evade all controls by switching to a Flag of Convenience registry.

Since few nations wish to set a dangerous precedent for their
own vessels by unilaterally attempting to assert jurisdiction over foreign vessels on the high seas, the chief thrust of international efforts has been to negotiate multilateral uniform standards which will actively be enforced by all flag states. Such standards include reciprocal inspection provisions in ports of the signatories. This ideal, even if achieved however, may not prove successful without the delegation of some flag state authority to a responsible international body.

Many Flag of Convenience nations, such as Liberia, have gradually attempted to apply some of the less burdensome international regulations and personnel licensing provisions without success. This lack of success is largely due both to the fact that their huge fleets rarely, if ever, call at a national port and that these nations lack the administrative and technical ability to carry out a global enforcement program.

The combined effect of exclusive flag state jurisdiction and the limitations imposed on coastal state pollution prevention jurisdiction is to divide efforts designed to control traumatic oil pollution and vessel casualties into two areas. The first area consists of those measures which are best accomplished by international multilateral efforts. These include efforts aimed at high seas pollution prevention as well as those that primarily take effect aboard the vessel itself. Included under the heading of international multilateral prevention efforts are: (a) vessel construction and equipment requirements; (b) regulations for the prevention of collisions on the high seas, including traffic separation schemes; and (c) officer and crew training and certification requirements.

The second area consists of measures which may be properly

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76. Efforts on the part of some nations to extend their territorial sea to 200 miles notwithstanding. See also High Seas Convention supra note 73, art. 5(1); Volkenburg v. Nederland-Amerik. Stoom v. Maats, 336 F.2d 480 (1st Cir. 1964); Advisory Opinion on the Constitution of the Maritime Safety Committee of the Intergovernmental Maritime Consultative Organization [1960] I.C.J. 149.


78. OECD Study, supra note 75, at 249-250. The major Flag of Convenience nations are, however, attempting to meet hull and machinery certification requirements by delegating their inspection duties to international classification societies such as Lloyd's. Liberia is also a party to the 1954 Oil Pollution Prevention Convention, supra note 16.
taken by the coastal state on a unilateral basis to exercise protective prevention jurisdiction along its coast. Whenever possible, such measures should attempt to conform to uniform standards to ease the practical burdens of compliance. Measures which may be included in this category of unilateral national traumatic pollution prevention include: (a) aids to navigation and hydrographic surveys; (b) pilotage; (c) vessel traffic systems; and (d) offshore deep-water ports. Limited equipment requirements to the extent necessary to comply with coastal state systems may also be imposed where reasonable.\(^7\)

III. INTERNATIONAL EFFORTS TO PREVENT TRAUMATIC POLLUTION

A. Construction and Equipment Standards

The chief purpose for formulating construction standards is to reduce structural failures and to minimize oil outflow when a ship's hull is ruptured. Structural failures account for a significant amount of high seas traumatic oil pollution\(^8\) since rough seas are a prime cause of such break-up. However, since such structural failures take place on the high seas, they are a relatively minor contributor to coastal pollution.

The most effective methods of preventing structural failure, whether due to age, poor design, or faulty workmanship, are preconstruction certification of design blueprints, close inspection of the building process, and periodic inspections after the hull is in service.

Distinctive problems are presented, however, when the countries of registry, ownership, and construction are different. Any nation has the right to set construction standards as a condition of granting registry,\(^9\) but other nations may seek to influence con-

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79. For example, a radio capable of communicating with coastal state authorities on designated frequencies.

80. Structural failures may account for as much as 50 percent of all tanker traumatic oil outflows. The chief cause of structural failure is the breakup in heavy seas of older ships, averaging 17 years old, with a heavy representation of "Flag of Convenience" vessels. Exact quantities of oil spilled in this manner are hard to estimate since the rough seas disperse the oil quickly and there is little idea of how much oil remains trapped in the vessel. Each year's winter storms on the Atlantic bring more reports of such breakups, such as the Liberian tanker \textit{Spartan Lady} which broke up and sank in high seas in April, 1975 after the Coast Guard rescued her crew. As much as 500,000 gallons of oil may have escaped before she went down. \textit{N.Y. Times}, April 5, 1975, at 33, col. 1. \textit{See generally OIL OUTFLOWS, supra note 40, at 6; EXXON OIL CO., REDUCING TANKER ACCIDENTS 5 (1973).}

81. High Seas Convention, \textit{supra} note 73, art. 5(1).
struction by virtue of their jurisdiction over the owner, or over the ship being built in their territory, thus placing the vessel under conflicting standards.

Great progress had been made in formulating international design and construction standards under the Safety of Life at Sea (SOLAS) Convention in 1960, since such safety requirements were a prime consideration before the emergence of concern over oil pollution. Moreover, many of these problems had also been eased by the emergence of a multibillion dollar maritime insurance industry. Handling in excess of $2.5 billion in premiums per year, these companies, through the utilization of international classification societies and direct economic pressure, exercise tremendous influence on vessel construction and safety standards.

Construction standards may also be used to minimize oil outflow once a casualty, such as a grounding or collision, occurs through such safeguards as reduced tank sizes and double bottoms.

The concept of limiting tank sizes in order to reduce the amount of oil outflow has had universal appeal. However, there has been less than universal agreement on the implementation of the concept. The standard sought is an optimum point at which the advantages of reduced tank size are still marginally greater than the disadvantages of increased surface area and oil clingage. After lengthy discussions, IMCO produced detailed regulations for reducing oil outflows utilizing their standard for tank size. Through a series of complicated formulae, center tanks are limited to 50,000 cubic meters, wing tanks to 30,000 cubic meters, and other tanks

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82. For example, Greek, United States, and Italian interests own about 70 percent of Flag of Convenience tonnage with the remaining ownership scattered throughout the world, often under the guise of dummy corporations. OECD Study, supra note 75, at 239.
84. Increased surface area increases potential operational pollution due to deballasting and tank washing.
85. The tank size, and therefore the maximum amount of oil outflow which could result from the tank being pierced, was limited to either 400 times the cube root of the deadweight tonnage or 30,000 cubic meters, whichever is greater, but no more than 40,000 cubic meters. 1973 Convention on the Prevention of Pollution from Ships, supra note 11, ch. III, Annex I. Compare the limits proposed by industry: 500 multiplied by the cube root of the deadweight tonnage. *Tanker Accidents*, supra note 80, at 14. See generally, Price, *Anti-Pollution Measures: IMCO Subcommittee on Ship Design and Equipment*, 8 *Marine Tech.* 1, 7 (1971).
86. Those tanks located inboard of a protective longitudinal bulkhead.
87. Those tanks which are against the outer skin of the vessel.
to 40,000 cubic meters (with some variations allowed to compensate for space occupied by segregated ballast tanks).

The installation of double bottoms\(^8\) is aimed at reducing oil outflow from tanks damaged by groundings\(^9\) and has attracted much controversy regarding safety, practicality, and necessity. The controversy over the installation of double bottoms reached a crescendo when Congress passed the Ports and Waterways Safety Act of 1972\(^{10}\) which, for the first time, gave the Coast Guard broad regulatory powers to establish vessel design criteria based on marine environmental protection.\(^{11}\) This act also included the power to establish standards for foreign ships entering United States waters and to deny entry for noncompliance.\(^{12}\) Implicit in this regulatory grant, but not expressly required, was the power to require double bottoms on future tankers. Under this authority, the Coast Guard proposed a 100 percent double bottom requirement on all future construction of any tankers of appreciable size built or registered in the United States. This proposal touched off a vigorous debate eventually culminating in Congressional hearings on the Coast Guard's proposed regulations.\(^{13}\) Various authorities asserted that such a requirement would result in a reduction of from 50 to 90 percent of tanker bottom damage oil outflow.\(^{14}\) While environmentalists were

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88. A double bottom is simply an additional layer of plating over the submerged part of the hull with a void space between the outer and inner hulls. In theory, most impacts will pierce only the outer hull and oil will be kept inside the tank, with flooding confined to the void space.

89. Groundings account for approximately 26 percent of all tanker casualties and 29 percent of traumatic oil outflow. Porricey, supra note 15, at 4; Oil Outflows, supra note 40, at 6.


91. While the Coast Guard has always had broad regulatory powers over vessel construction and equipment, the criteria had primarily been based on the safety of life and property. See, e.g., 46 C.F.R. § 160 (1975).

92. 46 U.S.C. §§ 391(a)(2),(13) (Supp. III, 1973). This power to establish construction standards for foreign vessels has never been used and is contrary to the official United States position, which seeks to attain uniform international standards through multilateral negotiation. It was included, however, so as not to hamper United States tankers competitively since most oil entering the United States is carried in foreign tankers. See infra note 99.


delighted by the Coast Guard proposal, American ship builders and oil companies rose up in arms. They charged that such regulations would have adverse effects on tanker stability and buoyancy due to increased floodable space, as well as increased building costs (10 percent, or as much as $7.5 million) with parallel increases in freight rates (8 percent), all for what builders considered a minimal benefit. The most damning argument against double bottoms, however, was that this would cause increased economic disadvantage to American shipbuilders, who were finally starting to get contracts to build Very Large Crude Carriers (VLCC’s), because such a requirement would drive buyers to other nations. It was further argued that United States waters would not really benefit from such a requirement since most oil entering this country is carried in small foreign tankers. This is because the VLCC’s, at which the double bottom requirement was primarily aimed, draw too much water to enter the major United States ports. Moreover, the State Department strongly counseled against unilateral enforcement of the double bottom requirement for smaller tankers in order to avoid reprisals and to preserve the United States’ negotiating position in talks on similar multilateral standards. Finally, it was argued that double bottoms might well be unnecessary in the future since supertankers would probably never enter dangerous coastal waters but would

95. **Tanker Accidents**, *supra* note 80, at 14. This argument ignores the fact that double bottoms could be used for segregated clean ballast water and therefore would not be floodable.

96. Hang-Sheng, *Incrementing Benefits and Costs of Compulsory Segregated Ballasting Reducing Oil Pollution of the Sea*, in *Social Impacts*, *supra* note 27, at 89, 93. A shipping industry cost/benefit analysis of double bottoms appears in *Coast Guard Hearings*, *supra* note 43, at 111-153. Industry groups, perhaps to forestall stricter governmental measures and to provide for self insurance, have created a number of devices to aid the fight against pollution. Notable among these are the Tanker Owners Voluntary Agreement Concerning Liability for Oil Pollution (TOVALOP), Jan. 7, 1969, 8 *Int’l Leg. Mat.* 497 (1969) and Contract Regarding an Interim Supplement to Tanker Liability for Oil Pollution (CRISTAL), Jan. 14, 1971, 10 *Int’l Leg. Mat.* 137 (1971). See generally Becker, *A Short Cruise on the Good Ships TOVALOP and CRISTAL*, 5 J. Maritime L. & Com. 609 (1974). Their motives may be suspect since the “Load on Top” (LOT) system was known to the industry for many years before it was adopted as a “new innovation” after a growing outcry against oil pollution and a showing that it was actually economically advantageous. Hunter, *supra* note 42, at 53.

97. See *supra* note 52.

98. American vessels currently carry between 5 and 15 percent of the oil imported into the United States. Because of the shallowness of the United States harbors only small tankers may be used and these usually are equipped with double bottoms anyway. VTS Legislative History, *supra* note 94, at 2768; *Hearings on S. 2089 and H.R. 8193 Before the Subcomm. on Merchant Marine of the Senate Comm. on Commerce*, 93rd Cong., 2d Sess., ser. 93-81, at 26 (1974) [hereinafter cited as *Senate Energy Hearings*].
operate exclusively at offshore deepwater ports.\textsuperscript{99}

In view of these arguments, the Coast Guard elected to attempt to implement the double bottom requirement through multilateral international negotiations. The 1973 Convention on Prevention of Pollution of the Sea from Ships encouraged double bottoms but did not require them.\textsuperscript{100}

In addition to construction standards aimed at new vessels, various attempts have also been made to require vessels of all types and ages to carry equipment designed to improve vessel safety. While it is easier for a vessel in international commerce to add some equipment to its inventory than to alter its basic construction, there is clearly a need for uniformity and flexibility in the type, amount, and specifications of required equipment in order to prevent wasteful and burdensome multiplicity.

There seems no doubt that a nation can establish reasonable equipment requirements for a vessel seeking entry into its internal waters.\textsuperscript{101} Similarly, a flag state has jurisdiction to require equipment on vessels of its registry.\textsuperscript{102} Less clear, however, is the right of a coastal state to require equipment on a vessel which is in innocent passage through its territorial sea or international strait. While coastal states may implement laws and regulations relating to transport and navigation which must be obeyed by vessels in innocent passage,\textsuperscript{103} a requirement beyond the minimum basic equipment (e.g., lights which are universally recognized as necessary to prevent chaos) would probably exceed the authority of the coastal state, amounting to an unreasonable interference with the right of innocent passage and the sovereignty of the flag state. The Commentary of the International Law Commission fails to disclose authority to require even such basic equipment, but few nations would contest the coastal state's implicit right to protect itself

\begin{itemize}
\item \textsuperscript{99} See discussion supra, at notes 48-62, on the future of deepwater ports for supertankers located offshore in safe waters.
\item \textsuperscript{100} See the 1973 Convention, supra note 11 ch. III, annex I, reg. 23(5). The Convention also mentions another alternative to double bottoms; the use of emergency high suction cargo transfer pumps to remove oil from ruptured bottom tanks to ballast tanks or portable bladders before any appreciable amounts of oil can escape.
\item \textsuperscript{101} Territorial Sea Convention, supra note 60, art. 16(2); Payne v. S.S. Tropic Breeze, 423 F.2d 236 (1st Cir.), cert. denied, 400 U.S. 964 (1970).
\item \textsuperscript{102} High Seas Convention, supra note 73, art. 5(1).
\item \textsuperscript{103} Territorial Sea Convention, supra note 60, art. 17.
\end{itemize}
against the passage through its waters of an obviously hazardous vessel.\textsuperscript{104}

The types of equipment requirements concerned with traumatic pollution prevention are chiefly directed at the ship's capability to navigate and maneuver. Groundings normally result from not knowing where the dangers are located. Collisions, on the other hand, are primarily connected with the vessel’s ability to maneuver. Modern technology has developed a bewildering array of devices available to the mariner, some of which are so basic to the design of the vessel as to border on construction requirements.

Navigation has been greatly improved by a number of sophisticated electronic devices such as radar, direction finders, gyrocompasses, and fathometers. Other electronic position locating devices are known as LORAN, and Navigation Satellites (NAVSAT). Since this equipment, expensive as it is, represents potentially a great benefit for a small cost (relative to the cost of a new vessel) most vessels have at least the more conventional items of equipment.

The influence of the marine insurance underwriters in requiring such equipment has been significant. Also under consideration for future prevention equipment requirements are such exotic devices as sonar doppler docking systems,\textsuperscript{105} low velocity measuring systems, television cameras to increase visibility, armor blisters on vulnerable parts of the hull, remote release stemhead anchors to avoid the bulbous speed bows of modern tankers, stern anchors, and sensitive instruments to accurately determine the constantly changing drafts at bow, midships, and stern.\textsuperscript{106}

While such equipment properly maintained and operated can prevent most groundings, collisions are presently prevented by “rules of the road” and equipment affecting the maneuverability of the tanker.\textsuperscript{107} The tenfold increase in tanker size without a corre-

\textsuperscript{104} See 4 Whitman, Digest of International Law § 16, at 386-96 (1965).

\textsuperscript{105} Tanker Accidents, supra note 80, at 9. Sonar doppler docking systems use sound wave frequency changes to gauge the location of and rate of approach to piers and docks.


\textsuperscript{107} Collisions account for between 25 and 30 percent of all tanker traumatic polluting incidents. The vast majority occur within the ecologically fragile coastal zone (particularly within harbors and around harbor entrances where crowded traffic lanes and slow speeds decrease maneuverability). Porricelli, supra note 15, at 4; Oil Outflows, supra note 40, at 5. “Rules of the Road” are discussed in the text accompanying note 131 infra.
sponding increase in power over the past 20 years, has adversely affected the stopping distance of modern tankers. This handicap, coupled with tremendous momentum, large turning radii, and virtual uncontrollability at speeds of less than 4 to 5 knots, has made the avoidance of damage producing collisions very difficult.

Proposals to overcome these maneuvering problems have been criticized as being inordinately expensive, while reducing stopping distance only 20 percent or the equivalent of a speed reduction from 16 to 14 knots. Industry spokesmen have proposed instead a series of special maneuvers involving repeated shifting of the rudder with stepped reductions in speed which they claim will produce better results. The effect of such maneuvers in a collision situation, where everything depends on each master knowing what the other is doing, remains to be seen.

The importance that each ship know what the other is doing suggests one United States equipment requirement which should be adopted internationally—vessel bridge to bridge radio-telephones. Despite rules for the prevention of collisions and vessel traffic separation systems, a great many collisions have occurred which could have been prevented if the masters had been able to communicate with each other.

108. Hunter, supra note 42, at 38.

109. From full ahead to stop, a 25,000 to 77,000 DWT tanker requires $8\frac{1}{2}$ to 9 minutes when backing with a single screw, steam turbine plant. A 144,000 DWT tanker requires 10 $\frac{1}{2}$ ship's lengths and 11 minutes. The time and distance required to stop increase proportionately with vessel speed and size (momentum) as a function of the shaft horsepower and propeller blade size and number available to brake. Oil Spillage Prevention, supra note 106, at 49. The 30,000 H.P. main propulsion plant of the average 250,000 DWT tanker is equivalent to a 1/3 H.P. engine on a 40 foot boat and such an arrangement is, in fact, used in a miniaturized shiphandling course for supertanker masters at Grenoble, France. VTS Legislative History, supra note 94, at 2778.

110. See Supership, supra note 52, at 29-38.

111. Recommended solutions include multiple screw, reversible pitch diesel propulsion plants, pop-out brake flaps on the rudder or hull similar to jet aircraft speed brakes or landing parachutes, and bow and side thrusters for alongside maneuvering. Generally, diesel plants are more effective than steam for stopping power, the former giving full power astern, while the latter is limited to 40 percent of the ahead power (50 percent of the RPM's and 80 percent of the torque). Oil Spillage Prevention, supra note 106, at 49. See also Hunter, supra note 42, at 38; Tanker Accidents, supra note 80, at 9-11.

112. Tanker Accidents, supra note 80, at 11.

113. See text accompanying notes 131 and 142 infra.

114. For example, a Coast Guard study of collisions in the United States from 1965 to 1969 revealed 309 collisions involving 618 vessels, 115 deaths, $20 million in property damage, and substantial ecological damage. Most of these could have been prevented by good commun-
flashing lights, signal flags, whistle signals or radio morse are inadequate because they are too slow and cumbersome and because few people today know how to properly use them. The success of the United States Bridge to Bridge Radiotelephone Act, administered by the Coast Guard in conjunction with the Federal Communications Commission, in reducing collisions indicates that the adoption of an international bridge to bridge radiotelephone convention would also result in a reduction of collisions. Such a convention, accompanied by an annex containing an international radio telephone code, allowing persons of different languages to communicate, would require all vessels over a certain size to possess a radiotelephone operable within certain range and frequency specifications and to maintain a continuous live listening watch.

The effect of the United States Bridge to Bridge Radiotelephone Act on foreign vessels in American waters, however, is not clear. The Act requires radiotelephones on “all vessels” of a certain size without regard to nationality, but is silent as to whether it expressly applies to foreign vessels. The intention of Congress to reduce vessel collisions through the use of bridge to bridge communications strongly suggests an interpretation requiring that all such vessels in American waters, not merely engaged in innocent passage, comply with the Act. This Congressional intent would be severely hampered if the large numbers of foreign vessels plying United States waters were free from this requirement. Such a re-

116. The Coast Guard reports a 10 percent reduction overall of collisions with Bridge to Bridge Radiotelephones with an 80 percent reduction in open water areas where there is time to see, communicate, and maneuver. U.S. COAST GUARD, VESSEL TRAFFIC SYSTEMS ISSUE STUDY: VOLUME I-EXECUTIVE SUMMARY 12 (1973).
117. An international radiotelephone code, similar to the present International Code of Signals, would allow two masters speaking different languages to communicate using a standard word code with the key printed in their respective languages.
119. Legislative History of the Bridge Radiotelephone Act, supra note 114, is also silent as to whether it was intended to apply to foreign vessels.
120. As used in the Act, the “bridge” of a vessel is its primary area for navigational and steering control.
quirement would be a reasonable one, causing only minimal expense, and should thus be acceptable under both international\textsuperscript{121} and domestic law.\textsuperscript{122}

It is not enough, however, to merely promulgate adequate international standards of construction and requirements of navigation and communications equipment. A number of traumatic incidents have revealed that navigation equipment already installed on vessels in compliance with insurance and other requirements is not properly maintained.\textsuperscript{123} Similarly, the most comprehensive construction standards will accomplish little if the nation having jurisdiction to enforce them lacks the capability to do so.\textsuperscript{124} If the promulgation of multilateral uniform international construction standards and equipment requirements is to be effective, the smaller nations of the world, particularly the Flag of Convenience nations, must receive technological and administrative assistance\textsuperscript{125} in building high caliber shipping inspection systems to enforce these standards. The most effective way to achieve a system such as those presently maintained by the United States and the United Kingdom, would be through an International Maritime Administration Bureau (IMAB) under the auspices of the Intergovernmental Maritime Consultative Organization (IMCO). Such an organization would provide training and assistance to nations desiring to set up an effective administration, or fulfill that role in situations where the flag state cannot. A global system of resident inspectors stationed at the world's major ports, backed by a staff of experts for examination of blueprints, etc., would ensure that all vessels would be subject to effective administrative control either by the flag state, as required by present international law,\textsuperscript{126} or by IMAB by

\textsuperscript{121} Territorial Sea Convention, \textit{supra} note 60, art. 16(2).

\textsuperscript{122} Lauritzen v. Larsen, 345 U.S. 571 (1953).

\textsuperscript{123} A number of Liberian vessels have been discovered, after having gone aground, to have had inoperative radar. The Liberian tanker \textit{Arrow} went aground causing a massive spill in Nova Scotia; she too had inoperative radar. Other equipment deficiencies discovered on grounded Liberian vessels have included inoperative or malfunctioning radios, gyro compasses, running lights, depth finders, and radio direction finders. \textit{See} Hunter, \textit{supra} note 42, at 36; \textit{Supership}, \textit{supra} note 52, at 59-61.

\textsuperscript{124} Inspecting the construction of a 350,000 DWT supertanker means examining 3,000,000 square feet of plating and 257 miles of riveting. Such a job requires years of education and experience if it is to be done properly. \textit{Supership}, \textit{supra} note 52, at 74-77.


\textsuperscript{126} High Seas Convention, \textit{supra} note 73, art. 5(1).
delegation from the flag state.

The simultaneous utilization of existing national resident inspector systems would minimize economic and practical difficulties. Such inspectors should be given authority to delay the sailing of a vessel until essential requirements are met, equipment is made operable, or other unsafe conditions are corrected, so that compliance is assured.

B. Collision Regulation and Traffic Separation

Although the proper construction and equipping of a vessel to control oil outflow when damage has occurred are important in preventing traumatic oil pollution, regulations for the conduct of vessels with respect to other traffic on the high seas are equally important since they lead to the reduction of collisions in the first place. These “rules of the road,” as they are commonly called, are designed to give masters a standard of conduct to avoid collisions and through which they can hopefully rely on other vessels to behave in an expected manner. These rules are primarily rules of maneuvering, although they also cover lights, shapes, and signals which must be displayed in different situations so that vessels may detect each other’s presence and ascertain what the other is doing.127

These rules were first adopted on a national basis in the early nineteenth century when both steam and sailing ships were small and slow. They originally evolved as standards of care adopted by admiralty courts to determine liability in collision cases.128 Later, national legislation was adopted by many nations requiring compliance, but the question arose as to whether vessels were bound by these statutes on the high seas and what rules should be applied in collisions involving vessels of differing nationalities. Eventually, it was held that the “rules of the road” had been adopted into the customary law of the sea and were binding on all vessels on the high

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127. The rules chiefly govern the status of one vessel. As privileged, it must maintain its course and speed, and the other vessel, as burdened, must keep out of the way of the privileged vessel. Which vessel is burdened and which is privileged depends on the type of vessel, the activity engaged in and the relative positions of the vessels. Lights, shapes, and whistle signals aid in ascertaining what the controlling parameters are. Signals are also used to communicate presence in fog, course changes, and danger. One problem that arises in multivessel situations is where a vessel is simultaneously required to maintain course and speed with respect to one vessel yet also keep out of the way of another. See 33 U.S.C. §§ 1062-1090 (1970).

A series of international conventions codified these rules. The most recent codification is the International Regulations for Preventing Collisions at Sea, 1960.130

The rules have been criticized as being outdated and ineffective under today's conditions of huge, fast ships and overcrowded seaways. Moreover, the rules are based on avoidance of responsibility for collision and give little guidance as to the proper action to take once the risk of collision becomes imminent other than to keep out of the way and avoid crossing ahead of the other vessel.131 The rules are also based on a two vessel situation and progressively fail as a guideline upon the involvement of more vessels.132 Finally, they fail to take into account the lack of maneuverability of huge, deep-draft superships which frequently cannot fulfill the obligations which these rules impose upon them.

These criticisms resulted in the adoption of more modern rules by IMCO in 1972, which are scheduled to possibly go into effect in January 1977.133 These rules include provisions on the use of radar,134 traffic separation schemes,135 vessels with deep drafts and limited maneuverability,136 and nondisplacement craft, such as a hovercraft.137

While these rules should prove extremely beneficial in overcoming the present inadequacies, further measures are necessary to reduce the number of possible collision situations. One of the most promising methods is the use of vessel traffic separation schemes, which are systems whereby all traffic headed in a given direction is routed through one corridor and traffic in the opposite direction through another corridor with as much physical separation between them as is practical. They are of the greatest value when used on major shipping lanes,138 harbor entrances and international straits.

129. The Scotia, 81 U.S. 170, 188 (1871).
132. Hunter, supra note 42, at 34 n.48.
135. Id., Rule 10.
136. Id., Rules 3(b), 3(g).
137. Id., Rule 3(a).
138. For example, the North Atlantic Track Agreement provided for the separation of
A large number of traffic separation schemes have been adopted throughout the world, but they have produced mixed results, largely because of the lack of sufficient enforcement jurisdiction to ensure compliance with routing plans. Although a coastal state has jurisdiction to enforce such schemes within the relatively narrow band of its coastal waters and to require compliance with any system by its flag vessels, there is at present no jurisdiction to force compliance by foreign vessels on the high seas shipping lanes and straits where the need for vessel traffic separation is often the greatest.

The only international body with the necessary competence and authority to deal with such a scheme is IMCO. Coastal states wishing to establish traffic separation systems on the high seas off their coasts presently must submit the plan to IMCO which, after approval, will promulgate the plan. IMCO, however, cannot give such plans legal force, but can merely publish them as recommendations and invite countries to advise their ships to comply. Recently, however, IMCO adopted a resolution encouraging member states to make it an offense for their ships to proceed against the traffic flow. Further compliance with traffic separation plans will be assured under the new collision rules adopted in 1972 which will oblige the parties to adopt legislation making it compulsory for their ships to obey the rules for traffic separation schemes embodied in the convention. This may not be enough to ensure compliance by nonparty state vessels or vessels of nonenforcing party states. Without total enforcement of high seas traffic systems by coastal states, flag states, or an international body, (which does not seem

the major east/west shipping lanes of the Atlantic. The Swedish liner Stockholm and the Italian liner Andrea Doria (neither nation was a signatory to the agreement) collided while on exact reciprocal courses which such a scheme was designed to avoid. Warbick, supra note 134, at 150 n.30.

139. A traffic separation scheme in the English Channel has reduced collisions as much as 60 percent in some circumstances. It has been found particularly effective on foggy days when vessels are reluctant to go against the flow of traffic. Beattie, Two Years of Routing in the Dover Strait, 22 J. INST. NAVIGATION 442, 446 (1969); Calvert, Human Factors and the Collision Problem, 22 J. INST. NAVIGATION 48 (1969). For a listing on systems presently in operation, with diagrams see IMCO, SHIP’S ROUTING AND TRAFFIC SEPARATION SCHEMES (1971).

140. If as few as 10 percent of the vessels fail to comply with the separation plan, its effectiveness is severely diminished. Comment, The Establishment of Mandatory Sealanes by Unilateral Action, 22 CATHOLIC U. L. REV. 108, 109 (1972).


142. Id., at 291.
likely in the foreseeable future) the success of vessel traffic schemes may well depend on a mutual enforcement effort by the admiralty courts and marine insurance underwriters.

Frequently, where moral persuasion or force of law is not enough to ensure compliance, economic penalties in the form of adverse judgments, loss of insurance coverage, or high premiums will provide the necessary incentive. One method of accomplishing this would be for the world's admiralty courts to adopt the rule of The Pennsylvania\(^{143}\) for areas where an IMCO traffic scheme is in effect. This rule, long followed by United States courts, would impose automatic liability on a vessel which becomes involved in a collision while it is not complying with a traffic separation plan, regardless of the fault of the other vessel, which may or may not share the damages.\(^{144}\) This, in turn, would lead insurance companies to revise their premiums to encourage compliance with such plans by penalizing vessels registered in nonenforcing nations. Ideally, insurance underwriters could write a term in their policies reducing coverage or invoking a high deductible when the insured vessel does not comply with a duly promulgated traffic separation plan. Flag states could also encourage compliance by revising their limitation of liability statutes\(^{145}\) to require a higher limitation in the event of noncompliance.

The use of such economic incentives coupled with international and domestic legal measures\(^{146}\) should go a long way toward ensuring

\(^{143}\) The rule provides that a vessel that is involved in a collision while it is in violation of a statutory safety rule is presumed to be at fault and therefore liable for at least part of the damages, unless it can prove that the violation could in no way have caused the collision. The Pennsylvania, 86 U.S. (19 Wall.) 125 (1873). See also Brown & Root Marine Operators, Inc. v. Zapata Off-Shore Co., 377 F.2d 724 (5th Cir. 1967); J.F. Campbell Co. v. Dick (The Victor), 153 F.2d 200, 202 (5th Cir. 1946).

\(^{144}\) Previously, under the United States rule of The Schooner Catharine v. Dickinson, 58 U.S. (17 How.) 170 (1854), where both vessels were at fault, the damages were evenly divided without regard to their relative degrees of fault. This rule was recently overturned when the Supreme Court adopted a comparative negligence damage apportionment rule for collision cases. United States Reliable Transfer Corp., 421 U.S. 397 (1975). The effect of this decision on the rule of the Pennsylvania is not yet clear.

\(^{145}\) Under such statutes, a shipowner without privity is allowed under certain circumstances to limit his liability for damage caused by his ship to the value of his interest in the vessel after the incident. See, e.g., The Limitation of Vessel Owner’s Liability Act, 46 U.S.C. §§ 181 et seq. (1970).

\(^{146}\) An alternative measure might be the use of treaties of friendship, commerce and navigation to allow the coastal state to exercise vessel traffic separation system enforcement authority over party state vessels. A. Manning, The Role of Compulsory Sealanes in Resolv-
the effectiveness of vessel traffic separation schemes on the high seas, in areas of high traffic density, and in converging shipping lanes.\footnote{147} Despite arguments that such traffic systems are an infringement on the freedom of navigation, it must be pointed out that such high seas freedoms should be exercised with reasonable regard for the safety of others, and for the prevention of traumatic oil pollution.\footnote{148} In this manner, vessel traffic separation rules may be considered analogous to other customary rules of the law of the sea which do not act "to limit or restrict the freedom of the high seas, but to safeguard its exercise in the interests of the entire international community."\footnote{149}

C. Training and Certification Requirements

Regardless of all the construction standards, modern equipment, inspections, collision regulations and vessel separation schemes, the conduct of the vessel ultimately depends upon the ability of the men who man her, for it is they who must operate equipment, navigate the vessel, and avoid collisions and groundings. The combination of all the technical requirements and preventive rules discussed above, when coupled with a competent, well-trained crew, should prevent all but the most unforeseeable or uncontrollable types of traumatic pollution incidents. Unfortunately, it is this last element which is too often lacking and prevents the attainment of effective traumatic pollution prevention.

This lack of competent officers and crews is the result of a number of factors. With the world's merchant fleet doubling every 8 to 10 years,\footnote{150} the shortage of competent officers and union demands for higher wages have encouraged cost-cutting owners to hire

\footnote{147} Similar efforts to separate shipping and oil rigs, through the use of designated fairways reserved for vessels, has already been successful in the Gulf of Mexico. See, e.g., Legg, Fairways Regulations: Jurisdiction and Effect, 26 J.A.G.J. 205 (1972); Knight, Shipping Safety Fairways: Conflict Amelioration in the Gulf of Mexico, 1 J. MARITIME L. & COM. 1 (1969); 33 C.F.R. § 209.135 et seq. (1975).

\footnote{148} High Seas Convention, supra note 73, art. 2.


\footnote{150} Bates & Yost, supra note 9, at 253.
less expensive and less competent personnel. Another factor has been the rapid increase in vessel size which has often resulted in huge vessels being placed in the hands of men with little or no experience in handling them. Moreover, there has also been a failure on the part of Flag of Convenience nations to exercise effective control over the licensing of the flag-vessel officers.

With 1 in 14 ships involved in collisions each year, there is widespread agreement that the deficiencies in seamanship and proficiency in the required navigational and shiphandling skills among ships' officers is becoming one of the primary focuses of the Flag of Convenience controversy. Liberia, for example, has experienced particular difficulties in supervising its ships' officers, despite the existence of a licensing system. The deficiencies of the Liberian maritime administration were pointedly brought to the world's attention by the October, 1970 collision between the two Liberian supertankers Allegro and Pacific Glory. After this disaster, which caused considerable pollution and loss of life, it was discovered that three of the Pacific Glory's officers and four of the Allegro's officers did not possess the required Liberian certificate of competency, while the officer on watch aboard the Allegro had no certificate at all. Subsequent experience with other Liberian vessels has shown that this is not an unusual situation. In fact, the International Labor Organization (ILO) reports that as many as 50 percent of Liberian officers do not possess the required Liberian license, and there is a widespread use of forged mariners' documents.

International efforts to achieve uniformity of standards for training and licensing have experienced a regrettable lack of success. The airline industry, although starting with a miserable safety record in its early years, has reached great heights in implementing international safety and licensing standards as a result of its relative

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151. Warbick, supra note 134, at 141-42.
152. Approximately 80,000 gallons of oil were spilled with clean-up costs of $3,000,000. Fourteen lives were lost in addition to severe damage to both vessels. OECD Study, supra note 75, at 250.
153. The Liberian tanker Arrow ran aground causing a massive spill. The officer on watch had no license. The Liberian supertankers Texanita and Oswego Guardian collided in 1972, sinking the former and taking 34 lives. No efforts to plot the other vessel on radar had been made; both vessels were travelling at high speeds in dense fog and the master of the Oswego Guardian fled from the scene at full speed without giving aid to the survivors of the Texanita as required, and after transmitting an erroneous position. Both masters were subsequently disciplined by Liberia. Supership, supra note 52, at 59-63.
154. OECD Study, supra note 75, at 250.
newness and concern over its human cargoes, but the ancient sys-

tem of shipping personnel regulation has not yet awakened to the

fact that modern vessels are capable of dealing death and destruc-

tion on as massive a scale as the airplane. International bodies such

as the ILO have concerned themselves with safety, but chiefly from

the point of view of providing a safe, habitable vessel for the crew

and not to prevent traumatic incidents per se.\textsuperscript{155} There is a growing

awareness, however, of the need for quick action to promote interna-
tional standards of training and certification.\textsuperscript{156}

The need for international standards was first recognized in 1926 when the Turkish master of the \textit{Boykourt}, in collision with the

French vessel \textit{Lotus}, was found to have no certificate of competency.\textsuperscript{157} The international response over the next 3 decades was

limited, however, to the adoption of two international conventions

setting only the vaguest and most general of standards. Even such

broad guidelines were rejected by most nations and only a few have

ratified the conventions.\textsuperscript{158} More recently, IMCO has announced

plans to undertake action in this area and hopes to produce a con-

vention in 1977 dealing with the minimum required qualifications

and certification of officers and crews as well as providing technolog-

ical assistance to developing nations in maritime administration.\textsuperscript{159}

International standards should include a system of global noti-

fication to all employers and maritime administrators of those per-

sonnel who have had their “tickets” lifted for incompetence. Modern

technology and identification systems should be employed to

produce a certificate which is not susceptible to forgery or use by

persons other than the issuee. The possession of such a certificate

issued by a party-state to maritime personnel should be considered

\textsuperscript{155} See Seven Maritime Sessions of the International Labour Conference, 78 \textsc{Int'l}

Labour Rev. 429 (1958); Argiroffo, \textit{Flags of Convenience and Substandard Vessels}, 110 \textsc{Int'l}


\textsuperscript{156} Hunter, \textit{supra} note 42, at 37 n.75.

\textsuperscript{157} Seven Maritime Sessions of the International Labour Conference, 78 \textsc{Int'l Labour}


\textsuperscript{158} These conventions are: Convention Concerning the Certification of Able Seamen,

June 29, 1946, [1954] 1 \textsc{U.S.T.} 605, \textsc{T.I.A.S.} No. 2949, 94 \textsc{U.N.T.S.} 11 (adopted by 18

countries including the United Kingdom, United States and Panama); Convention Concern-

ing the Minimum Requirements of Professional Capacity for Masters and the Officers on

Board Merchant Ships of Oct. 24, 1936, 54 \textsc{Stat.} 1683, \textsc{T.S.} 950, 3 \textsc{Bevans} 281, 40 \textsc{U.N.T.S.}

153 (adopted by 25 nations including the United States, Liberia, France, Norway, Panama,

Denmark and Italy). \textit{See also} \textsc{46 U.S.C.} § 224 (a) (1970).

\textsuperscript{159} Brown & Couper, \textit{supra} note 125, at 273.
primarily facie evidence of competence, and the present provision limiting revocation powers to the issuing state should be retained. However, port officials of all states should be empowered to inspect for such certificates and deny sailing clearance if the requisite minimum number of officers necessary to maintain a safe watch are not possessed of such a certificate. To prevent their utilization or employment on the high seas after leaving port, unlicensed personnel should be removed from the vessel and deported to the flag state or other appropriate country. To avoid deportation, merchant marine personnel should be required to possess the required documents verifying their status in order to enter the country legally without passport or visa. Entry without a certificate of competency should constitute illegal entry based on false pretenses. The convention should also proffer a system which forwards reports of incompetent performance to the flag state which, after conducting an investigation as required, should report on the disposition of the complaint.

Finally, one of the chief goals of the IMCO program must be to provide a mechanism, such as the proposed International Maritime Administration Bureau, whereby nations with expertise in these matters can assist other nations in establishing such a program. The Bureau itself could take over interim administration until such programs are established, and it could serve as a training ground for the future national administrators.

Unfortunately, the chances of reaching agreement on the necessary minutiae of an international uniform officer certification program, given the wide disparities in existing national systems, do not seem bright. There is no lack of models on which to draw since major maritime nations have long had stringent, comprehensive, albeit divergent, standards for training, education, testing, and other pertinent qualifications. The United States regulations, for example, cover dozens of areas including subjects for written examinations, qualifications for upgrading the permissible tonnage or waters of a license, physical qualifications, etc. The regulations are administered by a staff of hundreds of experienced specialists. Such stan-

160. See 46 U.S.C. § 224 (a) (6)-(7) (1970), which contain similar provisions for the enforcement of the Officer's Competency Certificate Convention of 1936; see infra note 162.
163. The United States system is administered by the Merchant Marine Safety Division of the United States Coast Guard.
standards, coupled with stringent construction and equipment requirements and inspections, are among the chief reasons that the United States' maritime safety record is one of the best in the world.

Governments are not the only agencies by which such improved standards can be achieved. Maritime labor unions have long been concerned with the safety of their members, but have resisted stringent certification standards in many cases out of fear that such standards could be used as weapons against them. In addition to vocal opposition before Congressional committees considering measures which might increase the liability of ships' officers for their actions, pressure from maritime labor organizations induced the 1958 Law of the Sea Conference to adopt a provision\textsuperscript{164} negating the Court of International Justice decision in \textit{The Lotus}.\textsuperscript{165} \textit{The Lotus} decision had given a nation jurisdiction over any officer entering its territory who had collided with one of the nation's vessels on the high seas or who had caused repercussions such as damage or injury affecting the nation. Lack of jurisdiction over foreign merchant marine personnel has been a recurring problem, particularly in light of the fact that many nations with appalling safety records have never instituted a public inquiry into a marine casualty and have never taken disciplinary action against the personnel involved.\textsuperscript{166}

Maritime industry and marine insurance interests can also be highly influential in establishing such standards. These groups have always recognized the necessity of protecting their financial interest in vessels by placing them in competent hands. Programs established by the major oil companies to train their masters in the handling of supertankers through the use of ship-handling courses and ship simulators serve as models for initial proficiency and qualification testing and periodic recertification and certificage upgrading programs.\textsuperscript{167} The aid of these groups should be sought in the formulation of standards, they should be encouraged to scourge their industry of unscrupulous owners who employ unqualified and incompetent personnel, and they should pressure noncomplying states to support and adopt international certification requirements.

\begin{itemize}
  \item \textsuperscript{164} High Seas Convention, \textit{supra} note 73, art. 11 (1).
  \item \textsuperscript{165} Case of the S.S. "Lotus" [1927], P.C.I.J., ser. A, No. 9.
  \item \textsuperscript{166} Houasesian, \textit{Post "Torrey Canyon": Toward a New Solution to the Problem of Traumatic Oil Spillage}, 2 CONN. L. REV. 632, 635 (1970).
  \item \textsuperscript{167} See \textit{TANKER ACCIDENTS}, \textit{supra} note 80, at 6.
\end{itemize}
D. Suggested International Regulatory Framework

There exist many areas in which effective international action can be taken to prevent traumatic vessel source oil pollution of the marine environment and its attendant vessel damage, economic loss, and human suffering. The achievement of effective international action in these areas is not a function of developing the necessary technology or administrative means. Rather, an international regulatory framework for traumatic pollution prevention already awaits the realization of all nations that their common interest lies in laying aside petty differences to concentrate instead on achieving the goal of assuring safe ships piloted by competent men in accordance with modern and effective rules of conduct. The savings will not only include hundreds of lives and billions of dollars, but may well encompass the ecological basis of marine life.

IV. National Efforts to Prevent Traumatic Oil Pollution

A. Introduction

Although international efforts to deal with traumatic pollution are improving, many nations, perhaps disillusioned with past international cooperative efforts to deal with such complex issues, have made the decision to take unilateral action concurrently with their efforts to arrive at international standards. Such nations can hardly be faulted for desiring to take immediate action to protect their environment rather than await the slow progress of international efforts. On the other hand, the actions taken by these nations, sometimes spurred by political as much as ecological concerns, have often exceeded the jurisdiction accorded them under current principles of international law. Such actions have included establishment of construction and equipment requirements for vessels in innocent passage, denying passage to vessels of certain size and draft without respect to the conditions of passage (i.e., channel depth), and extending their territorial jurisdiction beyond the currently recognized limit of 12 miles.168

Many of the measures taken unilaterally by individual nations present complex strategic, political, and economic questions.169

168. Although no agreement on the breadth of the territorial sea has been reached, the limitation of the contiguous zone beyond the territorial sea to a distance of 12 miles from the baseline of the territorial sea implicitly limits the territorial sea to 12 miles.

169. These questions go beyond the scope of this article and are currently under discus-
These measures are primarily various operational systems maintained under the authority of the coastal state and designed to either prevent collisions and groundings by the use of systems external to the vessel, or to remove vessel activity from the coastal ecosystem entirely. While there are a myriad of proposals, the chief areas of endeavor involve the upgrading of traditional systems of aids to navigation and pilotage, the implementation of vessel traffic systems, and the utilization of off-shore deepwater ports. The purpose of such systems is not to prevent all traumatic pollution, but primarily to protect the ecologically fragile coastal environment where the vast majority of collisions and groundings occur.170

B. Navigational Aids: Efforts to Prevent Groundings

The utilization of such traditional aids to navigation as lighthouses, buoys, pilots, and charts are almost as ancient as man’s use of the sea as a highway of commerce. The use of lighthouses to mark harbor entrances and on shore bonfires to warn ships off shoals appears in the historical accounts of ancient Egypt, Greece, and Rome. Two such aids, the Colossus of Rhodes and the Lighthouse at Alexandria, are counted among the wonders of the ancient world.

While a nation is under no obligation to provide lighthouses and buoyage per se,171 there does exist an international duty on the part of a coastal state to give appropriate publicity to dangers to navigation of which it is aware. Liability may result when it fails to do so.172 Such publicity need not take the form of aids to navigation to mark shallows and prevent groundings. However, most nations have chosen to provide such systems in the interest of the promotion and safety of international commerce.

Modern systems of lighthouses, light structures, and buoys are technologically advanced, often utilizing solid state electronic circuitry, solar sensing switches, and automatic or remote control operation. The use of special radar reflectors on such aids assists in their detection by ships’ radar during periods of reduced visibility and

170. Studies have shown that 86.6 percent of tanker collisions and 91.2 percent of tanker groundings occur within harbors, at harbor entrances, or in the coastal zone. OIL OUTFLOWS, supra note 40, at 5.


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has aided measurably in reducing groundings. Future systems may include the use of shore mounted transponders\(^\text{173}\) on salient features of the coastline to further aid the navigator by giving instant identification of reference points.

The placement and maintenance of all such aids must be done with great care, because, under the domestic law of many nations, mariners are entitled to reasonably rely on government aids even though provided gratuitously, and vessel owners may recover damages for injuries proximately caused by their malfunction or mislocation.\(^\text{174}\) Some courts have even extended this liability to also allow recovery by the owners of shore property, commercial fishermen, and others who are damaged by oil spilled from a grounded tanker as the result of malfunction or mislocation of government aids.\(^\text{175}\)

The effective use of aids to navigation not only reduces vessel groundings, but in many cases has greater cost effectiveness than more technically sophisticated systems and is thus particularly suited for use by emerging nations. National efforts on the part of emerging countries to establish an effective navigational aids system should be assisted through an international body such as the International Maritime Administration Bureau (IMAB). Such a program, operated under the auspices of IMCO, could include the transfer of technology as well as the providing of trained personnel to aid in training future system operators and in establishing the navigational aid system.

The use of pilots or local seamen intimately familiar with area waters and procedure, taken onboard arriving vessels to aid the master, has also had an historic role in the prevention of traumatic incidents.\(^\text{176}\) A complex body of law, not pertinent here, has grown

\(^{173}\) A transponder receives the radar signal of the vessel, magnifies it (often adding a distinct characteristic) and re-transmits it to the vessel. The location of the transponder appears as a magnified, coded blip on the vessel's radar. By comparing transponder blips on the radar with their charted location, the navigator may locate himself easily and avoid the common error of mistaking shore features.


\(^{176}\) The laws and usages affecting pilots can be traced back to Roman times. Repeated references to the authority of the coastal state to require a pilot appear throughout historical annals. See, e.g., Roman Law Digest, Book 19, tit. 2, Edict of Ulpian, I, 110; The Laws of Oleron, I, 232; The Consulate de Mer, II, 250; Ex parte McNiel, 80 U.S. (13 Wall.) 236, 239 (1871).
up around pilotage and the rights, duties, and liabilities of pilots. It is well settled that coastal states have the authority to reasonably require foreign vessels to take a pilot, and to charge incoming vessels reasonable fees for such services.\(^{177}\) Because of its great dependence on local conditions and customs, pilotage does not readily lend itself to uniform international regulation and has traditionally been a local concern. Pilotage could, however, be the subject of international cooperation to the extent that developing nations require assistance in establishing a pilotage system.

The effectiveness of pilotage in further reducing traumatic pollution is somewhat limited because of the human limitations involved and because it has already reached most of its preventive potential. Further incremental reductions in traumatic incidents may be achieved, nevertheless, by maintaining scrupulously high standards of competence for pilots\(^{178}\) and utilizing such technological devices as bridge to bridge radiotelephones to augment their effectiveness.\(^{179}\)

Another traditional method of preventing groundings has been the use of charts and hydrographic surveys. These charts are literally a type of "roadmap" of coastal waters with water depths, shipwrecks, shoals, buoys and other aids, coastal landmarks, and salient features marked. Again, great care must be taken in their preparation or liability for damage to the mariner who reasonably relies on them to his detriment, will attach to the government.\(^{180}\)

In recent years, the state of the art of hydrographic surveying and chart preparation has reached great heights.\(^{181}\) Unfortunately, the great increase in tanker drafts has offset these advances and has made the detection and marking of underwater wrecks, rocks, shoals, and pinnacles increasingly important. Because of the ex-


\(^{179}\) See text accompanying notes 113-22 supra.

\(^{180}\) As in the case of buoys and other aids, the government may avoid liability for mischartings, malfunctions, and mislocations by giving notice of the discrepancies. Navigators are put on constructive notice upon issuance of the "Notice to Mariners." Incidents occurring thereafter do not result in liability. De Bardeleben Marine Corp. v. United States, 451 F.2d 140 (5th Cir. 1971).

\(^{181}\) The preparation of charts in the United States is the primary responsibility of the National Ocean Survey (formerly the Coast and Geodetic Survey) of NOAA.
treme difficulty in detecting these obstacles by traditional methods, such as wire dragging and taking soundings, their marking has been all too frequently limited to after the fact discovery by the groundings of a behemoth vessel resulting in attendant damage and traumatic pollution.\textsuperscript{182} This problem is particularly acute in many developing nations which lack the capability to update surveys that may be decades old.\textsuperscript{183} The problem is frequently compounded by constantly shifting bottoms near river mouths and in all important international straits.

With the use of such exotic devices as side scanning doppler sonar, which produces a television-like picture by using sound waves, underwater television cameras, magnetic anomaly detection gear, and other instruments developed for anti-submarine warfare and underwater search and rescue purposes, the task of the hydrographer of the future in locating wrecks, pinnacles and other obstructions should be greatly eased. His chief task will be recharting literally millions of square miles of coastal ocean bottom—a task that will take years. Such a project would seem ideally suited for international cooperative efforts, such as the adoption of uniform chart symbols and abbreviations, technical assistance to emerging nations, and the joint conduct of new international hydrographic surveys.

At the invitation of a country and with crews augmented by local trainee/observers, a thorough survey of coastal waters could be conducted. Priority should be given to waters through which major shipping lanes pass. Groundings and related traumatic pollution incidents in such waters would be greatly reduced by the availability of these up-to-date, utilitarian charts.

Despite their value, accurate charts, pilots, and other aids to navigation cannot completely solve the problem of coastal groundings, and they do little to prevent collisions. The reason for this is that such systems may make it easier for the mariner, but inevitably their efficiency depends on his individual competence. In an effort to remove the dependency of traumatic pollution prevention systems on individual seamen, particularly in light of their deficiencies

\textsuperscript{182} See generally \textit{Supership}, supra note 52, at 32-39.

\textsuperscript{183} Some may be older. Throughout the 18th and 19th Centuries, the Royal Navy conducted surveys of most of the waters of what is now the Third World. Today, these ancient "Admiralty Charts," which are little changed since the original survey, are often the only charts available in remote areas.
C. Vessel Traffic Systems: Efforts to Prevent Collisions

Vessel Traffic Systems (VTS) is a term applied to a collection of marine traffic control systems of varying levels of sophistication which are designed to impose external supervision and control on vessel movements ranging from mere surveillance and position monitoring to actually controlling courses, speeds, and other vessel movements.

In its more sophisticated applications, VTS is not unlike Air Traffic Control; but while useful parallels can be drawn between the two systems, the problems faced by a vessel traffic system are often quite different. The air traffic controller has large amounts of airspace both vertically and horizontally in which to work his aircraft while the vessel traffic controller is not only limited to the horizontal boundaries of the river or harbor but must keep track of drafts, water depths, channels, and shoals. The vessel controller also deals with less maneuverable ships which at high speeds require thousands of feet to stop or turn and at too low a speed drift helplessly with the wind and current. Furthermore, the traffic with which the vessel traffic controller deals has origins and destinations at a myriad of locations within the harbor area rather than one or two central airport locations.

Nevertheless, despite the difficulties associated with VTS, such systems have proven extremely effective in reducing traumatic incidents. Systems of varying degrees of sophistication have been used in major European ports since the 1950's and 1960's and have resulted in a lower accident rate, while the traffic density has in some cases doubled.184 Similar results can be expected in the United States ports and waterways. In fact, studies have shown that order can be brought from the seeming chaos of thousands of vessels and almost all traumatic incidents can be eliminated, except for those caused by unexpected equipment failure or gross human error.185

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184. The Rotterdam VTS has reduced the accident rate to one quarter of its previous level since 1961, although traffic density doubled during the same period. TANKER ACCIDENTS, supra note 80, at 9-10.
185. See UNITED STATES COAST GUARD STUDY REPORT: VESSEL TRAFFIC SYSTEMS: ANALYSIS OF PORT NEEDS 15-16 (1973) [hereinafter cited as VTS PORT STUDY].
The United States, however, has been very slow to respond to the need for VTS and lags behind much of the world. One reason for this failure to respond has been the lack of any United States agency's statutory authority to undertake such action. The agency primarily responsible for maritime safety, the United States Coast Guard, has experimented with Harbor Advisory Radar (HAR), but its statutory authority to regulate or direct vessel movement has been limited in the past to only that which is necessary to eliminate threats to port safety (e.g. dangerous cargoes) and national security under the Magnuson Act.186 However, growing awareness of the traumatic pollution problem, increased tanker traffic, burgeoning barge traffic, the growing use of waterways for the transportation of hazardous materials,187 and several catastrophic collisions which could have been prevented by VTS, have all combined to convince Congress to pass Title I of the Ports and Waterways Safety Act of 1972.188 The Act provides the authority, for the first time, to regulate vessel movement, construction, and equipment for the protection of the marine environment as well as the protection of life and property. The Act empowers the Secretary of the department in which the Coast Guard is operating to issue regulations covering a wide spectrum of activities within the port area.189

The establishment of VTS is specifically provided by the broad regulatory power vested in the Secretary.190 Under this authority,
the Coast Guard has undertaken a major effort and VTS is already in operation in San Francisco, Puget Sound and the Houston/Galveston Ship Channel. Other systems are being studied for New York Harbor/Long Island Sound, New Orleans, the Intracoastal Waterway between New Orleans and Galveston, the Chesapeake Bay (Hampton Roads to Baltimore), the Port of Chicago, the Delaware River/Bay and Port of Valdez, Alaska which will be the southern terminus of the Alaskan pipeline and a major tanker port.\footnote{191. VTS Port Study, supra note 185, at 24-28. These sites were selected on the basis of the greatest need for accident reduction, but others may be added as political and ecological factors make their weight felt. Despite its slow start, the VTS effort in the United States has made great gains in the field and has attracted world attention, particularly in the use of computers with direct high resolution radar input to predict collision situations.}

The national VTS, as envisioned by the Coast Guard, will not encompass all of our national waterways, however. The Coast Guard first analyzes the safety records of each port, the type and causes of its accidents, its traffic density, and projected future development, and then conducts a rigorous cost benefit analysis to determine whether the employment of VTS is justified.\footnote{192. Id. at 1-11.} Once the preliminary decision is made that a port requires a VTS approach, further cost benefit analysis will determine what specific systems or combination of systems will be employed.\footnote{193. The vessel traffic system is controlled by the vessel traffic center which is manned wholly by Coast Guard personnel. Special regulations adapted to the local situation and having the force of law are promulgated to implement the system, and specify in great detail the procedures with which the covered vessels must comply. See, e.g., 33 C.F.R. § 161, Subpart B (1975) containing the regulations for the Puget Sound VTS. These regulations apply to all vessels 300 GRT and over, passenger vessels over 100 GRT, pushing/towing vessels over 26 feet, dredges, and floating plants. A vessel must check in and out of the system, give advance notice of arrival and departure, report origin and destination within the system, and any special circumstances or dangerous cargoes, as well as the vessel's name, type, length, draft, and speed over the ground. Other regulations require vessels to use the English language, maintain a continuous radio watch, report hazards, and transmit their intentions to other vessels in certain areas when meeting, crossing, or overtaking. The Coast Guard reserves the right to actually direct vessel movement but normally does not. In some cases, the study may result in the adoption of regulations especially tailored to the accident reduction needs of the port. Such regulations may include maximum tow length, minimum power requirements for push/tow vessels, times of bridge openings, etc. VTS Port Study, supra note 185, at 12.}

Aside from the use of bridge to bridge radiotelephones and traffic separation schemes (TSS),\footnote{194. See section III, B supra.} one of the most basic forms of VTS is the Vessel Movement Reporting System (VMRS),\footnote{195. Vessels may also be required to give advance notice of entry and departure in the}
vessels moving within the system check in periodically at designated points by radio to the vessel traffic center. The vessel traffic center plots their movements on a scale mock-up of the area and advises them of converging traffic and developing situations as reported to them.

Another sophisticated system is called "Basic Surveillance" whereby inexpensive, commercially available (or "off the shelf") radars and television cameras may be used to allow greater observation and supervision. Basic surveillance systems are particularly useful in restricted waters and at critical bends and intersections in waterways and ship channels as a supplement to VMRS. The personnel of the Vessel Traffic Center can see the situation developing and give advance notice to approaching vessels.196

The most sophisticated VTS System is the "Automated Advanced Surveillance" which utilizes expensive, specially made, high resolution radars and positive control features such as coding transponders, similar to those utilized by air controllers and computers. These are able to project vessel movements automatically and warn of developing collisions. Such systems are intended for extremely dense traffic situations or areas experiencing frequent low visibility where such positive control features, including actual direction of vessel movements by traffic center personnel, are essential.197

The growing use of such vessel traffic systems raises interesting questions and conflicts of domestic and international law. One of the first such conflicts is between the traditional authority and responsibility of a captain to control his ship and his duty to comply with the regulation or, in some cases, positive direction, of vessel movements under a VTS. Crucial questions in such cases concern when the master is entitled to or required to follow VTS direction and when the utilization of his own best judgment becomes permissible or even mandatory.198 There can be little doubt that when a master totally ignores the VTS or is patently wrong in overriding it,
liability will result.\textsuperscript{199} In order to resolve these conflicts, it is highly likely that the courts will look to cases dealing with compulsory pilotage for analogies. Similarly, there is little doubt that the government will be called on to answer in damages\textsuperscript{200} for active negligence in issuing erroneous instructions or information under the line of cases dealing with more conventional aids to navigation.\textsuperscript{201} Less clear, however, is the outcome in situations where the judgment call is not clear, or when the master fails to override erroneous or insufficient VTS instructions to avoid a collision. Also unclear is the result when the vessel traffic center does not issue erroneous information or directions, but merely fails to advise a vessel of a potentially dangerous situation or converging vessel.

Liability in these cases will probably hinge on the sophistication of the system in operation and the amount of information available to the master. Responsibility probably would not shift to the government for passive negligence until positive control of vessel movements is involved. Moreover, the recent adoption by the Supreme Court of the comparative negligence method of apportioning damages in admiralty cases\textsuperscript{202} will greatly ease the burden of assessing liability by allowing factors such as the knowledge available to each party, the VTS level and regulations, and the nature of the contested action (e.g. non-feasance/misfeasance, compliance/override) to interplay with traditional collision rules.\textsuperscript{203}

The use of VTS also presents difficulties under international law. Within their territorial seas, coastal states certainly have sufficient sovereignty to establish such systems.\textsuperscript{204} Foreign vessels\textsuperscript{205} seeking entry to internal waters where such systems are in operation may be required to comply with them as a condition of such entry.\textsuperscript{206}

\textsuperscript{199} This would result in liability both on the basis of fault and under the rule of The Pennsylvania in the case of breach of statutory safety regulations.

\textsuperscript{200} VTS Legislative History, \textit{supra} note 94, at 2792.

\textsuperscript{201} See, \textit{e.g.}, Afran Transp. Co. v. United States, 435 F.2d 213 (2d Cir. 1970). The policy decision has been made that potential benefits of accident reduction outweigh the increased exposure to tort liability.


\textsuperscript{203} Another alternative would be the adoption by Congress of a statute clarifying the obligations of a master under a VTS or insulating him from liability for complying with any vessel movement direction.

\textsuperscript{204} Territorial Sea Convention, \textit{supra} note 60, art. 2(1).

\textsuperscript{205} The vessels of the United States may, of course, always be required to comply with United States navigation laws regardless of the nature of the waters.

\textsuperscript{206} Territorial Sea Convention, \textit{supra} note 60, art. 16(2); \textit{cf.} Payne v. S.S. Tropic Breeze, 423 F.2d 236 (2d Cir. 1970).
Vessels merely engaged in innocent passage, however, without entry into internal waters are subject to less control. The application of VTS to such vessels would seem perfectly justified, since it is a regulation in the interest of marine safety and furthers the exercise of the freedom of international navigation. But the exercise of VTS jurisdiction to unreasonably hamper vessels in innocent passage would be unlawful.

The same rationale would be applicable to international straits. Not only would VTS not provide a legal basis for unreasonable interference with the right of transit through international straits, but the effective use of such systems could operate to alleviate many of the valid ecological concerns which have prompted some of the demands by nations bordering straits for increased jurisdiction over transiting vessels. Rather than discouragement of VTS, the major goal of international maritime cooperation should be the implementation of such safety oriented systems.

Beyond the territorial sea, the establishment and enforcement of VTS regulations is more difficult. The jurisdiction of the coastal state is limited to prevention of violations of its customs, fiscal, immigration, and sanitary regulations within a contiguous zone extending up to 12 miles from its coast. Aside from the effect of this limited jurisdiction, the waters retain their high seas characteristics and may not be subject to coastal state sovereignty. Since the application of VTS to such waters would amount, in a limited sense, to an assertion of sovereignty, alternative methods of ensuring foreign vessel compliance with VTS which need to be enforced beyond 3 miles must be found. One of the best ways to lawfully exercise jurisdiction over foreign vessels for such a reasonable and limited purpose is by agreement with the flag state through the amendment of the large number of treaties of commerce, friendship and navigation currently in effect.

207. Territorial Sea Convention, supra note 60, art. 17.
208. Id. art. 15(1).
209. Although the Department of Defense sought to have international straits excluded from the provisions of the VTS enabling legislation out of concern for the strategic implications of coastal state authority to operate comprehensive vessel traffic control systems in such straits, Congress expressly rejected such concerns as unwarranted. VTS Legislative History, supra note 94, at 2793.
210. Territorial Sea Convention, supra note 60, art. 24(1).
211. Id. art. 24(2).
212. High Seas Convention, supra note 73, art. 2.
213. See, e.g., The Treaty of Jan. 23, 1924, between the United States and Great Britain.
For vessels of those nations not party to these treaties the admiralty courts of the United States or the world could adopt judicial presumptions which would operate heavily against vessels which do not comply with the high seas VTS. Similar presumptions have been utilized in the Gulf of Mexico to encourage compliance with high seas safety fairways among offshore oil rigs. Since vessels in collision frequently must go into the coastal state for repairs, admiralty jurisdiction upon a collision would be inevitable and could be avoided only if the vessel and her sister ships forfeit profitable trade in that jurisdiction. Therefore, voluntary compliance would be greatly encouraged by such a presumption.

Since the establishment of such a high seas VTS would constitute a use of the high seas, its provisions must not unreasonably interfere with the freedom of navigation. Only the implementation of positive vessel control might fail to meet these criteria. Given the interest of the coastal state in protecting its coastal environment and the value of such systems in preserving life and property and preventing traumatic pollution, there should be little basis for international objection to mandatory participation in a reasonable advisory system within the contiguous zone. Although there may be situations where VTS is needed beyond 12 miles, such a distance would encompass the vast majority of VTS jurisdictional needs.

The world's maritime nations worry unduly about possible strategic and jurisdictional implications of VTS. Instead, they should strive to utilize its prevention potential to the limit. The establishment of VTS in the major international straits, coupled with new hydrographic surveys, modernized aids to navigation, and efficient pollution control systems is in the best interests of both the mar-

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214. See, e.g., Brown & Root Marine Operators Inc. v. Zapata Off-Shore Co., 377 F.2d 724 (5th Cir. 1967) (raising a prima facie presumption of fault against a vessel which strayed from safety fairways and collided with a stationary oil rig); The Victor, 153 F.2d 200, 202 (5th Cir. 1946). But see Boudoin v. J. Ray McDermott & Co., 281 F.2d 81, 88 (5th Cir. 1960) (where the presumption may be overcome by unavoidable circumstances). In some cases, the damages may be apportioned (such as where the vessel leaves the fairway but the structure is not lighted).

215. High Seas Convention, supra note 73, art. 2.

216. The adoption of a 12 mile territorial sea by the Third United Nations Conference on the Law of the Sea seems likely. This would remove most of the international jurisdictional problems of VTS.
time nations and the coastal nations. IMCO, operating through either IMAB or its Maritime Safety Committee should undertake immediate efforts to facilitate international cooperation in this area. The establishment of training programs, technology transfer, and surveys of particularly suitable areas are of the highest priority. Uniform international procedures for VTS communication must be established, as well as standards for the training and licensing of vessel traffic controllers. Programs to familiarize masters and pilots who will operate within a VTS must also be developed.

These upgrading projects, although expensive, could be funded simultaneously by reasonable user charges. Although nations may not charge for mere passage, the rendering of specific services such as VTS, unlike surveys and aids to navigation, would justify a reasonable user charge. There is no reason why straits nations should bear the severe ecological damage of traumatic pollution and also the total cost of upgrading prevention systems. The nations whose vessels will primarily benefit from the improved conditions should, by international negotiations and agreement under the auspices of IMCO, bear their fair share of the costs.

D. Offshore Deepwater Ports

Another approach to the reduction of coastal traumatic pollution damage is to reduce traffic density in the coastal zone and remove the greatest potential pollution threats entirely by having supertankers and other large vessels utilize offshore deepwater

217. See Territorial Sea Convention, supra note 60, art. 18; Commentary of the International Law Commission, 4 WHITEMAN DIG. INT'L L. 397 (1965). But see Convention Regarding the Regime of the Straits, signed at Montreux July 20, 1936, art. 2; 4 WHITEMAN DIG. INT'L L. 398 (1965). This does not prevent shipping nations from agreeing by treaty to pay for the establishment and operation of aids which the coastal state would not normally be under a duty to provide.

218. The most efficient way of levying such charges would be to divide the total annual cost of operating the VTS, as certified by IMCO, as well as an amortized portion of the establishment cost, among the governments of the nations whose vessels use the strait, proportionately to their use. No discrimination of nationality, size, or type of vessel (tanker, warship) should be allowed. The governments are then free to either absorb the costs or pass them on to the vessel owners.

219. Traffic density is, itself, a major factor in causing certain types of traumatic incidents such as collisions. Since every vessel added to a situation complicates maneuvering until the capacity of the Rules of the Road and man is exceeded, every vessel removed from the traffic helps to reduce the probability of collision.

220. Although the use of supertankers is presently in decline due to worldwide decrease in the demand for oil and overbuilding, the long term economic future seems bright since the
ports. The initial impetus for such ports arose not from ecological considerations, but rather from the growing United States dependence on foreign oil and the need to import that oil as cheaply as possible by utilizing supertankers. The use of such tankers for the direct importation of oil to the United States port is presently impossible; however, since no major United States port is capable of handling a true supertanker and only a few can handle a tanker of any appreciable size.

To dredge out the required miles of channel to the depths necessary to accommodate such large vessels would require excavating some billion cubic yards of earth.
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were also rejected. Offshore deepwater ports, however, were found to present an economic method for importing large quantities of foreign oil into the United States. It was also determined, almost simultaneously, that such ports presented the best solution to the growing threat of traumatic vessel source oil pollution of the coastal environment.

In its simplest form, an offshore deepwater port (DWP) is an installation which is located off the coast at a distance sufficient to provide adequate water depth to accommodate the largest tankers. It provides connections via hoses and underwater pipelines to the shore by which the tanker may take on or discharge oil. The projected costs of a deepwater port with its moorings, platforms, pipelines and shoreside facilities are currently estimated at approxi-

228. For example, The Cargo Oil Sea Transfer System (COSTS), whereby a supertanker transfers oil into a small tanker underway at sea, in company behind it, in a manner similar to the Russian Navy's underway replenishment system and the United States Air Force's mid-air refueling method. See Senate DWP Hearings, supra note 7, at 596-600 for a detailed description of the system in operation.

229. A common problem shared by all these alternatives is that they would require the use of many smaller tankers or tankbarges with their higher costs. The number of tankers necessary to meet expected import requirements would also increase traffic density and the risk of traumatic incident. It has been estimated that 2,600 tankers of 47,000 DWT would be required to handle United States imports in 1985. Frankel, Offshore Tanker Terminals: Study in Depth, U.S. Naval Inst. Proc., March 1973, at 56, 58.

230. Senate DWP Hearings, supra note 7, at 171-87. The following table, adapted from House DWP Hearings, supra note 222, illustrates both the problems and the savings. The figures for Daily Arrivals are for the number of tankers necessary to supply 3,000,000 barrels per day:

<table>
<thead>
<tr>
<th>Tanker Size</th>
<th>Daily Arrivals</th>
<th>Draft</th>
<th>Relative Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>30,000 DWT</td>
<td>13</td>
<td>35</td>
<td>100%</td>
</tr>
<tr>
<td>50,000 DWT</td>
<td>8</td>
<td>38</td>
<td>88%</td>
</tr>
<tr>
<td>250,000 DWT</td>
<td>1.5</td>
<td>65</td>
<td>45%</td>
</tr>
<tr>
<td>500,000 DWT</td>
<td>.75</td>
<td>95</td>
<td>38%</td>
</tr>
</tbody>
</table>

231. This was determined by the Council of Environmental Quality. House DWP Hearings, supra note 222, at 97. However, deepwater ports have been attacked by some groups, such as the Sierra Club, as ecologically dangerous. Senate DWP Hearings, supra note 7, at 567-92, 823-92.

232. This installation may be an artificial island, sea island, rigid-arm mooring, multiple mooring buoys, or single point mooring buoy. The Single Point Mooring (SPM) is the system overwhelmingly favored by the United States deepwater ports projects now under consideration. For a detailed examination of single point mooring design, operation, and reliability, as well as a discussion of deepwater port technology, see Senate DWP Hearings, supra note 7, at 380-99; House DWP Hearings, supra note 222, at 102, 378. The two major SPM systems are the Single Anchor Leg Mooring (SALM) and the Catenary Anchor Leg Mooring (CALM).
mately $500 million. Despite this expense, the use of deepwater ports promises not only to provide for the economic importation of foreign oil, but it should greatly lower traumatic incidents by reducing coastal traffic density and keeping tankers in deepwater away from shipping lanes thus minimizing the risk of grounding and collision. Of course, care must be taken to ensure that deep water port operations themselves do not become a source of oil pollution.

The use of offshore deepwater port technology also promises to provide facilities for superships other than tankers. Since deepwater ports are much cheaper than building or replacing traditional harbor facilities, established trading nations may turn large parts of present antiquated harbor facilities to other uses, while developing nations may choose to use deepwater ports and their associated cargo systems exclusively. While deepwater ports are not suitable for all types of cargoes, it seems likely that the future will see

233. The Louisiana Offshore Oil Port (LOOP) planned for a location 17 miles off Louisiana, estimates that it will cost $528 million for 3 SPM's and two 48 inch pipelines, 21 miles to shore with associated facilities. Senate DWP Hearings, supra note 7, at 149, 376-795. SEADOCK, planned for 25 miles off Freeport, Texas, estimates that it will cost $310 million for offshore facilities including pipeline, $80 million for the onshore terminal, and $155 million for the onshore distribution system. House DWP Hearings, supra note 222, at 45; Senate DWP Hearings, supra note 7 at 363-80. AMERAPORT is also proposed for a location off the Mississippi-Alabama border. House DWP Hearings at 438-517; Senate DWP Hearings at 468-74. Most of these projects are backed by a consortium of oil companies.

234. Some risk of pollution does exist, but the offshore location of the port removes it from fragile coastal ecosystems and gives clean-up authorities adequate time in which to respond. Port operations are also geared to minimize spillage. A tanker approaches to the general vicinity of an SPM and stops. A tender brings the necessary mooring lines to the tanker. The tanker is moored to a swivel and may adjust to changes in the wind and current by swinging or "weathervaning" 360 degrees. Similarly swiveled floating discharge hoses are also brought to the tanker and made fast. The oil flows at a high rate from the tanker, through the discharge hose to the mooring. From the SPM it flows by pipeline to the platforms (similar to current offshore oil platforms) and from there to the onshore refinery via the main pipeline. Every connection in the oil transfer system is fitted with special automatic and remotely operable safety valves. Operations are monitored from the operations platform which also contains offices and living quarters for the port's crew. Oil may be shut down instantly in the event of an emergency. The average port would consist of three widely separated SPM's and one or two platforms. Senate DWP Hearings, supra note 7, at 380-99.

235. Examples are Lighter Aboard Ship (LASH) vessels and Barge Aboard Catamaran (BACAT) vessels where cargo is containerized in floating lighters or barges which are loaded and offloaded by the ship's own cranes from the water alongside. The lighters are then made up into tows and taken into inland ports and waterways for ultimate distribution. Such vessels can handle 72 percent more cargo in 50 percent of the port time of a conventional freighter and no port facilities other than a mooring are required. See Barges That Go to Sea in Ships: LASH Vessels, BUSINESS WEEK, Aug. 7, 1971, at 74-75.

236. Senate DWP Hearings, supra note 7, at 171-87.

237. Bulk cargoes such as ore, wheat, etc. are difficult to handle in such ports although some cargoes may be slurried.
increasing application of the concept once their vague status under international law is resolved.

The complicated status of the United States deepwater ports under international law results from the fact that all United States deepwater ports must be built outside of the current 3 mile United States territorial sea.\(^2\) This is due to a number of considerations. First, and most obvious, it is usually necessary to go beyond 3 miles to attain the necessary water depth, particularly in the Gulf of Mexico, although this factor would not require a legislative mandate.\(^2\) Second, it is desirable to move the ports far enough offshore to protect the coastal zone and provide a water barrier to insulate the coast from spills and allow reaction time for control measures to be taken. Third, and perhaps most important, is the fact that under domestic law, the Continental Shelf Lands inside 3 miles upon which such ports would be built belong to the various states.\(^4\) The United States retained only a navigational servitude and the right to regulate construction in the waters over the shelf\(^4\) when it quit-claimed these lands to the states under the Submerged Lands Act. While this is sufficient to prevent the construction of a deepwater port under state authority without United States permission, other major problems such as obtaining state submerged lands, concurrent jurisdiction, state taxation rights, as well as possible state opposition\(^2\) make the construction of deepwater ports within the 3 mile limit undesirable, even if it is practically and ecologically feasible.

Beyond 3 miles, however, the United States has exclusive rights to the Continental Shelf both under international\(^2\) and domestic


\(^2\) Such considerations do mean, however, that even the adoption of a 12-mile territorial sea would not affect the status of most projects now under consideration, since they are beyond 12 miles.


\(^2\) The Northeastern States have been vehement in their opposition to deepwater ports such as NADOT (North Atlantic Deepwater Oil Terminal) proposed for the Delaware Bay. See Senate DWP Hearings, supra note 7 at 1251-69. Their chief fears are the onshore impacts, such as the construction or expansion of oil refineries. This may dictate siting near existing refineries or expensive long distance hook-up by pipeline. Id. at 408-09. Delaware has attempted to prohibit a deepwater port by statute. Coastal Zone Act, 7 DELAWARE CODE §§ 7001-7013 (1974).

\(^2\) The rights of the United States to the Continental Shelf under international law arise under Articles 1 and 2 of the Convention on the Continental Shelf, June 10, 1964, [1964]
law with the exception of the Gulf of Mexico, where Texas and Florida exercise 9 mile jurisdiction—still well short of the water depth necessary for such ports. While some problems concerning state jurisdiction will still exist, particularly with onshore facilities and pipeline connections, the location of deepwater ports beyond 3 miles provides for uniform federal regulation and prevents domestic legal problems, although it raises thorny questions of international law.

The chief questions under international law which arise with respect to the location of such offshore ports on the high seas are first, whether the United States, or any coastal nation, has the jurisdiction to build and operate such ports beyond its territorial sea; and second, what jurisdiction does the coastal nation have within the deepwater port with respect to enforcement of the necessary laws and regulations?

The controversy over jurisdiction to construct offshore deepwater ports on the high seas revolves primarily around differing philosophies of the nature of international law. One group views legal rights on the high seas as flowing only from existing international law and asserts that, since there is no authorization under present international law for such ports, they may not be lawfully constructed on the high seas. The pragmatists, on the other hand, assert that any use of the high seas not expressly forbidden by international law is permissible as long as it does not constitute an unreasonable interference with the rights of other nations.

246. See authority cited in note 235 supra. Generally speaking, a minimum depth of 100 feet is required for a deepwater port.
248. Within the territorial sea, the coastal nation is sovereign and may build and regulate deepwater ports at will subject only to the requirements that they must not hamper innocent passage (particularly through international straits and major shipping lanes); they should be properly marked and publicized so as not to constitute a hazard to navigation; they must not cause injury or interference to an adjoining state or the use of the contiguous high seas. Since these limitations exist on the exercise of sovereignty in the territorial sea, they would a fortiori be applicable to deepwater ports on the high seas as well. See generally Territorial Sea Convention, supra note 60, arts. 1, 14-16; The Corfu Channel Case, (1949) I.C.J. 4 at 28; The Trail Smelter Arbitration, 3 U.N.R.I.A.A. 1906 (1938); A. Soons, ARTIFICIAL ISLANDS AND INSTALLATIONS IN INTERNATIONAL LAW 4-6 (1974).
249. See, e.g., Knight, International Legal Aspects of Deep Draft Harbor Facilities, 4 J.
In order to fully understand the differences between these two opposing theories of high seas usage, it is necessary to examine the present legal regime of the high seas. Under present international law, as codified in the Convention on the High Seas, no nation may validly subject any portion of the high seas to its sovereignty. The freedom of the seas is guaranteed to all nations, but must be exercised under the conditions of the treaty and other rules of international law. Certain specific uses are recognized inter alia as valid exercises of the freedom of the sea. These include navigation, fishing, laying submarine cables and pipelines, and flight over the high seas. The uses expressly recognized, however, are not the only ones to which the high seas may validly be put. The convention also recognizes such uses as are generally recognized by the accepted principles of international law and which are exercised with reasonable regard to the interests of other states in their exercise of the freedom of the seas. An acceptable use must, therefore, not amount to an assertion of sovereignty, must be generally recognized, and must be reasonably exercised with respect to the interests of other nations to be valid under international law.

There are few international provisions dealing with high seas installations, and none of these may expressly serve as a basis for recognizing deepwater ports as a per se reasonable use of the high seas. The chief provisions dealing with fixed high seas installations are found in Article 5 of the Convention on the Continental Shelf. This article recognizes the right of a coastal state to build and maintain structures on the Continental Shelf which: (1) do not result in any unjustifiable interference with navigation or fishing; (2) have no territorial sea of their own nor affect the delimitation thereof; (3) are constructed after due notice and properly marked; (4) do not encroach unreasonably on essential recognized international sea lanes; and (5) which duly protect the living re-

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250. High Seas Convention, supra note 73.
251. Id. art. 2.
252. Id.
253. Id.
254. Shelf Convention, supra note 243.
255. Id. art. 5(1).
256. Id. art. 5(4).
257. Id. art. 5(5).
258. Id. art. 5(6).
sources of the sea. Such installations are expressly limited, however, to those "necessary for the exploration and exploitation of the resources of the Continental Shelf." This limitation on Continental Shelf installations has led some commentators to reason that, under the principle of treaty interpretation *inclusio unius est exclusio alterius*, the use of high seas installations for non-resource purposes is thereby prohibited under presently accepted international law. This has led some nations to take the position that deepwater ports can not be validly constructed or regulated on the high seas.

Such an interpretation fails to take into account the dynamic nature of international law. The International Court of Justice has adopted a more flexible approach to determining the validity of a coastal state's exercise of jurisdiction beyond the territorial sea. In the *Norwegian Fisheries Case (United Kingdom v. Norway)*, the court developed an analytical process to determine the validity of the exercise of jurisdiction by first looking at the delimitation under municipal law and then determining its validity with regard to other states based on accepted international law. While this case dealt with the validity of drawing baselines and the extension of the territorial sea, the reasoning of the court is laudable and should be equally valid in a case where only limited jurisdiction to use the high seas is sought.

Under a pragmatic approach to the right of coastal states to construct deepwater ports on the high seas, the absence of a clear authorization or an express prohibition requires that the validity of the use be determined by its reasonableness and regard for the rights of other states. This recognizes that the true nature of international law is one of constant claim, protest, rejection, and adjustment as nations constantly attempt to accommodate competing claims to the necessities of world order. Moreover, the proponents who view Article 5 of the Convention on the Continental Shelf as a

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259. *Id.* art. 5(7).
260. *Id.* art. 5(2).
261. The inclusion of one right implies the exclusion of any other.
262. *See* Knight, *supra* note 249, at 381.
limitation on offshore installations fail to take into consideration the fact that the convention itself is a codification of the reasonableness of a unilateral claim to limited extra-territorial jurisdiction. 266

The legality of high seas deepwater ports under international law should not be determined on the basis of whether such a use is legal or illegal ab initio. The concept of reasonable use prevents such determinations. 267 What constitutes a reasonable use in some circumstances will not constitute reasonable use in others. However, taking this factor into account, an initial determination can be made as to the possibility that a given use will be reasonable and thus accepted or acquiesced to by other nations.

When the constituent elements of a deepwater port are analyzed, it is quickly discovered that they offer no new use of the high seas which has not been previously recognized under international law. Taking the operations platform first, it becomes apparent that such platforms are expressly authorized under the Continental Shelf Convention. 268 Although that particular provision has been limited to resource related activities, that provision must be taken as non-limiting in view of the widespread historical use of similar structures for navigational aids, anti-aircraft platforms and radar towers. 269 It is difficult to see how merely changing the type of activity conducted on such a platform changes the basic reasonableness of its existence. Indeed, it would seem that the provisions of Article 5 of the Continental Shelf Convention should be applied mutatis mutandi to nonresource related high seas installations and should be used in determining the reasonableness of their establishment. 270 Such an application would also defeat charges that deepwater ports amount to an assertion of sovereignty on the basis that they constitute an exclusive and permanent use of the high seas. Deepwater

266. The first claim to special rights in offshore minerals and resources was a unilateral assertion by the United States. Other nations quickly embraced the concept which was subsequently codified in the Shelf Convention. See Truman Proclamation on the Continental Shelf, 10 Fed. Reg. 12303 (1945); 4 Whiteman Dig. Int'l Law 756 (1965).
267. See Knight, supra 249, at 377 n.59.
268. See note 243 supra.
269. See Dorshaw, supra note 265, at 209. Failure to recognize this obvious parallel would result in the anomalous situation of an oil platform being a "reasonable" and legal use, while an identical operations platform of a deepwater port a few miles away would be unreasonable and illegal.
270. The effect of this would be to assume that such facilities constituted a reasonable and valid use of the high seas as long as due notice is given, the structures are marked, and they do not interfere with sea lanes. See note 248 supra.
ports do not constitute a permanent legal use since their legality is concomitant with their utilization. Abandoned installations are no longer legal and must be capable of removal. 271

The second element of the deepwater ports which may be subjected to similar analysis is the pipelines running to the coastal state. The right to lay such pipelines is expressly recognized as a high seas freedom 272 and the extensive coverage of such facilities under international law 273 must result in the determination that such a use is per se reasonable and acceptable. Similarly, the single point mooring buoys are analagous to such traditional uses of the high seas as anchoring, mooring and navigational buoys, and lightships. 274 Parallels may also be drawn to roadsteads 275 and similar incidents to the exercise of the high seas freedom of navigation.

It is extremely difficult to see how the combination of such traditionally recognized uses of the high seas into a deepwater port facility should change the reasonableness of their use under international law. The establishment of deepwater port facilities on the high seas must be accepted as a reasonable exercise of the freedom of the seas. However, the basic guidelines of Article 5 of the Convention on the Continental Shelf must be followed and due care taken not to interfere with the legitimate interests and uses of other nations. 276

This is the position taken by the United States. 277 In enacting the Deepwater Port Act, Congress took great pains to provide that the Act would not affect the legal status of the high seas or the Continental Shelf; 278 that the living resources of the sea would be protected; 279 that the ports would be properly marked for navigational safety and safety zones established; 280 and that United States

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271. Shelf Convention, supra note 243, art. 5(5).
272. High Seas Convention, supra note 73, art. 2.
273. See, e.g., High Seas Convention, supra note 73, arts. 26-29.
275. Territorial Sea Convention, supra note 60, art. 9.
276. Other nations have arrived at a similar result by utilizing the “legal vacuum” theory which states that where there is no jurisdiction, what is not expressly prohibited is permitted as long as it is reasonable. See, e.g., The North Sea Equipment Act of 1964, 60 Am. J. Int’l L. 340 (1966), whereby the Netherlands extended its jurisdiction to all installations on its Continental Shelf. See also Dorshaw, supra note 265, at 219; Soons, supra note 248, at 22.
277. House DWP Hearings, supra note 222, at 69.
278. 33 U.S.C. § 1501(b) (Supp. IV, 1974).
279. Id. § 1505.
280. Id. § 1509.
Customs laws would be inapplicable. Further, the President and the Secretary were charged to enter into negotiations with Canada, Mexico, and the United Nations to develop appropriate international rules and understandings for such ports.

The question of jurisdiction to regulate activities in deepwater ports on the high seas presents somewhat different questions under international law than the question of jurisdiction to construct and maintain them. The difficulties arise primarily with respect to foreign nationals in deepwater port installations and foreign vessels within the designated safety zone. Normally, the jurisdiction of the coastal state over foreign nationals is based on plenary territorial sovereignty jurisdiction on land or in the territorial sea or, in some cases, upon acts outside the territory which have a harmful consequence within the territory of the coastal state. Such provisions would not apply in a deepwater port because its very status as a reasonable use of the high seas is dependent on the fact that it is not an extension of the territorial sovereignty of the coastal state.

Such territoriality would create the possibility of a deepwater port having a territorial sea of its own or otherwise affecting the delimitation of the territorial sea, both of which are prohibited by Article 5 of the Convention on the Continental Shelf. Such an effect would also create great problems of creeping jurisdiction or otherwise using such installations to extend the territorial sea. Intense opposition to such an outcome would be foreseeable. The basis of regulatory jurisdiction may not, therefore, be territorial.

One solution would be to analogize to the jurisdiction of the coastal state on resource related installations, recognized under Article 5. While this might be sufficient to support civil jurisdiction, it probably would not sustain the stricter, jurisdictional require-

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281. Id. § 1518(d).
282. Id. § 1521.
283. Id. § 1510.
284. See generally Soons, supra note 248, at 21.
285. Territorial Sea Convention, supra note 60, art. 2.
287. High Seas Convention, supra note 73, art. 2.
288. Shelf Convention, supra note 243, art. 5(4).
289. See Knight, supra note 249, at 384-85.
290. In most cases, civil actions accruing on the high seas are cognizable under the admiralty jurisdiction of the federal courts in any case.
ments of criminal prosecutions. This is particularly true where the impact felt within the United States is minimal, as in violation of regulations causing damage or injury. Under such circumstances, fifth amendment due process would be strained in giving effect to the extraterritorial jurisdiction under domestic law without regard to its validity under international law. Similarly, an analogy to extraterritorial jurisdiction in roadsteads beyond the territorial sea buttresses the position of the deepwater port as a reasonable use of the high seas, but does not support the exercise of criminal jurisdiction.

Thus, the best solution to the exercise of jurisdiction on offshore deepwater ports over foreign nationals and vessels would seem to be to obtain the flag state’s agreement to the exercise of such jurisdiction. This, in fact, is the solution adopted by Congress. It provides that foreign vessels will not be permitted to call at high seas deepwater ports unless the flag state has specifically agreed to recognize the jurisdiction of the United States over the vessel and its personnel while they are in the port.

In summary, it would seem clear that the establishment of “superports” on the high seas and the regulation of activities therein is valid under international law provided due consideration is given to the factors discussed above. There is much, however, that can be clarified and improved by effective international cooperation. Uniform international standards for the construction of such ports must be adopted, and the legal status of such ports as an acceptable use of the high seas should be codified so that it is no longer necessary to rely on analogies to other uses to support the construction of such ports. International attention should also be given to the jurisdictional problems involved with regulating the activities of foreign nationals and foreign vessels in connection with offshore deepwater ports as well.

293. Territorial Sea Convention, supra note 60, art. 9.
294. See House DWP Hearings, supra note 222, at 73, where the United States specifically rejects the roadstead analogy as supporting jurisdiction over deepwater ports by itself.
295. See note 58 supra.
296. 33 U.S.C. § 1518(c) (Supp. IV, 1974).
297. There remains the problem of amending a multitude of international conventions, which have provisions concerning harbors and ports, so that they also include such offshore ports. For a comprehensive treatment of the necessary amendments, see House DWP Hearings, supra note 222, at 86-89.
It is in the interest of all nations that such efforts be undertaken as soon as possible so that such facilities are available, not only to expedite commerce in oil and commodities, but so that the marine environment can benefit immediately from the added prevention of traumatic pollution that will result from the widespread use of such ports.

In passing the Deepwater Ports Act of 1974,\textsuperscript{298} Congress attempted to reconcile all of the various state, national, and international interests involved while providing a flexible framework for the rapid construction of such ports. The Act limits its effect to deepwater ports outside the 3 mile limit\textsuperscript{299} and further restricts the use of such facilities to the loading and unloading of oil.\textsuperscript{300} It establishes licensing requirements, procedures, and criteria for deepwater ports.\textsuperscript{301} Licenses are issued by the Secretary of Transportation,\textsuperscript{302} who exercises regulatory authority through his control of the license application process.\textsuperscript{303} License applications must set forth in detail construction plans, proposed ownership and other information\textsuperscript{304} and must be circulated to other concerned federal agencies for comment\textsuperscript{305} as well as to the Attorney General for an antitrust determination.\textsuperscript{306} An environmental impact statement is required,\textsuperscript{307} and criteria for environmental review of the statement is set forth in the Act.\textsuperscript{308} The Secretary is empowered to establish regulations for the protection of the marine environment and for the promotion of navigational safety, including rules for vessel movement, loading and unloading procedures, lights and warning devices, and the declaration of safety zones around the port.\textsuperscript{309}

The Act further prohibits the discharge of oil into the waters at a deepwater port.\textsuperscript{310} The owner/operator of the vessel or licensee of the port is not only liable for a $10,000 civil penalty for the

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\item \textsuperscript{298} 33 U.S.C. §§ 1501 et seq. (Supp. IV, 1974).
\item \textsuperscript{299} Id. § 1502(10).
\item \textsuperscript{300} Id. § 1503(a).
\item \textsuperscript{301} Id. § 1503.
\item \textsuperscript{302} Id. § 1503(b).
\item \textsuperscript{303} Id. § 1504(a).
\item \textsuperscript{304} Id. §§ 1503(c)-(h), 1504(a)-(c).
\item \textsuperscript{305} Id. § 1504(e)(1).
\item \textsuperscript{306} Id. § 1506.
\item \textsuperscript{307} Id. § 1504(f).
\item \textsuperscript{308} Id. § 1505.
\item \textsuperscript{309} Id. § 1509.
\item \textsuperscript{310} Id. § 1517(a)(1).
\end{enumerate}
spillage, but must give prompt notice to authorities or face an additional fine.\textsuperscript{311} The vessel owner/operator is also strictly liable for clean-up costs and damages resulting from such discharges up to a limit of $150 per gross ton or $20,000,000, whichever is less.\textsuperscript{312} The port licensee is also strictly liable for oil discharged from the port or from a vessel moored at the port, up to a limit of $50,000,000, thus placing him in the position of an insurer of the vessel with regard to oil discharge clean-up costs and damages in excess of the $20,000,000 owner/operator liability.\textsuperscript{313}

The Act creates a Deepwater Port Liability Fund which will provide money for clean-up costs and for damage claimants not actually compensated by vessel owner/operators or a port licensee. The Fund, backed by the United States Treasury, will constitute $100,000,000 to be collected by deepwater port licensees in the form of a user's fee of 2 cents per barrel of oil loaded or unloaded at the port.\textsuperscript{314} The Act also establishes procedures by which individuals damaged by oil pollution from a deepwater port may be represented by the United States Attorney-General in a class action.\textsuperscript{315}

The interests of coastal states of the United States are protected by the Deepwater Ports Act in a number of ways.\textsuperscript{316} Adjacent coastal states\textsuperscript{317} may set reasonable fees for the use of deepwater port facilities and land based support facilities in addition to proper taxes on the latter. These fees are designed as compensation to the state for otherwise unrecoverable economic, environmental, and administrative costs attributable to the construction and operation of such facilities and must be approved by the Secretary.\textsuperscript{318}

\begin{footnotesize}
311. Id. §§ 1517(a)(2)-(b).
312. Id. § 1517(d).
313. Id. § 1517(e). The owner/operator or licensee may escape liability only by showing that the damage resulted from an act of war, negligence of the United States Government in maintaining aids to navigation or due solely to the negligence of the injured party. Id. § 1517(g). The owner/operator of a vessel and the DWP licensee must furnish evidence of their ability to meet these potential liabilities. Id. § 1517(1).
314. Id. § 1517(f).
315. Id. § 1516(i).
316. One of the declared purposes of the Act is to "protect the rights and responsibilities of States and communities to regulate growth, determine land use, and otherwise protect the environment . . . ." Id. § 1501(a)(4).
317. Adjacent coastal states are those connected to a deepwater port by pipeline, located within 15 miles of a deepwater port or designated as such by the Secretary of Transportation. Id. § 1502(1).
318. Id. § 1504(h)(2). It is implicit that such fees must be justified and supported by statistics.
\end{footnotesize}
important to adjacent coastal states is the Act's provision that the Secretary may not issue a license without the approval of the Governor of each adjacent coastal state. Further, if requested by the Governor, the Secretary must condition the issuance of a license on compliance with state environmental protection programs. Licenses will not be issued unless the state is making "reasonable progress" toward a coastal zone management program for the area impacted by the deepwater port. States may also apply jointly to own, construct, or operate a deepwater port themselves, and they may impose additional requirements or liability for the discharge of oil from a deepwater port. The law of the adjacent coastal state within whose extended boundaries the deepwater port would be located applies to the port, but is administered by federal authorities.

Since the passage of the Deepwater Ports Act of 1974, work has gone forward in developing the regulatory framework necessary to supervise the construction and operation of the deepwater ports. The regulatory concept is not the promulgation of a blanket set of regulations covering all deepwater ports, but rather deals with each deepwater port individually because of the wide disparities between ports due to local geomorphic, demographic, and meteorological conditions. The regulations, therefore, are broadly constructed guidelines as to what must be furnished with the license application for review, rather than specifying the nuts and bolts of deepwater port construction. The regulatory development and administration of the license application process has been delegated

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319. Disapproval must be transmitted to the Secretary within prescribed time limits or approval will be conclusively presumed. Id. § 1508(b)(1).
320. Id.
322. 33 U.S.C. § 1508(d) (Supp. IV, 1974).
323. Id. § 1517(k).
324. Id. § 1518(b).
325. Id. §§ 1501 et seq.
326. The Secretary of Transportation has delegated much of this work to the Coast Guard because of their special expertise and responsibilities in this area.
328. See, e.g., DRAFT DWP/EIS, supra note 223. The objective of the regulations is to eliminate 90 percent of possible oil spillage, this being the most cost effective level of regulation. The anticipated savings in reduction of environmental and vessel damage and associated costs is in excess of $50 million over the next 15 years. Id. at 8.
by the Secretary to the United States Coast Guard in its role as the premier federal agency in the areas of maritime safety, marine technology, and marine environmental protection. Guidelines already exist to assist the license applicant in the preparation of his operations manual, design criteria, and environmental impact statement. Every effort has been made to ensure that such ports will be safely constructed with the absolute minimum of environmental impact from both their construction and operation. If these regulations are effectively implemented and administered, United States deepwater ports will be valuable contributions to our future economic and ecological well-being.

V. CONCLUSION

It is readily apparent from the foregoing discussion of the prevention of traumatic oil pollution and its causes that the problem is complex and multifaceted. It is also apparent that a multitude of measures may be undertaken to reduce not only the tragic ecological effects of such pollution, but also the attendant human suffering and economic damage. These solutions are available now. The effective prevention of traumatic pollution does not have to await any technological breakthrough or the completion of any scientific assessment of the problem. The problem has been thoroughly studied and its nature, causes, and impact are well understood. The tools to combat it are at hand.

329. See generally Department of Transportation, Coast Guard, Draft Guidelines for Preparation of a Deepwater Ports Operations Manual (1975). The manual must set forth in detail the provisions covering the organization of the DWP in a multitude of areas including personnel assignments and duties, vessel control procedures, cargo transfer procedures, logistics, environmental monitoring, accident and emergency procedures, safety measures, and equipment and general installation security.

330. See generally Department of Transportation, Coast Guard, Draft Guidelines for Developing Deepwater Ports Design Criteria (1975). The design requirements are primarily oriented to the use of the Single Point Mooring (SPM). The platforms and SPM’s must be designed to withstand the “hundred year” worst storm wind and wave for the site as supported by statistical information. Operating wind, wave, and current at which the largest size vessel to be handled will remain moored must also be provided as well as account taken of seiche nodals, tidal data, visibility, temperature range, and icing conditions.

331. See generally Department of Transportation, Coast Guard, Draft Guide to Preparation of Environmental Analyses for Deepwater Ports (1974). The analyses must include figures on the impact of the port on socio-cultural, demographic, governmental, historic, commercial and recreational factors, as well as land and water use. A full statement of the oceanographic, hydrologic, meteorologic, climatologic, geologic, geographic and topographic parameters of the site area must be included. The analyses must also take into account alternative sites and port construction techniques.
While many of these measures may be taken unilaterally by nations economically capable of such efforts, the total solution to global traumatic oil pollution lies only in real and genuine international cooperation. The world’s nations must realize that ending this major threat to the world ecosystem depends solely on their will. An appreciation of this all too simple reality will hopefully result in a world effort to cooperate in enforcing appropriate collision rules, construction and equipment standards, licensing requirements, and vessel traffic systems; and also to aid less fortunate nations in developing such systems, standards, aids to navigation, and other requirements for a viable and safe international commerce. Such an effort will result not only in ending a major problem from the list of ills that plague the world but, with a little luck, may prove a model for tackling the others.