CONSIDERATIONS AND RECOMMENDATIONS FOR A TEXAS SUPERTANKER PORT

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ABSTRACT

This report presents explicit recommendations regarding location and type of facilities for a proposed supertanker port along the Texas Gulf Coast, including the rationale for the proposed facilities.

Prior to the specific recommendations, the report presents a discussion of the engineering and ecological considerations, and legal and political backgrounds necessary to provide for the logical development of the proposed supertanker port facility. This discussion is based upon an extensive literature review.

Within the engineering considerations section is the rationale concerning specific items of technical consideration, developing in part a description of the potential magnitude of the supertanker port facilities that would need to be provided.

The ecological considerations section describes some of the potential problems associated with the existence of a supertanker port along the Texas Gulf Coast.

An extensive legal discussion is presented establishing the backgrounds of international, U. S., and state statues that may have relevance to a future supertanker port facility to be established off the Coast of Texas. Various political insights, agency involvement, and inter-relationships of political entities are examined.

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INTRODUCTION

The era of the very large bulk commodity vessel is here. The question is no longer when they will exist; rather it is who will predominate in providing facilities to handle them. It is no longer justifiable to delay construction of port facilities capable of handling very large vessels based upon uncertainty as to whether they will actually be constructed and put into operation. The axiom that ship size is dictated by harbor depths and other dimensions no longer applies; rather the corollary of this axiom now holds. Port facilities must be constructed to accomodate the massive sea-going vessels now in operation, as well as those of the future.

The dramatic increase in vessel size, prompted by the economies of large movements of low value bulk commodities such as coal, oil and iron ore, is rapidly rendering many existing ports and harbors obsolete. The economics of large ship transportation have already been proven. Currently, over 50 foreign deepwater port facilities are in operation, under construction, or planned, capable of accommodating 200,000 deadweight ton (DWT) vessels and larger. (58, p. 2,3) The United States is the only major industrial nation with no ports capable of handling vessels of this size. Several experts, including Dr. Henry S. Marcus of M.I.T., (58) have pointed out the serious consequences that will arise if the U. S. does not provide accommodations for these large bulk commodity carriers. Among the detrimental effects of not having U. S. ports capable of accommodating deep draft vessels are: (1) loss of competitiveness in overseas export markets, (2) higher costs of raw material imports, (3) further deterioration of the U. S. Merchant Marine, (4) possible relocation of industries outside the U. S., (5) balance of payments deficits, (6) loss in transportation savings,and (7) increased risks of vessel collisions (58).

Unquestionably, the most immediate need for deepwater ports in the United States is for facilities to accommodate very large tankers for crude oil importation. The United States is rapidly approaching an energy crisis. Seventy-five per cent of the United States' energy demand is currently satisfied by oil and gas. Even in view of the development of alternative energy sources, such as nuclear power, the U. S. demand for crude oil is expected to approximately double from 1970 to 1985. A recent study by Chase Manhatten Bank predicted U. S. oil use in 1985 of 30 million barrels/day. The National Petroleum Council predicts a total U. S. demand of 26 million barrels a day in 1985. This increased demand, coupled with a decrease in proven U.S. petroleum reserves, can only mean additional reliance upon the importation of foreign crude. Total foreign oil imports are predicted to increase from 3.4 million barrels a day in 1970 to 14.8 million barrels a day in 1985 by the National Petroleum Council.

To date, the average size tanker serving the United States is in the 45,000 to 50,000 DWT range. It is impossible to meet the increased demand for foreign crude with this size vessel (58, p. 1). Vessels of 200,000 to 300,000 DWT will be required, thereby creating the necessity for facilities capable of accommodating these vessels. Indicative of this trend to larger size tankers is the fact that 90 per cent of the new tanker capacity by 1975 will consist of tankers in excess of 125,000 deadweight tons (18, p. 2).

As in the case for the United States in general, the immediate need in Texas is for facilities capable of handling deep draft vessels involved in the importation of crude oil. It is recognized that in the future deep water port facilities for dry bulk commodities may also be economically justified. However, due to the wider variations in trade routes, types of commodities and cargo volumes, deepwater dry bulk cargo vessels are not so likely to predominate in the near future as are those with more operational flexibility. Of particular significance is the fact that the industries served by dry bulk cargo vessels are usually situated on harbors for reasons transcending traditional water transportation considerations.

> The relatively high relocational inflexibility prevalent in the dry bulk-consuming and generating industry, and the limited opportunities for the application of specialized and new handling, transshipment and distribution solutions as exist for the oil industry, suggest that such vessels will more or less have to use historic United States harbors, and that an optimum balance between the economics of ship size and traditional harbor improvements is more likely to have to be attained. (1, p. 2-3)

The United States Gulf Coast has the greatest concentration of oil refining and petrochemical processing facilities in the world.

Approximately 70 per cent of the refining capacity in this area is located on the Texas Gulf Coast.

Texas exhibits an economic structure strongly dependent upon the oil refining, oil producing and petrochemical industries. These activities contribute $13 billion annually to the economic progress of the state. Today 85 per cent of the total tonnage handled at Texas ports is crude oil or petroleum products (106, p. 6).

From 1954 to 1968, Texas' oil production decreased from more than 42 per cent of the nation's total to less than 35 per cent of this total (66, p. 43). This can only signal a need for increased imports of oil into Texas if it is to maintain its role of importance in the oil and petrochemical industires. Not to maintain this role would mean economic disaster for the state.

Projections of crude oil imports into Texas vary. The projections used in this report are those of the National Petroleum Council modified by an assumption that 35 per cent of all crude oil imported by the United States will be imported into Texas. This projection is in excess of the relative refining capacity of Texas because a portion of the crude imported into Texas is, and will likely continue to be, passed directly through Texas en route to the Midwest via Capline crude oil pipeline.

This report consists of two main sections. First, a discussion based upon an extensive literature search is presented of the engineering and ecological factors and the legal and political backgrounds to be considered in the selection of a supertanker port facility for Texas. Secondly, specific recommendation as to the location and type of facilities are made. These recommendations are based upon the factors and backgrounds considered in the first section.

CHAPTER I

FACTORS AFFECTING A SUPERTANKER PORT FOR THE STATE OF TEXAS

A. ENGINEERING CONSIDERATIONS

Tanker Size Trends

In 1960 the largest tanker in service was 100,000 deadweight tons (DWT). The current largest is approximately 380,000 DWT with a 500,000 DWT ship now under construction and a 1,000,000 DWT vessel on the drawing boards. In 1971 there were six tankers above 300,000 DWT and about three times that number on order. In 1970 there were 319 ships over 100,000 DWT, a number that should grow to more than 1000 by 1980 (97, p. 280; 58, p.2).

The trend to these larger vessels has been prompted by the economics of tanker transportation, with regards to the length of the major trade routes, the construction and operating costs, the crude oil demand, and transshipment facilities, both onshore and offshore. With a growing emphasis on the import of crude oil to meet the nation's energy demand, and as the Persian Gulf area becomes the world's focal point for crude oil production, this 12,000 mile voyage becomes of major significance to this country's petroleum industry.

A generally accepted principle is that construction costs increase at a slower rate than vessel size and capacity. That is, the unit costs of construction decrease with an increase in vessel size, although they increase at a much slower rate when the ship becomes larger than 250,000 to 300,000 DWT. For instance, the unit cost of constructing a 200,000 DWT vessel is roughly 10 per cent less than for a 100,000 DWT vessel (1, Figure 3).

Another generally accepted principle is that larger ships provide lower freight costs because of the economics of the increased volume of the product. Thus, the operating costs per ton of cargo decrease with an increase in vessel size because there is no drastic increase in the crew size nor in the fuel and maintenance requirements (1, p. 16). The current trend to the mammoth-sized tankers is, therefore, primarily based on the logistics of shipping much larger volumes of crude over longer trade routes.

Considerable debate has arisen over the optimum size vessel, centering not around the vessel capacity per se, but around the capacity of the terminals that receive them. Some contend that the 200,000 DWT vessel will become the most significant, since there are over 50 deep water port facilities, around the world (none in the U. S.), either in operation, planned, or under construction, that will be able to accommodate ships of 200,000 DWT and larger. The major advantage is that a vessel of the size can be directly routed to receiving terminals throughout the world without transshipment requirements.

Another widespread practice is that of using large tankers, up to 300,000 DWT and larger, to ship the crude to a transshipment terminal and then using smaller tankers for delivery. The Gulf Oil

Corporation currently operates six vessels above 300,000 DWT and has built major transshipment ports in Okinawa, Bantry Bay, Ireland, and Point Tupper, Nova Scotia. Their contention is that the large reduction in ocean freight costs justifies the expense of constructing and operating a deep water transshipment terminal and the expense of increased handling costs (1, p. 18).

The majority of this recent generation of tankers are in the 200,000 to 300,000 DWT class, including those already constructed and those on order. They will have an effective useful life of 20 to 30 years and possibly longer, a significant increase over the generation of tankers that preceded them (1, p. 21). This improvement is due to the advance of marine technology in developing better materials and construction techniques. Although there are larger supertankers in use and on order, considering the present receiving facilities and the time required to construct new ones, the 200,000 to 300,000 DWT ship will be the workhorse of the tanker fleet for at least the next decade.

Draft Requirements

Accompanying this drastic increase in tanker size, the corresponding draft has increased from about 48 feet for a fully laden 100,000 DWT ship to approximately 90 feet for a vessel of 500,000 DWT (97, Table 2). The U. S. has only two ports, both on the West Coast, that can service vessels larger than 80,000 DWT. Texas, with depth capabilities at its major ports varying from 30 feet at Orange to 40 feet at Houston, Port Arthur, and Corpus Christi, is currently unable to accommodate any of the larger ships. A 200,000 DWT tanker, fully loaded, will require a draft of 60-62 feet, whereas the Universe Ireland, carrying 312,000 DWT requires a draft of 81 feet. To accommodate these larger ships in the U. S., new ports or offshore transshipment facilities must be constructed and/or existing ones will have to be remodeled.

Today, 85 per cent of the cargo imported to Texas ports is crude oil or petroleum products. The Texas coastal area contains 25 per cent of the nation's refining capacity and 50 per cent of the total petrochemical industry. If Texas and the Gulf Coast are to remain an important influence in the oil refining industry, attention must be directed to expanding their port facilities, now restricted to vessels in the 40,000 to 50,000 DWT range. Since 70 per cent of the Gulf Coast refining capacity is centered in 22 refineries located between Corpus Christi, Texas and Lake Charles, Louisiana, this specific area becomes of vital interest (18, p. 2).

Current and near-future supertankers will require a water depth of approximately 90 to 110 feet, allowing for mean low water level and for an operational margin of approximately 10 feet for clearance purposes. The distance from Texas ports to the 90 foot contour varies increasingly from West to East: approximately 17 miles out from the Corpus Christi barrier islands, 26 miles out from Freeport, 45 miles from Galveston, and 70 miles from Sabine Pass. Considering these offshore distances, channels covering similar distances would have to be dredged in order to provide access to the major ports. Considerable dredging would also be required to provide access to the major ports with turning basins and channels, specifically in Corpus Christi Bay, Galveston Bay, and the Sabine Pass area. A mammoth dredging operation would be required to deepen and widen existing channels and to maintain them at the 90 foot level, an extremely expensive venture.

Dredging depends greatly on the type of material involved, the general range being from $0.40 to $2.50 per cubic yard for silt, while the cost of blasting and removing rock averages from $15 to $20 per cubic yard. Disposing of the spoil, in deep water or otherwise, encounters expensive difficulties as well. Using hopper dredges, the cost of moving one million cubic yards of spoil a distance of one mile is approximately $50,000. And maintaining the present channels in existing ports, such as Philadelphia, involves disposing of over eight million cubic yards per year (21, p. 20-21).

Navigational Considerations

Aside from the tremendous costs of dredging, other hazards are incurred as the supertanker approaches onshore facilities. A vessel in the 200,000 to 300,000 DWT class presents a new dimension to the problem of ship maneuverability, especially in confined areas. For example, a 200,000 DWT tanker requires over 20 minutes and a distance of two and a half miles to come to an unassisted "crash stop." (58, p. 13) Thus, considering the possible consequences of a collision or grounding, the use of supertankers in existing ports and channels would be extremely hazardous.

The increase in ship movements, especially tankers, has caused congestion around many harbors, thereby posing a constant threat of collisions and grounds. In fact, there have been over 500 tanker collisions in the world in the last ten years, 80 per cent of which occurred while vessels were either entering or leaving the harbor (58, p. 12). According to a study of 38 major oil spills around the world during the period from 1956 to 1969, 88 per cent of the total volume spilled was the result of collision, grounding, or sinking of tankers (41, p. 2-5-14). The collisions were primarily caused by smaller ships striking the tankers, often while the tanker was moving at a speed of less than one knot or either dead still in the water. Adding to this problem is the absence of federal regulation over marine traffic control. Thus, the potential disaster to the environment and the potential loss of human life become increasingly significant as the traffic in the world's ports increases.

Onshore Facility Requirements

An alternative to modifying existing onshore ports is the construction of offshore facilities, located in deep water, to which the supertanker can moor and unload its cargo. The offshore site may be, in reality, an extension of an onshore facility. The primary functions of the onshore facility would be storage, administration for the onshore and offshore complexes, and access to the existing pipeline distribution network. The onshore site should be chosen with regard to proximity to this network with special consideration to local environmental conditions. Land requirements will depend upon the design capacity of the tank farm and the possibility for future expansion. For example, the Delaware Bay Transportation Company purchased 1800 acres of land for onshore storage for their proposed offshore terminal at Big Stone Beach, Delaware (27, p. 1). This facility was to accommodate import volumes forecasted to be 900,000 barrels per day in 1975, growing to 2,000,000 barrels per day by 1985. The site was designed for a storage capacity of 21 million barrels, serving Philadelphia area refineries (27, p. 8).

Considering the massive amount of crude oil that a supertanker port will introduce, additional onshore pipelines will need to be constructed, but the existing pipeline transportation companies will have the advantage of previously purchased rights-of-way in many areas. Pumping stations with greater capacities will be required as well as larger pipelines. Some estimates indicate that the existing pipeline capacity of 50,000,000 tons per year along the Texas-Louisiana coast will need to be doubled in the next ten years (106, p. 7).

The onshore facility may have to serve the offshore facility in many other ways. It could provide a communication and transportation link for servicing and maintenance. It may also be required to provide fresh water for the offshore site, as well as waste and ballast treatment. Fire fighting equipment must be readily available and special attention must be given to the environmental impact of such a facility.

Offshore Terminals

While the primary function of the onshore facilities may be storage and distribution of crude oil to refineries, and provision of support facilities for an offshore facility, the main function of the offshore terminal will be the offloading of the crude from moored supertankers into pipelines leading to storage facilities, either off-shore or on-shore. Two major aspects which must be considered in the choice and design of an offshore terminal include: (1) forces transmitted to both the ship and terminal due to environmental conditions and (2) forces due to docking maneuvers.

The principal natural forces considered are drag from sea currents, wind, and wave action. Some (24, p. II-301) maintain that current is more critical and important than swells or wind when applied to large ships, while others (41, p. 4) contend that wave heights are the main consideration.

The docking maneuvers which can cause tremendous stress in the facilities, especially the breasting and mooring dolphins, include berthing the ship and restraining the ship in its berth. The huge mass of a fully loaded supertanker, even at very low speeds may cause stresses of upwards of 2,000 tons on flexible mooring dolphins (24, p. II-300). Once moored, stresses of 600 tons may be engendered by 11 foot waves (24, p. II-300). In order to counteract these forces, the design of fixed berth facilities usually includes mooring and breasting dolphins which are spaced at optimum distance and designed to distribute the stresses at both the dock itself and also along the hull of the ship.

Before considering some of the general types of offshore terminal in naturally occurring deep water may be more desireable, since the cost of submarine pipeline construction is usually less than the cost of dredging to the required depths.

Ecologically speaking, the results from an oil spill out at sea would be much less disastrous than one closer to shore. It has been found that tidal currents at bay entrances may spread an oil spill 9 miles in 3 hours, but 20 miles offshore, the same spill travels only 1 mile in 3 hours, allowing more time for containment and cleanup (41, p. 15).

An offshore facility would help tremendously in alleviating the congestion which a supertanker port close to shore could generate. The Dover Strait, which provides access to deep-water ports of France, Belgium and Holland is only 20 miles wide, narrowed by shoals, beset by the meeting of flood tides and plagued with frequent dense fogs. This area of water has been reported to handle as many as 1000 ship movements per day in addition to ferry crossings across the main channel (24, p. II-298). A collision involving a supertanker in this type of situation would seem very probable.

There are several types of facilities which may fulfill the above design requirements in varying degrees. The major types are briefly described below. It is not the intent, at this time to evaluate each terminal type, but rather to present them for consideration and to provide alternatives from which to make a recommendation later in this report.

Single Buoy Mooring System (Figure 1, Ref. 87, p. 32)

The single buoy mooring system, sometimes termed "monobuoy," consists essentially of a single point mooring, pipeline connections for off-loading and on-loading crude oil, and navigation devices. For special cases, the buoy may be equipped with a helicopter pad, and, where the offloading lines are fitted with float-sink buoys, with air compressors.

A cylindrical steel hull serves as the platform for the rotating pipe manifold assembly located in the center, and is usually surrounded by submerged fenders or skirts. The purpose of the fenders is to prevent damage to the buoy should the moored ship "ride up" on it during offloading operations.

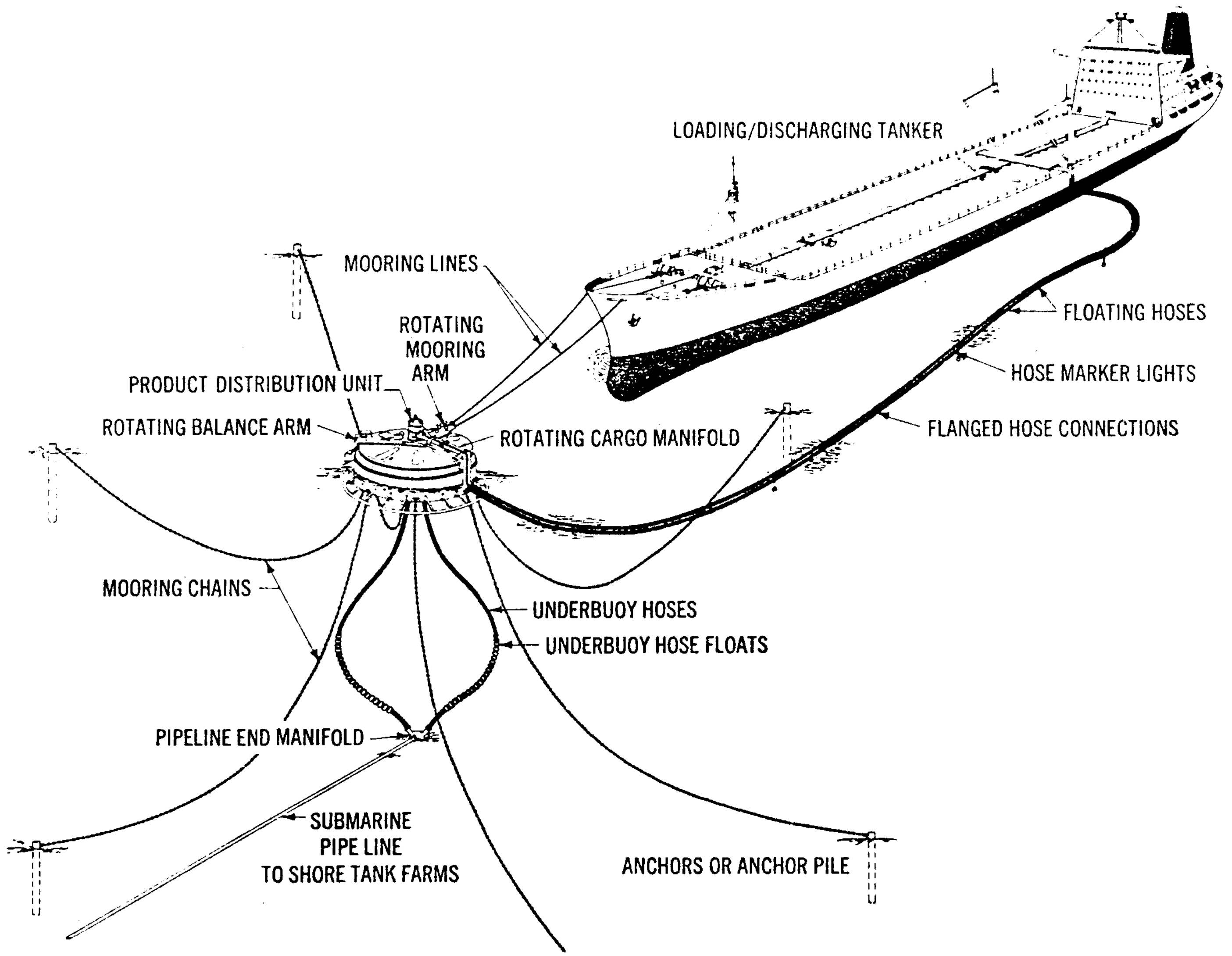


FIGURE 1

Single Buoy Mooring System
(87, p. 32)

The hoses to which the approaching vessel will connect may be floating on the surface of the sea, or may lie on the ocean floor between operations. In the case of the former, small launches or helicopters are dispatched to secure the lines to a boom from the ship which brings them aboard for the final connection. The lines fitted with float-sink buoys differ only in that they rest on the ocean floor when not in use and are brought to the surface through activation of the compressor on the single buoy mooring.

The primary advantage of this type facility is that the ship orients itself according to wave, wind, and current direction. The ship is secured only by a bow line and is then free to follow the path of least resistance. Also there are no stresses imposed on the hull of the ship due to fixed breasting facilities.

A disadvantage concerns the necessity of using small launches or boats to secure the floating lines. The tanker itself may load and unload in weather more severe than that which the launches may tolerate.

Offshore Berths with Multiple Orientation (Figure 2, Ref. 91, p. I-428)

The basic principle involved in the multiple oriented berth facility is that the ship may be oriented in the most advantageous position for the existing sea and weather conditions. The ship is docked in the breasted position and is moored in such a manner that offloading is accomplished as efficiently as possible. The ship is

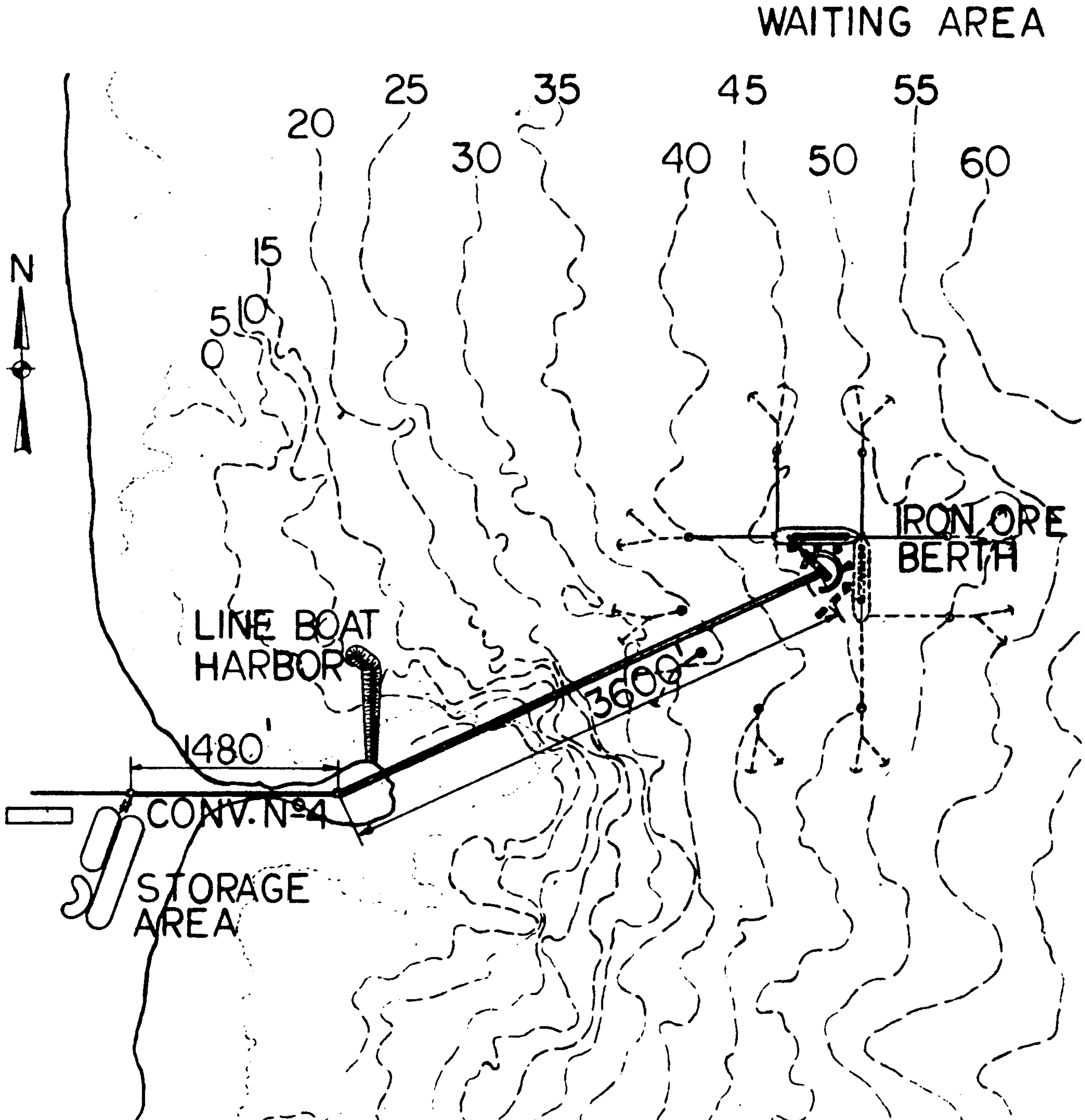


FIGURE 2

Offshore Berth with Multiple Orientation
(91, p. I-428)

moored with lines attached to the fixed dock and also with lines attached to several spread moorings on the sea-side of the ship. It may be pointed out that this type of dock is a variation of the "sea island" which is also a structure fixed off shore, but which does not have the "multiple orientation" capability. The supertanker port at Bantry Bay, Ireland is an example of a sea island.

Two limiting factors which must be considered for these docks are the stresses imposed during berthing and while docked, and limitations of weather.

Semi-Submerged Stable Platform (Figure 3, Ref. 50, p. I-73)

This docking facility basically consists of three submerged trimaran displacement cylinders connected to a deck structure. The cylinders are essentially ballast tanks which allow the dock either to maintain constant draft or adapt its draft to that of the tanker. Its advantages include high transportability and platform heave of less than 2 feet with wave heights of 15 feet. The large underwater volume of the facility provides it with this great stability. Since it is moored at only four corners, it is also capable of being detached from its moorings and moved to another site as demand dictates.

Again, the major problem is docking under severe weather conditions. Once docked, however, large wave heights, as mentioned above can be withstood during offloading.

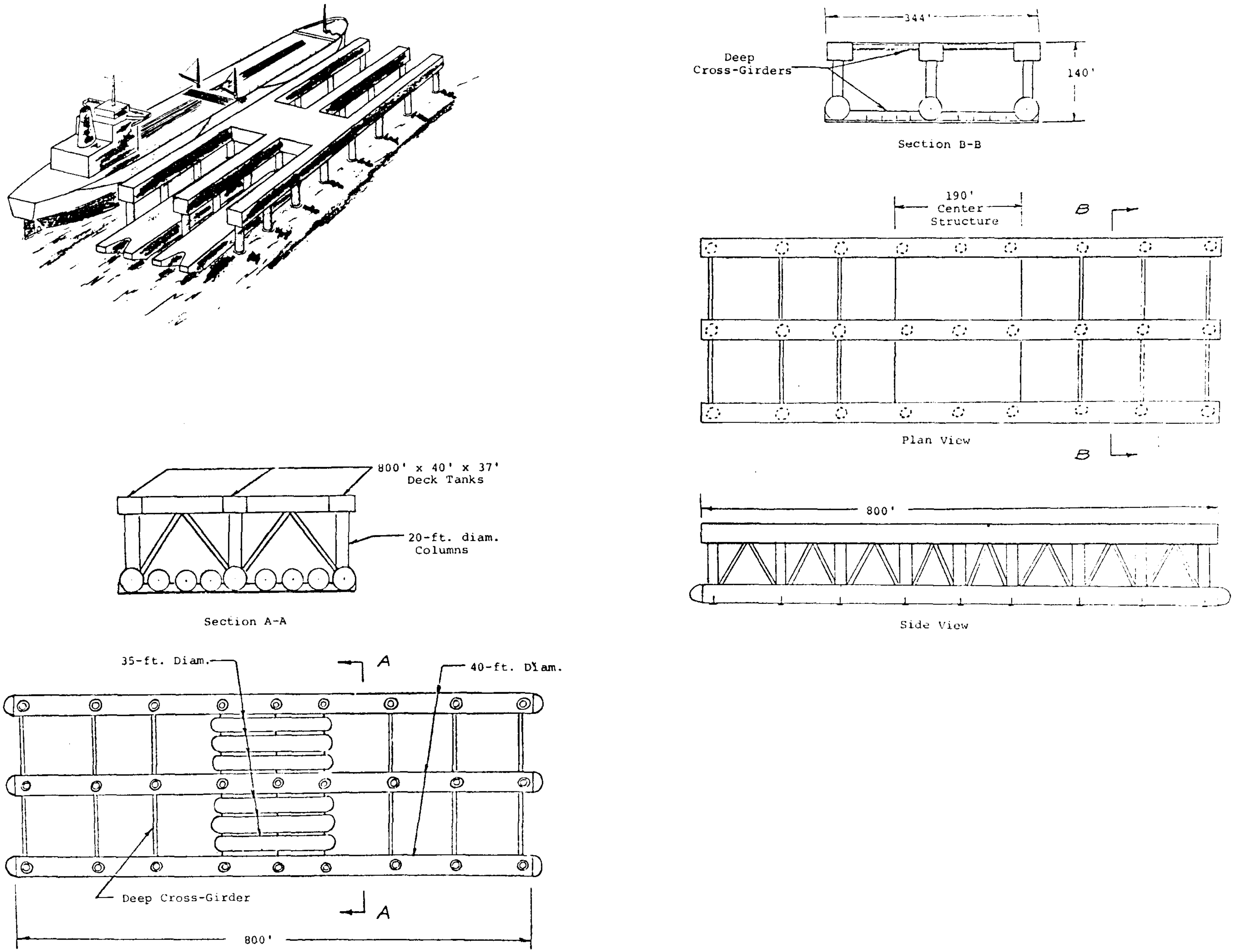


FIGURE 3

Semi-Submerged Stable Platform
(50, p. I-73)

Rotating Mooring (Figure 4, Ref. 84, p. 93)

A mooring of this type consists of a longitudinal platform which rotates 360 degrees around a "pin" located at one end. The "pin" is actually a cylinder or set of piles secured to the sea-bed, that contains a bearing system which allows the dock freedom of movement. The facility accommodates two tankers at a time, moored in a breasted position, and contains storage tanks beneath its deck. During crude oil offloading operations, both the ships and the dock orient themselves to the existing wind, wave, and current conditions.

Artificial Island (Figure 5, Ref. 79, Cover)

This is perhaps the ultimate in an offshore facility for supertanker operations. Depending upon the size of the port desired, the artificial island may be configured for many, e.g., 10, offloading operations at the same time. It may also contain complete facilities for environmental protection, fire protection and administration of the superport. Some of the docks mentioned above could conceivably be a part of a large artificial island. Offshore storage is another requirement which can be constructed as part of this facility. Finally, a breakwater constructed around the island will permit docking and offloading in very severe weather.

A consideration of the major design aspects has been presented above, as well as a general description of some of the types of offshore mooring facilities which have been designed, conceived or

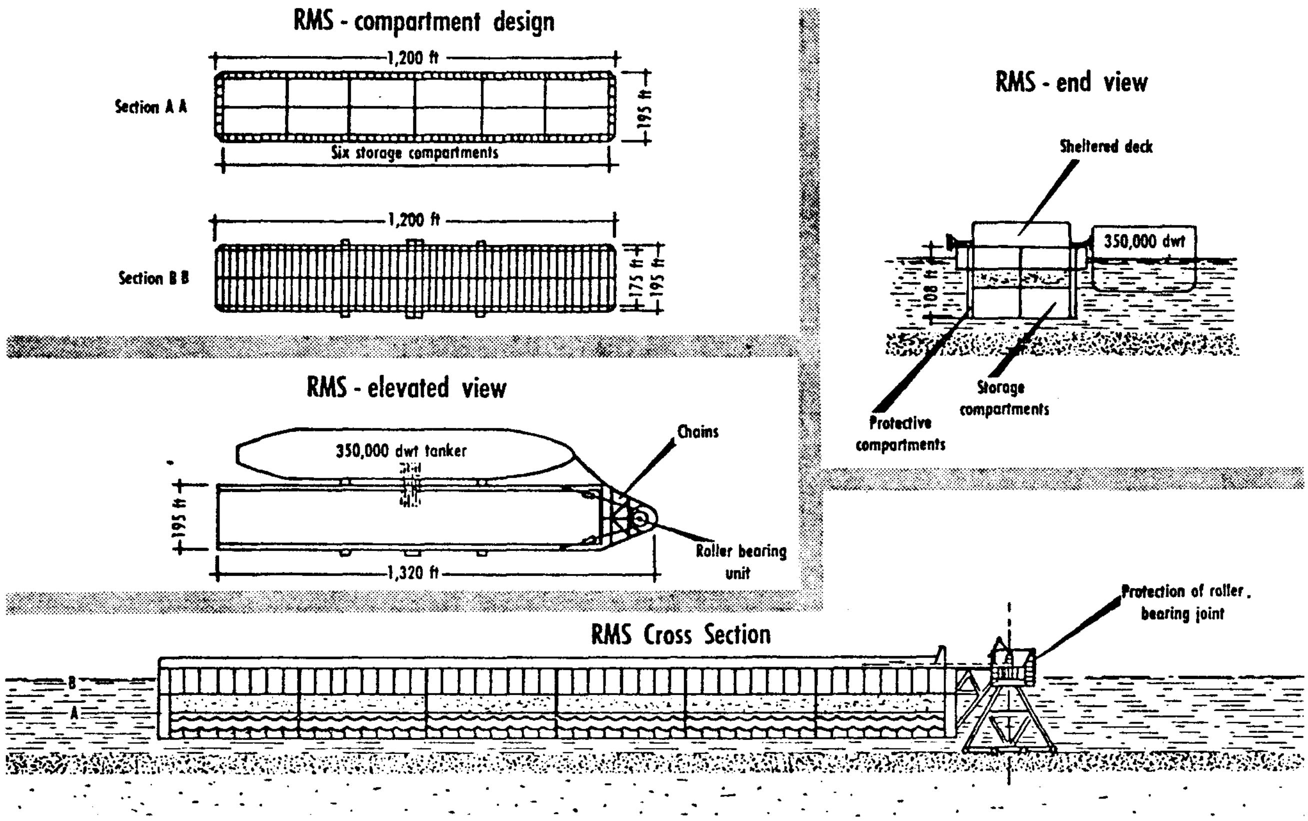


FIGURE 4

Rotating Mooring
(84; p. 93)

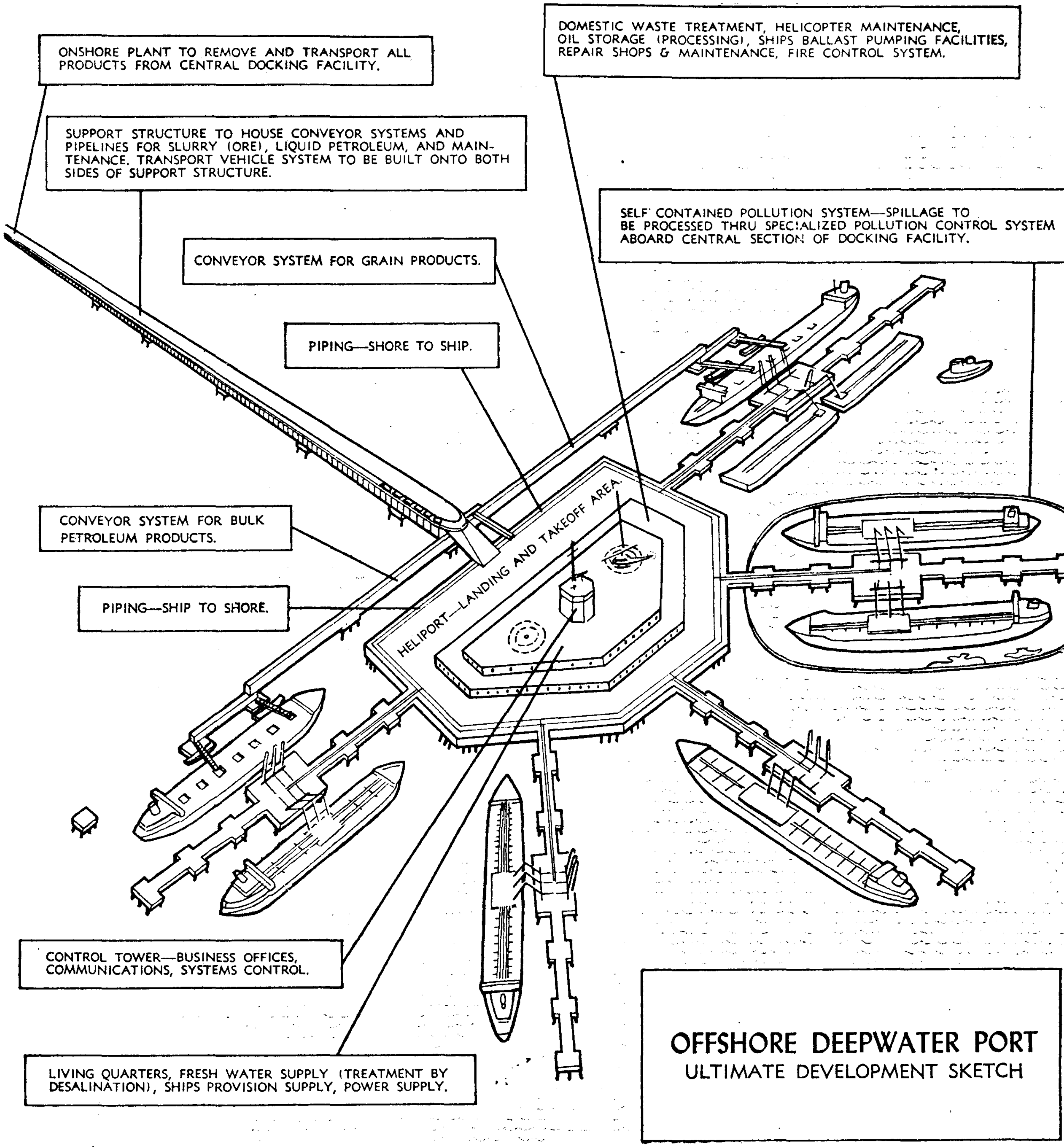


FIGURE 5

Artificial Island
(79, p. 1)

actually built. Later in this report these considerations will be analyzed in detail in order to arrive at an optimum facility to serve the crude oil needs off the coast of Texas.

Weather Features

The Gulf Coast area is very prone to hurricanes and tropical storms. Storm occurrences are irregular in nature, and their probabilities must be obtained by a random process based on historic storm occurrence data. The hurricane recurrence interval for the total Texas coast is 1.78 years (18, p. 187). Some recent studies have been done in an attempt to minimize losses due to hurricanes by using a computer-based system to predict their environmental effects.

Billions of dollars of industrial and community properties are exposed to possible damage or loss with the approach of every hurricane. Daily losses due to operational shutdowns may be as large as $500,000 for major offshore operators (5, p. 222). Also, new federal regulations for offshore oil and gas production make losses resulting from unnecessary shutdowns nonrecoverable. Thus, there is an increasingly large emphasis on the need for accurate hurricane risk predictions for offshore as well as onshore facilities.

Although offshore mooring systems are easily accessible, visibility is poor, especially in bad weather. Berthing the ship and loading/unloading the crude become hazardous operations in heavy seas. It is desirable that berth availability be 90-95 per cent, otherwise, the occupancy level decreases and costly ship delays result. Supertankers are not as affected by waves as smaller vessels (41, p. 2-6-4), however, wave conditions and the general sea state are important design considerations. Fortunately, the Texas coast, despite the hurricane threat, is not as active as some other areas, as for example, the North Atlantic. The average wave height off the Texas Gulf Coast is in the range of five to six feet, while during a hurricane the wave height may reach 25 to 30 feet. Although crude oil has been loaded from single point mooring devices in seas up to 20 feet in some areas, a maximum wave height of 10 to 15 feet is considered the limit for most operations (41, p. 2-6-7).

Considering the maneuverability problems inherent in supertanker operation, an offshore facility should be easily accessible with adequate water depth for turning basins and approaches. Ideally, the facility should be located near, but not interfering with, the existing safety fairways (sea lanes). Because of the larger turning basins and stopping distances required, the terminal should be located over an area of one mile radius for maneuvering with water depths of 90 to 110 feet for safe operation. It is very probable that one or two tugs will be needed to assist in berthing the vessel.

It is possible that separate shipping lanes will need to be established for the supertankers after they cross the continental shelf. With a more direct route to the offshore site there would be less congestion on the existing lanes and less probability of an accident. About 21 per cent of tanker collisions occur on the high seas (41, p. 2-6-14), indicating the need for adequate safety fairways. To provide for safer maneuverability in and around the terminal area, separate sea lanes for ingress and egress for supertankers along may be necessitated.

<u>Oil Spill Protection</u>

The offshore terminal, located in open sea, is more susceptible to oil spills under heavy sea conditions. Also, a spill would disperse over a larger area and would be more difficult to contain under heavy sea and high wind conditions. However, the dispersing of oil is an advantage when considering its effect on the coast. An oil spill close to the shore would be easier to contain in most cases, but the environmental impact of the concentrated oil makes this type of spill more dangerous.

Since the grounding of the Torrey Canyon in 1967 resulted in the spilling of 18 million gallons of oil over the English and French coasts, growing attention has been focused on the potential pollution of the world's oceans and coasts due to oil spillage. Although supertankers have a fairly good safety record and are probably less prone to accidents than smaller tankers due to their modern technology (41, p. 2-6-14), the potential consequences of a serious mishap are catastrophic. This possibility will probably be the greatest single obstacle to the development of marine offshore facilities, as well evidenced by the Delaware Bay supertanker port controversy.

In a strongly emotional conservationist movement, state legislation was passed prohibiting heavy industry and offshore transfer terminals from specific areas of Delaware's coast. Thus, the proposed construction of a major refinery complex and two offshore terminals was stopped (58, p. 20). In the design criteria of the Delaware Bay Development, the oil spill question was thoroughly considered. In fact, ten per cent of the cost of the development of the offshore terminal was planned for pollution control. Deep water curtains were designed to encircle the vessels during loading and unloading. Provision was also made for strict traffic control. Oil spill collection equipment was demonstrated to be operationally successful within a breakwater. A tug was to have been provided to furnish fire fighting capability and deploy oil spill containment booms if required. Subsea pipelines were to be buried to protect them from ship anchors and undersea turbulence. Also, special storage tanks of non-corrosive materials were to be designed that could resist cracking when subjected to differential settlement or earth tremors. Although these precautions were proposed, the Delaware Bay project was stopped because of the pollution threat, signifying the importance of the environmental question (4, p. 7).

Therefore, the design considerations for an offshore terminal must provide the best possible features of spill protection. There are over 100 offshore docking terminals around the world at the present time, and the operational experience from these should be an advantage in designing a facility for the Texas Gulf Coast that would produce an acceptable minimum of spill potential. Special consideration must be given to containment as well as prevention of oil spills. One possibility is that some type of barrier or oil curtain be employed around the loading/unloading area to effectively contain any spillage that might occur.

Pipelines and Storage

A major factor involved in the location and design of a supertanker terminal is the requirement for transferring the crude oil from the supertanker to shore-based refineries, including the method of conveyance and the amount of storage.

One alternative for the conveyance of crude oil to tank farms is transshipment from the large tanker to smaller vessels. This method however, appears undesireable from several standpoints:

1. The chances of an oil spill due to a collision are increased due to the increase in density of ships, both at the offshore supertanker port and at the onshore offloading facility.
2. Some type of offshore storage may be required, resulting in increased costs in maintenance and construction.

3. The daily input to the refineries and storage areas would not be as high as direct shipment by pipelines, considering a reasonable number of transshipment vessels.

Another means of transporting crude is the submarine pipeline. The obvious advantage of utilizing pipelines is the direct shipment of crude from the supertanker to onshore facilities, resulting in an efficient fulfillment of the crude demand. The pipeline could be routed either directly to one of several major junctions along the Texas Coast where the oil could be distributed to existing storage and refineries, or it could be routed to a new shore-based tank farm constructed expressly for handling crude from the supertanker port. The oil could then be apportioned to the refineries along the Texas Coast as the demand at each refinery dictated.

An analysis of the demand projected for 1985 for imported crude oil gives an indication as to the probable size and number of pipelines and storage tanks which will be required. It has been stated, for example (106, p. 7) that the current pipeline capacity of 50,000,000 tons per year in the corridor between Texas and Louisiana will have to be doubled in the next ten years ... an increase which would require a new 48-inch diameter line along the Texas-Louisiana boundary. More specifically, the National Petroleum Council (52, p. 1) has projected net oil imports of 5.3 billion barrels per year by 1985, an increase of 3.6 billion over the import figure for 1970. Assuming that the Texas Coastal Zone will maintain its current throughput of approximately 35 per cent of the crude imported into the United States, this would mean that the import quota for this area would be 1.26 billion barrels higher than the current quantity, or approximately 3,450,000 barrels higher per day. If the guide of 5 per cent of the deadweight tonnage of the tanker is used for the hourly off-loading rate (97, p. II-285), a 250,000 DWT supertanker would require equipment which could handle approximately 80,000 barrels per hour. A typical capacity which a single mooring buoy can accommodate is 50,000 barrels per hour through double 20 inch diameter lines (73, p. 77).

In addition to the increase in size and number of pipelines, additional storage will be required to meet the 1985 demand. One study of the Delaware Bay area (27, p. 10) calls for an ultimate storage capacity of 21 million barrels with approximately 4 million barrels per day input. It is thus contemplated that considerations will have to be given to acquiring land on the Texas Coast which will be used to locate the additional storage facilities required.

The pipelines constructed from the tank farm to coastal refineries should be constructed along existing rights-of-way. Current pipeline flow should be augmented initially, with new line construction proceeding as the demand increases during the period from the present through 1985.

B. ECOLOGICAL CONSIDERATIONS

The possible future ecological implications regarding the development of a supertanker facility along the Texas Gulf Coast is a topic of heated discussion in Texas today. Many special interest groups attempt in an unabashed manner to present "selected scientific" data to support their own proposals. They may try to negate and dismiss the collected presentations of other special interest groups that are presenting comparable but conflicting data.

Unfortunately those who are really knowledgable on the specific ecology of different coastal regions will probably play a rather small part in the decision of "where to put it." The marine biologists, oceanographers, aquatic scientists, and limnologists will undoubtedly prepare scientific papers concerning the effects of oil spills on specific aquatic plants and animals, but in reality the ultimate decision lies in the hands of the special interest groups motivated not necessarily by the resultant effect on the environment, but motivated by the most economical solution to the oil acquisition problem. If the special interest groups can still make a profit by bringing in crude petroleum while incurring spills and meeting liability suits, then they will continue to do so until the financial gradient becomes low enough to require them to provide for better and more competent anti-spill or pollution containment and elimination equipment to reduce liability suit payments.

The above statements have been described by some as too harsh of the special interest groups. Supposedly, the oil industry has provided great leadership in the reduction of industrial contamination of lands, estuaries, rivers, and open seas. They have on their staffs trained scientists and engineers trying to make their products more ameanable to natures life systems. However, when consideration is given to a 300,000 DWT vessel discharging crude oil at a rate of approximately 100,000 to 150,000 gallons per minute for 18 hours in an estuarine or marine area (81, Exhibit D-p. 2), more than usual or adequate safe guard spill prevention devices to maintain the estuarine/marine/coastal ecological system will have to be provided.

The principle endangering properties of crude oil spillage into a marine environment is its toxicity in high concentrations to many types of aquatic organisms. The ease at which it can be transported by the wind and currents to areas of high biological productivity (estuarine areas) is also a critical endangering property. The "light" crude oils having an SSU viscosity of less than 100 contain higher concentrations of fast acting toxidants and although it spreads quickly on the sea surface, it will also evaporate quickly (41, p. 2-6-11). The "heavy" oils, principally those of the Arabian Gulf, Lybia and Venezuela, contain many carcinogenic hydrocarbons that stay in the environment for long periods in the sediments because of ready mixing of the oils with the seawater and eventual settling of oil droplets into the sediments (41, p. 2-6-11). It is anticipated that the principle sources of petroleum crudes brought to the proposed Texas Supertanker facility will be coming from the "heavy" crude producing areas of the world, i.e., the Arabian Gulf, Lybia and Venezuela. This indicates a potential problem with the containment of "heavy" crude oil spills due to their rather good seawater mixing characteristics. It again points up the need for the facility and shipping lanes to be away from principle estuary/bay areas and commercial fishing grounds due to the high probability of pollutant concentration by organisms in the ecological food chain with the ultimate recipient of the concentration mechanism being the fish or shell fish connoisseur. A description of important ecological problems associated with Aquatic Crude Oil Spills is found in Table 1 (46, p. 10).

No statistician, federal, state, or private enterprise oriented, will present a 100 per cent probability of a no-system failure or tanker crude storage rupture occurring. Because of the problems involved with a potential spill of this magnitude, most earth scientists would agree on positioning or isolating the supertanker facility where it would do the most for the economy through industrial accessibility and at the same time provide for an absolute maximum of environmental protection through various control mechanisms such as:

1. Removal of the facility from established estuarine nursing grounds,

TABLE 1 - ECOLOGICAL PROBLEMS ASSOCIATED WITH AQUATIC OIL SPILLS

PROBLEM	RESULT OF DISRUPTION	REFERENCES
Toxicity of aromatics and phenolic oil fractions	1) Immediate non-specific mortality 2) Selective mortality of larval or juvenile organisms	Blumer, Souza, and Sass (1970) ; Mitchell, Anderson, Jones, and North (1970)
Emulsified oil toxicity	1) Increased overall spill mortality 2) Increased incorporation of oil into sediments for later release 3) Greatest impact on filter-feeding molluscs and intertidal fauna	Bellamy, Clarke, John, Whittick, and Darke (1967) ; Blumer, Souza, and Sass (1970)
Retention and biomagnification of toxic components	1) Taints commercially valuable shellfish and fishes 2) Potential decrease in future spawning success	Blumer, Souza, and Sass (1970) ; Blumer, Mullin, and Guillard (1970)
Changes in species diversity and composition	1) Replacement of typical unpolluted fauna by less desirable species 2) Decline in local fisheries	Dean and Haskin (1964); McCauley (1966)
Depopulation of benthos by oil in the sediments	1) Loss of sediment renewal by burrowing organisms 2) Loss of important food web components for shrimp and fish	Blumer, Souza, and Sass (1970) ; Rutzler and Sterrer (1970)
Decimation of key food web species	1) Loss of favored food organisms for commercial fish and invertebrates 2) General food web disruption	Santa Barbara Spill Report (1971); Wohlschlag and Copeland (1970)
Deposition of oily sediments and sludge	1) Smothering of sessile organisms 2) Increased mortality to benthos 3) Hinders repopulation through continuous release of unchanged oil 4) Loss of attached substrate for oyster spat and fouling organisms	Blumer, Souza, and Sass (1970) ; McCauley (1966); Rutzler and Sterrer (1970)
Destruction of aquatic vegetation by oil coating	1) Reduced system organic production 2) Loss of diverse epifauna as important "nursery" food resource 3) Loss of favored habitat for post-larval shrimp and juvenile crabs 4) Increased shoreline erosion	Mock (1966); Rutzler and Sterrer (1970)
Forced emigration of indigenous non-migratory species	1) Disruption of spawning in estuarine-breeding fishes 2) Displacement of local fisheries	National Estuarine Pollution Study (1970)
Blockage of normal migration routes	1) Spawning disruption in anadromous and catadromous fishes 2) Creation of atypical distribution patterns for organisms 3) Reduced survivorship of larval forms diverted away from optimum habitats	National Estuarine Pollution Study (1970)

2. Provision of containment barrier devices in the case of a spill,

3. Maintenance of oil pollution equipment and personnel in a readiness state to combat and control accidental spills, and

4. Establishment of strict navigational and operational regulations for use of the facility.

Since nearly 80 per cent of all commercially important marine organisms (shrimp, crabs, and menhaden) utilize the estuary regions along the Texas Gulf Coast at some stage of their normal growth cycle (46, p. 2), it is extremely important economically, legally, aesthetically, and politically that disruption of these major estuarine ecological regimes occur as seldom as possible.

Galveston Bay is an educational example of man's encroachment on a coastal estuary and the results are significant. There has been a gradual decrease in the biological productivity in Galveston Bay, a region of vast economic, recreational and social value to Texas, because of the following man inaugurated activities:

1. The initial dredging and subsequent redredging of the ship channel,

2. The damming of the major fresh water inflow to the estuary by the construction of Lake Livingston on the Trinity river with a resultant net increase in the salinity of the estuarine community,

3. The biological disinfection and at times sterilization of some parts of the Galveston Bay estuarine area through industrial wastewater introduction and chemical toxification,

4. The production of fredging spoils areas and subsequent covering of commercially active shellfish reefs with resultant increases in turbidity, reduction in light penetration and decrease in algal growth potentials,

5. The changing of the hydrodynamics of the estuary/bay area by deposition of dredging spoils with resultant increases in saline concentration and organism migration to more favorable environments, and

6. The general removal and filling in of large tracts of shoreside marsh and nursing grounds by land developers resulting in less access for developing species to protection location from natural predators.

Many of the existing port authorities apparently want to continue this pattern of "ecological surgery" of their bays and associated estuaries with seemingly little regard for possible widespread destruction of an estuary tidal area resulting from just one sizeable supertanker spill. Indeed, these ecological considerations of damage to primary estuarine/bay areas appear to have been overlooked and possibly disregarded in the apparent competition between the various port and navigational authorities for the acquisition of the supertanker facility in their neighborhoods.

Since most of the principle shellfish production areas are in the protected estuary or bay areas and most of the actual commercial nursery grounds lie near the existing principle estuary/bay areas of Galveston/Sabine Bays and Corpus Christi/Matagorda Bays, it would seem necessary as an initial step to prohibit supertanker operations in these areas due to the high probability of large aquatic organism devastations in the case of a large scale crude oil spill. However, the above two areas also constitute those regions along the Texas Gulf Coast where the principle industrialization, communication, pipeline, transportation and crude processing facilities are currently located. The facilities represent billions of dollars of fixed capital and operational assets. Therefore, wherever the facility is located, it is a near certain fact that the crude will be brought to the processing areas rather than the relocation of these processing areas to the crude supply. As a result it will become necessary to develop a site(s) where upon the people of the State of Texas can still enjoy the economics of marine harvesting and at the same time maintain strength and provide for expansion in the petrochemical/oil industry.

C. LEGAL BACKGROUND

The legal considerations involved in designing, constructing and operating an offshore port facility are exceedingly complex: particularly if the facility is to be located on the traditional "high seas." Nearly all the legal problems in connection with such a facility are, in one way or another, jurisdictional in nature. Perhaps the two most important among the many complex, often overlapping, and often conflicting questions needing consideration are:

1. Who will have jurisdiction for construction, maintenance and operation of the port facility? (This question is really in a grey zone between the political and legal realms.)
2. Who will be liable, and underwhat limits, for spills and other detrimental environmental effects of the facility?

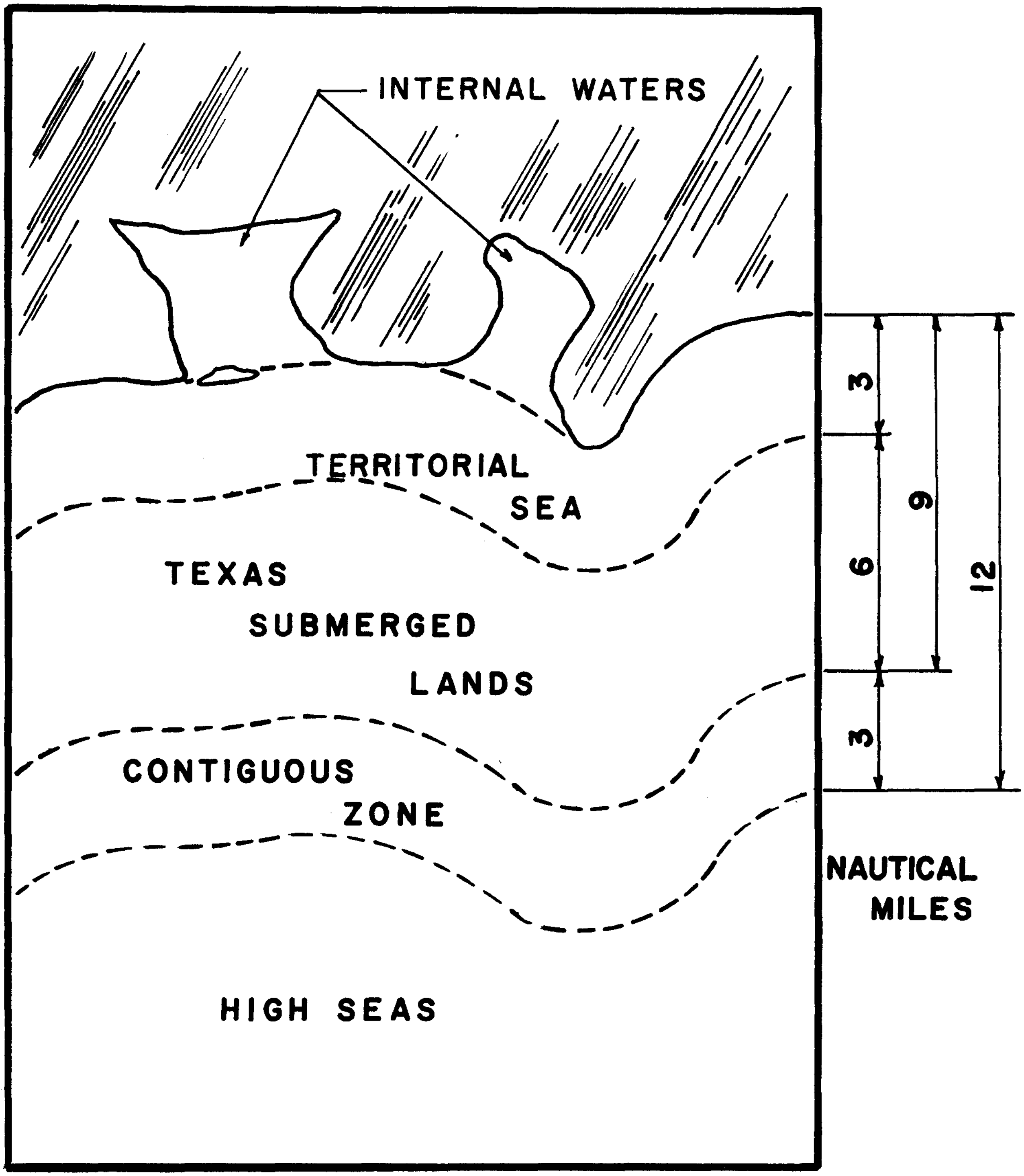
Prerequisite to an understanding of the legal problems inherent in an offshore port facility is an understanding of the various offshore zones of jurisdiction.

ZONES OF JURISDICTION

Traditionally, zones of authority have been concerned primarily with only two dimensions, i.e., surface zones. Basically, there are five different surface zones off Texas as illustrated by Figure 6.

Internal Waters

Internal waters refer to those waters recognized to be entirely within the boundaries of a nation and are completely under that nation's



SURFACE ZONES OF JURISDICTION

FIGURE 6

control. A bay or indentation in the coastline is legally considered to be internal waters "if it occupies a sufficiently deep indentation into a nation's coastline and presents a sufficiently narrow mouth to the open sea (53, p. 53). Internal waters are, in regard to the extent of governmental authority exercised over them, identical to the land territory of a nation: subject to complete sovereignty. Ships of other nations could enter them only with the permission of, and under the conditions of, the nation under whose sovereignty the water lies.

Our federal system adds some complexities to internal waters. Generally, however, the internal waters of a state are national internal waters surrounded by a particular state (for instance, Corpus Christi and Galveston Bays in Texas). Complexities arise when the water is adjacent to two or more states (such as Lake Tahoe, between California and Nevada).

Any onshore superport for the State of Texas would almost certainly be located in or adjacent to internal waters of both Texas and the United States.

Territorial Seas

The territorial sea is a belt of ocean bordering a nation's coastline whose width varies according to the claims of various coastal nations. The United States territorial sea extends three nautical miles from shore.

The only real difference between internal waters and territorial sea is that ships of other nations have the right of "innocent passage" through territorial seas. This basically means that a ship of any nation may pass, in a non-hostile manner and for a non-hostile purpose, through the territorial sea of another nation without having to ask permission. The ship must, however, meet certain conditions of passage.

Except for this right of innocent passage, a nation's territorial sea is just like internal waters, the water and everything in, on, above, or beneath it is subject to the nation's complete sovereignty.

Though there is no established agreement among nations on what the width of territorial seas should be, there is a trend toward widened territorial seas of 12 miles. At this time, however, the United States claims only three miles.

Some coastal nations have resorted to unilateral declarations of extensions of their "control" or "sovereignty" or "territorial sea," far enough out to bring particular fisheries under their wing and to keep others from exploiting these fisheries. This situation is most acute in Latin America where at least nine states have announced extension of their control to a distance of two hundred miles, and the number is growing (16, p. 238).

Because of engineering considerations (namely depth requirements) to be discussed later, it is extremely doubtful if any offshore port facilities of the type considered in this report would be located in territorial seas.

Texas Submerged Land

Texas submerged land extends seaward from the coastline for a distance of three leagues (9 nautical miles). The primary function served by deliniation of Texas submerged land is to define those coastal waters in which the State of Texas has the exclusive right to sell the natural resources or to sell the right to extract these resources as opposed to those areas where the federal government has these rights. The Submerged Lands Act of 1953 deeded outright title to all submerged lands within three miles of coastal states. Texas, however, has retained its 9 nautical mile limit.

Again, because of depth restrictions, it is highly unlikely that an offshore port facility would be located in Texas Submerged Lands. However, there is an extremely high likelihood of a pipeline from an offshore facility crossing Texas submerged lands, thus involving Texas legally.

The Contiguous Zone and Exclusive Fishing Zone

The contiguous zone may be defined as the zone adjoining territorial sea on the ocean side. An international conference on the Law of the Sea held in 1958 states that a nation's contiguous zone may not extend more than 12 miles from its coastline. The United States' contiguous zone is, therefore, nine miles extending from the three mile territorial seas to the 12 mile limit.

A contiguous zone, according to the 1958 treaty, is a zone of the high seas, contiguous to a coastal nation's territorial sea, in which the coastal nation may exercise the control necessary to:

1. Prevent infringement of its customs, fiscal, immigration or sanitary regulations within its territory or territorial sea;

2. Punish infringement of the above regulations committed within its territory or territorial sea.

The contiguous zone differs, in the legal sense, from a nation's territorial sea in that the territorial sea is, except for the right of innocent passage, subject to the complete sovereignty of the coastal nation and is therefore properly viewed as being within the nation's boundaries; whereas the contiguous zone lies outside these boundaries, but is an area in which the coastal nation may exercise certain limited rights for special purposes. For example, a nation could carry out anti-smuggling operations within its contiguous zone.

It is obvious that nations claiming territorial seas of 12 miles have no contiguous zones.

The U. S. exclusive fishing zone and the contiguous zone are exactly co-extensive; they both occupy a nine-mile belt along the outer edge of the three mile territorial sea. Also like the contiguous zone, the fishing zone is not a claimed area of total U. S. sovereignty.

The exclusive fishing zone was established by a 1966 Act of the Congress which asserts that the United States has exclusive right to the living resources therein. This zone is unique in that it was created by the unilateral action of the United States and is not the result of an international agreement.

The High Seas

The high seas are all waters beyond the outer limit of the territorial seas and are outside the control of any nation. Hence, the contiguous zone is part of the high seas with certain restrictions on the "freedom of the seas."

While "freedom of the seas" is a rather nebulous concept, it basically guarantees to all nations certain important rights to the use of the high seas without restriction or control by any other nation or authority. These rights include the rights to surface and air navigation; the right to fish; and the right to lay submarine cables and pipelines.

As territorial seas tend to widen, resource development continues further into the seas, and environmental concerns become more prominent, the traditional concepts of high seas and freedom of the seas will be in jeopardy.

The Continental Shelf

As the technological capabilities of developed nations enable them to exploit the sea's natural resources further and further from shore a third dimension of depth is added to the traditional surface dimensions to be considered in zones of jurisdiction. Potential conflicts over these offshore resources have led to another ocean zone - the Continental Shelf Zone.

Much confusion exists as to the precise limit of the continental shelf. The 1958 Geneva Treaty arrived at this definition:

> The seabed and subsoil of the submarine areas adjacent to the coast but outside the area of the territorial sea, to a depth of 200 meters or beyond that limit, to where the depth of the superjacent waters admits of the exploitation of the natural resources of the said areas.

This definition of the continental shelf has nothing to do with the geological definition. Geologists generally consider the continental shelf to extend to where it breaks sharply and plunges to deep sea.

Currently, there is no definite outer boundary of the continental shelf; the minimum 200 meter line will undoubtedly be pushed further outward as technological capability to exploit deeper natural resources develops.

But, the "adjacency" test is generally accepted as overriding in indicating a maximum breadth of the legal "shelf", as opposed to the "exploitability" test (16, p. 239). The International Court of Justice gives meaning to "adjacency" by referring to the continental shelf as "the natural prolongation or continuation of the land territory or domain ... into and under the high seas ..." This reverts essentially to the geological definition and means that nations can assert their rights of the continental shelf "over the submerged area out to the end of the seaward prolongation of their continental land mass" (16, p. 251).

The United States has already significantly stretched the 200 meter limit. The Department of Interior has issued lease maps in water depths of 6,000 feet (up to 100 miles offshore) and has issued oil and gas leases for tracts in water as deep as 1,500 feet (up to 30 miles from shore). In addition, the Department of Interior has issued exploration permits permitting core drilling as much as 200 miles from shore in water as deep as 4,300 feet (67, p. 268).

In the language of the 1958 treaty, a coastal nation "exercises over the continental shelf sovereign rights for the purpose of exploring it and exploring its natural resources." This is interpreted to mean that a coastal nation owns the natural resources of its continental shelf. Moreover, these rights (and ownership) are exclusive in the sense that if the coastal nation "does not explore the continental shelf or exploit its natural resource, no one may undertake these activities, or make a claim to the continental shelf, without the express consent of the coastal state (nation)" (33, p. 220).

The continental shelf zone does not affect the status of the waters above the shelf, which are high seas, and outside the boundaries of any nation. Any offshore facilities located above the continental shelf but outside the territorial seas of a nation are therefore on the high seas.

LEGAL JURISDICTION OVER DEATHS AND ACCIDENTS ON OFFSHORE FACILITIES

In the case of Rodrique v. Aetna Casualty and Surety Company (1969), the Supreme Court held that the outer Continental Shelf Lands

Act rather than the Federal Death on the High Seas Act will apply in cases involving wrongful deaths on drilling structures on the continental shelf (77). In essence, this decision means that the nature of the damages, which survivors of decreased oil platform workers as the result of deaths on artificial drilling structures on the continental shelf more than 3 nautical miles beyond the coastal boundary, will be in accordance with the Wrongful-death Act of the adjacent state. The argument is that Contress intended the structures to be treated as islands rather than vessels.

This decision is somewhat inconsistent with the previously mentioned zones of jurisdiction in that normally the state's jurisdiction would be expected to end at the edge of its submerged lands. Whether this decision would extend to injuries in addition to deaths; and to offshore port facilities, in addition to drilling platforms on the continental shelf is not yet clear.

INTERNATIONAL LAW REGARDING POLLUTION OF THE HIGH SEAS

As any port facility off the Coast of Texas will probably be beyond the territorial seas and contiguous zone (as it now exists), and thus on the high seas, it is imperative to develop a knowledge of the International Law regarding pollution of the high seas. Nearly all international agreements in this field to date have been confined to pollution resulting from spills (either intentional or accidental) from vessels. It seems logical that offshore platforms on the high seas would come under an extension of the same agreements.

Not until 1954 when the International Convention for the Prevention of Oil Pollution was concluded in London, had any substantive international achievements been made in relationship to pollution of the high seas. This Convention has been in effect since 1958 between a small number of countries. The 1954 convention dealt only with discharges of oil within certain geographically defined zones and such an offense was to be punishable under the laws of the ship's country of registry. The 1954 Convention had little legal "teeth" and depended largely on the cooperation of the participating states for enforcement.

Another international conference on the subject of oil pollution was held in Copenhagen in 1959 after the formation in 1958, of the Inter-Governmental Maritime Consultative Organization (IMCO) as a specialized agency of the United Nations. This convention resulted in a number of recommendations to extend the effectiveness of the 1954 convention. Among them was the recommendation that preparation, under IMCO auspices, should be made for a further inter-governmental conference on oil pollution which should considerably extend the prohibited ocean zones. This preparatory work resulted in the Second Conference on Oil Pollution held in London in 1962 during which most of the earlier recommendations did not achieve sufficient acceptance to come into effect until 1967.

The question of pollution of the high seas had also been considered by the Geneva Sea Conference of 1958, which adopted the following provision under Article 24:

> Every state shall draw up regulations to prevent pollution of the seas by the discharge of oil from ships or pipelines or resulting from the exploitation of the seabed and its subsoil, taking account of existing treaty provisions on the subject.

The amended London Convention of 1954 remains, to this day, the major international agreement in force against oil pollution of the sea. The almost total inadequacy as to scope and enforcement of the Convention is readily apparent. However, the second London Conference did mark the beginning of an open confrontation between coastal state interests as championed by Canada (37) and shipping and cargo-owning interests.

Many of the problems associated with oil pollution were brought forcefully to the public mind in March, 1967 by the much publicized "Torrey Canyon" incident off the southwest coast of Cornwall, England. To illustrate the international aspect of this disaster, the ship was owned by a Bermudian Corporation, registered in Liberia, under charter to a U. S. Corporation and sub-chartered to a British Corporation. The master and crew were all Italian Nationals. The salvage company was Dutch. The vessel grounded outside the territorial waters of Great Britain. The spillage not only spread along the coast of England, but across the English Channel to the coast of France as far as 225 miles away (70).

In spite of the undeniable environmental havoc brought by the Torrey Canyon disaster; it was, for those concerned with international pollution control, a blessing in disguise. After the disaster, IMCO and the Comitè Maritime International (C.M.I.) initiated what evolved into several international conferences and conventions to deal with civil liability for oil pollution damage. These conventions created many differences both within and between the C.M.I. and IMCO. These differences included:

1. The Scope of the Convention
2. The basis of Liability
3. The Channeling of Liability
4. Limitation of Liability
5. Evidence of Financial Responsibility
6. Jurisdiction
7. Other differences - mostly procedural (44, p. 98-105).

It was hoped that the differences seen by comparing the C.M.I. and IMCO Draft Conventions could be reconciled by the delegates of 44 nations to the 1969 International Legal Conference of Marine Pollution Damage in Brussels. A summary of the results of this convention is as follows:

1. Application of the Civil Liability Convention. The application of this convention is limited to pollution damage to the territory of a contracting state including its territorial sea, for "oil" only, in any sea vessel carrying oil in buck as cargo. Passenger vessel, dry cargo vessels, warships and other state owned vessels

used for non-commercial purposes are excluded. "Pollution damage" includes the cost of reasonable preventative measures taken by anyone after the incident, to prevent or minimize such damage. Government clean-up costs, as well as damages sustained by private interests, are thus included (43, p. 318).

2. Parties Liable under the Convention. All liability is channeled through the registered owner of the ship at the time of incident (or operator of state owned ship). Rights of recourse of owner against third parties are preserved. If a collision occurs all parties are liable unless exonerated (43, p. 318).

3. Basis of Liability - Fault vs. Struct Liability. This was and still is the most controversial issue considered by the convention. The deadlock was resolved by adopting "a species of strict liability, but with sufficient exceptions to make it insurable to the same limits of coverage as would have been available had liability been based on fault, with the burden of proof reversed." The owner is liable unless he can prove damage resulted from an Act of War, insurrection, etcetera, or a "natural phenomenon of an exceptional, inevitable and irrestible character," (an Act of God), or was wholly caused by an act of omission of a third party, done with intent to cause damage, or by negligence of any authority in maintaining navigational aids (43, p. 319).

4. Jurisdiction, Limitation of Actions, Judgments. The courts of any nation where damage has occurred, has jurisdiction. Any suit must be commenced within 3 years of damage (43, p. 320).

5. Limitation of Liability. The owner is liable for claims up to $134.40 per net ton or $14,112,000, whichever is less, unless the pollution is the result of his actual fault or privity in which case there is no limit (43, p. 321).

6. Financial Responsibility. The owner of any ship registered in a contracting state carrying over 2,000 tons of bulk oil as cargo must maintain insurance or other financial security in an amount equal to his liability where accident is not due to his fault or privity (43, p. 322).

The main issue when concerned with fighting oil pollution of the high seas is the conflict between attempts to end (or curtail) maritime pollution and the principle of freedom of the high seas. Dr. Dinstein, Senior Lecturer in International Law, Tel Aviv University, discusses three methods that have been evolved for coping with the problem of oil pollution of the high seas.

1. Extension of the Contiguous Zone.

Dr. Dinstein points out that, from a theoretical viewpoint, what the 1954 London International Voncention for the Prevention of Pollution of the Sea by Oil accomplishes is the creation of a special contiguous zone insofar as oil pollution is concerned. Oil pollution is not specifically mentioned in the 1958 Convention; though with some stretch of the imagination, it may be considered as falling within the realm of the sanitation clause (29, p. 366).

The contention remains, though, that a special contiguous zone was established in the 1954 convention with respect to oil pollution.

This zone extends to 50, rather than the regular 12 nautical miles from the shoreline. Within it, so as to preclude damage to the beaches of the coastal nation, the discharge of oil into the sea is prohibited. The 1954 Convention leaves enforcement to the flag nation (nation of registry) rather than to the coastal nation and the flag nation is "in duty bound to indict transgressors" (29, p. 366).

The Convention of 1954 was ammended in 1962 so that the prohibited zones are expanded, mostly from 50 to 100 nautical miles from the shoreline, and prohibits discharging oil and oily mixtures anywhere into the sea from any vessel that: (a) is not a naval vessel; (b) is of 20,000 gross tons or more; (c) is constructed after the entry of the Amendment into force in 1967. Thus, under this Amendment, the flag state is required to punish, in addition to those discharging oil into the expended prohibited zones, those polluting any part of the high seas (29, p. 367).

The creation of a special contiguous zone for pollution control extending beyond 12 miles is under considerable legal doubt. Some countries have, however unilaterally declared such extensions. Canada, for example claims that her pollution control measures extend one hundred miles from Canadian land (105, p. 538).

2. Limitation of the Quasi-Interritorial Powers of the Flag Nation.

The 1954 London Convention requires the flag nation to declare as a punishable offense pollution of the high seas within the prohibited zones. The previously mentioned Article 24 of the 1958 Geneva

Convention goes further; but, even though the obligation of the flag state to avert oil pollution appears to extend therein to the high seas as a whole, the qualification in regard to "existing treaty provisions" in effect maintains the contiguous zone formula (29, p. 368-370).

A second amendment to the 1954 London Convention, passed in 1969 but not yet in force, would cause a major shift in the control system. Here, for the first time, a sweeping prohibition of oil pollution of the high seas is introduced. Even though the amendment admittedly contains many loopholes, it transposes the problem from the contiguous zone to the high seas. The situation is accurately summed up by: "In the future, any strengthening of this convention is likely to hinge primarily on the provisions for supervision of compliance rather than on the substance of the prohibition." (88, p. 84).

3. Extension of the Powers of the Coastal Nation Beyond Its Own Ships.

The 1969 Brussels Convention provides that when a maritime casualty creates a grave and imminent danger to the coastline from actual or potential pollution of the sea by oil, the coastal nation is empowered "to take such measures on the high seas as may be necessary to prevent, mitigate or eliminate major harmful consequences" within the limitations already discussed. This is, in effect, a limited extension of the powers of the coastal state beyond its own ships. Dr. Dinstein admits that the Brussels Convention is inspired by the understandable wish to find the proper legal tools to tackle maritime disasters in the era of supertankers, but raises several questions as to whether the Brussels Convention can really solve the problem (29, p. 372). As previously mentioned, the Brussels Convention is not yet in force and serious doubts exist as to whether it will ever be put into force.

Recently, even irrespective of the Brussels Convention, there is a trend among coastal states to take the law into their own hands and legislate internal statutes, enabling them unilaterally to destroy on the high seas damaged tankers that threaten their coastline with serious pollution.

The first federal legislation of any real consequences regarding oil pollution of U. S. waters was the Water Quality Act of 1970 which, in actuality, amended the Federal Water Pollution Control Act of 1948. The Water Quality Improvement Act added ten new sections, 11 to 20 inclusive, to the earlier legislation. Of these, Section 11, entitled "Control of Pollution by Oil" is the most significant from a legal standpoint.

> The discharge of oil into or upon the navigable waters of the United States, their adjoining shorelines or the waters of the contiguous zone, in quantities determined harmful by the President, is prohibited, except where permitted under Article IV of the International Convention for the Prevention of Pollution of the Sea by Oil, 1954, as amended, or under such conditions as the President may, by regulation, determine to be not harmful. Any such regulation must be consistent with maritime safety, marine and navigation laws and regulations, and applicable water quality standards (45, p. 542).

Punishment is established in the form of fines not to exceed $10,000, or imprisonment for not more than one year, or both, for any person in charge of a vessel, onshore facility, or offshore facility who does not immediately notify the appropriate federal agency. Also the owner or operator of any such vessel or facility is liable to a civil penalty of not more than $10,000 per violation, to be assessed by the U. S. Coast Guard. The President is authorized to arrange for the removal of oil, unless he determines that it will be properly done by the owner or operator (45, p. 543).

In addition to the above, Section 11 requires the President to prepare and publish a National Contingency Plan for the removal of oil. When a marine disaster in or upon the navigable waters of the United States creates a substantial threat of pollution, the Federal Government is authorized to coordinate and direct all public and private efforts aimed at its removal, and summarily remove, and, if necessary destroy the vessel involved (45, p. 543-544).

Unless an owner or operator can prove that a discharge of oil was cuased solely by (a) an Act of God, (b) an Act of War, (c) negligence of the United States Government, or (d) an "act of omission of a third party without regard to whether such act or omission was or was not negligent," or any combination of such causes, the owner or operator of any vessel which releases a prohibited discharge is liable to the United States for the additional costs incurred for the removal of the oil by the Government, "not withstanding any other provision of law." The amount of such liability is, however, not to exceed $100 per gross ton or $14 million, whichever is the lesser. If the government can show that the discharge was the result of "willful negligence or willful misconduct within the knowledge of the owner," the owner or operator is responsible for full amount of such costs (45, p. 544).

Similar liability is imposed on the owners or operators of onshore facilities or offshore facilities (defined as facilities of any kind, other than vessels, located in, on, or under any of the navigable waters of the United States), subject however, to a limitation of $8 million (45, p. 545).

If the owner or operator of a vessel or a facility can show that a prohibited discharge of oil was caused by an act of an omission of a third party, the third party is liable to the United States for the actual costs incurred in the removal of the oil by the Government. If the third party is the owner or operator of a vessel which caused the discharge, his liability is not to exceed $100 per gross ton of $14 million, whichever is the lesser. In any other case, the third party's liability is not to exceed the limitation which would have been applicable to the owner or operator of the vessel or facility from which the discharge actually came, if such owner or operator had been liable. Again, if the United States can show willful negligence, liability for the full amount of removal costs holds.

Section 11 specifically provides that it in no way affects or modifies any legal obligations of owners or operators of vessels and facilities to any person or agency for damages to any public or privately owned property resulting from a discharge of oil, or from its removal.

While the 1970 Federal Water Quality Improvement Act was unilateral, several experts on international marine law feel that it was both essential and desirable. Allen I. Mendelsohn, an international marine law expert, states his reasoning thusly:

> The work on and passage by the United States Congress of the 1970 Federal Water Quality Improvement Act, though unilateral, was essential at the time because there was no effective international regime then existent. Moreover, its passage was immensely desirable because, when the Brussels Conference convened in 1969, it was fully aware of the bare minimum terms at which the United States might have been prepared to go along with an international rather than a unilateral approach. Unfortunately, the Brussels conferees apparently either did not understand those terms or did not believe that the United States was as serious about them as we were. Hence, they produced the 1969 Civil Liability Convention with higher limits of ship-owner liability than would have been expected prior to the work on the FWQIA but still lower than the minimum terms acceptable to the United States. That Convention, as we now know, will not be immediately ratified (64, p. 393).

COMPARISON OF THE WATER QUALITY IMPROVEMENT ACT AND THE BRUSSELS CONVENTION

As it is conceivable that a supertanker port off the coast of Texas could come under the jurisdiction of international law similar to the Brussels Convention, or under United States law such as the

Water Quality Improvement Act, a comparison of the two is in order. The following is a summary of a portion of an article by Healy and Paulsen (45, p. 561-570).

The Nature of the Liabilities Imposed.

The most fundamental difference between the Convention and Section 11 of the Water Quality Improvement Act, is that the Convention relates not only to government claims for "clean-up," but also to claims for other damages sustained by both private and public interests as a result of oil pollution. Section 11 covers only removal costs incurred by the United States Government. No provision is made for other claims, or for reimbursement of costs incurred by states, municipalities, or private parties who take steps to minimize the effects of an oil spill. Only seagoing vessels and other seaborne craft (other than public vessels) actually carrying "persistent" oil in bulk as cargo fall under the coverage of the Convention, whereas Section 11 applies to all vessels (with the exception of public vessels) using United States waters or waters of the contiguous zone, and to onshore and offshore facilities as well.

While the Convention follows the principle of channeling all liability though the registered owner of the vessel, reserving to him any right of recourse he may have against third parties, Section 11 imposes liability on the "owner or operator," a term defined as including "any person owning, operating or chartering by demise,(a) vessel."

Both Section 11 and the Convention are based on strict liability, rather than fault liability, with certain exceptions. The Section has been described as "similar to the concept of liability based on negligence with a reverse burden of proof."

Both Section 11 and the Convention exclude acts of War and both essentially exclude "acts of God", but the Convention is worded "a natural phenomenon of an exceptional, inevitable and irrestible character" - a phrase apparently more readily acceptable to the Soviet delegates.

Under Section 11, negligence of the U. S. Government is excepted without restriction. The Convention provision is broadened in that it exempts not only negligent or other wrongful acts of national governments, but also those of any provincial or municipal government whose responsibility it is to maintain light houses and other aids to navigation.

While Section 11 excepts discharges caused by the acts or omissions of third parties, whether or not negligent, the Convention refers only to "an act or omission done with intent to cause damage by a third party." Unintentional acts of negligence are not excluded, and the Convention exception is thus restricted to acts of sabotage, etcetera.

Limitations of Liability.

Under the Convention, where pollution is not the result of the owner's "actual fault or privity" i.e., his personal fault, as distinguished from fault of the master or crew, his liability will be limited to 2,000 "Poincare" francs (approximately $134) per ton of the vessel's adjusted net tonnage, subject to a ceiling of 210 million "Poincare" francs (approximately $14 million). The limitation figures under Section 11 are $100 per gross ton, likewise subject to a ceiling of $14 million. The adjusted net tonnage of a tanker is approximately 10 per cent less than her gross tonnage, so that $134 per adjusted net ton is the equivalent of about $121 per gross ton. In comparing that figure with the $100 per gross ton limitation of Section 11, it is important to remember that the Convention applies to oil pollution claims of every conceivable kind, whereas Section 11 is limited to United States Government claims for clean-up costs only. Section 11 stipulates that if a spill causes damage to the shorefront, the liable party is liable, in addition to liability to the Government, for damage sustained by owners of shorefront properties or other interests, whether public or private. The owner could invoke the right to limit such additional liability in accordance with the Limitation of Liability Act, under which he would be obligated to set up a separate limitation fund in an amount equal to the value of the vessel at the end of the voyage plus the earnings of the voyage.

Proof of Financial Responsibility.

Both the Convention and Section 11 provide for maintenance of evidence of financial responsibility. The provisions of Section 11, however, are much broader than those of the Convention; they apply to every vessel of 300 tons or more, regardless of type, which uses United States ports and waters for any purpose. The financial responsibility requirements of the Convention, on the other hand, apply only to vessels carrying more than 2,000 tons of "persistent" oil in bulk as cargo. The evidence required under the Convention must take the form of "insurance or other financial security, such as a guarantee of a bank or a certificate delivered by an international compensation fund," and a certificate attesting that the required insurance or other financial security is in force is to be issued by the state of the ship's registry. Under Section 11 financial responsibility may be established by "(a) evidence of insurance, (b) surety bonds, (c) qualification as a self insurer, or (d) other evidence of financial responsibility" acceptable to the President. Both the Convention and Section 11 provide that the amount of financial responsibility required must be equivalent to the amount of the "limitation fund," i.e., $100 per gross ton under Section 11 and approximately $134 per adjusted net ton under the Convention.

The Convention expressly excepts "the bankruptcy or winding up of the owner" whereas Section 11 implies that insolvency is not a defense to the insurer.

If the Convention were ratified by the important maritime nations, a single certificate evidencing financial responsibility to meet all oil pollution claims, wherever arising, would entitle a vessel to use the ports and waters of any nation which was a party to the Convention. Under Section 11, however, the owners and operators of thousands of vessels, of all types, sizes and flags, will be required to obtain and maintain insurance tailored specifically to fit claims of one particular type - those of the United States Government for clean-up costs.

SUMMARY

The foregoing, while admittedly complex, actually touches only the surface of the confusion and inconsistencies in the federal and international law which could pertain to a supertanker port off Texas. What is needed is a cohesive, comprehensive, and enforceable international agreement acceptable to all nations closing loopholes and eliminating inconsistencies in all aspects of international maritime law. The Brussels Convention (as were many of the conventions and treaties preceding it) was a well-intentioned, but probably ill-fated, attempt in this direction. Another conference charged essentially with rewriting the Law of the Sea has been called for by the United Nations sometime in 1973. Woodfin L. Butte, Professor of Law at The University of Texas at Austin, feels that this conference is in serious jeopardy (16, p. 237, 249, 257). Professor Butte also feels that this is probably a blessing, lest the 1973 conference result in a hopeless deadlock between the "have" and the "have-not" countries resulting in no law of the sea at all (15).

In the absence of an international agreement on the Law of the Seas, unilateral actions such as those taken by the United States in passing the Water Quality Improvement Act of 1970 will become the rule, rather than the exception, even in view of the expected resulting chaos. It is likely that federal legislation will be extended to apply to a supertanker port off the coast of Texas, but on the high seas.

The State of Texas will also become very much involved legally in a supertanker port for Texas. Again, the exact jurisdiction of Texas over facilities for Texas, but on high seas, needs legal clarification. It seems clear that Texas will be involved in permits and leases for pipelines crossing Texas submerged land, in throughput tariffs, and in workmen's compensation laws as a minimum.

The lack of legal guidelines pertaining to all aspects of a supertanker port should not preclude the construction of the port. To wait for precise clarification of the many legal complications would be an intolerable delay.

D. POLITICAL BACKGROUND

A supertanker port for Texas is a multifacited problem that will affect many public organizations and will in turn be under the partial jurisdiction of many governmental agencies. The politics behind how the location, design, and operation of the STP facility will be dictated, in reality, by how the different special interest groups settle into an accord.

In the past, the pattern has been for government to provide the necessary channel depths and navigational aids while private industry provides the portside improvements such as docks and piers (82). However, the magnitude of a STP and its inherent ability to monopolize oil importation in the surrounding region may cause a realignment of governmental-industrial involvement in port selection, construction, and operation.

The magnitude and possible placement of the STP are presently causing alterations in the usual process of port selection. With standard ports, the usual case involved an expansion of an already existing port facility where the cost and the relative simplicity kept the agencies and organizations involved limited and localized. The STP, with its inherent economic advantages, has cultivated the special interests of a multiplicity of governmental agencies and private and quasi-private organizations into a gordian conglomeration of regulations and standards.

As the American Petroleum Council's response to the Senate Committee on Interior and Insular Affairs deep water ports questionnaire states, this political tangle is now the crutial problem involved in the site selection for an STP:

> Where industry is confronted with the necessity for security authorizations from a variety of agencies whose determinations are based on differing criteria and subject to court challenges on sometimes abtruce grounds, it becomes extremely difficult to make the capital commitments necessary for the planning and construction of facilities ... in fact, the variety of governmental permits or approvals required and the difficulty in securing such approvals has effectively prevented industry from making a free choice of site (82).

Agencies and Organizations Involved in the Politics of a Texas STP

Since STP facility proposals for both Delaware and Main were negated by at least some portion of the political scene (21, p. 5), it is assumed that similar agencies and organizations will influence the process by which a Texas STP site is selected. Out of this political process will also evolve the authority that will control the STP's operation.

To convey a feeling for the magnitude of the special interests involved, a partial listing of governmental agencies and private organizations associated with Texas STP considerations follows. The brief explanation following each listing is not intended to represent that agency's or group's sole purpose, only its probable connection to the Texas STP. Also, to extend the roles of the specific governmental agencies past the related State and Federal Boundaries is highly questionable.

Federal Government

Legislative Branch:

Senate Committee on Interior and Insular Affairs.

This Senate Committee held a hearing on April 25, 1972, in connection with a study of national fuels and energy policies, to receive testimony regarding possible Federal policy on deep water harbor facilities and the use of supertankers (52, p. 1).

Executive Branch:

Office of the Special Representative for Trade Negotiations - Executive Office of the President.

Established in January of 1963, this office supervises and coordinates most aspects of U. S. foreign trade police. The special representative controls and directs three interagency committees: the Trade Executive Committee, the Trade Staff Committee, and the Trade Information Committee (99, p. 74).

Comment: This office will not exert design control over the Texas STP, but will be deeply interested in the project, in a spectator sense, because of the large volumes of a single import-oil- it will generate.

Office of Intergovernmental Relations - Executive Office of the Presidency

Established in February, 1969, and under the immediate supervision of the Vice President, this office is a clearinghouse for handling and solving Federal-State-local problems brought to the attention of the President or Vice President by State and local governments (99, p. 75).

Comment: If the Texas STP lies in international waters and is under Federal, State, as well as local jurisdiction, it will require a new interrelation between governmental regulations. With its clearinghouse nature, the Office of Intergovernmental Regulations may be the agency used to settle this new intergovernmental accord.

Council on Environmental Quality - Executive Office of the Presidency.

The Council, established by the National Environmental Policy Act of 1969 and staffed by the Office of Environmental Quality, develops and recommends to the President national policies which promote environmental quality (99, pp. 75-6).

Comment: The Council will not have design control over the construction, maintenance, or operation of the Texas STP, but will probably make recommendations within the Executive Branch concerning future regulations what will exert such control.

Bureau of Customs - Department of the Treasury.

The Bureau was created in 1927 for the purposes, among others, of assessing and collecting duties and taxes on imported merchandise and of controlling carriers and merchandise imported into the United States. It also enforces certain environmental protections programs of other agencies, such as the U. S. Coast Guard's prohibition on discharging refuse and oil into or upon coastal navigable water (99, pp. 105-7).

Comment: Together with the Office of Tariff and Trade Affairs, also of the Treasury Department, the Bureau of Customs will be the visible agency governing the applications of tariffs on imported crude oil. In addition, it is one of the policing agencies for oil spills.

U. S. Army Corps of Engineers - Department of the Army, Defense Department.

The Corps, in addition to providing R&D support to the Army, Air Force, NASA, and other governmental agencies, also has the responsibility for planning, programming, budgeting, engineering, construction, operation and maintenance, and real estate necessary for the improvement of harbors and waterways for navigation and related purposes. In addition it administers the laws for the protection and preservation of navigable waters (99, p. 141).

Comment: If the Federal Government is either fully or partially responsible for the construction or operation of the port, the Corps of Engineers will be the federal agency charged with that portion of the responsibility. In any case, it will be the determining agency for site selection, through its permit issuance and its great persuasive ability with other federal governmental permit issuing agencies.

Office of the Judge Advocate General - Secretary of the Navy, Department of Defense.

Authorized in June of 1880, the Office of the Judge Advocate General provides advice and information on legal aspects of such items as the law of the sea and of the seabeds, including marine pollution (99, pp. 161-2).

Comment: This office can give a complete listing of the current laws pertaining to the placement of a Texas STP and can possibly provide advice on possible future State/Federal/International laws that might be advantageous to enact.

Antitrust Division - Department of Justice.

In addition to seeking to enforce punishment and restraint on monopolization-of-trade cases, the Antitrust Division represents the nation in judicial proceedings reviewing certain orders of the Interstate Commerce Commission and the Federal Maritime Commission. It also supports competitive policies through comment and testimony on pending legislation and other matters and through formal intervention in regulatory proceedings (99, pp. 198-9).

Comment: If the Texas STP is a single location through which moves massive amounts of oil and if the STP is also owned and operated by private industry, the port may be opposed at permit hearings by the Antitrust Division of the Justice Department on the grounds that it is monopolistic and adversely affects the competion for oil importation by the different port areas along the Gulf Coast. If any federal monies are involved in the construction and/or operation of the STP, this office may object on the grounds that funding of this port does not offer neighboring regions equal development opportunities (34, p. 4).

Civil Division - Department of Justice.

The Civil Division of the Justice Department represents the U. S. Government in civil litigations brought against it in the areas of Admiralty and Shipping:

> ... all legal proceedings by and against the United States relating to ships, shipping, navigable waters, and workmen's compensation. Admiralty litigations includes suits for personal injury and property damage involving vessels, shore installations, and maritime personnel, equipment and cargoes; suits arising out of contracts involving shipping ... proceedings to enforce navigation and shipping laws; and litigation based on international maritime agreements (99, p. 200).

It also represents the United States Customs Court:

> ... all cases in this court, including suits brought by importers of merchandise to challenge the appraisement or classification of the imported goods or other decision of the Bureau of Customs arising out of the administration of the tariff laws and schedules (99, p. 200).

Comment: This division of the Justice Department will affect the operation of the Texas STP through involvement in legal challenges by industry to the crude oil tariffs regardless of the federal government's involvement in the operation of the STP, and through the same representation in the Admiralty and Shipping legal actions, if the federal government is responsible, in part or in whole, for the operation of the port.

Land and Natural Resources Division - Department of Justice.

This division supervises all suite and matters of civil nature in the Federal district courts, and the Courts of Claims relating to all real property, like lands, waters, and other related natural resources, on the Outer Continental Shelf and to the protection of the environment (99, p. 204).

Comment: The Land and Natural Resources Division may pursue all the federal environmental cases involving the Texas STP, and may help write the laws and regulations governing the construction of a STP that is on the high seas but still within the Outer Continental Shelf.

Office of Oil and Gas - Department of the Interior.

Established in 1946, this office is mainly a coordinating agency between the petroleum industry and the government that was established to mitigate, for the sake of the national security, the effects of interruptions in the importation of foreign oil. It also serves as an informational pipeline between these two groups through the National Petroleum Council (99, p. 217).

Comment: This agency could be a lobbying force with the federal government helping to advance the cause of STP's in the United States.

Oil Import Administration & Oil Import Appeals Board - Department of the Interior.

With both established in 1959, the Administration restricts the importation of crude oil via an import licensing program, and the Board hears the final appeals by petitioners affected by the Oil Import Administration's import licensing (99, pp. 218-9).

Comment: These are the agencies that control the crude oil import quotas, and can, therefore, control the economics of the Texas STP.

Bureau of Sport Fisheries and Wildlife - United States Fish and Wildlife Service, Department of the Interior.

The Bureau reviews environmental impact statements with an eye toward probable effects of projects on the fish and wildlife resources, and it sometimes makes conservation recommendations after review of the reports (99, p. 222).

Comment: When the eventual environmental impact statement is prepared for the construction of the Texas STP, the Bureau is the agency that will have to be satisfied with its potential marine interdiction considerations.

Geological Survey - Department of the Interior.

The Geological Survey supervises the operations of private industry on the Outer Continental Shelf in order to ensure maximum utilization of mineral resources and to limit damage or pollution to the total environment (99, p. 226).

Comment: By having "utilization" and "pollution" control over the industrial use of the Outer Shelf, the Survey will probably advise in site selection for the STP, to keep the port away from future active mineral leases and to keep it out of adverse natural effects areas.

Maritime Administration - Department of Commerce.

Established in 1950, the Maritime Administration develops ports, port facilities, and intermodal transportation systems, and also administers an insurance program, to insure operators and seamen against hostile action losses in the event that commercial companies will not insure these instances (99, pp. 280-1).

Comment: If Federal funding is used for the Texas STP, the Maritime Administration may be one of the funding agencies for either site preparation or port equipment or both.

Office of Import Programs - Department of Commerce.

The Import Programs Office handles special problems involving industries affected by import competition. It also participates in the staffing of the Oil Policy Committee and the Oil Import Appeals Board (99, p. 288).

Comment: If there is a crude oil import monopoly case resulting from the Texas STP, that the Justice's Antitrust Department may wish to pursue, the particulars of the future case could surface as a complaint in this office.

Occupational Safety and Health Administration - Department of Labor.

Established in 1971, the Administration has the authority to develop and issue health and safety standards and regulations, to investigate and inspect for compliance with the standards and regulations, and to issue citations for non-compliance (99, pp. 314-5).

Comment: The Occupational Safety and Health Administration will be a major source of design criteria and be one of the agencies inspecting the completed STP.

United States Coast Guard - Department of Transportation.

Established in 1915, the Coast Guard is responsible for enforcing the Federal laws on the high seas and navigable water of the United States. In addition, it furnishes navigation information to ships and enforces the rules and regulations governing the security of ports and the anchorage and movement of vessels in U. S. waters. This last function includes supervising the loading and unloading of dangerous cargoes, developing and enforcing fire-prevention measures, and controlling access to vessels and waterfront facilities (99, pp. 368-71).

Comment: Acting as marine police, the Coast Guard can be relied upon to provide general navigational aid in steering the supertankers to and from the vicinity of the Texas STP and to provide for portside security, but all of this only in as much as these functions can be carried out in U. S. waters.

National Transportation Safety Board - Department of Transportation (DOT).

The Board reviews and rules on the adequacy of transportation safety standards, determines compliance or non-compliance with the standards, and reviews all licenses issued by either the Secretary of the Administrator of DOT when such licenses come under appeal. In addition the National Transportation Safety Board acts as a clearinghouse and possible prime investigator for DOT on all pipeline and marine accidents (99, pp. 381-2).

Comment: The National Transportation Safety Board will probably be the agency to, in general, review the safety provisions of the Texas STP, and it will direct the investigation of any tanker collisions when the same are operating in U. S. waters.

Office of Water Programs - Office of Assistant Administrator for Media Programs, Environmental Protection Agency, an independent Executive Branch agency.

The Office of Water Programs is responsible for the Environmental Protection Agency's water quality programs (99, p. 407).

Comment: This office will manage the Federal water quality programs that the Texas STP will have to abide by.

Federal Maritime Commission - An Independent Agency in the Executive Branch.

Established in 1961, the Commission has several functions, among them are:

- the regulation of waterborne common carriers and certain other persons engaged in U. S. foreign commerce;
- authority over tariff filings by common carriers engaged in foreign commerce;
- the issuance of financial responsibility certificates for oil spillage cleanup, involving any vessel over 300 gross tonnage; and
- regulation of terminal operators (99, pp. 426-428).

Comment: This agency will not have design control over the construction of the Texas STP, but will control the tanker traffic using it as well as be the licensing agency for the terminal operator.

Federal Trade Commission - An Independent Agency in the Executive Branch.

The Commission is charged with keeping commercial competition free and fair (99, pp. 439-9).

Comment: If the issue of the Texas STP monopolizing oil imports into Texas is raised, this will be another agency involved in settling the issue.

Interstate Commerce Commission - An Independent Agency in the Executive Branch.

This Commission regulates carriers in interstate commerce and carriers in foreign commerce as it takes place in the United States. Oil pipelines are one of its jurisdictional areas (99, pp. 461-2).

Comment: The Interstate Commerce Commission will be one of the regulatory agencies for the Texas STP's pipelines which lie within the jurisdiction of the United States, both offshore and onshore.

Note: It is understood that in all cases, Federal, State, or local, the described regulations and agency involvements only apply when and only to that portion of a possible Texas STP that is within the appropriate Federal, State, or local jurisdiction. As mentioned in the Legal Background Section of this report, the limits of these jurisdictional areas currently are under question and possibly litigation.

State Government

Executive Branch:

Secretary of State.

The Office of the Secretary of State approves and files articles of incorporation of domestic corporations and other corporate instruments under the Texas Business Corporation Act and the Texas Non-Profit Corporation Act (40, pp. 6-7).

Comment: If the organization running the Texas Supertanker Port becomes a Texas corporation, either profit or non-profit, it will have to file with the Office of the Secretary of State.

The Natural Resources Division - Attorney General's Office.

This division handles all matters involving oil and water and advises the Railroad Commission, the General Land Office, and the School Land Board (40, pp. 18-9).

Comment: The Texas STP will be under the legal scrutiny of the Natural Resources Division of the Attorney General's Office when offshore lands are acquired or leased for it and when crude oil pipelines are established.

The Taxation Division - Attorney General's Office.

The Taxation Division handles all tax law cases involving state sales taxes and corporation taxes (40, p. 19).

Comment: If there arises any questions to an import or a corporation tax imposed on the Texas STP operators, this division of the Attorney General's Office will make the ruling.

Oil, Gas, and Utilities Tax Division - Comptroller of Public Accounts Office.

This Division administers the state tax on oil and utility companies (40, p. 13).

Comment: If the Texas STP is run by a private company and it is defined as either an oil company or a utility company (serving the needs of state's oil companies) this division will administer whatever tax is imposed on it by the Legislature. The tax administered by this division could be appealed to the Taxation Division, Attorney General's Office.

Texas Industrial Commission.

The Commission is responsible for attracting new industry into the State of Texas and for promoting the expansion of existing Texas industries (40, pp. 48-9).

Comment: The Texas Industrial commission does not have any power to control either the design, construction, or operation of a Texas STP, but it can serve as a powerful lobbying agent within the State government for the interest of a Texas STP.

The Coastal Areas Management Division - Commissioner of the General Land Office.

This agency assists the School Land Board and the Submerged Lands Advisory Committee in the areas involving state-owned submerged lands, when the issues of either conservation, navigation, or industrialization are also involved (40, pp. 20-2).

Comment: While a Texas STP organization will have to deal with the State's School Land Board in all matters involving state-owned submerged lands, the Coastal Areas Management Division of the General Land Office may be the agency acting for the School Land Board in these cases.

School Land Board.

The Texas Legislature in 1939 dedicated to the Permanent School Fund all of the seabed belonging to the State of Texas. At the same time the School Land Board was created to, amon other duties, manage these lands for the School Fund. This includes handling the leasing and the sale of the now Permanent School Fund controlled lands (40, p. 92).

Comment: Any submerged land controlled by the State of Texas that a Texas STP is built on or over or any such land over which the port organization wishes to run its pipelines will in high probability be land dedicated to the Permanent School Fund. In such cases the seabed areas will have to be either lease or bought through the School Land Board.

Submerged Lands Advisory Committee.

The Committee advises the School Land Board on requests to least submerged lands (40, p. 93).

Comment: A Texas STP organization seeking to lease submerged lands through the School Land Board may have to lobby with both the Submerged Lands Advisory Committee and the Coastal Areas Management Division of the General Land Office.

Texas Water Quality Board.

The Board is charged with providing for the quality of state waters and for issuing permits for discharging wastewater of what it terms acceptable quality into or adjacent to state waters (40, p. 85).

Comment: If a Texas STP discharges any treated or untreated wastewater, such as ballast water, the port may have to obtain a permit to do so from the Texas Water Quality Board.

The Oil and Gas Division - Railroad Commission.

This Division of the Railroad Commission enforces the state laws governing common carrier pipelines, this covers the areas of valuation, tariffs, service, operating authority, and other matters (40, pp. 82-4).

Comment: Once the crude oil of a Texas Supertanker Port is in a pipeline and that pipeline is within Texas' jurisdiction, the pipeline and the operating organization come under the regulation of the Oil and Gas Division of the Railroad Commission.

Division of Occupational Safety - State Department of Health.

This Division of the State Department of Health is responsible for the adoption, application, and implementation of employee safety measures in Texas. Although under the Health Department, the Division of Occupational Safety is under the administration of the Occupational Safety Board, a separate State agency (40, p. 171).

Comment: If any or all of a Texas STP is within the jurisdiction of the State of Texas, the operating organization will have to abide, to the same extent, by the employee safety standards set forth by the Division of Occupational Safety.

Division of Planning Coordination - Governor's Office.

This division, which exists for the convenience of the Governor is not established by law, coordinates the planning of the other State agencies and provides the Governor with information on the status of a possible Texas based STP.

The State Interagency Council on Natural Resources and the Environment and the Interagency Transportation Planning Council.

Both of these agencies are, as of this writing, charged with keeping the Governor of Texas informed on "all pertinent proposals or studies of deep water port facilities of Texas." (39, p. 2)

Comment: These two groups are merely intragovernmental information agencies and will not affect the mechanics of design, construction, or operation of any Texas STP.

Regional State-Related Agencies

Councils of Government:

Each Council of Government (COG) is charged by federal and state governments with the regional review of all projects in their jurisdictional areas that involve either State or Federal funds. Among other criteria the reviews are to check consistency of the projects with regional plans for development of the area and to insure proper environmental consideration and protection. Coastal COG's (Figure 7) in Texas affected by the possibility of a Texas STP are as follows:

Lower Rio Grande Valley Development Council - with offices in McAllen, Texas.

Coastal Bend Council of Government - with offices in Corpus Christi, Texas.

Golden Crescent Council of Government - with offices in Victoria, Texas.

Houston-Galveston Area Council - with offices in Houston, Texas.

South East Texas Regional Planning Commission - with offices in Beaumont, Texas.

Local Governments

Counties:

In succession from southwest to northeast, the Texas Gulf Coast Counties (Figure 8) involved in the possibility of a Texas STP,

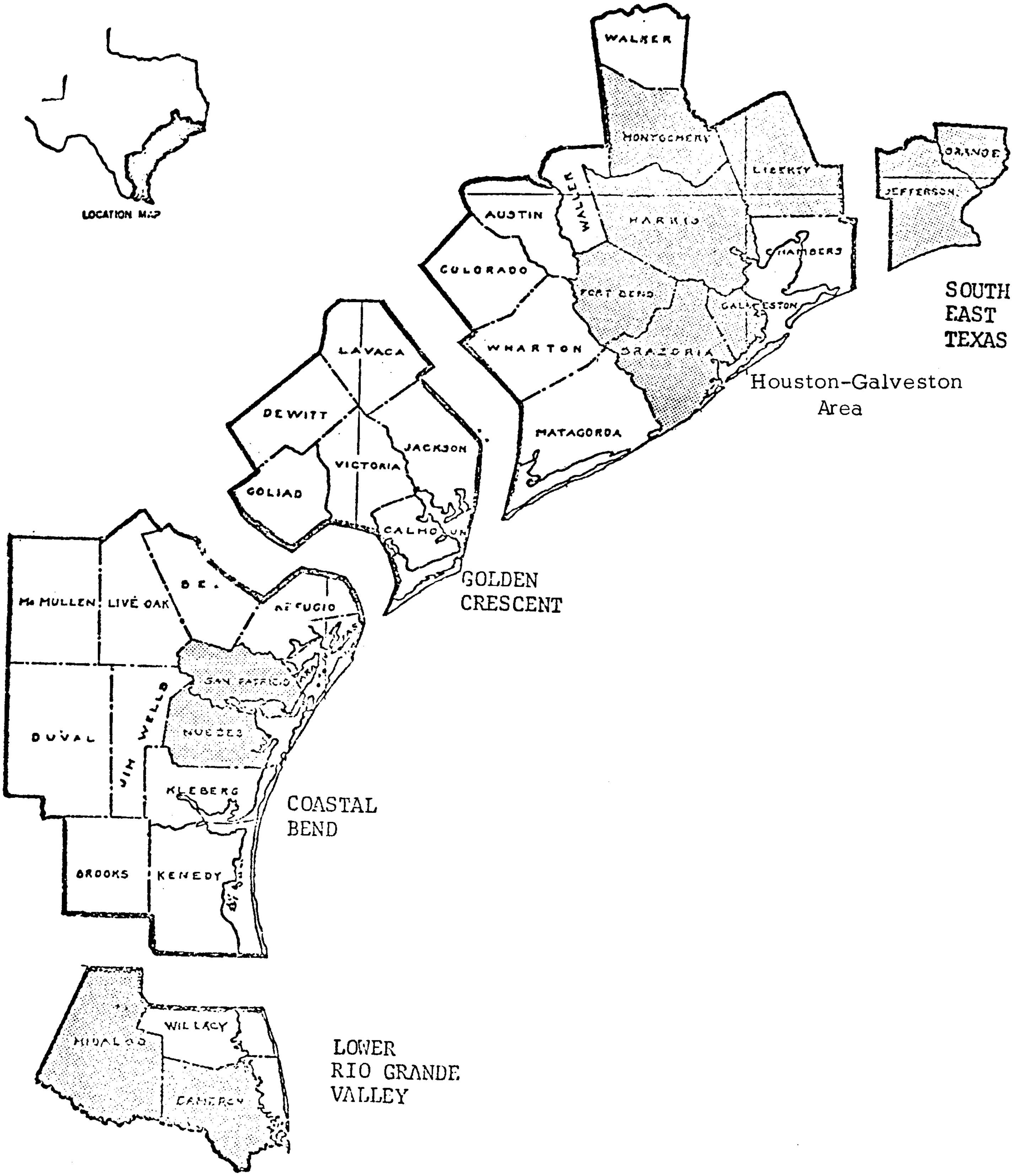


FIGURE 7

Councils of Government Along the Texas Gulf Coast (9,p.2)

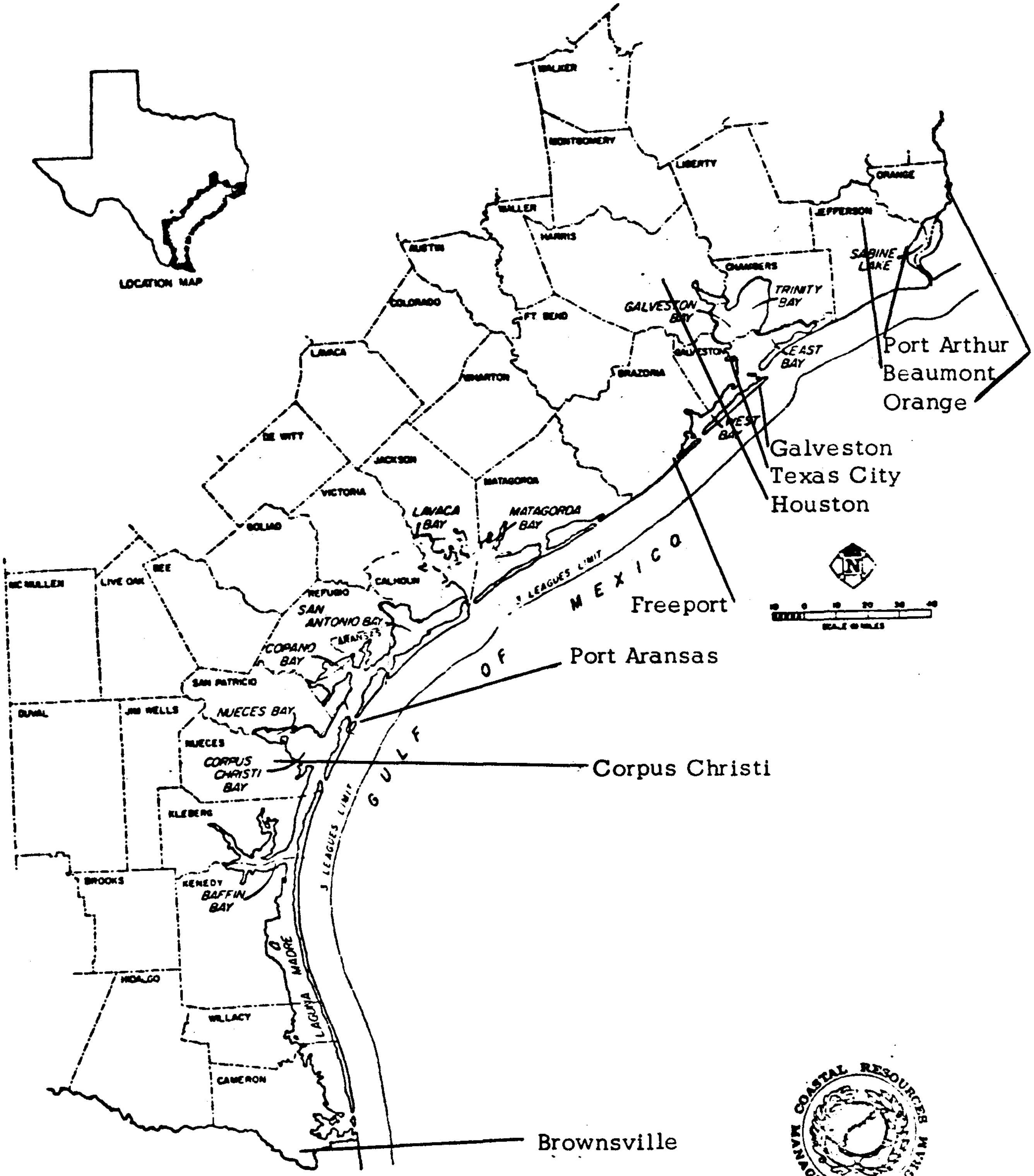


FIGURE 8

Texas Coastal Counties and Key Cities
(30, Figure II-1)

some of which are actively lobbying for the placement of such a facility on or off their shores, are as follows:

- Cameron County
- Willacy County
- Kenedy County
- Kleberg County
- Nueces County
- San Patrico County
- Aransas County
- Refugio County
- Calhoun County
- Matagorda County
- Brazoria County
- Galveston County
- Harris County
- Liberty County
- Chambers County
- Jefferson County
- Orange County

Cities:

Some of the Texas cities (Figure 8) which are interested in a Texas STP possibly being located in their area are as follows in regional order from Southwest to Northeast:

- City of Brownsville
- City of Corpus Christi
- City of Port Aransas
- City of Freeport
- City of Galveston
- City of Houston
- City of Texas City
- City of Port Arthur
- City of Orange
- City of Beaumont

Some of the more active Port Authorities seeking a Texas based STP located in their areas are:

- the Port of Brownsville
- the Port of Corpus Christi
- Galveston Wharves
- the Port of Houston
- the Port of Port Arthur

Quasi-Public Groups and Organizations

The following groups and organizations have an expressed interest in a Texas STP:

American Association of Port Authorities

American Pilots Association

Chambers of Commerce in the Texas Coastal Area

Some of the more active in the Texas STP issue are:

the Beaumont Chamber of Commerce

the Brazosport Chamber of Commerce

the Galveston Chamber of Commerce

the Houston Chamber of Commerce

Economic Research Division of Texas A&M

Galveston-Texas City Pilots

International Association of Ports and Harbors

International Longshoremen's Association

National Audubon Society

Oil Companies

Petro-chemical Companies

Sabine Pilots Association

Sierra Club

South Texas Regional Export Expansion Council

Texas Superport Study Corporation

Texas Water Conservation Association

Present Politics

Until recently the discussions in most political sectors have been of a Texas STP financed in whole or part by government, specifically the Federal government. Fortunately, for the interests favoring a STP being constructed in the near future, the probability of Federal financing is diminishing. With Federal monies involved, a myriad of complications arise as opposed to totally private financing. The time span involved with a Federal project (from consideration through construction), as demonstrated by the seven-to-ten year Interstate Highway Program lag time, far exceeds what is common practice for private industry today. The number of public-oriented design criteria drastically increase when a structure is being financed by the taxpayers as opposed to a group of private businesses. As emphasized by Professor Eliezer Ereli, of the University of Houston's College of Law, in his statement to the U. S. Army Corps of Engineers on Offshore Terminals (34, p. 4), the use of Federal monies may preclude the construction of a single massive STP off Texas, because of the Federal axiom of not wishing to give any one area an economic advantage. Professor Ereli states:

> A single superport may prove the most economical in the short run, but a series of offshore bulk terminals may be more satisfactory for the balanced development of all participants in the Federal system.

The possible use of Federal tax funds gave rise to this past emphasis on constructing a multi-purpose, multi-cargo terminal instead of the singular petroleum terminal that the oil companies point out is needed immediately and is most desireable from a safety standpoing. Both Federal funding and multi-cargo terminals are currently under decreasing consideration, as are the aspects of total governmental involvement in the Texas STP construction.

This does not mean that the Federal government will not have a major voice in the placement and construction of a STP in Texas. Because of the voluminous number of Federal permits and regulations involved with the site selection, as noted earlier in the listing of the many Federal agencies, Federal participation will be substantial. The exclusion, though, of Federal monies from the construction and operation of the port would appreciably limit this substantial federal involvement.

The Texas government is currently taking a benign, spectator's overview of the creation of a Texas STP, both in its site selection and its operation. The State will probably be taking a more active role eventually during the planning stage by ruling on seabed surface leases for the terminal and/or its pipelines. Most of the State's councils, boards, and commissions are waiting until a definite facility is proposed before determining their specific involvements. The most active of the State's organizations seems to be the Governor's Division of Planning Coordination, which appears to be mainly in a documentation role.

In the politics of a STP in Texas, there is considerable activity and competition on the local level. Different existing Port Authorities are lobbying for the use of their facilities as a supertanker port, mainly through the significant redredging of their channels and turning basins. Many of the Chambers of Commerce located along the Gulf Coast are voicing the economic advantages their location would offer the builders of a supertanker port. Interested groups, such as unions, environmental concern groups, and other groups that would be affected by the outcome of the Texas STP Controversy, are making their presence felt.

The prime movers to date and the only groups within the entire political arena with any serious affect on the outcome of a STP site selection along the Texas Gulf Coast are the U. S. Army Corps of Engineers and the interested oil companies.

Possible Future Politics

The future politics surrounding the Texas STP will probably have substantial oil industry involvement, with a moderate federal involvement, and a very slight state involvement, while the local political groups remain, in reality, as ineffective political centers, either reaping benefits or maintaining their status quo. The only main exceptions to this generalized categorization will be the public environmental concern groups and the unions. As seen in the past major projects involving new construction and new jobs, there two groups will have major lobbying and economic impacts on the consideration of the port.

At the Federal level, the U. S. Army Corps of Engineers will eventually dictate the site selection, while the remaining Federal agencies stay in the background and represent themselves in the port creation via permits and regulations. Some of the other Federal agencies, such as the Office of the Special Representative for Trade Negotiations and the Office of Oil and Gas of the Interior Department, may actually be lobbying for the creation of the Texas STP.

Meanwhile, what the State of Texas is lacking in the way of an overall maritime-oriented supervisory agency, could be remedied by the creation of an agency at the State level that would be parallel to a combination of the Federal Maritime Commission and the U. S. Army Corps of Engineers. Such a State agency, by directing concerted influence regarding a deepwater terminal, could insure that Texas interests are upheld during the critical consideration and design stages of a possible Texas STP.

CHAPTER II

A PROPOSED SUPERTANKER PORT FOR THE STATE OF TEXAS

A PROPOSED SUPERTANKER PORT FACILITY FOR THE STATE OF TEXAS
SPECIFIC RECOMMENDATIONS

Because of the pressing nature of the near future requirement for a supertanker facility along the Texas Gulf Coast, the previously described engineering, ecological, legal and political considerations, have culminated in a specific recommendation as to the optimum location and facility description for a supertanker port.

A. LOCATION RECOMMENDATIONS

The optimum supertanker port location along the Texas Gulf Coast as determined by the authors of this report, taking into consideration the location recommendations of a myriad of existing port authorities, navigation districts, special interest groups and political authorities, lies approximately 28 miles off the Texas Gulf Coast near Freeport, Texas. This offshore facility location in conjunction with onshore storage and service facilities should provide maximum environmental protection and at the same time require a minimum capital outlay.

B. FACILITIES RECOMMENDATIONS

It is recommended that the Texas Supertanker Port consist primarily of 3 interrelated facilities. These are: (a) offshore single-buoy moorings (monobuoys), (b) undersea pipelines serving the off-shore monobuoys, and (c) an onshore facility providing crude storage, pumping facilities, administrative and support services.

Independent Berthing Facilities Description.

A determination was made of the quantity of supertanker independent berthing facilities required along the Gulf Coast to meet a future Texas crude oil import demand of approximately 35 per cent of the total future U. S. demand. Conventional systems queuing theory was utilized to specifically determine the following:

1. The optimum number of supertanker independent berthing facilities that would be required to meet the energy crude oil import demand of incremental future periods,
2. The probable number of ships that would be involved in and around the existing supertanker facility, i.e., vessels waiting as well as those loading/unloading,
3. The probable number of ships that would be in the queue (waiting area) at any one time,
4. The average waiting time for an average vessel in the waiting area,

5. The total average time for an average vessel to be in the system from the time the vessel entered the system until the vessel left the supertanker facility loaded or unloaded.

Several basic assumptions made during the analysis included the following:

1. An average size vessel utilizing the supertanker facility is 300,000 DWT.
2. A random or poisson arrival or interarrival distribution of supertankers entering the independent berthing facility system.
3. A random or poisson departure distribution for supertankers leaving and being serviced in the independent berthing facilities.
4. A servicing priority of "first come, first served" for all vessels entering the system,
5. The maximum number of supertankers capable of providing curde oil for the supertanker facility is unlimited,
6. The arrival of a particular vessel to the supertanker facility has no effect upon the arrival rates of potential future vessels,
7. The entire 35 per cent of the total U. S. crude oil import demand, i.e., the suggested Texas crude oil import demand, is being processed through the supertanker facility.

8. The average servicing time for the supertankers at the facility (unloading/loading) is 20 hours.

The mathematics and theory of the queuing models will not be presented in this paper. However, for those interested in the exact evaluation procedures used, the system models can be found on pages 526-527 of Operations Research An Introduction by Hamdy A. Taha, a MacMillian Company publication, 1971.

The servicing rate or number of hours required to unload/load a ship at an independent berthing terminal facility was chosen from information gathered for unloading rates on a 312,000 DWT tanker capable of unloading crude oil at a rate of approximately 100,000 gallons per minute (81, Exhibit D, p. 2). Table 2 describes the result of the queuing theory analysis performed on the variables mentioned.

From the data presented in Table 2, it becomes evident that as the number of independent berthing facilities (C) increases, then the average number of ships waiting for a berth to open up decreases. The average waiting time for the vessels also decreases with increasing quantities of independent berthing facilities. Most important to the ship operators is the decrease in the total number of hours waiting and unloading as the vessel berthing facilities increase. Because of the high demurrage and operating costs for supertankers, there should be an optimization design developed comparing the costs for additional berthing facilities versus the costs per hour attributible to having

Year	Crude Import Required-U.S. (BBLs/Year)	Crude Import Required-Texas (BBLs/Year)	Supertanker Frequency Required to Meet Total Texas Crude Import Demand (ships/hour)	Independent Berthing Facilities Provided (C)	No. of ships waiting when supertanker facility has (C) independent berthing terminals provided (ships)	No. of ships in system (waiting & servicing) for (C) independent berthing terminals (ships)	Waiting time for ships when (C) Independent Berthing Terminals have been provided (hours)	Total system time (waiting & servicing) for ships when (C) independent berthing facilities have been provided (hours)
1975	2.7×10^{9}	0.945×10^{9}	0.0567	1	--	--	--	--
				2	0.35	1.48	6.2	26.2
				3	0.075	1.20	1.3	21.3
				4	0.012	1.14	0.21	20.2
1980	4.0×10^{9}	1.40×10^{9}	0.0840	2	1.30	2.98	15.5	35.5
				3	0.39	2.07	4.6	24.6
				4	0.075	1.75	0.9	20.9
1985	5.3×10^{9}	1.85×10^{9}	0.1115	3	1.24	3.47	11.1	31.1
				4	0.30	2.30	2.7	22.7
				5	0.072	2.53	0.65	20.65

TABLE 2
Queuing Theory Analysis Results for Supertanker Berthing Facilities

supertankers inactive. The priviledged information which would make such a study feasible is beyond the scope of this report.

From the models developed with the stated assumptions, by 1975 at least 2 separate supertanker independent berthing facilities or 1 combined supertanker terminal having 2 independent berthing facilities will be required. By 1980, 3 berthing facilities will be required and by 1985 approximately 4 will be required based on the above discussed queuing theory analysis and associated assumptions. These requirements were based upon a 100 per cent berthing time availability for the supertankers. No provision has been made for contigencies such as hurricanes or system failures in one or more of the independent berthing facilities. When the initial complexes are built, it may be necessary to provide for 1 extra independent berthing facility than is apparently necessary to meet unexpected system failure contingencies which could result in long waiting periods for supertankers.

Initially 2 independent single-buoy moorings would be located in a straight line configuration southeasterly from the Texas Gulf Coast near Freeport, Texas. The first buoy would be located approximately 95 01'--28 33', 26 nautical miles off of the coast in 95 foot deep waters. The second monobuoy would be approximately located 2 nautical miles further to sea in 100 foot deep water at coordinates 95 00'--28 32'. When other monobuoys are needed they would be placed progressively further to sea along the same alignment spaced at 2 nautical mile intervals.

Figure 1 represents an example of a commercially available single-buoy mooring system (SBM) in production today. The single buoy mooring system (SBM) recommended above is, at this time, the most desireable facility for several reasons.

From a construction standpoint it is felt that the single-buoy mooring system provides a minimum of time, as compared to other facilities, from the time construction is begun to the time it becomes operational. All of the fabrication of the buoy itself is done on shore, eliminating delays due to weather. The offshore work is minimal and consists mainly of anchoring the buoy and connecting the SBM to the offshore pipelines. Also, pipeline construction may proceed while the buoy is being fabricated.

The SBM has demonstrated through service at existing facilities, that it is exceptionally seaworthy, and can handle offloading operations in seas exhibiting 20 to 25 foot wave heights. Since the ship is allowed to orient itself along the path of least resistance, environmental forces and stresses due to contact with a wharf or dock are minimal or non-existent. If the ship does "rider up" on the buoy, fenders or skirts protect both the ship and the buoy from serious damage. Any size ship may dock at the SBM, with water depth the only limitation. The maneuverability area is limited only by the distance to the next SBM or to a water depth which is too shallow.

The main limitation of the SBM is that mooring operations are limited, since small launches are usually used to make connections of mooring lines to the buoy. The capability of landing a helicopter on the buoy may provide a solution to mooring problems in heavy seas.

Ship handling costs are reduced, since conventional harbor entry methods are eliminated. Also, the supertankers avoid the congestion and probability of collision that a harbor-type situation offers.

Finally the single buoy mooring is moveable. It can be relocated, if the need should arise, economically and efficiently.

The single buoy mooring system appears to provide the optimum means for servicing supertankers off the coast of Texas in the immediate future. As crude oil imports increase, more SBM's may be added to the existing system to meet the demand. The SBM is particularly suited to handling the demand for the next 15 years, during which time more permanent facilities may be planned and constructed.

Each independent berthing facility (monobuoy) should have supertanker unloading hoses capable of a cumulative 150,000 gallons per minute unloading rate. The underbuoy hoses should also be capable of a cumulative 150,000 gallon per minute flow rate at pressures in excess of 200 pounds per square inch.

Submarine Pipeline Description.

A submarine pipeline would be provided to connect by the use of a submarine pipeline manifold to the underbuoy hoses of the single-buoy mooring device. The submarine pipeline would be laid on the floor of the Gulf of Mexico and should not be buried due to the fact that the weight of the pipeline on the unconsolidated sediments, sands and muds of this region would probably cause the pipeline to bury itself in time anyway. The pipelines serving the independent berthing facility should be of sufficient size and material strength to allow for accumulated pumping rates of 150,000 gallons per minute from the monobuoy at pressures of 150-300 psi. This would probably require two 36 inch diameter submarine pipelines serving each monobuoy to achieve the required discharge rates. Other pipelines would also have to be provided going to and from the monobuoy. These would be ballast/ waste coming from the offshore facility to onshore treatment facilities and freshwater/bunkering C pipelines coming from onshore to the monobuoy.

The greater portion of the length of pipeline will be determined by the distance from shore-based storage facilities to each mooring device. Based upon the configuration recommended in another section of this report, each additional SBM will require about 2 miles more pipeline than that buoy which was most recently constructed. The routing of the pipeline to shore-based storage or junctions will also influence the length of pipe required. It is expected that crude oil pipelines will generally be routed directly to the tank farm constructed expressly for the supertanker facility. However, a detailed study of the existing pipeline junctions in the vicinity of the City of Freeport should be undertaken to determine the feasibility of direct pipeline movement of crude from the supertanker port directly into an existing or future commercial pipeline junction. This would provide the advantage of greater storage and maximum use of existing facilities.

The submarine pipelines would remain approximately 2-3.5 nautical miles to the right of the existing safety fairway that currently serves Freeport Harbor as shown in Figure 9. The submarine pipelines would tentatively bring the crude ashore at Bryan Beach (Figure 10) cross under the Intra-coastal Waterway, and continue inland, maintaining sufficient clearance from existing marsh and waterway areas, until arrival at the onshore facility. The exact location of the onshore facility will primarily depend upon land availability. It appears from cursory investigations that there is considerable land available in the immediate Freeport, Velasco Heights, and Clute region.

<u>Onshore Facility Description.</u>

The onshore facility for the Texas Supertanker Port would tentatively be located in the Freeport, Velasco Heights, Clute region of the Texas Gulf Coast. It would provide primarily for crude storage, crude pumping facilities to the refinery distribution network, administrative and oil pollution control crews and equipment capable of monitoring and containing any pollution threats anywhere in the facility (offshore as well as onshore).

The onshore facility would probably want to provide for at least 15 days storage in the event of a major system failure offshore. By 1975 this would mean a storage requirement of approximately 39 million barrels, based on an estimated daily throughput by 1975 of approximately

2.6 million barrels per day. An initial storage capability of approximately 40 million barrels is recommended initially, with subsequent increases in storage capacity as daily input prescribes. By 1985, the required storage to meet a projected Texas imported crude oil throughput of approximately 5.1 million barrels per day will be approximately 70-80 million barrels for a storage capacity of 15 days. With the storage tank requirements and pumping station requirements, a very large onshore facility would need to be provided, possibly requiring 3000-4000 acres of land by 1975. By 1985 nearly twice as much land (approximately 7000 acres) will be required to meet the greatly increased storage requirements. It is, therefore, recommended that approximately 7000 acres be initially purchased in order to provide for adequate storage requirements through 1985. The onshore crude storage system previously described would probably have the capability of segregating crude from various parts of the world because of differences in viscosity and sulfur contents. The differences create refining problems for specific petrochemical processes.

The onshore facility will need to provide pumping facilities in order to pump the crude from the crude storage tanks to the existing/future private oil company pipelines for transport to the respective petrochemical/refining facilities all along the Texas Gulf Coast region. No definitive estimates can be made as to the pumping capacity to be required, although it will certainly need to be more than the average daily throughput. Both the pumping capacity as well as the storage capacity will have to increase with corresponding crude oil import requirements.

The onshore facility will also provide for fire-fighting, pollution control, administrative and support services as required. The fire-fighting equipment and crews needed to control a facility such as this, would probably be a major expense both from an initial capital outlay and a daily operating expense standpoint.

The onshore facility would serve as the primary focal point for the training and maintaining of crews and equipment to monitor and control oil leaks and develop expertise in containment/cleanup procedures and techniques that would be used in the event of minor as well as major crude oil spills.

Of primary importance to the overall success of the terminal is the coordination of all of the terminal facilities, onshore, pipeline, and offshore, by one administrative/communication/coordinating center located physically at the onshore facility site. This administrative center would initiate actions with incoming supertankers, dispatch pilots and powerful tugs and ultimately position the supertankers safely alongside the single buoy moorings. This administrative onshore center could then provide for the safe and efficient simultaneous crude oil unloading and ballast/sewage unloading and treatment and at the same time provide for fresh water to be piped aboard ship along with Bunkering C oil if required. The administrative center through the use of advanced navigational and surveillance equipment could also monitor adjacent sea lanes and supertanker facility waiting areas and coordinate the efficient arrival/departure of the supertankers to and from the monobuoy complex.

Miscellaneous.

The overall facility described above would require separate, controlled navigational areas for supertankers awaiting a berthing facility availability. These separate navigational areas would probably be restricted or warning areas described so as to limit non-supertanker vessel use of these areas. The required waiting area would probably be a strip 4 nautical miles long by 3 nautical miles seaward starting approximately 30 nautical miles off the Cedar Lakes region of the Texas Gulf Coast. The waters in the waiting area would be approximately 120 feet deep. This would maintain the supertankers in waiting at least 5 nautical miles from the actual monobuoy unloading complex.

It is also deemed necessary that controlled ingress and egress seaways, restricted to supertanker use only, be provided and designated by the U. S. Army Corps of Engineers to provide for safety from oil spill and supertanker damage as a result of collisions of supertankers with smaller vessels.

C. ECOLOGICAL IMPLICATIONS

From an ecological standpoint it appears after much consideration that the optimum location for the proposed supertanker facility lies off the relatively inactive Freeport region of the Texas Gulf Coast. Why?

Principally, Freeport does not have an appreciable barrier island structure and associated large estuary which would be disturbed by passing several 36-50 inch diameter crude and products pipelines to and from a deep water supertanker facility proposedly located 25-28 statute miles off of the current coast of Freeport. One 48-inch pipeline, 30 miles long would contain over 12 million gallons of crude in it during the pumping cycle. If for instance a break either natural or man-made occurred, at 100,000 gallons per minute pumping rate, it would not take but a few minutes to drain several million gallons of oil directly into an estuary. At Freeport, however, the following are several advantages based on natural location:

1. If an oil spill did occur between the mainland and the intra-coastal canal, it would be possible to easily confine the spill by setting up barrier booms or containment curtins at selected points across the intra-coastal canal due to its very narrow nature. This confinement of the spill or break oil would most certainly kill nearly all the organisms in contact with it, but after the cleanup operation, the area would be small enough for rapid ecological recovery especially

through seeding or restocking the affected area from commercial nurseries. The spill would be considerably more convenient to handle in this confined area and subsequent crude recovery using the latest in oil pollution recovery equipment would be possible. Rapid repair of the broken pipeline would also be possible utilizing the shipyard facilities at the Freeport shipping basin. Most important, however, is the fact that minimum damage (possibly none) would occur to any existing estuary nursing and commercial fishing areas in the principle fishery regions of Galveston Bay and Matagorda Bay.

2. If the spill occurred at some point between the offshore facility and the mainland, two basic conditions could occur. First, if close to shore, the crude would probably accumulate on the mainland shores directly across from Freeport due to prevailing shore winds and then generally pollute the sandy shores up and down the coast for a distance of 10-15 statute miles in either direction. If this happened, it would most certainly cause a state wide-coastal disaster alert and containment vessels/crews from both Galveston Bay as well as Corpus Christi Bay could provide for a two sided logistical containment of the spill along with crews from the onshore facility at Freeport. If quick response were initiated, probable containment except in unusually bad storms would be quick. Of major importance is the fact that the oil slick would accumulate on the faces of the barrier islands and not be readily allowed entrance into a delicately balanced estuary tidal

nursing ground. Although this alternative may still seem very harsh and unacceptable to many environmentalists, it is very probable that sometime during the life of such a facility, regardless of its location, a similar situation will occur. However, being away from the principle nursery grounds and principle commercial fishing areas, it would be tentatively producing a minimal damage while at the same time affording ample opportunity for successful containment and cleanup operations.

3. If the spill occurred at some point far at sea either at the offshore facility or more than 10 miles off the coast line, the resultant oil slick would be at the mercy of the prevailing winds. Oil slicks move roughly as a unit in the direction of the wind and parallel to it at a rate of approximately 3 per cent of the mean surface wind (102, p. 381). There are two basic mechanisms involved with the generation of an oil spill: spreading brough about by the physical properties of the crude (density, specific gravity, surface tension, etc.) and translation of the oil slick as a unit as a result of prevailing winds, surface current and waves forces. For a spill generated on the open seas, the principle mechanism important from a containment and cleanup standpoint is translation. Of the 3 forces tending to cause translation, it is generally felt that for the open sea the wind component is the most efficient transport mechanism (101, p. 358). If the winds are variable, there is a real possibility that with proper containment, no shoreline pollution would occur at all. However, if the seas and winds are

constant toward the coastline, the slick could hit the coast 60-100 miles either side of Freeport if containment was not successful. This could mean that the Galveston Bay or Matagorda Bay estuaries and commercial fishing grounds would be affected.

The above situations would hopefully never happen. However, analysis such as above is necessary to develop contingency plans and procedures in the advent of a similar real situation arising. The possibility of having a large oil spill especially due to a supertanker incident again points up the requirement and necessity for stringent anti-pollution devices and procedures and the need for readily available containment and pollution abatement equipment, should such a disaster occur. Pollution protection, anti-spill equipment and leak detector devices will have to be installed on the tanker, the offshore facility, the pipelines and even on the onshore storage and pumping facilities.

Estimates from previous major oil spills off the coast of Cornwall, England and Santa Barbara, California point up the uneconomical alternatives to the oil companies generated as the result of a major oil spill. Crude oil originally worth about 8 cents per gallon cost upward of $1.00-$7.50 per gallon of crude spilled in recovery and containment costs alone (3, p. 172). However, the tanker spills named above involved infant ships compared to the potential spills involving 300,000 DWT supertankers described within this paper. Very few new ecological problems will be substantially different from present oil pollution problems. However, the degree and magnitude of the problem, and the quantity of oil causing the problem is new.

The oil companies dislike an oil spill as much as anyone (probably more) because through recent litigation they have been incurring nearly absolute liability for cleanup operations and payment of damages. The salt water contamination makes the crude very expensive to process when it is recovered as an oil-water emulsion. This results in economic burdens of the following nature to the organization assuming liability for the oil spill:

1. The buying of special containment barrier and oil pollution control equipment,
2. The building of special pollution control handling and positioning vessels to take the abatement equipment to the oil spill site(s),
3. The paying of workers high wages for hazardous duty on the high seas in a cleanup operation,
4. The making of settlements in and out of court for private property damages, and
5. The general personnel expenses associated with coordinating a very messy, disagreeable and expensive operation.

And so in reality, the justification for extreme safety and careful handling conditions in order to prevent crude oil interdiction of marine ecological areas is principally a two-fold economic proposition. Both parties would lose; the oil industry by being required by law to bear the burden of oil pollution abatement liability and the people of the State of Texas that use for recreation or livelihood the affected region damaged by the oil spill by not having this natural resource available for complete resource utilization and enjoyment.

D. ENGINEERING IMPLICATIONS

In addition to the ecological advantages for the location off the coast of Freeport, this site provides several logistical advantages that make it even more attractive. Although it is desireable to have the facility as near the shore as possible to reduce the expense of constructing the submarine pipelines, the proximity to the existing oil refinery areas and pipeline distribution networks is also of major importance. A situation thus evolves of obtaining the best optimum balance between these two variables: (1) the offshore distance to the facility and (2) the onshore distance to the refineries. The location of the offshore facility is chosen from this optimum within the context of the environmental impact.

As before mentioned, the principle refinery area along the Texas Gulf Coast lies between Corpus Christi and the Beaumont-Port Arthur area. The Freeport location is roughly at the midpoint between these two extremities, thereby centralizing the introduction of the crude to the Gulf Coast refinery complexes. Freeport is also near the existing onshore pipeline network, which could provide the transportation of the crude to the Texas refineries or other receiving points further inland as required by the oil companies.

The offshore site is located in water depths of 95 to 105 feet over an adequate area for maneuvering with a minimum possibility of groundings. The area is located about four nautical miles from an existing safety fairway, providing easy access if the supertankers were to use existing sea lanes. New and separate supertanker sea lanes would be required for safety reasons to relieve the congestion in the existing safety fairways. The configuration of the facility would be so designed to provide separate lanes for ingress and egress to and from the system.

The Freeport location is apparently the optimum site considering the proximity to existing facilities, thereby reinforcing the already strong argument of the ecological advantages. Centered in the refinery and pipeline system of the Texas Coast, the location is outside of the major bay and estuary regions of Matagorda and Galveston Bays. Also, the area is not as heavily populated as the Corpus Christi, Houston-Galveston, and Beaumont-Port Arthur areas. This would ease the expense, future environmental pollution impact, and other problems associated with the already industrially developed areas of the State of Texas.

E. LEGAL IMPLICATIONS

1. The proposed supertanker port, if built by domestic petroleum companies as recommended, will fall under the jurisdiction of the United States, even though it is clearly on the high seas. As Willford L. Butte, Professor of Law at The University of Texas at Austin, points out "a nation has the right to control actions of its nationals wherever they are." (15)

2. Liability for oil pollution will most likely be as provided for by the Water Quality Improvement Act of 1970 or some similar federal legislation with expanded limits of liability.

3. The proposed supertanker facility is clearly within the continental shelf of the United States, but as this facility is not directly involved with the exploitation of the resources of the shelf, the United States will not be able to claim jurisdiction under the Convention on the Continental Shelf.

4. While the mooring buoys proposed are outside the legal jurisdiction of the State of Texas, the pipelines coming ashore will have to cross Texas Submerged land, thereby intimately involving Texas legally in the supertanker facility. In fact, the necessity of obtaining a permit and leases from the State of Texas for such a pipeline in effect gives Texas the right of review of the entire project.

5. The Rodrigue v. Aetna case (77) also involves Texas legally in the proposed superport. Damages for injuries to and

deaths of workers on the facility would most likely be covered by the Laws of Texas.

6. Tariffs on the imported crude will be imposed by the United States. Taxes may impose some type of throughput tax, especially on that crude not being refined in Texas, but passing through Texas to refineries elsewhere.

7. The possibility of monopoly law suits will be lessened by creation of a common carrier corporation under the Interstate Commerce Commission. Rate of return of a common carrier is restricted to 7 per cent.

8. Private ownership of the superport facility will allow the construction of the offshore buoys in one location. Public financial participation would probably require facilities of a similar nature to be built in several locations so that governmental favoritism would not be shown to a particular area.

F. POLITICAL IMPLICATIONS

The STP should be owned and administered by domestic private industry, financed and run entirely by a consortium of oil companies and acting as a common carrier for transporting the imported crude oil. At no time should the common carrier own the oil. Ownership jurisdiction of this common carrier should be over the offshore portion of the port "in toto" and onshore to the limits of the tank farm.

The Federal agencies involved should not be expanded either in number of jurisdiction. There is currently a sufficient number of them, with sufficient power, to insure adequate compliance of the Texas supertanker port with all applicable Federal laws and statutes.

The lack of current State involvement should be remedied by the establishment of a "Texas Maritime Commission," to be patterned closely after the Federal Maritime Commission. The purpose of this new state agency would be to protect and coordinate the State's interests in maritime affairs. Specifically, these aims can be accomplished by charging the Commission with:

- The ruling on State import taxes and throughput taxes involving marine imported commerce;
- The regulation and certification of terminal operators;
- The licensing of harbor improvements involving dredging;
- The coordination of new port construction; and
- The licensing of the handling of dangerous products at ports as they relate to environmental considerations.

Relation with Other Ports.

The element of monopoly is evident when such a massive amount of imported crude oil, as described for this port, is handled through one port. Although this will in effect price the existing Texas port authorities out of the business of crude oil importation, monopoly is not expected to be a viable complaint against the supertanker port so long as governmental funding is kept out of the port's development. Most of the crude imported today is handled at industry-owned terminals, and the Texas Supertanker Port of the future will not preclude the construction of other such ports of its size. The Louisiana Offshore Oil Port (LOOP) facility proposed off of Louisiana is expected to be in operation at approximately the same time as the Texas terminal, and, for the antitrust agencies of the governments, it will be offering equitable competition to the Texas Supertanker Port.

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