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Sea-based installations are assuming ever-increasing significance in mankind's exploration and exploitation of the oceans. However, at the same time, these structures present complicated regulatory problems and environmental dangers. This article discusses various offshore installations and their environmental consequences. In addition, both national and international regulatory schemes are analyzed and critiqued. The piece concludes by suggesting that, to date, official action in this area has been piecemeal and incomplete.

I. INTRODUCTION

As scientific progress permits ever-increasing exploitation of oceanic resources and increasing use of the sea for military purposes,[1] the spectre of marine pollution from ocean-based installations offers a challenge to the international legal community. While the untapped potential of the ocean provides a promising frontier for continued technological discovery and innovation, the risk of spoiling the marine environment is a constant danger. Mankind's traditional utilization of the ocean, both as a source of food[2] and for navigational purposes, has been joined by his unending quest for energy, minerals, and other ocean resources.[3]

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1. *See* Dore, *International Law And The Preservation Of The Ocean Space And Outer Space As Zones Of Peace: Progress And Problems,* 15 CORNELL INT'L L.J. 1, 4 (1982).

2. "[M]ore than 50 per cent of the world's population relies exclusively on fish for the supply of protein and as the population increases this reliance upon the oceans as a food source will become more important." Versteeg, *The International and National Response to the Problems of Marine Pollution,* 3 AUCKLAND U.L. REV. 209, 209 (1978).

3. By the mid-1990's, forecasters estimate that offshore drilling will provide almost 50% of global oil production. *See* Dore, *supra* note 1, at 5. Studies also indicate that seabed mineral deposits are in such abundance that a substantial portion of the world's demand for nickel, manganese, copper and cobalt will be commercially produced from the deep seabed. *Id.* at 5 n.8.

The development of offshore areas (especially to exploit oil and gas resources) can create environmental problems arising from dredging, pipeline operations, and drilling activities.[4] Dredging can destroy fresh water aquifers[5] and cause particulate pollution of the water column. In addition, dredging can disturb toxic wastes which have "safely" settled into ocean sediments. This disturbance may then reintroduce these wastes to the benthos and to marine organisms living in the water column; thereby creating new opportunities for these wastes to become ingrained in the food chain.[6]

Although the laying of pipelines and submarine cables primarily for communication or energy transmission purposes[7] has little effect upon the organisms in the water column,[8] and has only localized effects on the benthos,[9] pipelines always pose the risk of pollution damage caused by a leakage of their contents into the marine environment. Oil spills resulting from pipeline punctures constitute the most prevalent and frequently publicized harm resulting from offshore resource exploitation. A particularly troubling aspect of this type of pollution is that the long-term effects of oil spills remain basically unknown, and there are unanswered questions about whether oil is assimilated into the marine food chain.[10]

Drilling activities also threaten the ocean environment. Hydrocarbon releases may enter the food chain,[11] and the resultant "[t]urbidity, minor oil and grease spills, effluents from service craft, and similar activities degrade water quality, with an impact upon fish and other marine biota."[12] In addition, most offshore installations demand precious coastal land as operating space for their onshore activities, and these onshore operations produce "water and air pollution, water and energy consumption, waste disposal, and noise and aesthetic pollution" problems.[13]

Reducing worldwide dependence on scarce fossil fuels has en-

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4. Cohen, *Mineral Development And The Coastal Areas*, 3 J. ENERGY L. & POL'Y 113, 116-20 (1982).

5. *Id.* at 119-20.

6. *See* Johnston, *Mechanisms and Problems of Marine Pollution in Relation to Commercial Fisheries*, in MARINE POLLUTION 3, 68-69 (R. Johnston ed. 1976); NUCLEAR REGULATORY COMM'N, FINAL ADDENDUM TO FINAL ENVIRONMENTAL STATEMENT RELATED TO MANUFACTURE OF FLOATING NUCLEAR POWER PLANTS BY OFFSHORE POWER SYSTEMS 15-21 (pt. II, 1976) [hereinafter cited as FINAL ADDENDUM].

7. FINAL ADDENDUM, *supra* note 6, at *iv.*

8. Cohen, *supra* note 4, at 118.

9. *See* BUREAU LAND MGMT., U.S. DEP'T OF INTERIOR, PIPELINE ACTIVITIES, DRAFT ENVTL. ASSESSMENT RECORD, NEW ORLEANS, LA. 201 (1979); *see, e.g.*, Cohen, *supra* note 4, at 117.

10. *See* Cohen, *supra* note 4, at 118.

11. *Id.* at 119.

12. *Id.*

13. Woodson, Corbett, & Tannen, *Onshore Impact in Florida of Offshore Energy Development*, 31 U. FLA. L. REV. 284, 287 (1979) [hereinafter cited as Woodson].

couraged research and development efforts involving conversion systems designed to harness the electrical potential of the ocean.[14] Other growth areas for ocean activity encompass complex communication systems and transportation networks, as well as underwater storage and recreational installations.[15] The increasing scarcity of coastal land space for heavy commercial use has spurred the movement of factories, industries, and oil refineries to man-made floating platforms or artificial islands.[16] Floating industrial plants (FIP's) provide accommodation systems and process facilities by utilizing barges as their foundation and transportation structure.[17] Potential FIP's include petrochemical plants, nuclear power plants, lumber mills, hotels, cement plants, steel production plants, and refuse or waste disposal facilities.[18] "In short, in the years to come the oceans

14. Potential environmental effects of an OTEC [Ocean Thermal Energy Conversion] facility include pressure, temperature, and salinity changes in the surrounding waters as a result of mixing water from two ocean levels, metallic and fluid leaks into the ocean, and possible lowering of air temperature with attendant increases in fogging and changes in wind patterns. The actual effects of an ATEC [sic] facility can only be estimated because the technology is new. The easily predicted environmental effects accompanying the dredging for laying the transmission cables and the onshore support facilities include water pollution, air, noise and aesthetic pollution, and land use concerns.

Id. at 316-17.

15. Dore, *supra* note 1, at 5.

16. *See id.*

17. MAR. AD., U.S. DEP'T OF TRANSP., 1 FLOATING INDUSTRIAL PLANTS: AN EMERGING MARKET FOR U.S. SHIPYARDS 19 n.1 (1982) [hereinafter cited as FIP'S 1]. The potential environmental problems associated with floating power plants, for example, include "thermal pollution, the transport and utilization of the fuel source, waste disposal, air and water pollution, and the effects of undersea transmission lines." Woodson, *supra* note 13, at 314.

18. FIP'S 1, *supra* note 17, at 20, 30-31. For a discussion elaborating on the environmental impact of constructing and operating a floating nuclear power plant, see Kindt, *Ocean Resources Development: The Environmental Considerations Involved In The Offshore Siting Of Nuclear Power Plants,* 3 SUFFOLK TRANSNAT'L L.J. 35, 54-61 (1979), *reprinted as* Kindt, *Offshore Siting of Nuclear Power Plants,* 8 OCEAN DEV. & INT'L L.J. 57, 68-74 (1980). There are 31 FIP's which could become operational by 1990. These FIP's include:

1. Liquid Natural Gas (LNG)
2. Liquified Petroleum Gas (LPG)
3. Waterborne Alcohol Plants
4. Oil Refineries
5. Floating Nuclear Powerplants
6. Offshore Power Systems (Offshore Source of Renewable Energy)
7. Offshore Energy Systems (OTEC)
8. Offshore Power Systems (Peak Shaving)
9. Offshore Power Systems (Offshore Source of Fossil Fuel)
10. Offshore Desalination Systems

will open up a vast frontier for a new industrial civilization that will depend on the sea for its survival."[19]

Unfortunately, the economic importance of the ocean to mankind's survival may be transcended by its strategic and operational military value.[20] The discernable trend has been toward the militarization of the sea and the seabed.[21] In addition to traditional navigational use by naval vessels which constitutes the most prevalent military activity on the high seas,[22] sophisticated underwater weapon systems have been developed for "deployment in the vast reaches of the oceans."[23] The regulation of military objects emplaced on the ocean floor and other military uses of the seabed[24] has received sparse attention by the international community. Due to their devastating destructive potential, nuclear weapons have received the most attention. For example, in 1971, the Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Seabed and the Ocean Floor and in the Subsoil Thereof (Seabed

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11. Floating Ammonia Plants
12. Sea Chemicals
13. Aluminum Production
14. Ocean Food and Energy Farms
15. Floating Fish Factories
16. Offshore Mining (Manganese Nodules)
17. Offshore Mining (Sand and Gravel)
18. Cement Grinding
19. Concrete Mixing
20. Hardening Ocean Floors
21. Glass Factory Barges
22. Offshore Sugar Factories
23. Bulk Storage
24. Lighter
25. Steel-Making Plants
26. Floating Cities
27. Offshore Airports
28. Offshore Hotels
29. Hospitals
30. Pulp and Paper Plants
31. Refuse and Chemical Incineration

MAR. AD., U.S. DEP'T OF COM., FINANCIAL AND LEGAL ISSUES RELATED TO INDUSTRIAL PLANT VESSELS, FINAL REPORT, 2 DETAILED STUDY 3, 5-6 (1981) [hereinafter cited as INDUSTRIAL PLANT VESSELS].

19. Dore, *supra* note 1, at 5.

20. *Id.*

21. *See* Zedalis, *"Peaceful Purposes" And Other Relevant Provisions Of The Revised Composite Negotiating Text: A Comparative Analysis Of The Existing And The Proposed Military Regime For The High Seas*, 7 SYRACUSE J. INT'L L. & COM. 1, 2 (1979) [hereinafter cited as *Peaceful Purposes*].

22. *Id.* at 4.

23. Dore, *supra* note 1, at 3; *Peaceful Purposes, supra* note 21, at 4-8.

24. For a listing of articles discussing the present and prospective military uses of the seabed, including installations, structures, and devices, see Treves, *Military Installations, Structures, And Devices On The Seabed*, 74 AM. J. INT'L L. 808, 808 n.1 (1980).

Arms Control Treaty)[25] was enacted to ban the deployment of nuclear weapons on the seabed. Other military activities and objects, while not explicitly mentioned by the drafters of the United Nations Convention on the Law of the Sea (LOS Convention),[26] would most certainly be affected by the legal regime which would result from international acceptance of the LOS Convention.[27]

The regulation of offshore installations has emerged as an important global concern due to the tremendous potential of the ocean as: (1) a bountiful provider; (2) a site for industrial operations; (3) a host medium for national security devices; and (4) a locus for increased international tension over expanding military activities. Thus, the potential domestic and international regulatory problems and provisions relating to these structures need to be examined to determine if adequate and effective controls and restrictions exist to protect the marine environment.

II. MARINE POLLUTION FROM OFFSHORE INSTALLATIONS

A. The Definitional Problem Reviewed: Ocean Uses Vis-a-vis Utilization of Ocean Resources

The ocean is the earth's greatest natural resource. Covering seventy-one percent of the earth's surface, the ocean constitutes a *sine qua non* of worldwide ecological balance.[28] Virtually all offshore installations exploit or utilize ocean resources to some extent—even if the resource utilized is just sea water flowing as a coolant through floating nuclear power plants. To appropriately analyze the effect of offshore installations on this ecological balance, the distinction between ocean "uses" and ocean "resources" must be delineated.

Arguably, the transportational and commercial uses embodied by: (1) the maintenance of navigational freedoms and the freedom of overflight; (2) the interests of countries in ensuring their security; (3)

25. Feb. 11, 1971, 23 U.S.T. 701, T.I.A.S. No. 7337 (entered into force May 18, 1972) [hereinafter cited as Seabed Arms Control Treaty].

26. Dec. 10, 1982, *reprinted in* 21 I.L.M. 1261, U.N. Doc. A/CONF.62/122 (1982) [hereinafter cited as LOS Convention].

27. Treves, *supra* note 24, at 809.

28. Waldichuk, *Control of Marine Pollution: An Essay Review*, 4 OCEAN DEV. & INT'L L.J. 269, 269 (1977).

> The oceans play a vital role in man's life-support system. They cover four-fifths of the earth's surface, they photosynthesize 70% of the oxygen of the earth's atmosphere, and they drive the atmospheric heat engine.

Note, *Method of Analysis and Precedents in the International Litigation of Marine Pollution Claims*, 9 COLUM. J.L. & SOC. PROBS. 537, 538 (1973).

the use of the ocean as a waste receptacle; and (4) the exploitation of the living and nonliving resources found in the ocean constitute oceanic "resources." However, the resources of the ocean should be further delimited and categorized as "living resources" (e.g., fish stocks, marine mammals, and cetaceans) or "nonliving resources" (e.g., minerals, oil, and gas). Resolving the definitional distinction is especially important because the wealth of the ocean has been estimated within various generalist categories. This system tends to create confusion and to prohibit the comparison of different estimates and figures. Such diverse and ambiguous terms as "extractive vis-a-vis nonextractive ocean uses,"[29] "fluids and soluble minerals vis-a-vis insoluble minerals,"[30] and "consolidated subsurface deposits vis-a-vis unconsolidated surface deposits"[31] contribute to the problems inherent in examining ocean resources as they relate to the law of the sea.

One of the better analyses divides ocean resources into "space-extension" resources, "flow" resources, and "stock" resources.

> The particular resources of the oceans, which may be held open for inclusive enjoyment or subjected to exclusive appropriation, are of very different kinds in terms of their characteristics bearing upon the potentialities of shared use. There are "space-extension" resources whose distinctive characteristic is their utility as media of movement, transportation, and communication. There are "flow" or renewable resources, of which different quantities become available at different times and which may or may not be increased or diminished by human action. Finally, there are "stock" resources, of which the quantity is relatively fixed and which may be abundant or scarce.[32]

In view of the terminology employed in the LOS Convention, space-extension resources would be more properly categorized as "uses" of the ocean. While there is some overlap, flow resources should be considered as synonymous with living resources, and stock resources should be delineated as nonliving resources. Therefore, at the risk of being overly simplistic, the only general delimitations which should be utilized in this area are "uses," "living resources," and "nonliving resources."

Accordingly, the "resources" of the ocean constitute the tangible wealth of the ocean which can be captured by mankind either now or in the future, and have a valuation which can be determined with

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29. *See* SENATE COMM. ON COM., 93D CONG., 2D SESS., THE ECONOMIC VALUE OF OCEAN RESOURCES TO THE UNITED STATES 1-6 (Comm. Print 1974) [hereinafter cited as OCEAN RESOURCES].

30. *See* Wenk, *The Physical Resources of the Oceans*, in THE OCEANS 83, 85 (1969). This article is a classical summary on the overall physical resources to be found in the ocean.

31. *Id.* "Nonliving resources" have also been called physical or nonrenewable resources, and "living resources" have been termed biological or renewable resources. *See* C. DRAKE, J. IMBRIE, J. KNAUSS & K. TUREKIAN, OCEANOGRAPHY 377 (1978) [hereinafter cited as DRAKE].

32. McDougal, *The Law Of The High Seas In Time Of Peace*, 25 NAVAL WAR C. REV. No. 3, at 35, 42 (1973). For an elaboration of these categorizations, see M. MCDOUGAL, H. LASSWELL, I. VLASIC, LAW AND PUBLIC ORDER IN SPACE 776 (1963).

reasonable certainty. The resources of the ocean are subdivided into living resources, such as fish stocks, or nonliving resources, such as oil and gas. The term "resources" should be differentiated from the term "uses."

> Historically, the oceans have been used for trade and transport, military purposes and as a source of food. Today we must add to this list deep-sea mining, the recovery of hydrocarbons, scientific enquiry and environmental and pollution problems. Furthermore, as a result of technological change, the traditional uses are undergoing significant modifications.[33]

Thus, the ocean can be "used" for transportation, communication, and recreation. It can also be used as an instrument of national security and as a receptacle for wastes. Nevertheless, rapid changes in the law of the sea have caused definitional confusion as to precisely what constitutes a "use" of the ocean. Article 2 of the 1958 Convention on the High Seas (High Seas Convention)[34] implies that fishing is a use of the ocean. Utilizing the living and nonliving resources may constitute a subset of ocean uses, however, it is probably a misnomer to label the aforementioned ocean uses as ocean "resources." For example, "energy" has been categorized as an ocean resource along with transportation, communication, and recreation,[35] when it should properly be defined either in terms of the dollar value of oil and gas reserves, or in terms of the potential electrical output of different offshore energy systems (in dollars). In a similar manner, transportation, recreation, fishing, offshore petroleum, deep seabed mining, and even "scientific research" have been lumped together as ocean "uses."[36]

In an attempt to alleviate confusion, the "uses of the ocean" and related terminology should be defined in accordance with the evolving law of the sea. Some ocean uses are similar to the four freedoms acknowledged under the High Seas Convention; i.e., navigation, fishing, overflight, and communication via the freedom to lay submarine cables.[37] The exploitation of both nonliving and living resources (sedentary species only) on the continental shelf constitute a use of the ocean under articles 2 through 5 inclusive of the 1958 Convention

33. Pontecorvo & Mesznik, *Economic Organization and the Exploitation of Marine Resources*, in MARINE POLICY AND THE COASTAL COMMUNITY 85 (1976) [hereinafter cited as Pontecorvo]; *see* DRAKE, *supra* note 31, at 377.

34. Apr. 29, 1958, 13 U.S.T. 2312, T.I.A.S. No. 5200, 450 U.N.T.S. 82 (entered into force Sept. 30, 1962) [hereinafter cited as High Seas Convention].

35. OCEAN RESOURCES, *supra* note 29, at 5.

36. Pontecorvo, *supra* note 33, at 85, 86, 99.

37. High Seas Convention, *supra* note 34, art. 2.

on the Continental Shelf (Continental Shelf Convention).[38] In addition, the utilization of the living resources of the ocean is specifically delineated under the 1958 Convention on Fishing and Conservation of the Living Resources of the High Seas (Fishing Convention).[39] None of these conventions specifically defined ocean "uses" per se, but the implied delineations are obvious. These delineations have led to the categorizations established in the LOS Convention.[40]

As the most authoritative pronouncement of the developing law of the sea, the LOS Convention expressly or impliedly delimits the following as "uses" of the ocean:

a. commercial and noncommercial navigation[41] (including innocent passage[42] and transit passage[43]);
b. overflight;[44]
c. communication;[45]
d. exploitation of living resources;[46]
e. exploitation of nonliving resources;[47]
f. scientific research;[48] and
g. waste disposal.[49]

Accordingly, these LOS Convention categories form the definitional basis for "ocean uses" per se. The exploitation of living and non-living "resources" are considered to be two subparts of "ocean uses." This approach is impliedly verified by: (1) the way in which the term "fishing" was used in the High Seas Convention;[50] (2) the delineation of a separate convention in 1958 to deal specifically with fishing and "living resources;"[51] (3) the freedoms outlined in article 87 of the LOS Convention; and (4) the use of the language in other various articles. The language in article 56 of the LOS Convention, for example, asserts in part that within its exclusive economic zone (EEZ) a coastal state has "sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether

38. Apr. 29, 1958, 15 U.S.T. 471, T.I.A.S. No. 5578, 499 U.N.T.S. 311 (entered into force June 10, 1964) [hereinafter cited as Continental Shelf Convention].
39. Apr. 29, 1958, 17 U.S.T. 138, T.I.A.S. No. 5969, 559 U.N.T.S. 285 (entered into force Mar. 20, 1966) [hereinafter cited as Fishing Convention].
40. *See* LOS Convention, *supra* note 26, arts. 17-74, 77-79, 87, 90, 109-20, 133-53, 192-265.
41. *See* LOS Convention, *supra* note 26, arts. 17-45, 90.
42. *Id.* arts. 17-32, 45, 52.
43. *Id.* arts. 37-54.
44. *Id.*
45. *Id.* arts. 51, 58, 79, 87, 109, 112-15.
46. *Id.* arts. 61-71, 87, 116-20.
47. *Id.* arts. 51, 55-58, 79, 87, 112-15, 133-53.
48. *Id.* arts. 238-65.
49. *Id.* arts. 192-237.
50. High Seas Convention, *supra* note 34, art. 2.
51. *See* Fishing Convention, *supra* note 39.

living or non-living, of the waters superjacent to the sea-bed and of the sea-bed and its subsoil . . . ."[52] It should also be noted that the production of energy from ocean water, currents, and/or winds could ostensibly constitute a utilization of nonliving resources. However, this definition may cause confusion because the LOS Convention often refers to these types of nonliving resources in terms of "offshore installations."[53] While offshore installations have been utilized primarily for exploiting offshore oil and gas, and will be utilized for generating energy via ocean thermal energy conversion (OTEC) systems,[54] similar installations can be used for mariculture[55] or aquaculture,[56] which naturally exploit "living resources." Therefore, from the way in which the different terms are utilized, it appears that the drafters of the LOS Convention considered living and nonliving resources to be two distinct categories constituting subparts of "ocean uses."

B. Major Offshore Installations Related to Resource Exploitation

Mining companies have asserted that low cost ocean platforms can be constructed near deposits of seabed minerals, making it economi-

52. LOS Convention, *supra* note 26, art. 56 (emphasis added). The misnamed "exclusive economic zone" is not exclusive because pursuant to the LOS Convention, countries retain many traditional high seas freedoms. Although the term "economic zone" would be a more appropriate designation, this analysis will sometimes retain the term "exclusive economic zone" (EEZ) to remain consistent with other commentators.

53. *Id.* arts. 56, 60.

54. *See* STAFF OF SENATE COMM. ON COM., SCI. & TRANSP., 95TH CONG., 1ST SESS., CONGRESS AND THE OCEANS: MARINE AFFAIRS IN THE 94TH CONGRESS 246-55 (Comm. Print 1977) [hereinafter cited as CONGRESS & THE OCEANS]; Knight, *International Jurisdictional Issues Involving OTEC Installations,* in OCEAN THERMAL ENERGY CONVERSION: LEGAL, POLITICAL, AND INSTITUTIONAL ASPECTS 45 (Knight, Nyhart, & Stein eds. 1977). Federal grants for OTEC research have risen substantially since 1982. From a low of $100,000, they have grown to $36 million—one-fifth of all research funds designated for solar production of electricity. The Department of Energy (DOE) estimated that 180 million kilowatt hours (kwh) per year could be generated by the Gulf Stream off the U.S. East Coast—75 times more power than DOE estimated would be used in the United States during 1980. Schiefelbein, *Teaching Poseidon to Turn a Profit,* SAT. REV., Jan. 6, 1979, at 23-24.

55. Smith & Marshall, *Mariculture: A New Ocean Use,* 4 GA. J. INT'L & COMP. L. 307, 307 (1974); *see* Holt, *The Food Resources of the Ocean,* THE OCEAN 95, 105-06 (1969) (a classic summary of the food resources found in the ocean).

56. *See* CONGRESS & THE OCEANS, *supra* note 54, at 35-37. *See also* J. MERO, THE MINERAL RESOURCES OF THE SEA 24-27 (2d ed. 1969) (the classic work on nonliving ocean resources); D. ROSS, INTRODUCTION TO OCEANOGRAPHY 352, 355-56 (2d ed. 1977) [hereinafter cited as ROSS 1977]; Wenk, *supra* note 30, at 83. *See also* SUBCOMM. ON NAT'L SECURITY POLICY AND SCIENTIFIC DEVELOPMENTS OF THE HOUSE COMM. ON FOREIGN AFFAIRS, 92D CONG., 1ST SESS., EXPLOITING THE RESOURCES OF THE SEABED 15 (Comm. Print 1971) (by G. DOUMANI).

cal to mine, beneficiate, and load minerals in midocean.[57]

In addition, ocean-based installations have been developed to provide electrical energy. Since nuclear power plants typically require 500 acres of ground and one million gallons of cooling water per minute, few land-based sites exist which still meet these requirements. Therefore, the energy industry has developed "floating" nuclear power plants (FNP's) which can be adapted to different offshore sites.[58] Following standardized construction at a single facility, each FNP would be floated to and anchored off the coastal area it was designed to serve.[59] Underwater cables would transmit the generated electricity to shore, and the entire facility would be surrounded by a breakwater to protect it from waves, ship collisions, and large storms.[60] Although FNP's will be "using" the space provided by the ocean, the large amounts of cooling water they require would actually constitute an ocean "resource" per se.

Whether eventually sited at sea or not, another type of nuclear facility which utilizes the resources of the ocean is the fusion reactor.[61] While the fusion reactions of the sun are "uncontrolled," the fusion process in these facilities can be harnessed to generate electric power.[62] When technically feasible, fusion reactors would become a prime source of energy because the deuterium in the world's oceans constitutes an inexhaustible supply of fuel.[63] However, both FNP's and fusion reactors have potential environmental problems involving thermal discharge, perimeter contamination, and the risk of major nuclear accidents which should be cautiously assessed.

Scientists have speculated that energy can also be generated by utilizing windpower,[64] waves,[65] salinity gradients,[66] tides,[67] cur-

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57. R. HALLMAN, TOWARDS AN ENVIRONMENTALLY SOUND LAW OF THE SEA 4 (Rep. of the Int'l Inst. for Env't & Dev. 1974).

58. Binder, *The Energy Crisis, The Environment and the Consumer: A Solomonian Task*, 1 OHIO N.U.L. REV. 215, 235 (1974); Morris & Kindt, *The Law of the Sea: Domestic and International Considerations Arising from the Classification of Floating Nuclear Power Plants and Their Breakwaters as Artificial Islands*, 19 VA. J. INT'L. L. 299, 300-01 (1979) [hereinafter cited as Morris].

59. NUCLEAR REGULATORY COMM'N, FINAL ENVIRONMENTAL STATEMENT: MANUFACTURE OF FLOATING NUCLEAR POWER PLANTS BY OFFSHORE POWER SYSTEMS 3-1 (pt. II, 1976) [hereinafter cited as NUCLEAR EIS]; *see* Morris, *supra* note 58, at 300-01.

60. NUCLEAR EIS, *supra* note 59, at 3-1; *see* Morris, *supra* note 58, at 300-01.

61. *See* Pollack & Congdon, *International Cooperation in Energy Research and Development*, 6 LAW & POL. INT'L BUS. 677, 681 n.34 (1974) [hereinafter cited as Pollack]. Fusion refers "to the liberation of energy by the nuclear combination of the isotopes of hydrogen or helium, as in the nuclear reactions that occur in the sun." *Id.*

62. *Id.*

63. HALLMAN, *supra* note 57, at 4; Pollack, *supra* note 61, at 681 n.34; *see* U.S. ATOM. ENERGY COMM'N, CONTROLLED NUCLEAR FUSION 3-21 (1968).

64. CONGRESS & THE OCEANS, *supra* note 54, at 246-47.

65. *Id.* at 248.

66. Salinity gradients occur where the fresh water of rivers meets the seawater of

rents,[68] and "heat gradients;" i.e., interchanges between cold and warm water levels in the ocean.[69] By harnessing the "thermal resources" of the ocean to produce electrical energy, deep-sea turbines would operate OTEC systems.[70] An OTEC facility converts the temperature differential between the surface water and deep ocean water into energy.[71] This "thermal energy" ultimately can be transformed into usable electrical power through either an "open cycle" or a "closed cycle" system.[72] An OTEC plant can be: (1) deployed on land; (2) moored on stationary near-shore or ocean-based platforms; or (3) floated on "grazing" vessels.[73] These plantships can then transmit electricity to the mainland or supply power to on-site energy intensive refining and manufacturing processes, such as aluminum or ammonia production.[74]

Although they are technologically less advanced than OTEC systems, other ocean energy conversion modes have received increased attention. Ocean wave power is one of these new technologies. Wave power is generated from wind energy that derives its power from solar energy.[75] Several systems have been developed for transforming energy from ocean waves into usable electrical energy. These systems include the ocean valve system,[76] Salter's Ducks,[77] Cockerell's

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the ocean. Hypothetically, these salinity gradients can be harnessed to produce energy. *Id.*

67. *Id.* at 248-49.

68. *Id.*

69. *Id.* at 250-51; HALLMAN, *supra* note 57, at 4.

70. *See* CONGRESS & THE OCEANS, *supra* note 54, at 250-51. These OTEC systems resemble "Rube Goldberg" specialties, *i.e.*, elaborately designed devices which perform relatively simple tasks.

71. Richards & Vadus, *Ocean Thermal Energy Conversion: Technology Development*, 7 OCEAN MGMT. 327, 328 (1981) [hereinafter cited as Richards].

72. Woodson, *supra* note 13, at 316; *see* Richards, *supra* note 71, at 328. The "closed cycle" involves a working fluid such as ammonia, freon, or propane and is the preferred method of operation. In this type of system, warm water from the surface is pumped through heat exchangers where the working fluid vaporizes. The vaporized fluid expands, creating a pressure sufficient to drive a turbine that generates electricity. From the turbine, exhaust vapor flows into a condenser to be cooled by cold seawater pumped from the ocean depths. The vapor returns to its liquid state after cooling. *See* Woodson, *supra* note 13, at 316.

73. Richards, *supra* note 71, at 328-29.

74. Woodson, *supra* note 13, at 316; *see* Richards, *supra* note 71, at 328.

75. U.N. ENV'T PROGRAM, ENERGY REPORT SERIES, THE ENVIRONMENTAL IMPACTS OF PRODUCTION AND USE OF ENERGY: PART III. RENEWABLE SOURCES OF ENERGY, U.N. Doc. ERS-7-80, 1, 58 (1980) [hereinafter cited as U.N. ENERGY REPORT].

76. The ocean valve system is designed to convert the low pressure head produced by waves into a high pressure head needed to turn an electrical generator. A conventional valve system has been developed by the United Kingdom. The system includes two reservoirs, valves to each reservoir, and a generator turbine. Valves are arranged

Rafts,[78] oscillating water column systems,[79] and Dam-Atoll.[80] To be effective, most of these wave energy generating systems must be moored far enough off the coast to take advantage of the larger waves.[81]

Another potential commercial ocean energy conversion system uses tidal energy. Tidal power arises from the combination of kinetic and potential energy created by the earth-moon-sun system.[82] Two physical conditions needed for an effective tidal power site include: (1) a large tidal amplitude of at least five meters; and (2) a coastal topography which permits the impoundment of a substantial amount of water with a relatively narrow entrance to a storage basin.[83] This

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at the bottom of a structure well below sea level and only open inwardly. As a wave reaches the structure, there is an increase in hydrostatic pressure which forces the valves to open and raise the water level inside the reservoir. The high-level reservoir is connected to a turbine. As the water level rises it turns the turbine which drives a generator. The water flows into a second low-level reservoir where water is discharged through valves. These valves only open when a wave trough is in the area of the first valves. Thus, the valve system results in a stream of ocean water flowing from the level of the wave crest to the level of the wave trough over the generator turbine. Woodbridge, *Sources and Potential Uses of Wave Energy,* in 4 ALTERNATIVE ENERGY SOURCES II 1727, 1729-31 (T. Veziroglu ed. 1981) [hereinafter cited as Woodbridge].

77. Salter's Ducks are named after their inventor Stephen Salter of England. The Duck is an oscillating valve, several of which are mounted on a long spine. The Ducks rotate about the spine following the action of the waves and absorb power from such movement. Since the Ducks are shaped so that the front face maximizes the energy absorbed whereas the rear face minimizes the regeneration of waves, the Ducks bob in the water. Thus, the name "Ducks." Woodbridge, *supra* note 76, at 1731-32; *Salter's Ducks Look Good in Tests,* OCEAN INDUS., Feb. 1979, at 73, 74.

78. This system, developed by Sir Christopher Cockerell, molds itself to ocean waves. Three or more rafts connected together by hinges at their lower edges have hydraulic jacks atop them. The hydraulic jack on one raft is connected by a rod to the end of the next raft. The rafts bend at the hinge as the crest of the wave passes. This bending action causes the rod to activate a piston. The oscillating pistons pump fluid through a hydraulic turbine which turns a generator. Woodbridge, *supra* note 76, at 1732.

79. This system uses the "effect of an oscillating column of water on a confined air space above the column." Woodbridge, *supra* note 76, at 1733. The water level inside a container with no bottom and a hole in the top, forces air out of the confined space as the water column rises. The air passes through a turbine that turns a generator. As the wave trough passes, air is drawn back into the container. *Id.; Waves Actuate Air-column Turbine,* OCEAN INDUS., Feb. 1979, at 70, 71.

80. The Dam-Atoll device patented by Lockheed Corp. can generate 1 or 2 MWe of power. Dam-Atoll is a dome-shaped device which floats slightly below the neutral level of the sea. Waves enter an opening on the top of the device. Guide vanes located at the opening cause entering waves to spiral into a vortex. This swirling water column turns a turbine to generate power. *Lockheed Banks on Wave Energy for Electricity,* IRON AGE, Aug. 13, 1979, at 49; *see* Higgins & Schreiber, *DAM-ATOLL — A System for Extracting Energy from Ocean Waves,* in 4 ALTERNATIVE ENERGY SOURCES II 1743, 1744-45 (T. Veziroglu ed. 1981).

81. Woodbridge, *supra* note 76, at 1728-29.

82. U.N. ENERGY REPORT, *supra* note 75, at 55.

83. *Id.;* Andre, *Cheap Electricity from French Tides,* IEEE SPECTRUM, Feb. 1980 at 54, 56.

second requirement limits potential sites to bays with narrow inlets, river estuaries, or sets of strategically located islands.[84]

Several ocean powered plants have successfully provided electricity to coastal areas. The Rance tidal power station near Saint-Malo, France, has generated electricity from tidal currents since 1966.[85] From 1976 to 1980, almost 500 million kilowatt hours (kwh) were produced by the plant[86] at a variable cost of 0.74 to 6.172 cents per kwh.[87] A second tidal power plant has been built at Minas Basin in the Bay of Fundy, Nova Scotia;[88] the first of potentially three tidal power plants.[89] Additional ocean energy conversion technologies generate electrical power from salinity gradients[90] and ocean currents,[91] and Westinghouse and Tenneco have worked jointly on a project to develop a plant that uses seawater to produce hydrogen and oxygen through electrolysis.[92] The energy potential of the seawater would be converted by nuclear reactors. Ostensibly, such a plant would be used to "produce liquid hydrogen and methanol at competitive prices for trans-shipment to the shore."[93]

With the exception of the OTEC systems, which have had pilot projects underway,[94] most of these other proposals for generating energy from the ocean have remained in the planning stages.[95]

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84. U.N. ENERGY REPORT, *supra* note 75, at 55.

85. Andre, *supra* note 83, at 54; Banal & Bichon, *Tidal Energy in France. The Rance Tidal Power Station: Some Results after 15 Years of Operation*, J. INST. ENERGY, June 1982, at 86 [hereinafter cited as Banal].

86. Banal, *supra* note 85, at 90.

87. Andre, *supra* note 83, at 57.

88. *Tidal Power Test Taps Fundy Flow*, ENG'G NEWS REC., Oct. 29, 1981, at 39.

89. *Id.*

90. "When two aqueous phases having different salt concentrations (*i.e.*, different activities of H_20) are mixed, a large amount of energy is released at the interface between the two solutions." U.N. ENERGY REPORT, *supra* note 75, at 60. This salinity gradient energy is easily convertible to electrical or mechanical energy. *Id.* at 61.

91. This technology generates electricity by passing an ocean current through a powerful magnetic field. Thus, sea-current power generation "works on the same theory as magnetic-hydrodynamic power generation." Young, *Magnet System Plugs into Ocean Current as Power Source*, INDUS. RESEARCH/DEV., July 1979, at 82.

92. HALLMAN, *supra* note 57, at 4.

93. *Id.*

94. *See* CONGRESS & THE OCEANS, *supra* note 54, at 251 (in California, one small pilot project is already underway, and another is planned).

95. *Id.* However, it should be noted that at a cost of $100 million France has built a tidal power system on the Rance River. The USSR has started operating an experimental tidal power station on the Barents Sea, 50 miles from Finland, and has announced plans to build more such plants in the future. ROSS 1977, *supra* note 56, at 381. "Plans to build tidal stations near the English Channel and in Passamaquoddy Bay (between the United States and Canada) have existed for years," but have not been built for political reasons. *Id.* The French tidal plant on the Rance River near

C. *Major Offshore Installations Unrelated to Resource Exploitation*

For offshore installations unrelated to resource exploitation, the space which the ocean provides constitutes a use which should be differentiated from ocean resources. Since undeveloped coastal areas of the world have rapidly disappeared, mankind must look to the ocean for room to expand. In the United States, for example, fifty percent of the population lives within fifty miles of the coast. By the year 2000, this percentage is expected to reach eighty percent.[96] Concern in the United States over the increased destruction of environmentally sensitive marshes and coastal wetlands, which are important components in maintaining the delicate ecological balance of the ocean, led to passage of the Coastal Zone Management Act of 1972 (CZMA)[97] and the Magnuson Fishery Conservation and Management Act of 1976 (FCMA or MFCMA).[98]

Recreational uses of the ocean have encouraged the proposed construction of floating villages designed to provide aquatic sports.[99] Scientists have also planned to use ocean space for cities, waste disposal plants, airports, and deepwater ports.[100] Deepwater ports, for example, must be developed because they are needed to accommodate the very large crude carriers (VLCC's). The average draft of these supertankers prevents them from utilizing regular ports.[101] Unfortunately, there are only nine onshore ports worldwide which can offload oil tankers of 200,000 deadweight tons, and no such ports exist on the east coast of the United States.[102]

Although offshore drilling rigs are generally associated with resource exploitation, ocean space needs to be used to link such installations to onshore facilities by means of pipelines. In the North Sea, pipelines will be 115 to 225 miles long and reach depths of 230 to 400

Saint-Malo produces more than 600 million kilowatt hours (kwh) of electricity per year. Schiefelbein, *supra* note 54, at 24, col. C.

96. CONGRESS & THE OCEANS, *supra* note 54, at 73-74 (as used, coasts include those adjoining the Atlantic and Pacific Oceans, the Gulf of Mexico, and the Great Lakes).

97. 16 U.S.C. §§ 1451-1464 (1982).

98. *Id.* §§ 1801-1882.

99. HALLMAN, *supra* note 57, at 5.

100. *Offshore Parts and Terminals: Hearings on H.R. 5091 & H.R. 5898 Before the House Comm. on Merchant Marine and Fisheries,* 93d Cong., 1st Sess., 69-70 (1973) (statement of John Norton Moore, Counselor on Int'l Law, U.S. Dep't of State).

101. *See* Arbuckle, *The Deepwater Port Act and Energy Facilities Siting: Hopeful Solution or Another Part of the Problem?,* 9 NAT. RESOURCES LAW. 511 (1976); Krueger, Nordquist, & Wessely, *New Technology and International Law: The Case of Deepwater Ports,* 17 VA. J. INT'L L. 597 (1977); Note, *Deepwater Port Act of 1974: Some International and Environmental Implications,* 6 GA. J. INT'L & COMP. L. 535 (1976); Comment, *Territorial Status of Deepwater Ports,* 15 SAN DIEGO L. REV. 603 (1978) [hereinafter cited as *Territorial Status*]. *See also* Amercian Bar Association Resolution Re Deepwater Port Legislation Adopted By The House of Delegates August, 1974, *reprinted in* 7 NAT. RESOURCES LAW, 693 (1974).

102. HALLMAN, *supra* note 57, at 4; *see Territorial Status, supra* note 101, at 604-05.

feet.[103] Undersea oil storage tanks have been a reality for over a decade. In 1969, Abu Dhabi installed the first seabed storage tank, which had a capacity of 500,000 barrels.[104] This steel storage tank was located under 155 feet of water, and more oil tanks have been added to the complex since then.[105] A concrete storage tank with a capacity of one million barrels has been situated in Norwegian oil fields under 230 feet of water.[106] These types of installations have firmly established the feasibility of more sophisticated installations that will actually utilize the nonliving "resources" of the ocean.

Several FIP's (floating industrial plants) have been designed primarily to be transported via water routes to their permanent sites. One such project is a pulp mill located on the Jari River in Brazil,[107] which has produced 750 tons per day of bleached pulp.[108] The plant was constructed at a Japanese shipyard and towed to the Jari tributary of the Amazon River in Brazil.[109] Due to the lack of industrial facilities, trained personnel, and favorable weather conditions in the Amazon region, construction of the plant in Japan saved over twelve months of construction time and thereby reduced costs fifteen to twenty percent.[110] While this type of FIP is eventually dry-docked and surrounded with landfill, it still retains some aspects of a "floating installation," and this scenario demonstrates the advanced state of the technology necessary to stabilize such an industrial plant during its transportational phase.

A second operational FIP is the world's first barge-mounted polyethylene plant.[111] The polyethylene plant is part of a petrochemical complex at Bahía Blanca, Argentina.[112] The plant, which produces 120,000 metric tons of low density polyethylene per year,[113] was also built at a shipyard in Japan, towed to the operating site, and began operations within eighteen months of the date of the order.[114] By

103. HALLMAN, *supra* note 57, at 4. "At Forcados in Western Nigeria there is already a 14 mile, 48 inch pipeline out to the area of exploitation." *Id.*
104. *Id.*
105. *Id.*
106. *Id.*
107. FIP'S 1, *supra* note 17, at 121; INDUSTRIAL PLANT VESSELS, *supra* note 18, at 39, 42.
108. FIP'S 1, *supra* note 17, at 122; INDUSTRIAL PLANT VESSELS, *supra* note 18, at 39.
109. INDUSTRIAL PLANT VESSELS, *supra* note 18, at 39.
110. *Id.*
111. FIP'S 1, *supra* note 17, at 140.
112. *Id.*
113. *Id.* at 141.
114. *Id.* at 140.

employing the floating industrial plant concept to replace on-site construction, building time was more than halved.[115]

FIP's have several advantages. First, because the plants are constructed at a shipyard rather than at the site, quality control is improved and construction time shortened.[116] This is especially true if the alternative to the FIP is a land-based plant situated at a remote area of a developing country.[117] Secondly, FIP's pose fewer risks to people and their environment than land-based counterparts because FIP's are far removed from populated areas.[118] Thirdly, because FIP's provide cost efficient access, processing industries located at or near the sources of their raw materials are much more economical to operate.[119] This cost-saving concept is particularly applicable to offshore hydrocarbon or natural gas recovery installations.[120] Finally, FIP's can be towed from one resource site to another due to their mobility. Therefore, the entire useful life of the plant is exhausted instead of being wasted at locations where the resource recovery life would be less than the useful life of the facility.[121]

D. Major Military Offshore Installations and Uses Unrelated to Resource Exploitation

The primary intent of the negotiators at UNCLOS III in categorizing some offshore installations as "unrelated to resource exploitation" was to provide a separate set of provisions governing offshore national security installations. Since much of the technology involving these installations has not been fully developed, specific provisions regulating this ocean use activity were apparently not created. However, an examination of various military installations and uses will provide a useful interpretative tool for those provisions of the LOS Convention which are tangentially related.

As technological capabilities continue to advance, military strategists will focus an increasing amount of interest and effort toward using transnational ocean space for national security purposes.[122]

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115. *Id.*
116. *Id.* at 23; INDUSTRIAL PLANT VESSELS, *supra* note 18, at 44.
117. INDUSTRIAL PLANT VESSELS, *supra* note 18, at 43.
118. *Id.* at 45.
119. FIP'S 1, *supra* note 17, at 25.
120. *Id.*
121. *Id.; see* INDUSTRIAL PLANT VESSELS, *supra* note 18, at 45.
122. *See Peaceful Purposes, supra* note 21, at 1. The militarization of the ocean and seabed is attractive, especially with regard to the basing of nuclear weapons, because such a deployment scheme would move the locus of strategic conflict away from populated land areas. Hence, the operational effectiveness of nuclear devices would be greatly enhanced by restricting the degree of human and property destruction resulting from a thermonuclear exchange. *Id.* at 1-2. Moving strategic weapons from land-based installations into the sea would also reduce the vulnerability of a nation's deterrent system to a first attack. In addition, a credible undersea deterrent capability

Considerably more attention has been given to the traditional military uses of the ocean, especially those uses involving the navigational mobility of naval vessels.[123] Even so, the emplacement of objects in the ocean and on the seabed for national security purposes has continued to play an expanding role in the militarization of the sea.[124] These installations can be divided into two broad categories: (1) weapon systems; and (2) detection, surveillance, and communication devices.[125] The analytical framework of this section, however, will examine ocean-based military activities and devices within four specific use areas: (1) the navigational use of the water surface or column; (2) the deployment of seabed missiles for strategic defensive or offensive purposes; (3) the emplacement of seabed-based surveillance devices and weapons systems for both tactical and strategic purposes; and (4) the conduct of military research, including weapons testing.[126]

Navigational and other related uses by naval vessels encompass the most common military activity on the high seas.[127] These activities are comprised of basic everyday naval maneuvers or training operations and include, for example, the "transiting of surface ships and submarines as well as various anti-ship exercises, conducted on the water surface, and ASW [anti-submarine warfare] exercises, conducted below the water surface in the navigable water column."[128] Naval vessels have been designed to effectuate one or more traditional missions: (1) naval presence; (2) sea control; (3) projection of power ashore; and (4) strategic deterrence.[129] Naval presence represents the orchestrated, noncombative use of sea power to pursue foreign policy objectives. The relative quantity, quality, and character of

would increase strategic flexibility by allowing decision-makers greater reaction time in a crisis situation. *See* Dore, *supra* note 1, at 6.

123. Treves, *supra* note 24, at 808.

124. *Id.* at 809

125. *Id.*

> These objects can be emplaced on the seabed directly or by means of storage or other facilities; they can be placed on board submersibles moving on the seabed, or on rigs and platforms or installations moored to the seabed. They can be carried by facilities designed for military purposes or installations whose main purpose is not military, such as oil rigs and platforms, scientific research installations, and thermal energy conversion plants.

Id. International practice has treated nuclear weapons and other modes of mass destruction separately from matters relating to the use of conventional weapons. Dore, *supra* note 1, at 4 n.4.

126. *Peaceful Purposes, supra* note 21, at 4.

127. *Id.*

128. *Id.*

129. *Id.* at 4-5.

the naval forces employed by a country can prove determinative in its attempt to influence political events ashore.[130] On the other hand, sea control encompasses a nation's capacity to assert its use of the sea and to deny that use to adversaries.[131] Thus, effective control over the sea is essential to the performance of other vital nonstrategic naval missions.[132] Projection of power ashore involves the ability to threaten and destroy military targets along both the coast of an adversary and deep inside an opponent's territory. Amphibious assault forces, tactical aircraft bombardment, and naval bombardment may be combined to accomplish this mission.[133] Finally, strategic deterrence, the fourth naval mission, strives:

> —To deter all-out attack by any nation possessing a nuclear warmaking capability;
>
> —To threaten any nation contemplating less than all-out attack with a counterforce capability sufficient to create apprehensions of unacceptable risks of devastating response; and
>
> —To maintain an international political climate conducive to the actualization of foreign policy objectives.[134]

Submarines carrying nuclear weapons (SSBN's) perform the mission of sea-based strategic deterrence. With the deployment of more offensively orientated strategic missiles at sea, the importance of strategic deterrence in the upcoming decades will grow. This importance will be due, in part, to the increasing vulnerability of land-based intercontinental ballistic missiles (ICBM's).[135]

The deployment of sea-based missiles for strategic defensive or offensive purposes (the second category of high seas military activity)

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130. Zedalis, *Military Uses of Ocean Space and the Developing International Law of the Sea: An Analysis in the Context of Peacetime ASW*, 16 SAN DIEGO L. REV. 575, 580 (1979) [hereinafter cited as *Peacetime ASW*]. The weakness or strength of a country's naval force may serve to supplement or detract from the credibility of express or tacit threats implicit in attaining a particular foreign policy objective. *Id.*

131. *Id.* at 578-79.

> Assertion means that the navy of a particular nation can protect its own ships transporting resources, material, or personnel to or from one particular spot on the globe to another, or can remain at a specific location in the face of efforts to displace it. Denial is the opposite; it is the ability to prevent transiting foreign ships from effectively using sea lanes, or to force an adversary to choose between fleeing a specific position or remaining at the risk of suffering substantial damage.

Id. at 579.

132. *Id.*

133. *Id.* at 579-80.

134. *Id.* at 580.

135. *Peaceful Purposes, supra* note 21, at 5. Some military strategists have suggested deploying the MX missile on board several hundred conventionally-powered submarines. Another possible scenario under consideration would place "ICBMs on stationary launching pads fixed to the ocean floor or on huge mobile track platforms capable of moving along the ocean floor from one location to another." *Id.* at 5-6. For a brief discussion of the deployment advantages of undersea weapons systems, see Dore, *supra* note 1, at 6 n.15.

consists of systems capable of delivering or intercepting ICBM's.[136] Theoretically, an anti-ballistic missile defense system (ABMD) could be "stationed aboard surface ships, submarines, or on submerged stationary or mobile launching platforms. . . ."[137] Such a basing mode would provide an ABMD plan with mobility and/or concealment advantages; and upon successful interception of an incoming ICBM, it would avoid affecting inhabited territory since the destructive impact would occur over ocean space.[138]

The deployment of sea-based surveillance devices and weapon systems for both tactical and strategic purposes comprises the third category of military activity.[139] Detection and communication devices provide nuclear submarines and other vessels with command, targeting, and navigation information.[140] Similarly, anti-submarine warfare (ASW) installations detect submarines and gather knowledge pertaining to their positions, movements, and numbers.[141] Although a variety of platforms have been utilized to deploy ASW equipment,[142] the primary underwater acoustic detection devices include sonobuoys and fixed acoustic array systems which are offshore military installations deployed below the navigable water surface.[143]

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136. *Peaceful Purposes, supra* note 21, at 6.

137. *Id.*

138. *Id.*

139. *Id.*

> While most of the seabed based surveillance devices presently deployed by the U.S. Navy are located along the Atlantic, Pacific, or Gulf coasts of the United States, the coasts of certain allies, or at various strategically located ocean choke points, efforts have been made to obtain a much more ambitious long-range high seas detection capability.

Id.

140. Treves, *supra* note 24, at 810. Knowledge of an adversary's nuclear submarines' positions, movements, and numbers "plays an important role in avoiding (or countering) surprise attacks and maintaining the balance of forces, and, ultimately, in the proper exercise of deterrence." *Id.* In addition, "whatever disarmament or arms limitation measures are taken, detection devices may be a primary means of verification." *Id.* On the other hand, opponents of enhanced detection and surveillance systems have expressed concern that an "excessive transparency of the oceans may prove harmful," because the deterrent efficacy of nuclear armed submarines depends on their ability to remain undetected. *Id.*

141. *Id.* Basically, ASW operations consist of four integrated functions: detection, identification, localization, and destruction. Several types of devices perform these first three functions, including, "visual and radar apprehension, infra-red line scan, magnetic anomaly detection, sonobuoy, and underwater acoustic array systems." *Peacetime ASW, supra* note 130, at 582-83.

142. Surface and subsurface vessels, free-floating and moored buoys, fixed-wing and rotary aircraft, satellites, and the seabed have all served as hosts to ASW devices. *Id.* at 583.

143. *Id.*

After emplacement on the ocean surface, sonobuoys lower detection instruments several hundred meters into the water column to search for acoustic energy. Any sensory information received by the buoy is then transmitted and analyzed by equipment stationed on board aircraft. Since ocean turbulence displaces free-floating sonobuoys, countries have developed and deployed Moored Surveillance Systems (MSS's).[144] Comprised of a series of air-dropped, "command-activated," high-endurance sonobuoys that automatically moor themselves to the ocean floor, an MSS provides a long-range, deep-sea detection capability.[145]

Fixed acoustic detection array systems could potentially scan vast expanses of ocean space.[146] One model, the Sonar Surveillance System (SOSUS), employs a series of hydrophones built into a passive network[147] of several individual acoustic and detection units, each designed to monitor specific ocean areas. These separate systems, linked by cables to shore-based processing equipment, possess an estimated effective range extending to between several hundred kilometers[148] and 1000 nautical miles.[149] A second long-range ocean surveillance system, "Sea Spider," is a passive detection device anchored at a depth of approximately 5000 meters by three cables. Allegedly stationed several hundred miles north of Hawaii, Sea Spider is reported to be powered by a nuclear battery.[150] A third fixed network was conceived in the early 1970's. The Suspended Array System (SAS) consists of a massive tripod tower anchored on the ocean floor.[151] Stationing one such device in each ocean could conceivably insonify all ocean space.[152]

The most important sea-based ASW weapons consist mainly of submersible anti-ship mines.[153] These devices fall into three traditional

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144. *Id.* at 586.

145. *Id.* at 588. Each MSS sonobuoy can be moored in depths of 3000 fathoms of water and would contain elaborate communication and detection instruments. Once activated, a sonobuoy may function for up to 90 days. *Id.; see also Peaceful Purposes, supra* note 21, at 6-7 & n.27.

146. *Peacetime ASW, supra* note 130, at 588.

147. An active acoustic detection device consists of both electromechanical transducers, designed to convert electrical energy into acoustic energy which is then propagated through ocean space, and hyper-sensitive hydrophones or listening instruments that detect the sound emissions reflected from the transiting vessels. Passive acoustic detection devices, on the other hand, consist of nothing more than hydrophones. Due to certain natural impediments, the active device has a much more attenuated range than the passive device. *Peaceful Purposes, supra* note 21, at 7 n.28.

148. *Peacetime ASW, supra* note 130, at 588.

149. *Id.* at 588 n.58.

150. *Id.* at 589.

151. *Id.* "An acoustic detection array consisting of both electromechanical transducers and hydrophonic receivers sits on top of the structure." *Id.*

152. *Peaceful Purposes, supra* note 21, at 7.

153. *See id.*

types: physical-contact; depression; and magnetic/acoustic. Designed to detonate upon impact, physical-contact mines can be deployed in free-floating or moored versions.[154] In contrast, both the depression and magnetic/acoustic varieties are moored to the ocean floor and are activated "by certain vicissitudes in the immediately surrounding water column" caused by transiting vessels.[155] Fluctuations in hydrostatic pressure activate depression mines, whereas changes in magnetic or acoustic energy levels cause magnetic/acoustic mines to explode.[156] However, range limitations on all three traditional types of mines reduce the effectiveness of these weapons.[157] The "Captor" anti-submarine mine promises to overcome the limited utility of traditional mines. Captor utilizes an MK-46 torpedo with an active and/or passive homing device that makes it a lethal weapon against deep-diving submarine vessels.[158]

The fourth major category of ocean-based military activity includes the conduct of military research, including weapons testing. Such activity contemplates various types of research using the water surface, navigable water column, or seabed and subsoil.[159] Following the resolution of the technical and physiological problems associated with mankind's use of the deep ocean,[160] seabed activity could occur at the most perilous depths.[161] While marine research has been conducted by submersible vehicles capable of both column navigation and seabed crawling, permanent aquahabits may eventually serve as permanent underwater homes to submarines and other vehicles. Such depots could conceivably extend the length of operational exercises

154. *Peacetime ASW, supra* note 130, at 590-91.

155. *Peaceful Purposes, supra* note 21, at 7.

156. *Peacetime ASW, supra* note 130, at 591.

157. *See id.*

158. *Id.* Essentially, "Captor" is a submersible mine moored to the seabed which contains an MK-46 torpedo. When a magnetic or acoustic detection device reveals a disturbance caused by a submarine, this torpedo is unleashed from its mine casing. The sensor effective radius of the Captor torpedo is approximately one kilometer, and once activated, the torpedo's homing device takes over and guides the ammunition to its target. *Id.*

159. *Peaceful Purposes, supra* note 21, at 8.

160. As noted by one commentator:

> [d]rastic cutbacks in both powers' space programs have diverted research in the aerospace industry from outer space to "inner space"—the oceans. United States aerospace firms have directed their surplus capacity toward the development of proto-types of various kinds of submersibles and equipment for ocean use. The result is that contemporary oceanological research has become increasingly oriented towards the military.

Dore, *supra* note 1, at 7 n.20.

161. *Peaceful Purposes, supra* note 21, at 8.

by all submersible vessels. In addition, underwater research facilities could provide a prime location for testing military ordnance.[162] Given the tremendous potential for the continued militarization of the sea and the seabed,[163] national security installations and devices pose a serious threat, not only to the marine environment by pollution, but also to the preservation of the ocean as a zone of peace.

III. U.S. LEGISLATION RELATED TO MARINE POLLUTION BY OFFSHORE INSTALLATIONS

The major U.S. legislation impacting upon marine pollution from offshore installations (both related and unrelated to resource exploitation) includes:

a. the National Ocean Pollution Research and Development and Monitoring Planning Act of 1978 (NOPRA);[164]
b. the Clean Water Act of 1977;[165]
c. the Federal Water Pollution Control Act of 1972 (FWPCA);[166]
d. the Deepwater Port Act of 1974;[167]
e. the Trans-Alaska Pipeline Authorization Act;[168]
f. the Outer Continental Shelf Lands Act of 1953 (OCSLA);[169]
g. the OCSLA Amendments of 1978;[170]
h. the Submerged Lands Act of 1953 (SLA);[171]
i. the Coastal Zone Management Act of 1972 (CZMA);[172]
j. the Deep Seabed Hard Minerals Resources Act (Seabed Resources Act);[173]
k. the Ocean Thermal Energy Conversion Research, Development, and Demonstration Act (OTEC Reserach Act);[174] and
l. the Ocean Thermal Energy Conversion Act of 1980 (OTEC

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162. *Id.*
163. Dore, *supra* note 1, at 7.
164. 33 U.S.C. §§ 1701-1709 (1982).
165. PUB. L. NO. 95-217, 91 Stat. 1566 (1977) (codified at 33 U.S.C. §§ 1251, 1254-1256, 1259, 1262-1263, 1281-1288, 1291-1292, 1294-1297, 1311, 1314-1315, 1317-1319, 1321-1324, 1328, 1341-1342, 1344-1345, 1362, 1364, 1375-1376 (1982)).
166. 33 U.S.C. §§ 1251-1375 (1982).
167. *Id.* §§ 1501-1524; 43 U.S.C. § 1333 (1982).
168. 43 U.S.C. §§ 1651-1655 (1982).
169. *Id.* §§ 1331-1343.
170. 16 U.S.C. §§ 1456-1456a, 1464 (1982); 30 U.S.C. § 237 (1982); 43 U.S.C. §§ 1331-1356, 1801-1866 (1982).
171. 10 U.S.C. §§ 7421-7426, 7428-7430 (1982); 43 U.S.C. §§ 1301-1303, 1311-1315 (1982).
172. 16 U.S.C. §§ 1451-1464 (1982).
173. PUB. L. NO. 96-283, 94 Stat. 553 (1980); PUB. L. NO. 97-416, 96 Stat. 2084 (1983) (codified at 26 U.S.C. §§ 1, 4495-4498, (1982); 30 U.S.C. §§ 1401-1403, 1411-1428, 1441-1444, 1461, 1470, 1473 (1982)).
174. 42 U.S.C. §§ 9001-9009 (1982).

Act).[175]

Numerous governmental agencies have shared in administering this plethora of statutory programs which effect marine pollution and ocean based activities. Therefore, domestic regulatory efforts have followed a piecemeal approach by focusing on specific activities and geographical areas. This division of authority and overlap of authority has led to inefficient interagency competition, conflict, and confusion.[176]

In acknowledgement of the potentially deleterious impact of mankind's activities on the marine environment[177] and of mankind's increasing reliance on ocean resources, Congress expressed a need to better understand the effects of ocean pollution upon coastal resources.[178] To this end, a "comprehensive Federal plan for ocean pollution research and development and monitoring, with particular attention being given to the inputs, fates and effects of pollutants in the marine environment,"[179] was created. The Interagency Committee on Ocean Pollution Research, Development, and Monitoring (empaneled under the provisions of NOPRA) was empowered to coordinate U.S. marine pollution regulation.[180] In addition, a comprehensive five-year research and development plan was authorized, with the National Oceanic and Atmospheric Administration (NOAA) designated as the lead agency.[181]

Under the Clean Water Act of 1977, which amended the FWPCA,

175. *Id.* §§ 9101-9102, 9111-9127, 9141, 9151-9153, 9161-9163 (1982); 46 U.S.C. §§ 1271, 1273-1274, 1279 (1982).

176. *See* 33 U.S.C. § 1701(a)(4) (1982). As noted by Congress, "[n]umerous departments, agencies, and instrumentalities of the Federal Government sponsor, support, or fund activities relating to ocean pollution research and development and monitoring. However, such activities are often uncoordinated and can result in unnecessary duplication." *Id.*

177. *Id.* § 1701(a)(1). "Marine Environment" was defined to include the "coastal zone (as defined in section 1453(1) of title 16); the seabed, subsoil, and waters of the territorial sea of the United States; the waters of any zone over which the United States asserts exclusive fishery management authority; the waters of the high seas; and the seabed and subsoil of and beyond the Outer Continental Shelf." *Id.* § 1702(4).

178. *Id.* § 1701(a)(3).

179. *Id.* § 1701(a)(2).

180. *See* U.S. DEP'T COM., CATALOG OF FEDERAL OCEAN POLLUTION RESEARCH DEVELOPMENT AND MONITORING PROGRAMS, FISCAL YEARS 1978-80 iii (1979).

181. 30 U.S.C. § 1701(b) (1982). In adopting the NOPRA, Congress enumerated the following three purposes:

> (1) to establish a comprehensive 5-year plan for Federal ocean pollution research and development and monitoring programs in order to provide planning for, coordination of, and dissemination of information with respect to such programs within the Federal Government;
>
> (2) to develop the necessary base of information to support, and to provide

U.S. jurisdiction over marine pollution by oil and other hazardous substances was extended to 200 miles. In addition, pollution in other ocean areas impacting upon this 200-mile zone was claimed to fall within U.S. control.[182] Pursuant to the congressional scheme which was established, the Environmental Protection Agency (EPA) was granted primary responsibility to administer a permit program regulating the discharge of pollutants into national waterways.[183] The FWPCA contained several complementary provisions relating to the operation of offshore installations. Section 1321 of the FWPCA prohibited the discharge of oil or hazardous substances into the territorial sea or waters of the contiguous zone or in connection with activities carried out under the OCSLA or the Deep Water Port Act of 1974.[184] Section 1326 of the FWPCA established limitations on thermal discharges to "assure the projection and propagation of a balanced, indigenous population of shellfish, fish and wildlife . . . ."[185] Finally, section 1343 subjected ocean discharges to the National Pollutant Discharge Elimination System (NPDES).[186]

A licensing scheme for the construction and operation of deepwater ports beyond the territorial sea was created under the Deepwater Port Act of 1974.[187] Protecting the marine and coastal environment from the adverse impacts of offshore construction received express congressional recognition pursuant to the Act's declaration of policy.[188] Authority to administer the deepwater port program was vested in the Department of Transportation (DOT).[189] The U.S.

> for, the rational, efficient, and equitable utilization, conservation, and development of ocean and coastal resources; and
>
> (3) to designate the National Oceanic and Atmospheric Administration as the lead Federal agency for preparing the plan referred to in paragraph (1) and to require the Administration to carry out a comprehensive program of ocean pollution research and development and monitoring under the plan.

Id.

182. *See* Moore, *How Not to Protect Our Oceans,* NEWSDAY, July 10, 1978, at 42, cols. 1-3.

183. 33 U.S.C. § 1251(d) (1982).

184. *Id.* § 1342(b)(1).

185. *Id.* § 1326(a).

186. *Id.* § 1343(a). The NPDES requires that any point source emitting a polluted discharge obtain a permit issued by the EPA Administrator. *Id.* § 1342.

187. 33 U.S.C. §§ 1501(a)(1), 1503 (1982).

> "[D]eepwater port" means any fixed or floating manmade structures other than a vessel, or any group of such structures, located beyond the territorial sea and off the coast of the United States and which are used or intended for use as a port or terminal for the loading or unloading and further handling of oil for transportation to any State, except as otherwise provided in section 1522 of this title. The term includes all associated components and equipment, including pipelines, pumping stations, service platforms, mooring buoys, and similar appurtenances to the extent they are located seaward of the high water mark.

Id. § 1502(10).

188. *Id.* § 1501(a)(2).

189. *Id.* §§ 1502(17), 1503.

Coast Guard was delegated oversight responsibility for most of the operational and engineering duties imposed on developers by Congress.

The exploitation of oil, gas, and mineral resources on the outer continental shelf has come under the auspices of the OCSLA[190] and its 1978 Amendments.[191] Under the statutory plan adopted by Congress, a leasing program was created to facilitate and subject to environmental safeguards, the "expeditious and orderly development" of these vital national resources.[192] Federal jurisdiction was:

> extended to the subsoil and seabed of the outer Continental Shelf and to all artificial islands, and all installations and other devices permanently or temporarily attached to the seabed, which may be erected thereon for the purpose of exploring for, developing, or producing resources therefrom, or any such installation or other device (other than a ship or vessel) for the purpose of transporting such resources, to the same extent as if the outer Continental Shelf were an area of exclusive Federal jurisdiction located within a State . . . .[193]

Offshore installations not "developing" the resources of the continental shelf, however, would not fall under OCSLA regulation.[194]

All installations conducting exploration and exploitation operations on the outer continental shelf were mandated to employ "technology, precautions, and techniques sufficient to prevent or minimize the likelihood of blowouts, loss of well control, fires, spillages, physical obstruction . . . of the waters or subsoil and seabed, or other occurrences which may cause damage to the environment . . . ."[195] Regulatory control with respect to the promulgation of safety measures for artificial islands, installations, and other devices was vested

190. 43 U.S.C. §§ 1331-1343 (1982).

191. 16 U.S.C. §§ 1456-1456(a), 1464 (1982); 30 U.S.C. § 237 (1982); 43 U.S.C. §§ 1331-1334, 1337, 1340, 1343-1356, 1801-1802, 1811-1824, 1841-1847, 1861-1866 (1982).

192. 43 U.S.C. § 1332(3) (1982). In recognition of the significant impact associated with the exploration, development, and production of minerals on state coastal and noncoastal environments, *id.* § 1332(4), Congress asserted that:

> the rights and responsibilities of all States and, where appropriate, local governments, to preserve and protect their marine, human, and coastal environments through such means as regulation of land, air, and water uses, of safety, and of related development and activity should be considered and recognized . . . .

Id. § 1332(5).

193. *Id.* § 1333(a)(1). In 1983, Congress initiated the Exclusive Economic Zone Implementation Act of 1983 (EEZA) to delimit an EEZ of 200 nautical miles. S. 750, 98th Cong., 1st Sess. § 101(2) (1983). The United States jurisdiction asserted under the EEZA would extend to not only artificial islands, but also other economic installations and structures, and it would facilitate the protection and preservation of the marine environments. *Id.* § 102(3).

194. *See* Morris, *supra* note 58, at 305.

195. 43 U.S.C. § 1332(6) (1982).

with the Department of Transportation and the Coast Guard.[196] However, authority to prevent the obstruction of navigable waters by offshore structures was reserved for the Secretary of the Army.[197]

In the territorial sea, the rights of coastal states to title and ownership of the lands beneath the navigable waters of the United States were confirmed by the SLA.[198] The SLA also explicitly granted to states "the right and power to manage, administer, lease, develop, and use the said lands and natural resources all in accordance with applicable state law . . . ."[199] The CZMA provided states with financial assistance to develop and administer management programs for the lands and water resources of their coastal zones.[200] Preserving the resources of the nation's coastal zone for successive generations and assisting states in the development and implementation of management programs to use coastal resources received equal emphasis in the congressional declaration of SLA policy.[201] Unfortunately, no specific environmental guidelines or regulations were directed toward offshore installations.

Deep seabed mining activities conducted by U.S. citizens and vessels have fallen under a licensing scheme established pursuant to the Seabed Resources Act.[202] Federal regulation of mining operations on

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196. *Id.* § 1333(d)(1).

197. Id. § 1333(e); 33 U.S.C. § 403 (1982). Under the Rivers and Harbors Appropriations Act of 1899, the Army Corps of Engineers is empowered to establish safety fairways and anchorage areas and to control the erection of structures in shipping approaches to major coastal ports. *Id.* §§ 403, 404. In addition, the Corps was authorized to regulate dredging and the disposal of dredge spoils in navigable waters. *Id.* § 419.

198. 43 U.S.C. § 1311(a) (1982).

199. *Id.*

200. 16 U.S.C. § 1454(a) (1982).

201. *Id.* § 1452. An effective exercise of state responsibility pursuant to the CZMA would give "full consideration to ecological, cultural, historic, and esthetic values as well as to needs for economic development . . . ." *Id.* § 1452(2).

202. 30 U.S.C. § 1412 (1982). Not all offshore mining activities were subject to the licensing requirements of Subchapter I. Among those activities exempted were the following:

> (A) Scientific research, including that concerning hard mineral resources.
>
> (B) Mapping, or the taking of any geophysical, geochemical, oceanographic, or atmospheric measurements or random bottom samplings of the deep seabed, if such taking does not significantly alter the surface or subsurface of the deep seabed or significantly affect the environment.
>
> (C) The design, construction, or testing of equipment and facilities which will or may be used for exploration or commercial recovery, if such design, construction, or testing is conducted on shore, or does not involve the recovery of any but incidental hard mineral resources.
>
> (D) The furnishing of machinery, products, supplies, services or materials for any exploration or commercial recovery conducted under a license or permit issued under this subchapter, a license or permit or equivalent authorization issued by a reciprocating state, or under an international agreement.
>
> (E) Activities, other than exploration or commercial recovery activities, of the Federal Government.

Id. § 1411(a)(2).

the high seas, in part, was designed:

> (4) to accelerate the program of environmental assessment of exploration for and commercial recovery of hard mineral resources of the deep seabed and assure that such exploration and recovery activities are conducted in a manner which will encourage the conservation of such resources, protect the quality of the environment, and promote the safety of life and property at sea; and
>
> (5) to encourage the continued development of technology necessary to recover the hard mineral resources of the deep seabed.[203]

An extensive environmental assessment program was established by the Seabed Resources Act to determine "the effects on the environment from exploration and commercial recovery activities including seabased processing and the disposal at sea of processing wastes . . . ."[204] The administrator of NOAA was charged with overall responsibility for the assessment and research programs mandated by Congress. In addition, NOAA was empowered to prescribe mining guidelines for the protection of the environment.[205] Prior to issuance of a license or permit, a "programmatic environmental impact statement" would be required with respect to ocean areas in which U.S. citizens would undertake exploratory and/or commercial recovery activities.[206]

With passage of the OTEC Research Act in 1980, Congress recognized the growing importance of using the ocean to produce electrical energy and acknowledged the need to encourage the development of commercial ocean thermal energy conversion technology.[207] To facilitate the research and development of OTEC plants, a comprehensive management plan was authorized which would include "an analysis of the environmental, economic, and societal impacts of ocean thermal energy conversion facilities."[208] During the same year, a compre-

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203. *Id.* § 1401(b)(4)(5).

204. *Id.* § 1419(a)(1).

205. *Id.* § 1419(b). Discretion was vested in the Administrator of the NOAA to require:

> the use of the best available technologies for the protection of safety, health, and the environment . . . , except where the Administrator determines that the incremental benefits are clearly insufficient to justify the incremental costs of using such technologies.

Id.

206. *Id.* § 1419(c)(d).

207. 42 U.S.C. § 9001(a)(5) (1982).

208. *Id.* § 9002(c)(7). The research and development program was placed under the auspices of the Department of Energy. As defined by the OTEC Act, an

> "ocean thermal energy conversion facility" means any facility which is standing or moored in or beyond the territorial sea of the United States and which is designed to use temperature differences in ocean water to produce electricity or another form of energy capable of being used directly to perform work, and includes any equipment installed on such facility to use such electricity or

hensive legal regime was established under the OTEC Act to "authorize and regulate the construction, location, ownership, and operation of ocean thermal energy conversion facilities connected to the United States . . . consistent with the Convention on the High Seas, and general principles of international law."[209] If an applicant for an OTEC license failed to provide adequate assurance that his plantship would be operated in such a way as to prevent degradation of the thermal gradient, the administrator of NOAA was empowered to deny the application.[210] The administrator could also prescribe needful regulations for OTEC "locations that may (1) adversely effect the environment; (2) interfere with other reasonable uses of the high seas or with authorized uses of the Outer Continental Shelf; or (3) pose a threat to human health and safety."[211] In addition to the environmental assessment program mandated under the OTEC Act,[212] an environmental impact statement (EIS) must be prepared

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other form of energy to produce, process, refine, or manufacture a product, and any cable or pipeline used to deliver such electricity, freshwater, or product to shore, and all other associated equipment and appurtenances of such facility, to the extent they are located seaward of the highwater mark; [and an] "ocean thermal energy conversion plantship" means any vessel which is designed to use temperature differences in ocean water while floating unmoored or moving through such water, to produce electricity or another form of energy capable of being used directly to perform work, and includes any equipment installed on such vessels to use such electricity or other form of energy to produce, process, refine, or manufacture a product, and any equipment used to transfer such product to other vessels for transportation to users, and all other associated equipment and appurtenances of such vessel . . . .

Id. § 9102(11)-(12).

209. *Id.* § 9101(a)(1). Section 9111 created a licensing requirement for the ownership, construction, and operation of OTEC facilities or plantships. *Id.* § 9111.

210. *Id.* § 9111(c)(13). In deciding whether to grant an application, the Administrator must determine whether the OTEC project will serve the national interest. "[T]he degree to which the proposed ocean thermal energy conversion facilities will affect the environment" must be considered in the decision-making process. *Id.* § 9112(i)(3)(C).

211. *Id.* § 9112(b).

212. *Id.* § 9117(a). The environmental assessment program was designed to evaluate the impact of individual OTEC plantships and facilities, as well as the magnitude of the cumulative effect of large numbers of OTEC operations. *Id.* As created by Congress, this program would be designed to determine, among other things:

(1) any short-term and long-term effects on the environment which may occur as a result of the operation of ocean thermal energy conversion facilities and plantships;

(2) the nature and magnitude of any oceanographic, atmospheric, weather, climatic, or biological changes in the environment which may occur as a result of deployment and operation of large numbers of ocean thermal energy conversion facilities and plantships;

(3) the nature and magnitude of any oceanographic, biological or other changes in the environment which may occur as a result of the operation of electric transmission cables and equipment located in the water column or on or in the seabed, including the hazards of accidentally severed transmission cables; and

(4) whether the magnitude of one or more of the cumulative environmental effects of deployment and operation of large numbers of ocean thermal energy conversion facilities and plantships requires that an upper limit be placed

for each application.[213] Furthermore, Congress expressed a desire to seek effective international action and cooperation: (1) to guarantee that there was noninterference with the use of thermal gradients by OTEC facilities and plantships; (2) to assure the protection of these facilities and plantships including navigational safety; and (3) to resolve other matters relating to those OTEC operations that would be conducive to international agreement.[214]

Finally, the National Environmental Policy Act of 1969 (NEPA)[215] has had a substantial impact upon offshore installations because all major federal action significantly affecting the quality of the human environment must comply with EIS requirements under section 4332(2)(c) of NEPA.[216] While specific activities may fall outside the scope of NEPA, the preferred practice for all prospective offshore operators would necessitate the preparation of an EIS before substantial investments were made. To avoid potential environmental litigation, for example, the United States delegation to UNCLOS III drafted a multi-volume EIS when there was doubt as to whether "international negotiations" likely to affect the environment constituted a "major federal action." Both resource development and environmental protection of offshore areas, however, would be better served if a program of long-term "fate and effects studies" were utilized.[217]

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on the number or total capacity of such facilities or plantships to be licensed under this chapter for simultaneous operation, either overall or within specific geographic areas.

Id. § 9117(b).

213. *Id.* § 9117(e).

214. *Id.* § 9162.

215. 42 U.S.C. § 4321-4370 (1982).

216. *Id.* § 4332(2)(c). Section 4332(2)(c) of NEPA provides, in part, that a detailed statement be prepared considering:

(i) the environmental impact of the proposed action,

(ii) any adverse environmental effects which cannot be avoided should the proposal be implemented,

(iii) alternatives to the proposed action,

(iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and

(v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

Id. § 4332(2)(c). The issuance of a license for an OTEC facility or plantship, for example, has been designated as a "major Federal action significantly affecting the quality of the human environment" for purposes of section 4332(1)(c) of title 42. *Id.* § 9117(e). However, Congress has exempted certain activities from NEPA requirements. *See* 43 U.S.C. § 1652(d) (1982) (*e.g.*, construction of the Trans-Alaska pipeline).

217. A "programmatic EIS" requirement similar to that found in the Seabed Resources Act would be most helpful in assessing the effect of offshore activity on the marine environment. *See* 30 U.S.C. § 1419(d) (1982).

Instead of numerous, overlapping, individual EIS's, a cumulative assessment program such as the one mandated by the OTEC Act[218] could generate the best understanding of the impact of ocean-based activities on the marine environment, and hence, the best informed decision.

The scope of the FWPCA appears sufficiently inclusive so that only a few offshore installations operating on the United States continental shelf will escape EPA regulation. Most facilities that discharge substances into the waters, either accidentally or intentionally as a manufacturing by-product, will be subject to the NPDES process. Numerous other federal statutes also regulate certain types of conduct within various jurisdictional zones. In addition, the individual states have been granted extensive powers to regulate land use, to establish pollution control standards, to provide for the conservation of living resources, and even to prohibit certain activities within their territorial waters. Thus, in determining the feasibility of a specific offshore construction project under domestic law, a potential developer would be wise to investigate both federal and state legislation. While federal statutes do not deal with artificial islands, installations, or devices as a generic class, but rather with the regulation of certain technologies and activities in specific areas, these acts may serve as models for future domestic legislation which may evolve following international acceptance of the LOS Convention.

IV. THE LAW OF THE SEA PROVISIONS

A. *International Legal Regime Regulating Marine Pollution from Offshore Installations*

Regulatory authority over all offshore installations, artificial islands, and devices depends primarily upon the facility's location and national origin. Under the LOS Convention, the scope of jurisdictional control vested in a coastal state varies from one ocean zone to another. Over internal waters, for instance, the authority of a coastal state is absolute and exclusive,[219] and within its territorial sea, the state sovereignty which can be exercised is almost as extensive, except for the right of innocent passage (and other related navigational rights).[220] Hence, regulating offshore installations situated in these

218. 42 U.S.C. § 9117(a)-(b) (1982).

219. *Peacetime ASW, supra* note 130, at 598-602.

220. *Id.; see* LOS Convention, *supra* note 26, art. 2, para. 1. Under the LOS Convention, the right to innocent passage is subject to the laws of the coastal state regulating: "the protection of navigational aids and facilities and other facilities or installations [and] the preservation of the environment of the coastal State and the prevention, reduction and control of pollution thereof . . . ." LOS Convention, *supra* note 26, art. 21, para. 1(b)-(f). In comparison, all countries retain the "freedom to construct artificial islands and other installations permitted under international law," sub-

areas would fall strictly within the jurisdiction of the coastal state.

Similar regulatory power over ocean structures has been granted to the coastal state with regard to its continental shelf[221] and its EEZ (exclusive economic zone).[222] Since the provisions pertaining to the EEZ are specifically enumerated and similar to the continental shelf provisions, an analysis of jurisdictional control over artificial islands and other installations in the economic zone serves to illustrate jurisdictional issues both in the EEZ and on the continental shelf. Within its EEZ, a coastal state retains authority with regard to: "(i) the establishment and use of artificial islands, installations and structures; (ii) marine scientific research; [and] (iii) the protection and preservation of the marine environment."[223] Pursuant to article 60, a coastal state has exclusive rights to construct, to authorize, and to regulate the operation and use of: "(a) artificial islands; (b) installations and structures for the purposes provided for in article 56[224] and other economic purposes; [and] (c) installations and structures which may interfere with the exercise of the rights of the coastal State in the

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ject to those provisions of the LOS Convention which relate to the outer continental shelf. LOS Convention, *supra* note 26, art. 87, para. 1(d).

221. Article 80 of the LOS Convention deals with "[a]rtificial islands, installations, and structures on the continental shelf" and states *in toto* that "[a]rticle 60 applies *mutatis mutandis* to artificial islands, installations, and structures on the continental shelf." LOS Convention, *supra* note 26, art. 80. Article 60, regulating facilities in the EEZ, is governed by article 56 which imposes an implied, if not express, obligation upon coastal states to ensure "the protection and preservation of the marine environment." *Id.* art. 56, para. 1(b)(iii). Therefore, installations on the continental shelf must be operated in a manner consistent with the protective penumbra of article 56. In addition, the express and implied "health and safety" provisions and "protection of the marine environment" obligations contained in article 60, paragraphs 2 and 3 must be applied *mutatis mutandis* to continental shelf installations. *Id.* art. 60; *see id.* art. 80.

222. LOS Convention, *supra* note 26, art. 80; *see id.* art. 79, para. 4. Although article 80 "would treat installations on the continental shelf beyond the economic zone in the same manner as those within the zone, there was sentiment for taking, with respect to the area beyond 200 miles, the approach . . . which refers to the coastal state jurisdiction only in respect of installations for the exploration and exploitation of the natural resources of the continental shelf." Stevenson & Oxman, *The Third United Nations Conference On The Law Of The Sea: The 1975 Geneva Session*, 69 AM. J. INT'L L. 763, 783 (1975) [hereinafter cited as *1975 Geneva Session*].

223. LOS Convention, *supra* note 26, art. 56, para. 1(b).

224. Article 56 of the LOS Convention affirms a coastal state's:

> sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the waters superjacent to the sea-bed and of the sea-bed and its subsoil, and with regard to other activities for the economic exploitation and exploration of the zone, such as the production of energy from the water, currents and winds . . . .

Id. art. 56, para. 1(a).

zone."[225] The language of article 60 clearly indicates "that all artificial islands and all resource and other economic offshore installations (*e.g.*, artificial deep water ports) are *ipso facto* subject to coastal state" control.[226] An equally compelling argument can also be made "that the 'may interfere' test in subparagraph (c) 'tilts' heavily toward the coastal state even with respect to noneconomic installations in the economic zone."[227] Since an installation necessarily excludes others from using the area it occupies, a coastal state should logically be given control over all structures which may interfere with the exercise of its economic rights in the zone.[228]

A country seeking to erect an artificial island, installation, or structure must give due notice of its construction plans and provide a permanent warning of their presence.[229] In addition, a coastal state may also "establish reasonable safety zones around such artificial islands."[230] Abandoned or disused facilities must be removed to ensure safe navigation.[231] However, neither the offshore facilities nor the

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225. *Id.* art. 60, para. 1.

226. *1975 Geneva Session, supra* note 222, at 777. The general consensus expressed by the drafters of the LOS Convention was that "artificial islands, deepwater ports, airports, power plants, and similar new fixed economic uses of the economic zone should be subject to coastal state authorization and regulation." Stevenson & Oxman, *The Third United Nations Conference On The Law Of The Sea: The 1974 Caracas Session*, 69 AM. J. INT'L L. 1, 23 (1975).

227. *1975 Geneva Session, supra* note 222, at 777.

228. *See* Oxman, *The Third United Nations Conference On The Law Of The Sea: The 1976 New York Session*, 71 AM. J. INT'L L. 247, 264 (1977). Under article 246 of the LOS Convention, for example, a coastal state may withhold its consent regarding marine research projects conducted in the economic zone or on the continental shelf if that project:

> (a) is of direct significance for the exploration and exploitation of natural resources, whether living or non-living;
>
> (b) involves drilling into the continental shelf, the use of explosives or the introduction of harmful substances into the marine environment;
>
> (c) involves the construction, operation or use of artificial islands, installations or structures referred to in articles 60 and 80;
>
> (d) contains information communicated pursuant to article 248 regarding the nature and objectives of the project which is inaccurate or if the researching State or competent international organization has outstanding obligations to the coastal State from a prior research project.

LOS Convention, *supra* note 26, art. 246, para. 5.

229. LOS Convention, *supra* note 26, art. 60, para. 3.

230. *Id.* art. 60, para. 4. The LOS Convention mandates that all vessels respect these zones. *Id.* art. 60, para. 6.

> The breadth of the safety zones shall be determined by the coastal State, taking into account applicable international standards. Such zones shall be designed to ensure that they are reasonably related to the nature and function of the artificial islands, installations or structures, and shall not exceed a distance of 500 metres around them, measured from each point of their outer edge, *except as authorized by generally accepted international standards or as recommended by the competent international organization.* Due notice shall be given of the extent of safety zones.

Id. art. 60, para. 5 (emphasis added).

231. *Id.* art. 60, para. 3. Countries removing structures must conduct these operations with "due regard to fishing, the protection of the marine environment and the

safety zones associated with them may be established where they would interfere with the use of internationally recognized sea lanes.[232] Regardless of where an offshore installation is located, its construction and operation would be subject to a recognized duty to protect and preserve the marine environment from pollution, as established and codified by the LOS Convention.[233]

Pursuant to part XII, section 1 of the LOS Convention, states have a general obligation to: (1) "protect and preserve the marine environment;"[234] (2) "take, individually or jointly as appropriate, all measures consistent with this Convention that are necessary to prevent, reduce and control pollution of the marine environment from any source, using for this purpose the best practical means at their disposal and in accordance with their capabilities;"[235] and (3) "take all measures necessary to ensure that activities under their jurisdiction or control are so conducted as not to cause damage by pollution to other States and their environment."[236] In addition, countries are cautioned that their anti-pollution efforts must not "transfer, directly, or indirectly, damage or hazards from one area to another or transform one type of pollution into another."[237]

The specific obligation of countries to prevent pollution from offshore installations related to resource exploitation flows from article 194, paragraph 3(c) of the LOS Convention.[238] A concomitant duty to prevent pollution from offshore installations unrelated to resource exploitation follows in paragraph 3(d).[239] Together, these provisions provide that:

> 3. The measures taken pursuant to this Part shall deal with all sources of pollution of the marine environment. These measures shall include, *inter alia*, those designed to minimize to the fullest possible extent:
>
> . . . .

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rights and duties of other States. Appropriate publicity shall be given to the depth, position, and dimensions of any installations or structures not entirely removed." *Id.*

232. *Id.* art. 60, para. 7.

233. Oxman, *The New Law of the Sea*, 69 A.B.A. J. 156, 162 (1982). The LOS Convention "contains elaborate environmental provisions that both expand environmental rights and obligations and limit certain unilateral environmental actions, with the rights, obligations and limitations subject to third-party adjudication or arbitration." Oxman, *Introduction: On Evaluating the Draft Convention on the Law of the Sea*, 19 SAN DIEGO L. REV. 453, 459 (1982).

234. LOS Convention, *supra* note 26, art. 192.

235. *Id.* art. 194, para. 1.

236. *Id.* art. 194, para. 2.

237. *Id.* art. 195.

238. *Id.* art. 194, para. 3(c).

239. *Id.* art. 194, para. 3(d).

(c) pollution from installations and devices used in exploration or exploitation of the natural resources of the sea-bed and subsoil, in particular measures for preventing accidents and dealing with emergencies, ensuring the safety of operations at sea, and regulating the design, construction, equipment, operation and manning of such installations or devices;

(d) pollution from other installations and devices operating in the marine environment, in particular measures for preventing accidents and dealing with emergencies, ensuring the safety of operations at sea, and regulating the design, construction, equipment, operation and manning of such installations or devices.[240]

The "in particular" parts of these provisions, however, are difficult to interpret because they have nothing to do with minimizing pollution. Furthermore, it is difficult to determine to whom or to what these provisions refer if they are designed to operate as a retention of rights.

Intentional pollution of the marine environment[241] by offshore installations would be regulated by the LOS Convention provisions regarding ocean "dumping."[242] Article 1, paragraph 5(b) excludes, however, wastes "incidental to . . . the normal operations of vessels, aircraft platforms or other man-made structures"[243] from the definition of dumping. Within the specific provisions governing dumping, paragraphs 1 and 2 of article 210 obligate countries to adopt laws, regulations, and other measures "to prevent, reduce and control . . . dumping."[244] While paragraph 3 apparently requires countries to monitor their industries for regulatory compliance,[245] the obligations contained in article 210 are analagous to those adopted to control other sources of marine pollution.

"Enforcement" with respect to dumping is governed by article 216.[246] National laws enacted in accordance with the LOS Convention and international standards established through competent international organizations, such as the International Maritime Organization (IMO), shall be enforced:

(a) by the coastal State with regard to dumping within its territorial sea or its exclusive economic zone or onto its continental shelf;

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240. *Id.* art. 194, para. 3(c)-(d).

241. As defined by article 1, paragraph 4:

"pollution of the marine environment" means the introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities . . . .

Id. art 1, para. 4.

242. The term "dumping" includes "any deliberate disposal of wastes or other matter from vessels, aircraft, *platforms or other man-made structures at sea.*" *Id.* art. 1, para. 5(a)(i) (emphasis added).

243. *Id.* art. 1, para. 5(b)(1).

244. *Id.* art. 210, paras. 1-2.

245. *Id.* art. 210, para. 3.

246. *Id.* art. 216.

(b) by the flag State with regard to vessels flying its flag or vessels or aircraft of its registry;
(c) by any State with regard to acts of loading of wastes or other matter occurring within its territory or at its off-shore terminals.[247]

Pollution from seabed activities both related and unrelated to resource exploitation are governed by article 208 and enforced under article 214.[248]

Article 208
Pollution from sea-bed activities

1. Coastal States shall adopt laws and regulations to prevent, reduce and control pollution of the marine environment arising from or in connection with sea-bed activities subject to their jurisdiction and from artificial islands, installations and structures under their jurisdiction, pursuant to articles 60 and 80.

2. States shall take other measures as may be necessary to prevent, reduce and control such pollution.

3. Such laws, regulations and measures shall be no less effective than international rules, standards and recommended practices and procedures.

4. States shall endeavor to harmonize their policies in this connection at the appropriate regional level.

5. States, acting especially through competent international organizations or diplomatic conference, shall establish global and regional rules, standards and recommended practices and procedures to prevent, reduce and control pollution of the marine environment referred to in paragraph 1. Such rules, standards and recommended practices and procedures shall be re-examined from time to time as necessary.[249]

Article 214
Enforcement with respect to pollution from sea-bed activities

States shall enforce their laws and regulations adopted in accordance with article 208 and shall adopt laws and regulations and take other measures necessary to implement applicable international rules and standards established through competent international organizations or diplomatic conference to prevent, reduce and control pollution of the marine environment arising from or in connection with sea-bed activities subject to their jurisdiction and from artificial islands, installations and structures under their jurisdiction, pursuant to articles 60 and 80.[250]

The language of these provisions is generally self-explanatory. Coastal-state jurisdiction extends over all offshore installations for the purposes of preventing marine pollution. The reference to article 60 means that this coastal-state jurisdiction exists in the economic zone,[251] and the reference to article 80 established pollution jurisdic-

247. *Id.* art. 216, para. 1(a)-(c). In 1979, the International Maritime Organization (IMO) became the successor organization to the Intergovernmental Maritime Consultive Organization (IMCO). Hence, the term "IMO" should be used instead of IMCO.
248. *Id.* arts. 208, 214.
249. *Id.* art. 208.
250. *Id.* art. 214.
251. *Id.* art. 60.

tion over the continental shelf area.[252]

A regional approach to regulating offshore installations should not be neglected. The character of a regional regulatory authority would be international in spirit yet national with regard to enforcement and implementation processes. Although countries would cooperate to initiate and implement regionally tailored regulations pertaining to offshore activities and installations, domestic legislation over both coastal and internal structures would be preserved, without ignoring the high seas, which fall under no one sovereign's jurisdiction.

An example of a regional agreement relating to offshore operations arose from the Intergovernmental Conference on the Convention on Civil Liability for Oil Pollution Damage from Offshore Operations held in London from October 20 to 31, 1975, and from December 13 to 17, 1976.[253] The resultant convention, entitled the Convention on Civil Liability for Oil Pollution Damage Resulting from Exploration for and Exploitation of Seabed Mineral Resources (Seabed Mineral 1976 Convention),[254] established a fund to compensate persons harmed by oil pollution resulting from seabed exploration.[255] Although the title of this Convention suggests that deep seabed mining activities are covered, the parties thereto dealt only with oil pollution damage resulting from installations involved with drilling for offshore oil and gas.[256] Despite this limitation, the Seabed Mineral

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252. *Id.* art. 80.

253. *See* 16 I.L.M. 1450 (1977).

254. *Opened for signature* May 1, 1977, *reprinted in* 16 I.L.M. 1451 (1977) [hereinafter cited as Seabed Mineral 1976 Convention].

255. *Id.* art. 6.

256. As defined in the Seabed Mineral 1976 Convention, an "installation" would include:

> (a) any well or other facility, whether fixed or mobile, which is used for the purpose of exploring for, producing, treating, storing, transmitting or regaining control of the flow of crude oil from the seabed or its subsoil;
>
> (b) any well which has been used for the purpose of exploring for, producing or regaining control of the flow of crude oil from the seabed or its subsoil and which has been abandoned after the entry into force of this Convention for the Controlling State concerned;
>
> (c) any well which is used for the purpose of exploring for, producing or regaining control of the flow of gas or natural gas liquids from the seabed or its subsoil during the period that any such well is being drilled, including completion, or worked upon except for normal maintenance operations;
>
> (d) any well which is used for the purpose of exploring for any mineral resources other than crude oil, gas or natural gas liquids, where such exploration involves the deep penetration of the subsoil of the seabed; and
>
> (e) any facility which is normally used for storing crude oil from the seabed or its subsoil; which, or a substantial part of which, is located seaward of the low-water line along the coast as marked on large-scale charts officially recognized by the Controlling State; provided, however, that
>
> . . . .
>
> (i) where a well or a number of wells is directly connected to a platform or similar facility, the well or wells together with such platform or facility shall constitute one installation; and
>
> (ii) a ship as defined in the International Convention on Civil Liability for

1976 Convention exemplifies a plausible regional approach to solving problems with regard to marine pollution from offshore installations. Therefore, the Convention could eventually serve as a good precedent for future regional arrangements regulating other forms of environmental harm.

B. International Legal Regime Regulating Military Uses and Installations

Historically, great deference to military use of ocean space has been the international legal norm.[257] Under the customary law of the sea, all states were free to emplace any military security "installation, structure, or device on the deep seabed," even if it rested beyond the reach of national jurisdiction.[258] However, two restrictions on this freedom have gained widespread recognition. First, international treaties have imposed specific legal obligations and prohibitions on state parties seeking to militarize the ocean.[259] Secondly,

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Oil Pollution Damage, done at Brussels on 29 November 1969. . ., shall not be considered to be an installation.

Seabed Mineral 1976 Convention, *supra* note 254, art. 1, para. 2.

257. *See Peacetime ASW, supra* note 130, at 661.

258. Treves, *supra* note 24, at 851. A coastal state's sovereignty over its internal waters is absolute and extends in a like manner over the territorial sea, except with regard to the right of innocent passage. *Peacetime ASW, supra* note 130, at 603. Pursuant to the LOS Convention, innocent passage does not extend to:

> (a) any threat or use of force against the sovereignty, territorial integrity or political independence of the coastal State, or in any other manner in violation of the principles of international law embodied in the Charter of the United Nations;
>
> (b) any exercise or practice with weapons of any kind;
>
> (c) any act aimed at collecting information to the prejudice of the defence or security of the coastal State;
>
> (d) any act of propoganda aimed at affecting the defence or security of the coastal State;
>
> (e) the launching, landing or taking on board of any aircraft;
>
> (f) the launching, landing or taking on board of any military device;
>
> (g) the loading or unloading of any commodity, currency or person contrary to the customs, fiscal, immigration or sanitary laws and regulations of the coastal State;
>
> (h) any act of wilful and serious pollution contrary to this Convention;
>
> (i) any fishing activities;
>
> (j) the carrying out of research or survey activities;
>
> (k) any act aimed at interfering with any systems of communication or any other facilities or installations of the coastal State;
>
> (l) any other activity not having a direct bearing on passage.

LOS Convention, *supra* note 26, art. 19, para. 2. Therefore, under international law the emplacement of military devices by a foreign nation without consent violates the sovereignty of a coastal state and entitles the coastal state to remove these devices once deployed. *Peacetime ASW, supra* note 130, at 604.

259. Treves, *supra* note 24, at 851-52.

users of the ocean must pay "reasonable regard" to the interests of other countries.[260]

Several international conventions explicitly regulate strategic military uses of the ocean.[261] The more significant of these agreements include the following:

a. Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space and Under Water (Nuclear Test Ban Treaty);[262]
b. The Antarctic Treaty of 1959 (Antarctic Treaty);[263]
c. Treaty for the Prohibition of Nuclear Weapons in Latin America (Tlatelolco Treaty);[264]
d. Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Seabed and the Ocean Floor and in the Subsoil Thereof (Seabed Arms Control Treaty);[265] and
e. Treaty on the Limitations of Anti-Ballistic Missile Systems, U.S.-U.S.S.R. (ABM Limitation Treaty).[266]

Parties to the Nuclear Test Ban Treaty prohibited test explosions of nuclear weapons on or beneath the surface of the ocean within territorial and high seas areas.[267] Under the Antarctic Treaty of 1959, a nonmilitary zone was established,[268] subject to the continuation of traditional military uses of the high seas in the region.[269] Further-

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260. Dore, *supra* note 1, at 17.

261. *Peaceful Purposes, supra* note 21, at 8.

262. Aug. 5, 1963, 14 U.S.T. 1313, T.I.A.S. No. 5433, 480 U.N.T.S. 43 (entered into force October 10, 1963) [hereinafter cited as Nuclear Test Ban Treaty].

263. Dec. 1, 1959, 12 U.S.T. 794, T.I.A.S. No. 4780, 402 U.N.T.S. 71 (entered into force June 23, 1961) [hereinafter cited as Antarctic Treaty].

264. Feb. 14, 1967, 634 U.N.T.S. 281 [hereinafter cited as Tlatelolco Treaty].

265. Seabed Arms Control Treaty, *supra* note 25.

266. May 26, 1972, 23 U.S.T. 3435, T.I.A.S. No. 7503 (entered into force October 3, 1972) [hereinafter cited as ABM Limitation Treaty].

267. Nuclear Test Ban Treaty, *supra* note 262, art. 1. Article 1 states:

> Each of the Parties to this Treaty undertakes to prohibit, to prevent, and not to carry out any nuclear weapon test explosion, or any other nuclear explosion, at any place under its jurisdiction or control;
>
> (a) in the atmosphere; beyond its limits, including outer space; or underwater, including territorial waters or high seas; or
>
> (b) in any other environment if such explosion causes radioactive debris to be present outside the territorial limits of the State under whose jurisdiction or control such explosion is conducted.

Id. However, the emplacement or storage of nuclear weapons was not prohibited. Treves, *supra* note 24, at 820.

268. Antarctic Treaty, *supra* note 263, art. I. Article I reads:

> 1. Antarctica shall be used for peaceful purposes only. There shall be prohibited, *inter alia*, any measures of a military nature, such as the establishment of military bases and fortifications, the carrying out of military maneuvers, as well as the testing of any type of weapons.
>
> 2. The present Treaty shall not prevent the use of military personnel or equipment for scientific research or for any other peaceful purposes.

Id. paras. 1-2.

269. *Id.* art. VI. Article VI of the Antarctic Treaty provides that:

more, the explosion of nuclear devices and the disposal of radioactive wastes were specifically prohibited.[270] In 1967, Latin American states joined together to ban the development and deployment of nuclear weapons within their sovereign waters following the enactment of the Tlatelolco Treaty.[271] The Seabed Arms Control Treaty barred the emplacement of nuclear weapons and other weapons of mass destruction[272] on the ocean floor further than twelve miles from the deploying country's coastline.[273] Structures, launching installations, and other facilities designed to store, test, or use such weapons were also

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> The provisions of the present Treaty shall apply to the area south of 61 South Latitude, including all ice shelves, but nothing in the present Treaty shall prejudice or in any way affect the rights, or the exercise of the rights, of any State under international law with regard to the high seas within that area.

Id.

270. *Id.* art. V.

271. Tlatelolco Treaty, *supra* note 264, arts. 1, 3. Article 1 of the Treaty reads as follows:

> 1. The Contracting Parties hereby undertake to use exclusively for peaceful purposes the nuclear material and facilities which are under their jurisdiction, and to prohibit and prevent in their respective territories:
> (a) The testing, use, manufacture, production or acquisition by any means whatsoever of any nuclear weapons by Parties themselves, directly or indirectly, on behalf of anyone else or in any other way, and
> (b) The receipt, storage, installation, deployment and any form of possession of any nuclear weapons, directly or indirectly, by the Parties themselves, by anyone on their behalf or in any other way.
> 2. The Contracting Parties also undertake to refrain from engaging in, encouraging or authorizing, directly or indirectly, or in any way participating in the testing, use, manufacture, production, possession or control of any nuclear weapon.

Id. art. 1. However, the Tlatelolco Treaty exempted explosions for peaceful purposes, and in contrast to the Seabed Arms Control Treaty, encompassed only nuclear weapons, not "other weapons of mass destruction." In addition, the Tlatelolco Treaty failed to prohibit the construction of seabed structures or installations designed to store, test or use such weapons. Treves, *supra* note 24, at 825.

272. "Chemical, biological, and radiological weapons have been mentioned" as included in the category of "other weapons of mass destruction," primarily because their effects are comparable to those of nuclear weapons. Treves, *supra* note 24, at 821.

273. Seabed Arms Control Treaty, *supra* note 25, art. I, para. 1. Pursuant to this provision:

> [t]he States Parties to this Treaty undertake not to emplant or emplace on the seabed and the ocean floor and in the subsoil thereof beyond the *outer limit of a seabed zone* . . . any nuclear weapons or any other types of weapons of mass destruction as well as structures, launching installations or any other facilities specifically designed for storing, testing or using such weapons.

Id. art. I, para. 1 (emphasis added). Article II reads: "For the purpose of this Treaty, the *outer limit of the seabed zone* referred to in article I shall be coterminous with the twelve-mile outer limit of the zone referred to in part II of the Convention on the Territorial Sea and the Contiguous Zone . . . ." *Id.* art. II (emphasis added).

prohibited by the parties to the Seabed Arms Control Treaty.[274] Finally, United States and Soviet development, testing, and deployment of seabased anti-ballistic missile (ABM) systems outside of their national territory were foreclosed by the ABM Limitation Treaty.[275]

While these agreements have aided in the partial "denuclearization" of the ocean,[276] numerous flaws, ambiguities, and omissions have rendered uncertain their effectiveness with respect to complete demilitarization.[277] The term "peaceful purposes," for instance, has been left undefined and has led to several conflicting interpretations.[278] The status of nuclear devices which are not categorized as weapons per se remained unclear.[279] Under the Tlatelolco Treaty, for example, transport or propulsion devices which are separable from their nuclear weapons are not included.[280] One commentator has argued that the Seabed Arms Control Treaty should "be deemed to have also prohibited the peaceful application of nuclear energy in such areas as seabed transport, or with respect to mining, drilling or blasting on the seabed for purely commercial reasons."[281] On the other hand, some vehicles carrying weapons of mass destruction that can move on the seabed arguably fall outside the Treaty's ban because they are independently mobile and need not be affixed to the ocean floor or its subsoil.[282] Nor did the Seabed Arms Control Treaty specifically address what limitations exist with regard to military activities transpiring immediately off a nation's coastline. Thus, coastal states could conceivably "emplace . . . weapons of mass destruction within their twelve-mile coastal zones"[283] or invite their allies to do so. Finally, most of the agreements contain withdrawal provisions which permit parties to escape their obligations if overrid-

274. *Id.* art. I, para. 1. According to the U.S. position, seabed devices and installations that are not weapons or designed to store, test, or use weapons (especially listening and other warning devices) were not excluded by the Seabed Arms Control Treaty. Treves, *supra* note 24, at 822 & n.86.

275. *See* ABM Limitation Treaty, *supra* 266, arts. I, IX. ABM systems are designed to "counter strategic ballistic missiles or their elements in flight trajectory" and consist of:

> (a) ABM interceptor missiles, which are interceptor missiles constructed and deployed for an ABM . . . mode; (b) ABM launchers, which are launchers constructed and deployed for launching ABM interceptor missiles; and (c) ABM radars, which are radars constructed and deployed for an ABM role, or of a type tested in an ABM mode.

Id. art. II.

276. *Peacetime ASW, supra* note 130, at 595.

277. Dore, *supra* note 1, at 15.

278. *Id.* at 12. For a resolution of this definitional dilemma, see *infra* notes 304-308 and accompanying text.

279. Dore, *supra* note 1, at 14.

280. Tlatelolco Treaty, *supra* note 264, art. 5.

281. Dore, *supra* note 1, at 14.

282. *Id.* at 15.

283. *Id.* at 16.

ing national interests are invoked.[284] Since the scope of this interest remains largely unelucidated, the protection of the marine environment from nuclear degradation and the preservation of the ocean as a zone of peace via these conventions may be more illusory than real.

Until enactment of the LOS Convention, conventional military installations (i.e., nonnuclear) and other types of traditional naval activities on the high seas were governed by the principles which are enunciated in the 1958 High Seas Convention.[285] For example, article 2 of the High Seas Convention has firmly established the premise that:

> The high seas being open to all nations, no State may validly purport to subject any part of them to its sovereignty. Freedom of the high seas is exercised under the conditions laid down by these articles and by the other rules of international law. It comprises, *inter alia*, . . .:
>
> (1) Freedom of navigation;
>
> (2) Freedom of fishing;
>
> (3) Freedom to lay submarine cables and pipelines;
>
> (4) Freedom to fly over the high seas.
>
> These freedoms, and others which are recognized by the general principles of international law, shall be exercised by all States with reasonable regard to the interests of other States in their exercise of the freedom of the high seas.[286]

Among the unspecified freedoms acknowledged under general principles of international law is the right to use the high seas for all reasonable military activities.[287] As previously mentioned, the most commonly enjoyed right permits the free passage of military vessels. Although the High Seas Convention did not explicitly delimit the full extent of permissible military activity,[288] the drafters of the Convention restricted military uses to those within the bounds of reason.[289] Furthermore, the right to emplace installations and other military devices finds legal support under the obligations imposed on coun-

284. *See, e.g.*, Nuclear Test Ban Treaty, *supra* note 262, art. IV; Seabed Arms Control Treaty, *supra* note 25, art. VIII; ABM Limitation Treaty, *supra* note 266, art. XV, para. 2.

285. *Peaceful Purposes*, *supra* note 21, at 9.

286. High Seas Convention, *supra* note 34, art. 2.

287. *Peaceful Purposes*, *supra* note 21, at 21.

288. *Id.* at 12.

289. *Id.* at 16. A suggested balancing test to determine the "reasonableness" of an activity is as follows:

> If the benefits derived from the particular exclusive military use outweigh the inconvenience caused to inclusive areas of the seas, and the utilizing state refrains from either exercising jurisdiction over foreign nationals within the area or preventing them from traversing the area, then the activity comports with article 2 of the Convention.

Id.

tries to respect reasonable uses of the ocean.[290] Therefore, ambitious national security projects such as Captor and SAS would not be proscribed.[291]

The Convention on the Continental Shelf[292] also mandated that countries pay "reasonable regard" to the interests of other ocean users.[293] Consequently, nations wishing to emplace weapons and other military devices on their continental shelf or the seabed of the high seas would be obligated:

a. to provide due notice of any installations which might interfere with the freedoms of the high seas;
b. to maintain a permanent warning system indicating the presence of the installation;
c. to remove abandoned or unused installations and devices; and
d. to avoid congesting any sea lanes, which are essential to international navigation.[294]

Even when considered in combination with the provisions found in all of the multilateral agreements enacted prior to the LOS Convention, these four conditions have exerted only a minimal influence on determining what types of military activities should be perceived as legitimate under international law. Clearly, the "[d]emilitarization and disarmament of the oceans" have not been the resulting legal regime's *raison d'être.*[295]

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290. Treves, *supra* note 24, at 836. Countries "may not interfere with the emplacement or operation of these installations and devices." *Id.* Countries may not impede or hamper their emplacement, and they may not remove or destroy them. Furthermore, countries may not interfere with their functioning, for example, "through the use of magnetic or electronic devices or lasers." *Id.* On the other hand, interested countries may inspect and observe unmanned facilities and equipment as long as the inspection and observation do not interfere with operational functions. *Id.*

291. *Peacetime ASW, supra* note 130, at 661. "[B]ecause ASW activities are by their very nature subsurface, the amount of interference they cause inclusive uses is virtually non-existent." *Id.* at 616.

292. Continental Shelf Convention, *supra* note 38, art. 2.

293. *Id.;* Treves, *supra* note 24, at 835.

294. Continental Shelf Convention, *supra* note 38, art. 5; *see* Treves, *supra* note 24, at 835-36. However, no country would be empowered to construct, operate, or maintain installations of any kind that would interfere with resource exploitation of the continental shelf by the coastal state unless the latter has given its consent. *Id.* A similar analysis subjects the seabed and subsoil of a country's EEZ to the regime of the continental shelf. *Peacetime ASW, supra* note 130, at 650.

> Because the affixation and utilization of acoustic detection arrays and antisubmarine mines constitutes construction, operation, and use of installations and structures that may interfere with the rights of the littoral State in the area, these are subject to advance authorization and regulation. As a result, the coastal State is clearly entitled to enact regulations prohibiting foreign State military installations or structures on the seabed of its EEZ.

Id. at 651.

295. *Peacetime ASW, supra* note 130, at 595. With regard to the international legal framework governing military installations and uses:

> [t]he elusiveness of the subject seems to lie, on the one hand, in a certain reluctance, especially of the major powers, to discuss it explicitly, and, on the

Nevertheless, the legal regime created by the High Seas Convention served as a model for the drafters of the LOS Convention.[296] Assuming eventual international acceptance, the LOS Convention would become the most comprehensive and significant contribution toward developing a global consensus on regulating all uses of ocean space.[297] Unfortunately, specific regulations set forth with regard to military activities and devices were conspicuously lacking;[298] however, tangential provisions of the LOS Convention govern similar uses and structures. For example, article 87 of the completed text provides that:

> 1. The high seas are open to all States, whether coastal or land-locked. Freedom of the high seas is exercised under the conditions laid down by this Convention and by other rules of international law. It comprises, *inter alia*, both for coastal and land-locked States:
>
> (a) freedom of navigation;
>
> (b) freedom of overflight;
>
> (c) freedom to lay submarine cables and pipelines, subject to Part VI;
>
> (d) freedom to construct artificial islands and other installations permitted under international law, subject to Part VI;
>
> (e) freedom of fishing, subject to the conditions laid down in section 2;
>
> (f) freedom of scientific research, subject to Parts VI and XIII.
>
> 2. These freedoms shall be exercised by all States with due regard for the interests of other States in their exercise of the freedom of the high seas, and also with due regard for the rights under this Convention with respect to activities in the Area.[299]

Although the freedom to construct artificial islands and other installations[300] and the freedoms of scientific research were added to the list of enumerated rights, the freedom to utilize the high seas for mil-

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other, in the present inclination of international law to focus mainly on the economic uses of the sea. As a consequence, rules concerning military activities and military objects on the seabed are almost never clearly spelled out. They have to be inferred from the most general principles of the law of the sea, such as the sovereignty of the coastal state over its territorial sea and the freedom of the high seas, and from an assessment of what more detailed rules, usually concerning jurisdictional rights and economic uses, do not say.

Treves, *supra* note 24, at 811.

296. *See Peaceful Purposes, supra* note 21, at 16-17.

297. *Peacetime ASW, supra* note 130, at 595.

298. *See* Treves, *supra* note 24, at 809. Although not explicitly considered, military objects were definitely on the minds of the negotiators at the LOS Convention. *Id.*

299. LOS Convention, *supra* note 26, art. 87, paras. 1-2.

300. However, artificial islands in the EEZ are:

> subject to the coastal state's "exclusive right" both to construct them and to authorize and regulate their construction and operation whatever their purpose. Consequently, artificial islands for military purposes cannot be built or operated against the coastal state's will.

Treves, *supra* note 24, at 840.

itary purposes was not explicitly affirmed.[301] Even so, the reference to "other rules of international law" and the use of the term *"inter alia"* recognize that other freedoms are permitted under rules of international law and were not precluded by the LOS Convention.[302]

Article 88 of the LOS Convention declares that "[t]he high seas shall be reserved for peaceful purposes."[303] "Peaceful purposes" can be interpreted in two ways: (1) that only nonmilitary uses are permitted; or (2) that "peaceful purposes" establishes a nonaggressive standard and prohibits only those military activities that are aggressive.[304] While some commentators have suggested that only nonmilitary uses should be tolerated, this interpretation is implausible. Article 87 not only enumerates freedom of navigation, but also recognizes other freedoms acknowledged under customary international law. Given this context, a broad view of the freedoms of the high seas is suggested, and this interpretation would include traditional military uses, especially the right of navigation for military vessels.[305] Moreover, article 95 of the LOS Convention provides that: "[w]arships on the high seas have complete immunity from the jurisdiction of any State other than the flag State."[306] Clearly, some use of the ocean by military vessels was contemplated by and acceptable to the drafters of article 95.[307] Therefore, the most logical and realistic interpretation of "peaceful purposes" accepts the nonaggressive norm of conduct as defining permissible military activity on the high seas.[308]

Scattered among provisions regarding various areas of the sea and the seabed, the principle of using ocean space exclusively for peaceful purposes has not been confirmed as a general rule.[309] Hence, the geographical scope of whatever use limitations are imposed by the LOS Convention in requiring activities to conform to peaceful purposes is narrow.[310] While the High Seas Convention conditioned the exercise

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301. The language of article 87 of the LOS Convention fails to incorporate "other unstated freedoms recognized by the general principles of international law," in contrast to article 2 of the High Seas Convention. *Peaceful Purposes, supra* note 21, at 17.

302. *Id.*; Zedalis, *Military Installations, Structures, And Devices On The Continental Shelf: A Response*, 75 AM. J. INT'L L. 926, 931 (1981).

303. LOS Convention, *supra* note 26, art. 88.

304. *Peaceful Purposes, supra* note 21, at 18-19.

305. *Peacetime ASW, supra* note 130, at 601.

306. LOS Convention, *supra* note 26, art. 95.

307. Dore, *supra* note 1, at 18.

308. *Id.*; *Peaceful Purposes, supra* note 21, at 19-20; *Peacetime ASW, supra* note 130, at 615. However, article 19 of the LOS Convention enumerates specific activities, which if conducted by a foreign state vessel in the territorial sea of another state, would not be included in the right of innocent passage. For a list of those prohibited activities, see *supra* note 258.

309. Treves, *supra* note 24, at 817.

310. *Id.* The peaceful purposes doctrine:

> applies to the International Seabed Area, the high seas, and, through the ref-

of freedoms to the obligation that they be undertaken with "reasonable regard" for the interests of others, the LOS Convention requires users to give "due consideration" to the interests of other states in their exercise of the freedoms of the high seas.[311] Despite dissimilar terminology, the difference between the two conditions is primarily a semantic one—with the underlying premise of both cautioning ocean users to continue to refrain from conducting aggressive activities,[312] and thereby preserving the standard of "reasonableness" established under the High Seas Convention.[313] Therefore, the deployment of military objects or installations on the international seabed or high seas would be permissible to the extent that such uses do not significantly infringe upon another country's exercise of its maritime freedoms.[314]

V. CONCLUSION

Regulation of offshore installations by the United States must be revised to specifically address newly emerging uses for ocean resources and space. Congress can no longer rely solely upon the patchwork approach of such tangential legislative programs as NEPA to provide the type of administrative supervision necessary to protect and preserve the marine environment. Section 1333 of OCSLA should be revised to cover artificial islands and other structures "utilizing" ocean resources in addition to those facilities engaged in "developing" these resources. Gaps in coastal zone management jurisdiction should be filled. Outside the three-mile territorial sea of the United States, for example, the scope of concurrent state environmental laws, which would not otherwise apply to installations within the three-mile to twelve-mile area, should be extended to encompass the newly recognized twelve-mile territorial sea. Licensing and regulation of the construction and operation of ocean-based

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erence to the provisions on the high seas contained in Article 58, paragraph 2, the economic zone. It does not extend to internal waters. . . . It seems to apply to the continental shelf beyond 200 miles even though this part of the seabed is not included in the economic zone or the Area; because the coastal state's rights over it are related to the conduct of economic activities, for all other purposes the continental shelf beyond 200 miles must be considered a part of the bed of the high seas to which, as we have seen, the principle applies.

Id.

311. LOS Convention, *supra* note 26, art. 87(2).
312. *Peaceful Purposes, supra* note 21, at 20.
313. Dore, *supra* note 1, at 18.
314. *Id.* at 18, 24.

structures should eventually be consolidated within a single federal agency, preferably the NOAA.

The paucity of United States regulatory attention regarding artificial islands and offshore installations has also been reflected in the international legal approach to the problem. Although the LOS Convention represents a substantial expansion over the preconvention legal regime for offshore structures, the LOS Convention contains several ambiguities which should be resolved. For installations situated outside territorial waters, the provisions enumerated in the economic zone appear to provide the most appropriate and comprehensive regulatory scheme. However, uncertainty exists regarding the jurisdictional authority exercised by coastal states over artificial islands, installations, and devices located on the continental shelf seaward of the 200-mile EEZ. Finally, the full extent of the "international standards" exception of article 60, which allows a safety zone potentially greater than 500 meters around an artificial island or structure, should be ascertained. By working through the IMO, a regulatory framework designed to mitigate any conflict between the navigational hazards posed by offshore installations and the use of existing sea lanes should be vigorously pursued.

As long as land and land-based resources amenable to development by mankind continue to diminish, the importance of utilizing the ocean as a home for offshore installations and as a source of economic sustenance will increase. While the technology designed to facilitate this growth continues to draw international and national attention, the problems encountered in controlling the deleterious technological impact on the ocean must receive commensurate consideration. Domestic and international regulatory safeguards must be expanded and frequently reassessed to meet newly emerging challenges to the marine environment.