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The Perplexities of the U. S. Marine Transportation System

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THE PERPLEXITIES OF THE U. S. MARINE TRANSPORTATION SYSTEM

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Introduction

Following World War II, the United States merchant marine possessed unchallenged hegemony at sea, but this war-induced phenomenon was short lived. The U. S. merchant marine, today, is struggling to attain physical and economic health, but it is a formidable undertaking since approximately 95 percent of U. S. ocean-borne trade is currently being carried by foreign flag vessels.

The diminution of the American maritime posture is a perplexing matter since it can be regarded, intuitively, as both unnatural and untimely. The U. S. has a heritage of the sea that predates the founding of the Republic. The oceans, and the ships that sail them, have been a prominent factor in shaping virtually every crucial moment in our Nation's history.

Recent Presidentially-appointed national committees and commissions concerned with development of a national ocean program have been cognizant of this inextricable link. Yet, in the course of their deliberations they consciously chose to exclude serious discussion of the marine transportation system.[1]

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[1]". . . the problems of the U. S. merchant marine . . . are extremely complex and deserve more careful, concentrated thought than the panel was able to contribute in light of the broad scope of the Marine Resources and Engineering Development Act." [U. S., Commission on Marine Science, Engineering and Resources, Industry and Technology, Panel Report, vol. 2 (Washington, D.C.: Government Printing Office, January 1969), p. 45.]

"Of all the fundamental and pressing issues which NACOA wanted to include in this Report, but did not, Marine Transportation stands out. However . . . it was next to impossible to examine the issues and choices from an adequate perspective in the absence of a detailed analysis of the maritime transportation system as it interrelates with problems of economic growth, social costs and benefits, and environmental goals." [U.S., National Advisory Committee on Oceans and Atmosphere, A Report to the President and the Congress (Washington, D.C.: Government Printing Office, June 1972), pp. v-vi (Foreword).]

At this point, an interpretation of marine transportation system is warranted. The Merchant Marine Act of 1936 (as amended), through the use of its regulatory and promotional powers, remains the principal mechanism for maritime policy. Designed to "further the development and maintenance of an adequate and well-balanced American merchant marine, to promote the commerce of the United States, to aid in the national defense," the Act called for a strong merchant marine that would be:

> -- sufficient to carry its domestic water-borne commerce and a substantial portion of the water-borne export and import foreign commerce of the United States . . .
>
> -- capable of serving as a naval and military auxiliary in time of war or national emergency.
>
> -- owned and operated under the United States flag by citizens of the United States insofar as may be practical.
>
> -- composed of the best-equipped, safest, and most suitable types of vessels, constructed in the United States and manned with a trained and efficient citizen personnel.
>
> -- supplemented by efficient facilities for shipbuilding and ship repair . . .[1]

As used in this paper, the marine transportation system will focus upon the "well-balanced" aspects of maritime activities. Emphasis will be placed on the carriage of water-borne commerce and related supportive activities and industries. Although the ability of the merchant marine to function as a naval and military auxiliary will not be specifically examined in this paper, a related aspect will be reviewed concerning the foreign-flag vessels under so-called "Effective U. S. Control (EUSC)."

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[1] See Charles D. Baker, "Water Transportation and National Policy -- A Study in Success and Failure." Proceedings of the Marine Technology Society (September 1973), pp. 579-585.

Many factors have deterred national ocean-policy committees from examining the issues associated with the U. S. marine transportation system. The rationale for omission includes the embedment of the transportation system in a complex and established legislative and bureaucratic framework; the extensive interaction of this industry with complex international, political, economic and legal issues; and the enormity of the developmental, investment, labor and international competitive problems which beset the industry.

This paper, with only the broadest of perspectives, attempts to make some general comments concerning the economies of the marine transportation system and the interrelationships between marine transportation modes and related industry.

The Multiplier Effect of Marine Transportation and Related Industry

In developing this examination, it is intended to proceed on the assumption that a marine transportation system and its related industry have a multiplier effect on the national economy which might be a major factor in determining the relative rate of increase of gross national product among the nations of the world and, ultimately, be a major factor in determining the relative national standings in per capita income.

To illustrate this supposition, it has been estimated that in the ten-year period from 1958 to 1967, the beleaguered U. S. merchant marine contributed $11.3 billion in quantifiable benefits to the nation at a cost of $2.7 billion.[1] This represents a net benefit of $8.6 billion, or over $4 in benefit for each dollar of cost.

A supportive espousal also is offered by officials of the Maritime Administration wherein they estimate that if all energy fuels and materials needed by 1985 were to be imported on U. S. flag vessels, the subsidy cost ($8.1 billion) to the U. S. taxpayers of a shipbuilding/operating program sufficient to carry these essential materials would generate the following returns:

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[1]James R. Barker and Robert Brandwein, The United States Merchant Marine in National Perspective (Lexington, Mass.: Heath Lexington Books, 1970).

-- 2.1 million man-years of employment would be generated to build and operate the vessels

-- $20.3 billion in wages would be paid to shipyard and shipboard employees

-- $11.3 billion would be paid in income taxes

-- A $57 billion expansion in gross national product (GNP) would be generated

-- $9.3 billion in balance-of-payments gain would result.[1]

If this hypothesis is even partially correct, then there is cause for grave national concern, for by any objective analysis, our progress in the development of a marine transportation system is lagging behind that of many other nations. This concern also must be extended to those activities which are directly associated with marine transportation -- the development of deep water ports and offshore oil terminals, the establishment of integrated through services for unitized cargos, the construction and repair of very-large and ultra-large tankers and nuclear-powered merchant ships, the development of offshore commercial and industrial facilities, the development of marine-based rapid transit systems for the movement of goods and people, and the utility of Effective U. S. Control (EUSC) ships in time of war or national emergency.

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[1] J. Kasputys and J. B. Young, "Subsidies, Seed Money, and National Security," Sea Power (Washington, D. C.: Navy League of the United States, September 1973), pp. 23-30. (Hereafter referred to as Subsidies -- Sea Power.)

Review of Specific Areas of Concern

The aforementioned generalizations are made evident by a review of specific areas of concern for a marine transportation system:

-- Transport of Oil

-- Unitized Cargos

-- Specialty Carriers and Offshore Platforms

-- Marine-Based Transit Systems

-- Shipbuilding and Ship Repair

-- Effective U. S. Control (EUSC) Ships

Transport of Oil

On a worldwide basis the trend in oil transportation has been toward the use of ships of increasing size and draft.[1] Figure (1) clearly demonstrates the economy of scale associated with supertankers. The trend to size must, however, be accompanied by deepwater port capabilities, and, because no existing U. S. port has the requisite draft accommodations, the supertanker has to date bypassed the United States. In advocating the development of deepwater ports, President Nixon stated the following in his Energy Message of 1973:

> If we do not enlarge our deepwater port capacity, it is clear that both American and foreign companies will expand oil transshipment terminals in the Bahamas and the Canadian Maritime Provinces. From these terminals, oil will be brought to our conventional ports by growing numbers of small and medium size transshipment vessels, thereby increasing the risks of pollution from shipping operations and accidents. At the same time, the United States will lose the jobs and capital that those foreign facilities provide.
>
> Given these considerations, I believe we must move forward with an ambitious program to create new deepwater ports for receiving petroleum imports.[2]

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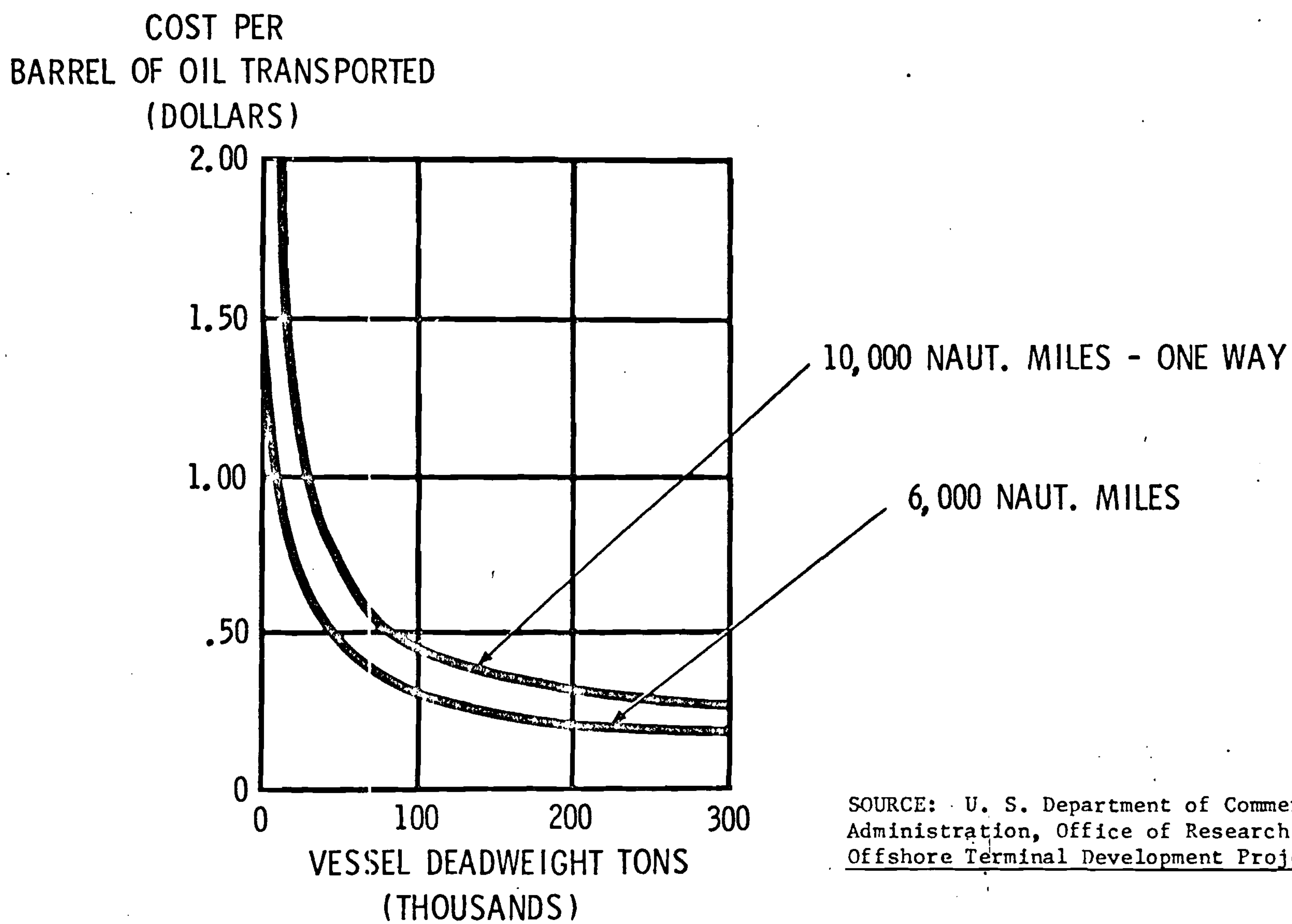
[1]U.S., Department of Commerce, Maritime Administration, The Economics of Deepwater Terminals (Washington, D. C.: Government Printing Office, 1972), pp. 5-8.

[2]President's Energy Message of April 18, 1973 to the Congress of the United States.

OIL TRANSPORTATION COST VS. VESSEL SIZE & ROUTE LENGTH



SOURCE: U. S. Department of Commerce, Maritime Administration, Office of Research and Development, _Offshore Terminal Development Project_, Sept. 1971.

FIGURE (1)

In his Energy Message of 1974, the Arab oil embargo notwithstanding, President Nixon, again, made a strong appeal for appropriate legislation to "permit the development of new deepwater port facilities offshore." He explained:

> Even though our policy is to achieve self-sufficiency, we will clearly continue to import oil as long as it is available at reasonable prices. To enable us to import fuel more economically, I have proposed Federal Government licensing of the construction and operation of deepwater port facilities three miles or more at sea on the Outer Continental Shelf. The main use of these facilities would be to import crude oil in ships that are economically and environmentally desirable, but are too deep of draft to permit their entry into our port facilities on the East and Gulf Coasts.
>
> This legislation would also eliminate many of the legal uncertainties which now drive private investors away from American waters and to other nations of the Western Hemisphere. The present system only serves to create investments and jobs abroad and raises our costs of imported oil, already high, even further . . . (the Arab oil embargo) has opened our eyes to the short-sighted policy (of excessive dependency on foreign supplies of a vital good) we had been pursuing.[1]

Total tanker arrivals for the 48 contiguous states in 1971 numbered 67,700 with 84 percent of these along the Eastern Seaboard. West Coast arrivals amounted to 6.5 percent, and Gulf Coast arrivals were 9.5 percent of the total.[2] The cost of transporting oil to the U. S. East Coast is shown in Table (1). At the present time (prior to the Arab oil embargo)

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[1]President's Energy Message of January 23, 1974 to the Congress of the United States.

[2]Bureau of National Affairs, Inc., Environmental Reporter (Washington, D. C.: Bureau of National Affairs, Inc., May 1973), p. 19.

TABLE 1

COST OF OIL PER TON DELIVERED TO THE EAST COAST FROM OCEANIC SERVICES
(Foreign Flag Ships)

	Existing Situation	Canadian Off-shore Terminal	Offshore Island and Pipeline	Offshore Island and Feeder Vessels
Cost of Ocean Freight		5.30	5.30	5.30
Transfer Charges		.35	.65	.80
Transport to Refinery		1.13	.40	.38
Cost of Unloading		.15	.15	.15
Cost of Pollution Control		.15	.15	.15
Cost Oil Per Ton	10.85	7.08	6.65	6.78
		(326,000 ton ship)	(326,000 ton ship)	(250,000 ton ship)

SOURCE: U.S. Department of Commerce, Maritime Administration, Office of Research and Development, Offshore Terminal Development Project, September 1971.

more than 104,000,000 tons of oil per year are transported by ship to the East Coast.[1] Considering the differentials indicated in Table (1), an annual cost savings of approximately $425 million per year could be realized through the implementation of a super carrier/offshore terminal system. Such a differential would warrant a multi-billion dollar investment at current expectations for return on capital and, indeed, this is supported by the number of offshore terminal studies now being conducted by private and local interests.[2] Significantly, the legislation submitted to Congress pursuant to the President's energy messages includes states, political subdivisions and public or municipal corporations among the entities that could be authorized to construct or operate deepwater port facilities beyond the three mile limit.[3]

Concerning the investment of U. S. private capital in the requisite super carriers, the Merchant Marine Act of 1970 has gone far to encourage the development of a U. S. flag bulk carrier fleet capable of transporting a reasonable proportion of our growing imports of petroleum and other bulk commodities.[4] Indeed, the current shipbuilding "boom" in the United

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[1]U.S., Department of Commerce, Maritime Administration, Office of Research and Development, Offshore Terminal Development Project (Washington, D. C.: Government Printing Office, September 1971).

[2]Three deepwater terminals are presently under active consideration: Sea Dock, near Freeport, Texas; LOOP, near Grande Isle, Louisiana; and one off Delaware.

[3]For a general discussion of the various planning and arrangements for offshore port financing see Duncan C. Gray, "Sources of Funds Required," Planning for Offshore Ports (Washington, D. C.: Marine Technology Society, 1974).

[4]U. S., Congress, House, Report of the Activities of the Merchant Marine and Fisheries Committee, 92D Congress (Washington, D. C.: Government Printing Office, 1972), p. 11.

States is being fueled by the most liberal financing terms in history.[1] In contrast with the worldwide financing available for ships, the credit-worthy U. S. flag shipping transaction can merit 100 percent financing -- rather than the maximum 70 or 80 percent abroad; can be at a money cost significantly lower -- by 3 to 5 percent; and, more important, can be a fixed rate over a duration approximating the life of the ship (20 to 25 years) rather than the 8 to 12 year term customary elsewhere.[2]

By the mid-1980's, the United States will have to import between 50 to 60 percent of its petroleum products, as compared to the 26 percent we had currently imported prior to the oil embargo.[3] In terms of balance of payments, the United States imported $3.6 billion worth of energy fuels in 1971 while exporting only $1.5 billion -- primarily coal. By 1985, this balance-of-trade deficit for energy could rise to $25 billion annually.[4]

It should be generally conceded that the construction of deepwater ports (be they monobuoys, fixed structures, floating or artificial islands) makes both economical and environmental sense. The critical questions however concern tanker movements. It is, of course, obvious that for at least the next decade, even with the President's Project Independence for energy self-sufficiency, we will continue to be dependent upon foreign

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[1] Marine Engineering/Log (New York: Simmons Boardman Publishing Corporation, October 1973), pp. 27-33.

[2] Ibid.

[3] U. S., Council on Environmental Quality, Energy and the Environment (Washington, D. C.: Government Printing Office, August 1973), p. 7.

[4] Ibid.

sources for our energy supplies. Shall we risk a dual dependency by becoming dependent upon foreign bottoms to transport these fuels to our shores? As of December 31, 1971 the U. S. flag tanker fleet consisted of 291 ships (both private and government owned) with an average tonnage of 27,000 DWT.[1] To carry the projected crude imports it is envisioned that 200 supertankers (VLCC's) will be needed, supplemented by 300 to 500 small shuttle tankers (although in some cases pipelines could be used) for transshipment from U. S. offshore port facilities to major refineries and distribution centers.[2] If offshore facilities are not constructed, it has been estimated that 2,600 tankers, averaging about 47,000 DWT each to conform with existing port limitations on the East and Gulf Coasts, would be required to meet future U. S. import requirements.[3]

The crux of the problem is what should the "mix" be for the U. S. flag tanker fleet, recognizing that the operating scenario lacks clear definition. As of December 31, 1973, there were 49 tankers under construction or on order. Of this total, 11 tankers are very large crude carriers (VLCC's) ranging between 100,000 to 265,000 DWT; 13 are approximately 90,000 DWT and 25 are less than 40,000 DWT.[4] About one-half

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[1] U. S., Department of Commerce, Maritime Administration, A New Wave in American Shipping (Washington, D. C.: Government Printing Office, 1972), pp. 72-73.

[2] Marine Engineering/Log (New York: Simmons Boardman Publishing Corporation, April 1973), p. 5.

[3] Maritime (Washington, D. C.: AFL-CIO Maritime Trades Department, Spring 1972), p. 5.

[4] U. S., Department of Commerce, Maritime Administration Tabulation, "Shipbuilding Contracts Under Merchant Marine Act of 1970," (1973).

of these 49 tankers are covered by the Cost Differential Subsidy (CDS) provision of the Merchant Marine Act of 1970. CDS applications pending before the Maritime Administration's Subsidy Board include an additional 98 tankers ranging in size from 80,000 DWT to 400,000 DWT.[1]

These ships probably will be ready for sea in the 1975 - 1978 time frame, and they will be looking for both adequate cargos and port facilities. To insure that there will be available cargos there is mounting sentiment in the Congress to pass legislation allocating a certain percentage of U. S. oil imports for carriage in U. S. flag tankers. During the first and second sessions of the 92nd Congress, 182 Congressmen (42 percent of the House membership) sponsored or co-sponsored 26 separate bills for allocating a certain percentage of U. S. oil imports for U. S. flag ships. One bill (H.R. 13324) would have required that 50 percent of all U. S. oil imports be transported by U. S. flag ships. The expressed purpose of the bill was to "assure that the United States does not become wholly dependent on foreign vessels for its rapidly increasing oil imports with resultant adverse implications for our national security, balance of payments, domestic economy, and marine environment." Although there was widespread Congressional support for this bill, it was defeated in the Senate -- but only by seven votes. Similar legislation is now before the 93rd Congress and is being actively considered.

[1]U. S., Department of Commerce, Maritime Administration Tabulation, "Pending Construction Differential Subsidy Application," (1973).

Another factor which must be recognized concerning our tanker mix is the eventual completion of the Trans-Alaskan Pipeline whose sea leg will consist of oil being transported from Valdez, Alaska to West Coast refineries and to a Panama Isthmus transshipment point. Carrying oil between domestic ports (Valdez to West Coast ports) will be restricted to U. S. flag vessels as governed by the Merchant Marine Act of 1920 ("The Jones Act"). Section 27 of that Act stipulates:

> That no merchandise shall be transported by water, or by land and water, on penalty of forfeiture thereof, between points in the United States, including Districts, Territories, and possessions thereof embraced within the coastwise laws, either directly or via a foreign port, or for any part of the transportation, in any other vessel than a vessel built in and documented under the laws of the United States and owned by persons who are citizens of the United States . . .

The make-up of our tanker fleet is further complicated by the current limitations associated with construction subsidies. The Merchant Marine Act of 1970 provides for a Construction Differential Subsidy (CDS) to encourage U. S. built ships. Its success is evident with the order backlog of U. S. shipyards at a peacetime high. In addition, pending CDS applications, which totaled 180 ships (both tankers and non-tankers) as of the first of this year, are far in excess of the 30 ships per year target of the Act. With CDS funding limited to $300 million annually, how should the dollars be apportioned among the various vessel applicants?[1]

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[1]For a discussion of this particular problem see Henry S. Marcus, "The Need to Redefine the Objectives of the U. S. Maritime Subsidy Program," <u>Proceedings of the Marine Technology Society</u> (September 1973), pp. 565-577.

The issue of government-subsidized tanker construction becomes more perplexing when the environmental issue is introduced. Various environmental groups, in 1972, had obtained a court order to halt the contracting for subsidized tanker construction until the Maritime Administration filed an environmental impact statement.[1] An impact statement was eventually filed, under protest, and in the Fall of 1973, the environmentalists, somewhat satisfied that certain environmental protection equipment (such as anti-collision radar and inert-gas tank blanketing systems) were being required, decided against further court action.[2] The really expensive requirements such as double bottoms and segregated ballast tanks are still generally in abeyance. Although agreement was reached at the recent Intergovernmental Maritime Consultative Organization for segregated ballast tanks in new tankers, the agreement does not become operative until ratified by 15 or more countries representing 50 percent of world tonnage.[3] Since CDS funding is limited by statute to a fixed percentage, the imposition of environmental protection features either not required or exceeding the standards of foreign ships could easily negate the value of the CDS allowance.[4] The alternatives are then the establishment of

[1] Marine Engineering/Log (New York: Simmons Boardman Publishing Corporation, October 1973), p. 9.

[2] Ibid.

[3] Shipyard Weekly (Washington, D. C.: Shipbuilders Council of America, November 8, 1973).

[4] The Merchant Marine Act of 1970 provides for diminishing levels of the Construction Differential Subsidy starting with 45% of domestic building cost in 1971 and declining 2% each year until a maximum of 35% is reached in 1976. The drop of the subsidy base will require a substantial reduction in the cost of ships constructed in U. S. shipyards.

uniform international standards, legislating an offsetting adjustment in the CDS percentage, or, all else failing, having the owner opt for the less costly foreign flag vessel.

Let us consider one final facet of the oil transport picture -- refining capacity. In 1970, there were 268 refineries in the U. S. with an average daily capacity of about 50,000 barrels. To keep pace with the projected demand, it has been determined that we will require by 1980 the equivalent of 58 new refineries with an average capacity of 160,000 barrels per day.[1] To date, only one new refinery is under construction. Recognizing the environmental pressures concerning refinery construction, particularly since the preferred siting is generally in the already overburdened coastal zone, just how does the U. S. accommodate this needed refining capacity. Perhaps offshore refineries offer the solution, particularly when it is desirable to have your refinery centers in proximity to the areas of heaviest energy consumption. Consider the situation today: the Gulf Coast currently has only 16 percent of the U. S. energy demand, but has about 40 percent of the country's refining capacity. The East Coast, on the other hand, has 40 percent of the demand but only 12 percent of the refining capacity.[2] Although it has been estimated that roughly a 50 percent expansion of refining capacity is possible at existing sites,[3] perhaps the ultimate solution is the construction of offshore refineries.

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[1] Ocean Industry (Houston, Texas: The Gulf Publishing Company, August 1972), pp. 38-44.

[2] Ibid.

[3] U. S., Council on Environmental Quality, Environmental Quality -- The Fourth Annual Report of the Council on Environmental Quality (Washington, D. C.: Government Printing Office, 1973), pp. 207-208.

In any event, it is evident that oil transport offers tremendous economic opportunities for the United States. How successful we will be in realizing these economies depends upon our ability to treat our transportation system in its totality -- a process which has yet to be adequately demonstrated -- for, in summarizing, several issues remain to be confronted and resolved. Specifically, what is needed includes the following:

-- To enact appropriate legislation to permit the construction of deepwater, super tanker port facilities.

-- To assess U. S. flag tanker fleet requirements (as well as offshore port facility needs) in terms of Project Independence . . . achieving self-sufficiency in energy by 1980.

-- To determine the major sources of oil. These sources could range from the U. S. Outer Continental Shelf, the Arctic, or Middle East. Each of these sources places a different set of requirements on the shipping industry and the tanker mix.

-- To enact oil cargo preference legislation to insure a fixed quota of the oil trade is reserved for U. S. flag tankers. As expressed by the President's Commission on American Shipbuilding:

> Because of the increasing bilateral trade pressure from developing and oil-producing nations, because of the increasingly assertive participation of state-owned fleets in shipping, and because of the past reluctance of U. S. oil companies to build and operate U. S. flag tankers, it appears necessary that a quota of the petroleum and gas trade be reserved for efficient and competitive U. S. built, U. S. manned ships if the United States is to have a significant portion of this transportation under its control and to have the capability to build and repair the necessary vessels.[1]

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[1] Report of the Commission on American Shipbuilding (Washington, D. C.: Government Printing Office, October 1973).

-- To develop a national position in the event of pressure from oil-producing nations to dictate oil carriage requirements. Again, quoting from the Report of the Commission on American Shipbuilding:

> The Department of State has pointed out, in Congressional hearings, that Iraq and the Arab Federation of Egypt, Libya, and Syria have announced plans to establish oil tanker fleets. Venezuela, Kuwait, and Saudi Arabia have also expressed similar goals. By virtue of their control of the oil itself, there is little doubt that the oil-producing nations have the power to require that their tonnage carry a portion of their oil exports . . . The United States faces this world situation without the national objectives which are so clear in other countries.[1]

-- To review both the adequacy and apportionment of Construction Differential Subsidy (CDS) funds particularly in relation to world shipbuilding activity. For example, at the end of 1973 there were 3,359 merchant ships under construction or on order in the major shipbuilding countries and tankers represented 75.7 percent of the total.[2] As commented upon in the Marine Engineering/Log:

> While nothing is certain in the shipping business, the present uncertainties of the oil situation would seem to indicate that this huge order book of tankers is more than the world fleet would need in the foreseeable future.[3]

The Arab oil embargo has produced a panoply of energy-related issues, and the character and viability of the U. S. merchant marine will be determined by the pursuant policies and planning actions of the U. S. government.

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[1]Ibid.

[2]Marine Engineering/Log (New York: Simmons Boardman Publishing Corporation, February 1974), p. 116.

[3]Ibid.

Unitized Cargos

The techniques which have been pioneered by United States technology include, initially, the pallet ship, the container ship, the barge-carrying ship (LASH and SEABEE), and, ultimately, the nuclear-powered barge-carrying ship. Figure (2) shows the economic advantages which accrue from implementation of each mode of unitization. The cost savings are large indeed.

The United States' experience with respect to the realization of the economies of unitized cargos has again been one of bright promise accompanied by much frustration. The achievement of unitization brings with it a substantially higher productivity per laborer on the docks and a blurring of distinction between teamster and longshoreman functions. As seen from figure (2) this is not an incremental percentage gain in productivity but a multiplication in productivity by factors as high as five.

As viewed by the unions, parsimony with respect to sharing the benefits of such modernization with labor resulted in a costly national strike in 1972 which affected the balance of trade and delayed the national realization of the economics of unitization.[1] Additional difficulties have resulted from the manner in which container ships must operate. Specifically, the economics of an efficient container ship operation dictate

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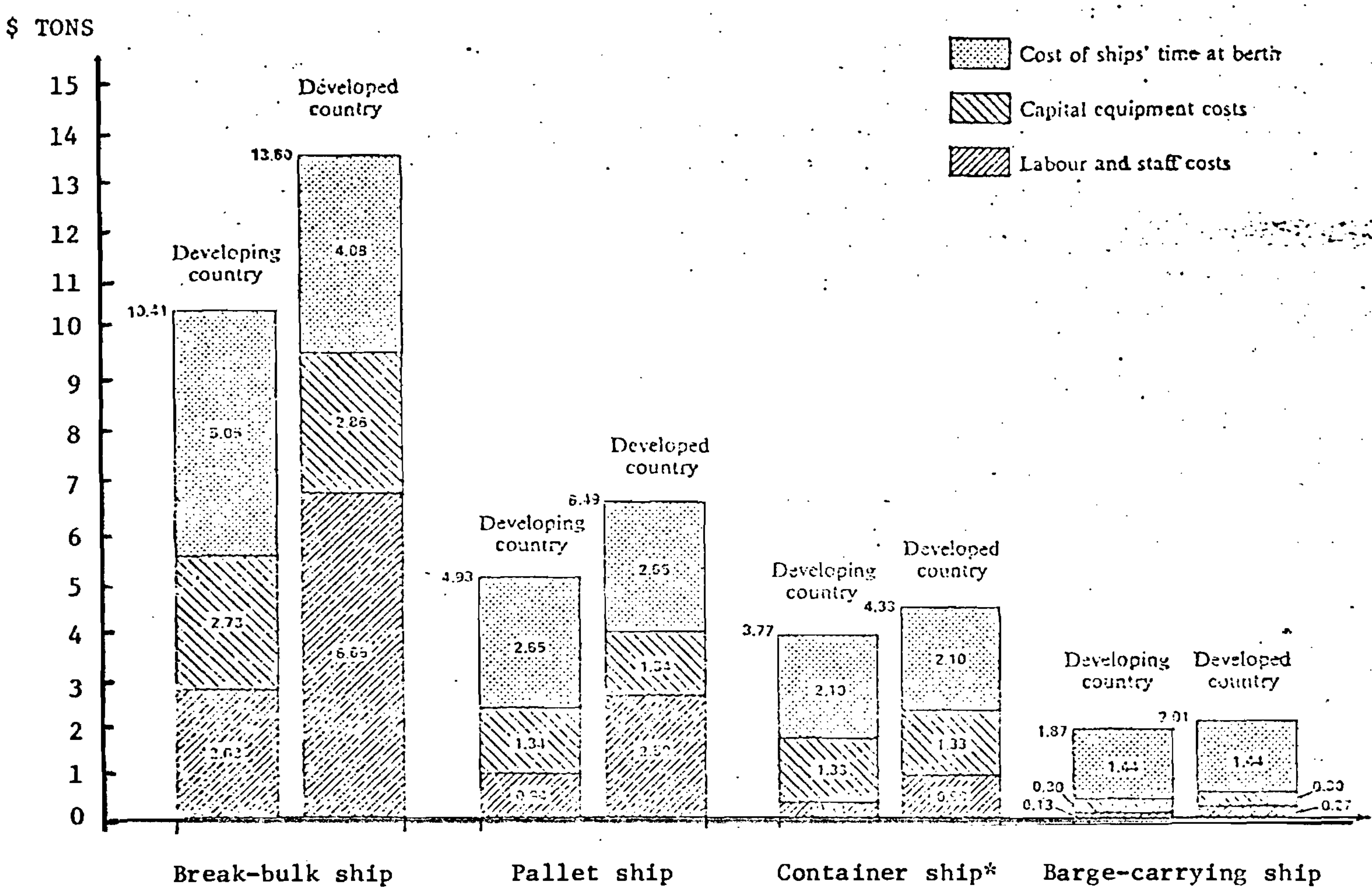
[1]In 1972, two longshore contract disputes caused a 135-day work stoppage at Pacific Coast ports and a 57-day stoppage at Atlantic and Gulf Coast ports. [See U. S., Department of Commerce, Maritime Administration, A New Wave in American Shipping (Washington, D. C.: Government Printing Office, 1972), p. 37.]

FIGURE (2)

TOTAL PORT COST PER TON FOR BREAK-BULK AND UNITIZED SHIPS

(All Units Door to Door)



* The total port cost per ton for the container ship is that of the combined roll-on/roll-off, lift-on/lift-off container berth.

SOURCE: Arthur D. Little, Inc., Organization for Economic Cooperation and Development.

keeping the number of port calls to a minimum. Cargos can be funneled to their ultimate destinations through a relatively small number of ports with economic advantages to the carrier. This, of course, presents a serious problem to those ports being denied direct vessel services. This poses the threat of ports claiming unjust discrimination and seeking recourse through the Federal regulatory agencies.[1] These same regulatory agencies, specifically the Federal Maritime Commission and the Interstate Commerce Commission, are also trying to resolve conflicting regulatory statutes which are inhibiting the optimum movement of unitized cargos. At present, intermodal freight cannot be shipped through to its destination using a single bill of lading and a single rate.

To correct this situation, H.R. 15465 ("The Intermodal Bill") was introduced in the 92nd Congress to facilitate "through intermodal freight movements involving offshore marine transportation." The bill would create a new type of carrier -- the "Intermodal Carrier" -- who would offer a through service to the shipper utilizing a single bill of lading, quoting one simple rate for the entire shipment from point of origin to point of destination, and being fully responsible for all liability concerning the shipment.

In providing this service, the Intermodal Carrier, in addition to utilizing its own facilities, could also utilize the facilities of other "underlying carriers." The Intermodal Carrier could be a rail carrier, a

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[1]U. S., Federal Maritime Commission, Tenth Annual Report (Washington, D. C.: Government Printing Office, 1971), pp. 15-16.

motor carrier, or an ocean carrier. Thus, an ocean carrier acting as an Intermodal Carrier could offer a through service at a single rate for a shipment from Peoria, Illinois to Milan, Italy using an underlying rail carrier to the Port of New York, then its own vessel from New York to a port in Italy, and then to Milan using the facilities of an Italian inland transportation system, either rail or motor carrier. The obvious advantage of this method is the shipper deals only with one carrier (the Intermodal Carrier), is quoted one rate, uses only one shipping document, and looks only to the Intermodal Carrier to resolve whatever problems may arise. Regulatory responsibility over the through movement and through rate would be vested in the Federal Maritime Commission.

The increasing use of containers has necessitated expansion at several U. S. ports. Prompting such moves usually is the substantial acreage needed for container marshalling yards. Recognizing the growing expense and difficulties associated with coastal zone land acquisition for industrial usage, the employment of heavy-lift helicopters could offer a viable alternative. Specifically, marshalling yards could be placed further inland with the helicopter providing the transportation link between the yard and port. This system would ease both the strain of coastal zone development and motor-carrier traffic to and from the port.

As shown in figures (3), (4), (5) and (6) the United States has experienced and continues to experience a declining share of the transportation market. As compensating factors, the U. S. is now the leader in barge-on-board (or lighter-aboard) ships (LASH and SEABEE) and an increase in domestic shipbuilding has been experienced as a result of the

U. S. FLAG MERCHANT SHIPS - PRIVATELY OWNED
(Foreign and Domestic Trades)

DECLINE IN NUMBER OF VESSELS: 1969 - PRESENT

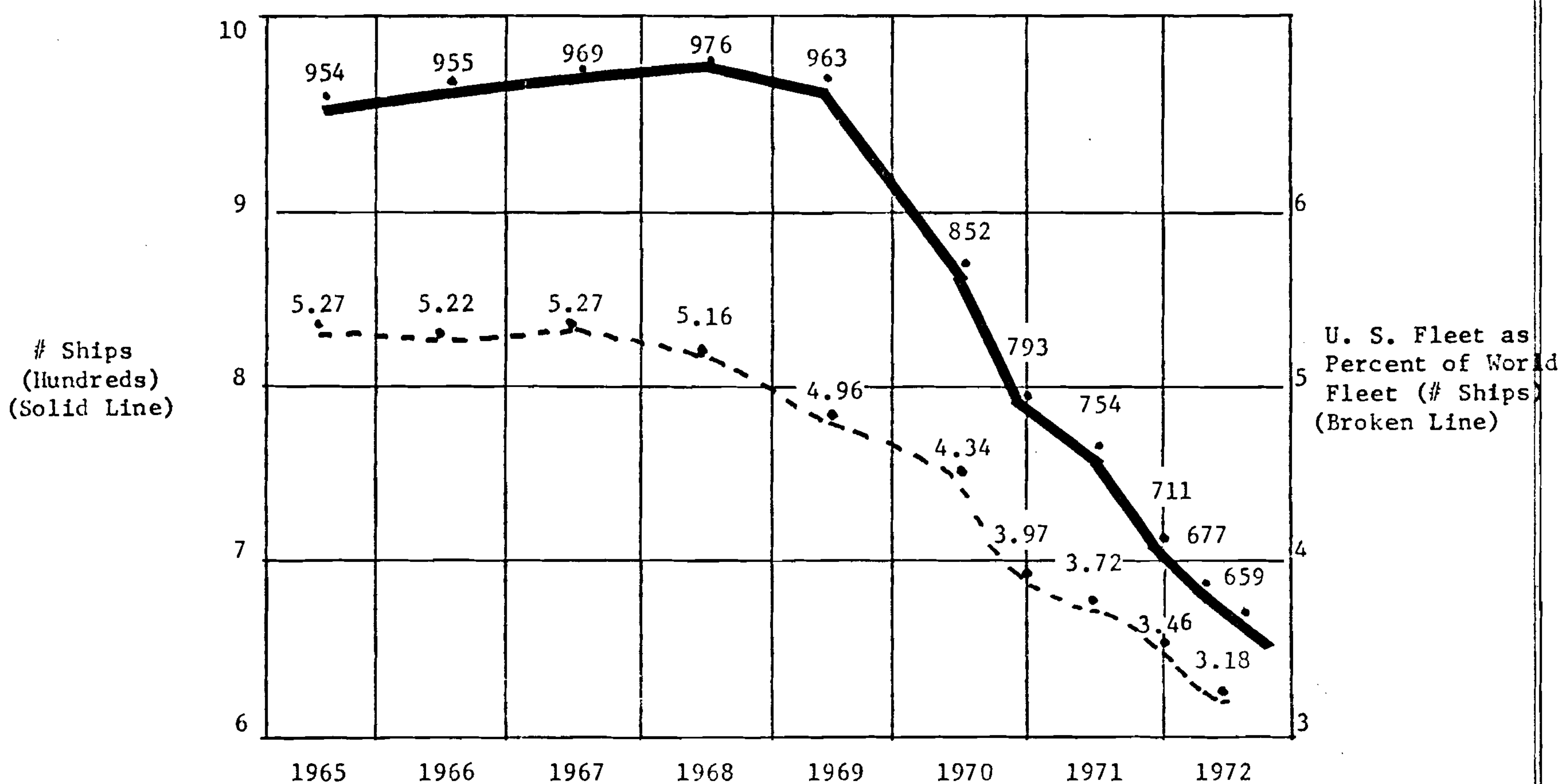
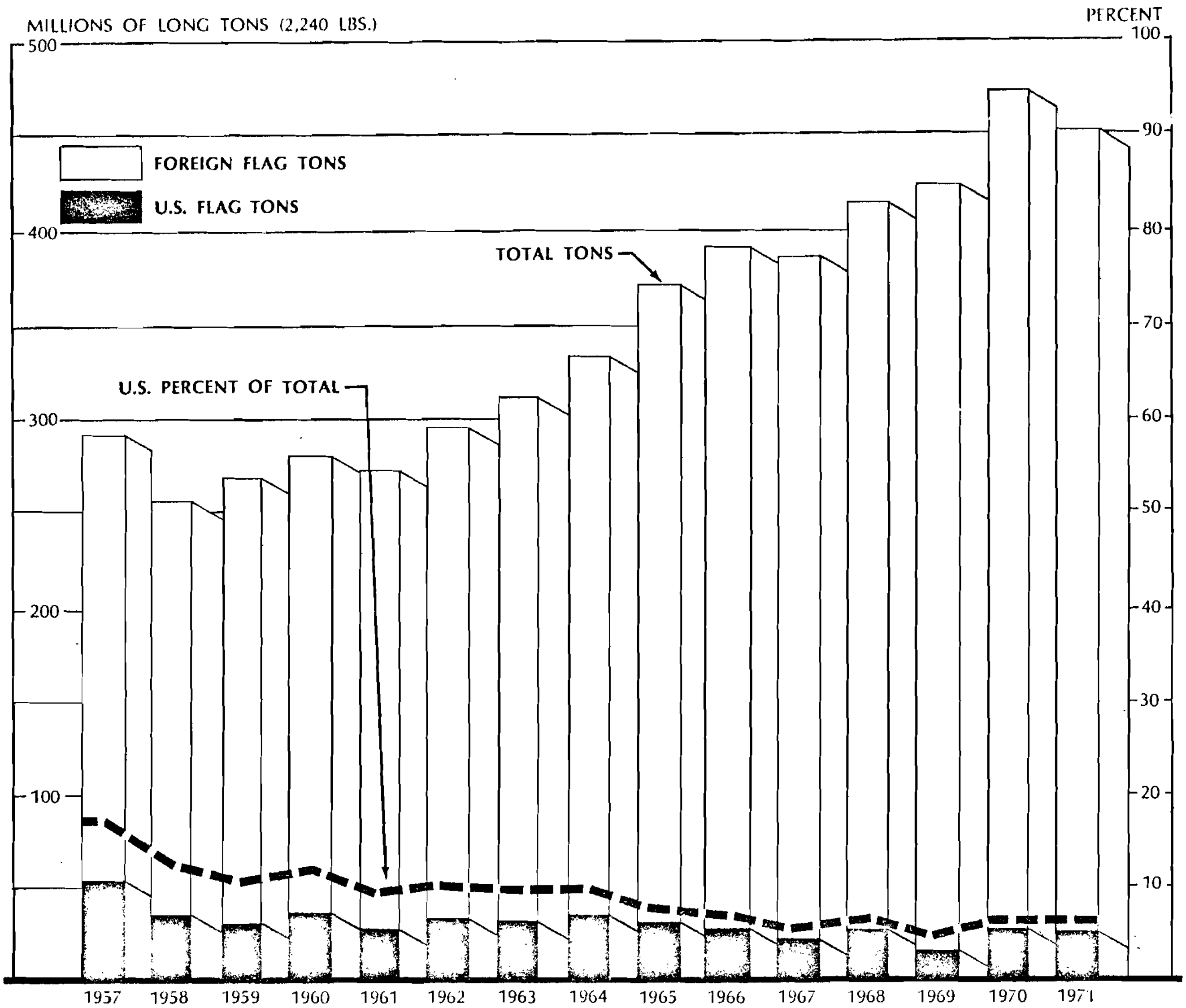


FIGURE (3)
SOURCE: U. S., Department of Commerce, Maritime Administration, Office of Subsidy Administration.

FIGURE (4)

U.S. OCEANBORNE FOREIGN TRADE: COMMERCIAL CARGO CARRIED [TONNAGE]



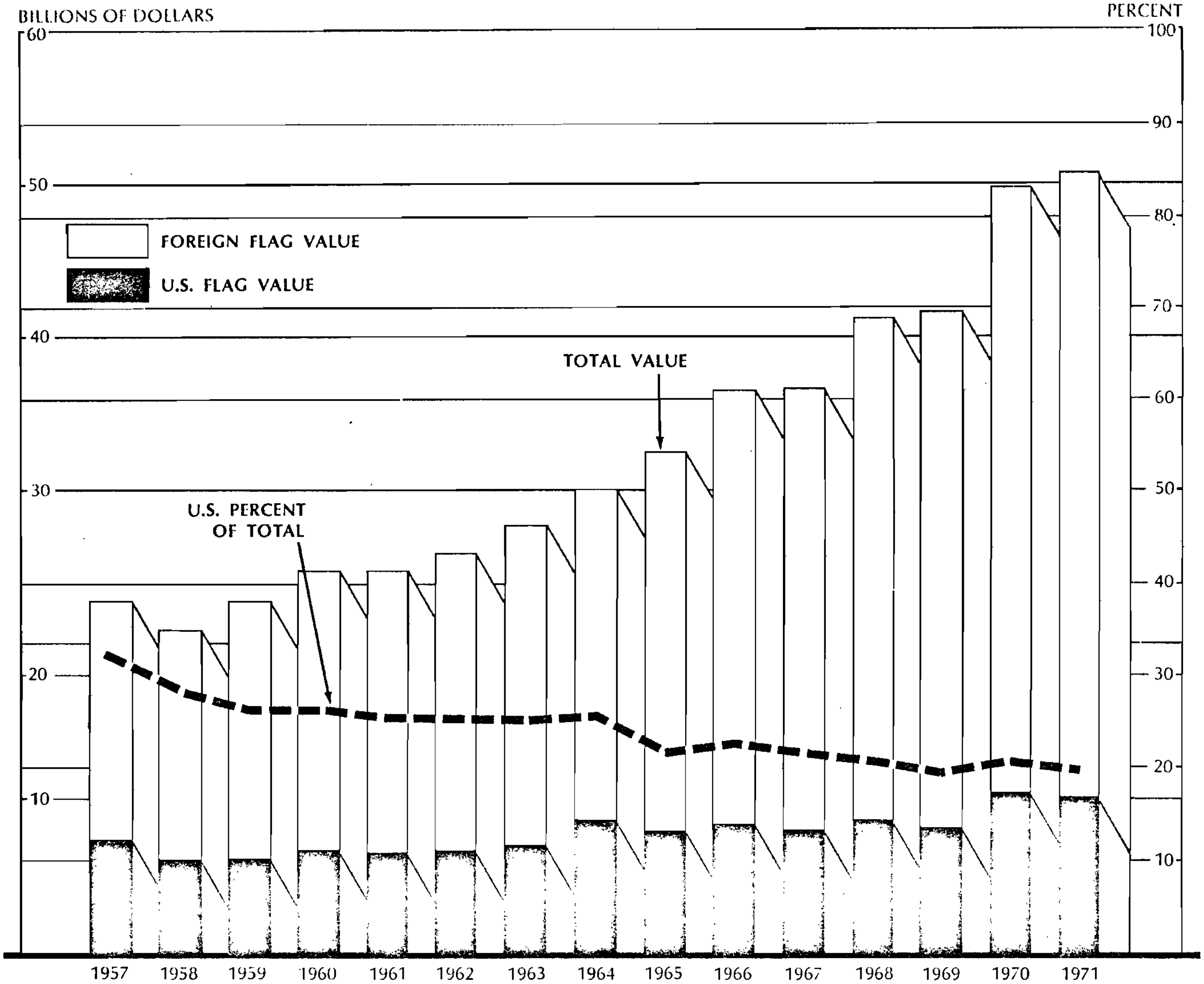
CALENDAR YEAR	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971*
Total Tons (Millions)	289.3	253.3	267.0	277.9	272.4	296.8	311.6	332.8	371.3	392.3	387.6	418.6	426.1	473.2	456.9
U.S. Flag Tons	50.8	30.9	27.1	31.0	26.3	29.6	28.5	30.5	27.7	26.2	20.5	25.0	19.1	25.2	24.3
U.S. Percent of Total	17.6	12.2	10.2	11.1	9.7	10.0	9.2	9.2	7.5	6.7	5.3	6.0	4.5	5.3	5.3
Liner Total Tons	46.7	43.4	48.1	50.7	49.0	48.3	48.9	50.3	49.2	49.9	47.9	46.1	41.0	50.4	48.8
Liner U.S. Flag Tons	17.8	14.0	13.5	14.5	12.6	12.7	13.5	14.2	11.2	11.4	10.6	11.1	9.2	11.8	10.3
Liner U.S. Percent	38.0	32.3	28.1	28.6	25.8	26.2	27.7	28.1	22.8	22.9	22.2	24.0	22.6	23.5	21.0
Non-Liner Total Tons	135.1	105.1	106.9	109.0	106.7	125.2	136.2	161.4	171.6	189.5	190.4	209.5	211.6	240.7	216.2
Non-Liner U.S. Flag Tons	16.2	8.8	8.2	8.4	7.8	8.3	8.2	9.8	8.2	6.9	5.4	6.4	4.4	5.4	4.7
Non-Liner U.S. Percent	12.0	8.4	7.7	7.7	7.3	6.7	6.0	6.1	4.8	3.6	2.8	3.0	2.1	2.2	2.2
Tanker Total Tons	107.5	104.8	112.0	118.2	116.7	123.3	126.5	121.1	150.5	152.8	149.3	163.1	173.5	182.1	192.0
Tanker U.S. Flag Tons	16.8	8.0	5.4	8.1	5.9	8.5	6.8	6.6	8.2	7.9	4.5	7.5	5.5	8.0	9.4
Tanker U.S. Percent	15.7	7.6	4.8	6.9	5.1	6.9	5.4	5.4	5.5	5.2	3.0	4.6	3.2	4.4	4.9

*Preliminary data subject to future revision.

SOURCE: U. S., Department of Commerce, Maritime Administration, A New Wave in American Shipping, 1972.

FIGURE (5)

U. S. OCEANBORNE FOREIGN TRADE: COMMERCIAL CARGO CARRIED [DOLLAR VALUE]



CALENDAR YEAR	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971*
Total Value ($ billions)	22.8	20.9	22.8	24.7	24.7	25.9	27.5	30.0	32.4	36.4	36.6	41.1	41.7	49.7	50.7
U.S. Flag Value ($ billions)	7.3	6.0	6.0	6.5	6.3	6.5	6.9	7.7	6.9	8.2	7.9	8.5	8.0	10.3	10.0
U.S. Percent of Total	32.1	28.6	26.1	26.4	25.6	25.1	25.1	25.8	21.4	22.5	21.7	20.7	19.2	20.7	19.8
Liner Total Value	16.4	15.3	16.8	18.5	18.3	18.9	19.5	21.3	22.3	24.8	24.8	26.8	27.0	33.5	33.0
Liner U.S Flag Value	6.4	5.4	5.5	5.9	5.7	5.8	6.2	7.0	6.2	7.5	7.4	7.8	7.4	9.7	9.3
Liner U.S. Percent	39.1	35.3	32.5	32.1	31.4	30.1	31.5	32.8	27.8	30.4	29.8	29.0	27.3	28.8	28.2
Non-Liner Total Value	4.0	3.4	3.7	3.6	3.7	4.3	5.2	5.9	6.6	8.2	8.6	10.8	11.0	12.2	12.8
Non-Liner U.S. Flag Value	.5	.3	.3	.3	.4	.4	.5	.5	.4	.4	.4	.5	.4	.4	.4
Non-Liner U.S. Percent	12.6	9.2	8.4	9.0	10.6	9.6	9.6	8.6	6.3	4.9	4.5	4.6	3.8	3.3	3.5
Tanker Total Value	2.4	2.2	2.3	2.6	2.7	2.7	2.8	2.8	3.5	3.4	3.2	3.4	3.6	4.0	4.9
Tanker U.S Flag Value	.4	.3	.2	.3	.2	.3	.2	.2	.3	.3	.2	.2	.2	.2	.3
Tanker U.S. Percent	16.8	11.4	7.5	10.4	7.3	9.4	9.0	8.8	8.2	7.7	4.8	6.6	5.2	5.6	5.7

*Preliminary data subject to future revision.
Note: Includes Government sponsored cargo; excludes Department of Defense cargo and U.S./Canada translakes cargo.

SOURCE: U. S., Department of Commerce, Maritime Administration, A New Wave in American Shipping, 1972.

DECLINE IN MARITIME EMPLOYMENT SHIPBOARD JOBS

U. S. FLAG FLEET

(Foreign and Domestic Trades)

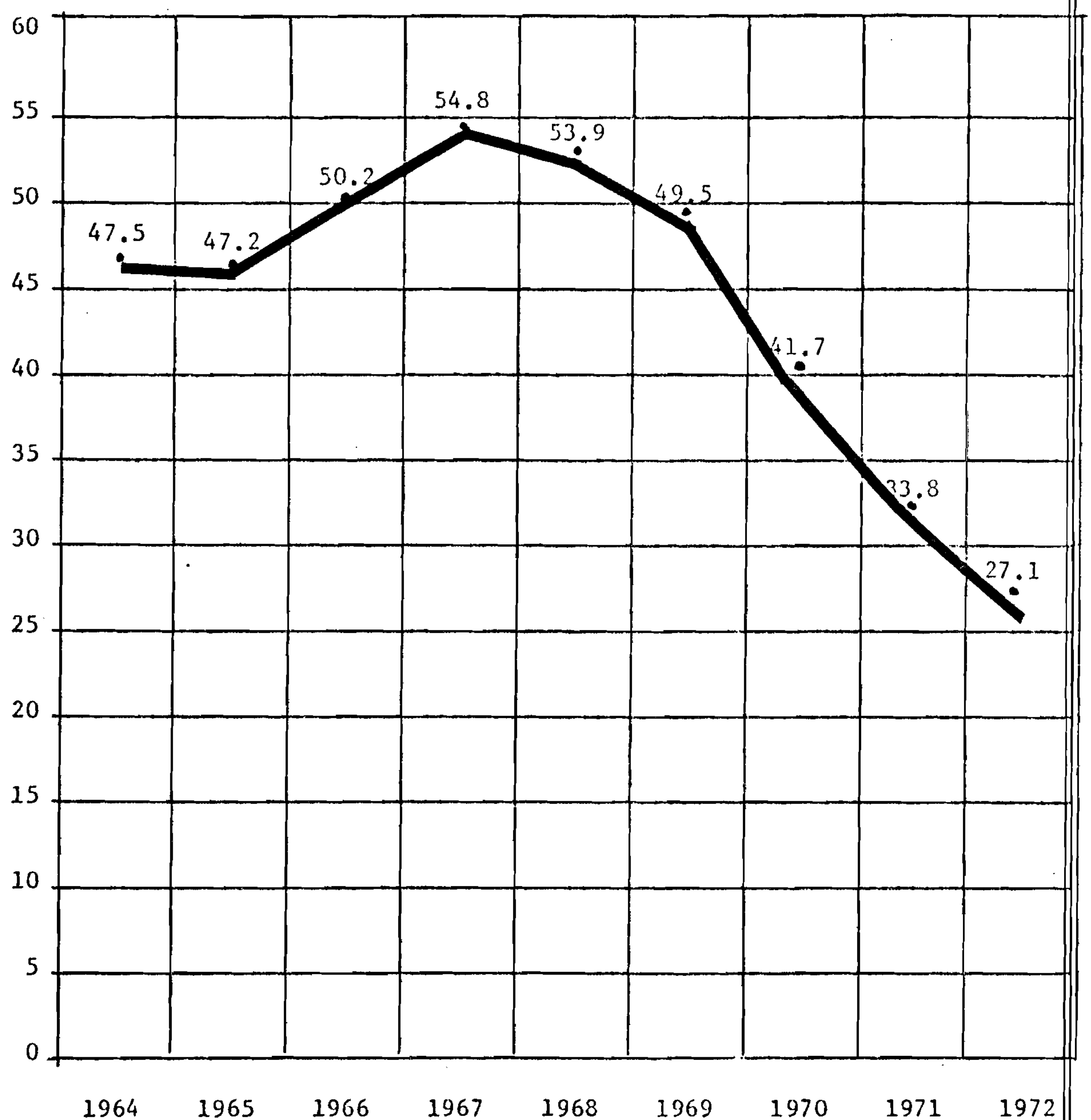


FIGURE (6)

SOURCE: U. S., Department of Commerce, Maritime Administration.

Merchant Marine Act of 1970. Although American shipbuilding is at a record peacetime high, nothing has yet transpired to indicate that the new capability will do more than maintain current relative world ranking of the fleet.

Of additional concern is the trend of events with respect to nuclear merchant ships. As shown in figure (7), short-term economic gain accrues from utilization of large size, nuclear-powered ships in commercial service. Recognizing that this comparative analysis was prepared before the current oil shortage, circumstances now appear to be combining to make more attractive the possibility of constructing nuclear-powered U. S. flag merchant ships. Bunker fuel prices are now 200% more than the 1972 price of $2.50 a barrel, and it is expected that costs will shortly hit $9.00 a barrel.[1]

The Federal Maritime Commission is currently seeking to hammer out a formula which will permit steamship lines and carrier groups to impose bunker fuel surcharges to offset the skyrocketing cost of operating merchant ships. These escalating bunker fuel prices are also causing ship operators, as an economy measure, to limit the number of U. S. ports serviced at a time when the devaluation of our dollar is increasing the amount of U. S. exports, particularly to Western Europe.

Legislation is now before Congress (H.R. 7694) that would establish a nuclear merchant ship incentive support program by providing federal support payments to cover "such portion of the construction cost differences arising from the use of nuclear propulsion units . . . necessary for the purpose of fostering the advance of U. S. flag maritime technology . . ."

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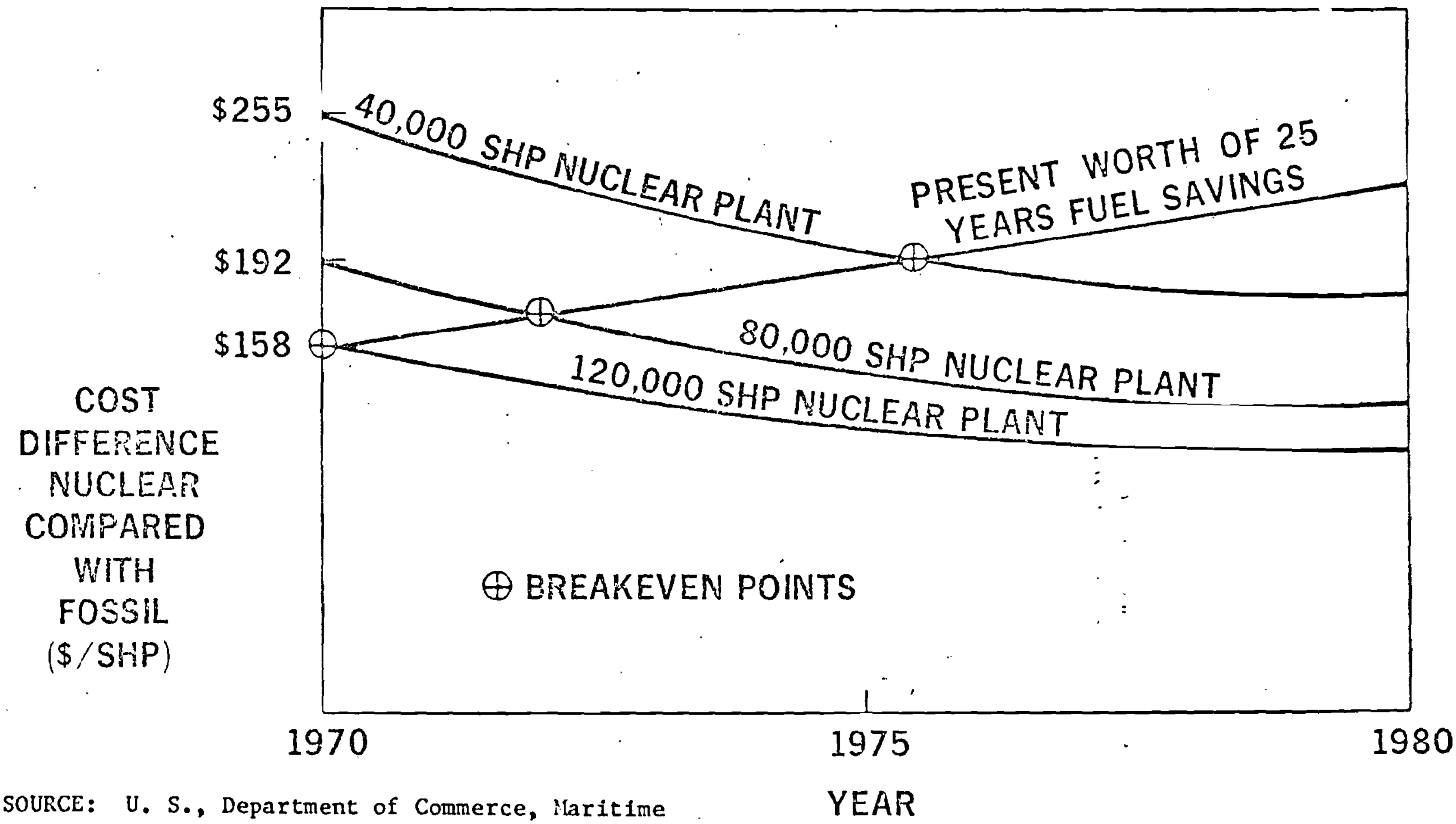
[1]Larry C. Manning, "Atoms at Sea," Sealift (Washington, D. C.: Military Sealift Command, January 1974).

FIGURE (7)

NUCLEAR/FOSSIL FUEL SHIP BREAKEVEN COMPARISONS (TODAY'S DOLLARS; P.W. DISCOUNT RATE, 8%)



SOURCE: U. S., Department of Commerce, Maritime Administration, Office of Research and Development, Maritime Nuclear Propulsion Program, Sept. 1971.

Such payments would be repayed by the recipients through recapture of 20 percent of the nuclear ship's annual net operating income until the full amount of incentive payments are recovered.[1]

Although the prospects for building nuclear merchant ships appear brighter, the Administration does not support the program envisioned by H.R. 7694 because of lingering questions as to economic feasibility, licensing and regulation, safety, financial responsibility, third party liability, indemnification limits and international reactions.[2]

Meanwhile, the foreign trend toward nuclear-powered ships, as illustrated by figure (8), continues. Unless the United States shortly overcomes its current cautious approach, it will lead to domination in this area by Japan, West Germany, and Russia. If this occurs, it will serve as another example of where the U. S. failed to exploit its technological lead, thus allowing others to acquire the dominant positions. (For added emphasis, it should be noted that the nuclear power plant of the West German ship Otto Hahn is a U. S. designed system.)

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[1] The cost estimates vary for construction of a nuclear-powered merchant ship, as compared to a conventionally-powered ship. For example, a 400,000 DWT conventionally-powered tanker costs approximately $125 million. Estimates for a comparable nuclear-powered ship range from $40 to $100 million more.

[2] Shipyard Weekly (Washington, D. C.: Shipbuilders Council of America, November 8, 1973).

WORLDWIDE NUCLEAR PROPULSION ACTIVITY

FIGURE (8)

U. S. A.	 LAID-UP	N. S. SAVANNAH laid-up in 1970 after 455,000 miles and 8 years of operation. MARAD's advanced nuclear propulsion system competitive now at high power levels. Growing industry interest coupled with cautious government attitude.
WEST GERMANY	 IN SERVICE	Government and industry aggressively pursuing international market. Exploring possibility of joint nuclear shipbuilding program with British interests. R&D continuing on advanced reactor technology for 1980 - 1990 propulsion systems.
JAPAN	 IN SERVICE	Very aggressive government industry program. Projecting market of 300 nuclear containerships in period 1980 - 2000.
RUSSIA	 IN SERVICE	LENIN was world's first nuclear powered ice breaker.
	 UNDER CONSTRUCTION	ARKTIKA is first ship of a series of two advanced nuclear powered ice breakers. Commercial propulsion activity not known.
NORWAY SWEDEN NETHERLANDS	ITALY FRANCE UNITED KINGDOM	Design studies only. Varying degrees of interest and capability.

Specialty Carriers and Offshore Platforms

Accompanying the development of supertankers and cargo ships has been an additional class of specialty carriers. These include LNG (liquid natural gas) ships, OBO (ore/bulk/ore) ships, RO/RO (roll-on/roll-off) carriers, mobile offshore drilling rigs, oceangoing tug-supply vessels, workover units and pipe burying barges. The full panoply of industrial ships of massive scale has resulted in the movement of heavy industry to the coastal zone in order to minimize transportation costs and optimize on ocean transport. This has been particularly true in Japan, the Netherlands, Sweden, and Germany.[1] In major shipyard modernization alone, future investment plans are expected to total more than $350 million because of the interest of American shipyards in entering the world market for the construction of LNG ships and the requirements of the Alaskan oil trade.[2]

Such developments have not been without effect beyond purely economic terms. Each new and expanded industry has resulted in a consumptive use of the already crowded coastline and has added to the pollution problem of bays and estuaries. The logical step beyond coastal location is that of outward movement to fixed or floating stable platforms or artificial

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[1] U. S., Department of the Army, Corps of Engineers, Institute for Water Resources, Foreign Deep Water Port Developments, 3 vols (December 1971).

[2] U. S., Department of Commerce, Maritime Administration, A New Wave in American Shipping (Washington, D. C.: Government Printing Office, 1972), p. 13.

islands located well beyond interference with other competing uses of the zone. Accompanying this industrial movement has been the development of platform and island designs for a multitude of functions.

An analysis of both stable platforms and artificial islands in marine enterprises has demonstrated their cost effectiveness in such applications as offshore petroleum drilling, oil refineries and storage, ocean mining and dredging, fishing and fish processing, energy generation, harbors, airports, oceanographic research stations, and even urban living and recreation centers.[1] Integration of these functions, where feasible, on single platforms or in platform complexes could achieve the full economic benefit and enhance the investment.

United States development in this total set of industrial complexes is presently limited to the offshore oil platform and offshore oil storage, and a few specific projects, such as offshore deepwater port facilities for VLCC's and floating nuclear power plants.[2] Aside from these, a coherent and total national program for ocean platform development does not now exist. In evaluating the significance of this deficiency, it should be reemphasized that offshore facilities locate industries for which pollution control on land is difficult, if not well nigh impossible, in a controllable environment, and provide structures in waters which, without dredging, are deep

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[1] H. R. Talkington, "Transfer of Navy Platform Technology to Solution of Societal Problems," Journal of the Marine Technology Society (January - February 1973), pp. 56-60; G. Schreuder and C. Stigter, Sea Island Project (N.V. Holland: Bos Kalis Westminster Dredging Group, March 1972).

[2] U. S., National Advisory Committee on Oceans and Atmosphere, Second Annual Report of the National Advisory Committee on Oceans and Atmosphere (Washington, D. C.: Government Printing Office, June 1973), pp. 16-23.

enough to qualify as deepwater harbors. The cost of such facilities appears to be competitive if not superior to coastal counterparts, and they can be built without uprooting and interfering with existing enjoyment of the land and coastal zone. A further advantage of floating facilities is their ability to be relocated in response to demographic change.

Marine-Based Transit Systems

No discussion of marine transportation would be complete without some reference made to the movement of goods and people to the coastal zone and to the inland.

There are more than 25,000 miles of navigable inland waterways serving almost every concentration of the nation's heavy industry and its most efficient farming areas. It has been estimated that on the river one dollar will produce 300 miles of service; by rail, the same amount will produce 66 miles and by truck, 15 miles.[1] These economies can best be seen in the fact that inland barges perform ten percent of the inter-city ton miles and receive in revenues half of one percent of the nation's freight bill.[2] With a national annual inter-city freight bill of approximately $80 billion, there is an inherent national potential for savings which is measured in billions of dollars if substantial increments of inter-city freight are shifted from land to water. The trend has been for industries to move to the river bank where they can take direct advantage of the economies of barge transportation for their raw materials and products. But, almost as important, they can play the

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[1] J. A. Creedy, "The Potential of Our Inland Waterway," Proceedings of the Marine Technology Society (September 1973), pp. 401-408.

[2] Ibid.

barge lines against the railroads and achieve so-called "water-compelled" rail rate reductions. Such reductions range up to 60 percent and have tended to accelerate the movement of industry to the river banks.[1]

The advent of the container ship and barge/lighter ship have brought a new international dimension in international trade to the river system. For containerized cargos, ocean carriers and inland transportation companies have developed facilities and procedures for handling intermodal movements to and from the ports. But intermodalism has not developed as rapidly as has been hoped for in the United States. The principal problem is caused by the conflicting standards of our regulatory laws. Thus far, carriers have only extended through services under single factor rate-making to so-called landbridge and minibridge services between ports. Truly integrated services are not yet offered to and from inland points under through rate and through route arrangements. The greatest challenge facing our ocean shipping system is to begin to accept general cargo ocean transportation as a link in an integrated "origin-to-destination" system.[2] If containerization is to approach its true potential, regulatory impediments must be resolved.

Correspondingly, the barge carrying ships (LASH and SEABEE) have served to extend shipping services to river ports or other ocean ports which could not accommodate the deep-draft "mother ship". Like the container ship, these vessels open a new means of through transportation.

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[1] J. A. Creedy, "The Potential of Our Inland Waterway," Proceedings of the Marine Technology Society (September 1973), pp. 401-408.

[2] R. P. Holubowicz, "The Challenge Facing the Ocean Shipping Industry," Maritime Reporter/Engineering News (May 15, 1972), pp. 19-21.

Let us turn briefly now to the movement of people. The basic problem of primary interest in this area can best be expressed by the following:

> Eighty percent of the metropolitan areas in the United States are located near a body of water -- an ocean, lake, river, estuary, sound, or bay. Some 90 million people live and work close to water. In view of these facts it is not surprising that it appears feasible to expect that by 1980 one-half million urbanites in some 30 cities could utilize over-the-water craft daily as their primary mode of transportation. Such a turn of events would result in 200,000 fewer private cars in downtown business areas daily, 12,000 new jobs in manufacturing and operating the system, a higher quality of life for many city dwellers, and a number of secondary benefits not yet clearly perceived.[1]

The reality of the situation, however, is that the movement of people has undergone the same characteristic development dilemna that has been seen in the other forms of maritime commerce. U. S. technology has developed hydrofoil craft, air-cushion vehicles, surface-effect vehicles, and captured-bubble craft. At present, though, few if any of these advanced marine craft are in commercial service in the United States. In contrast, the Soviet Union has more than 300 regularly scheduled commercial hydrofoil services operating on its inland waterways and canals. Cities of the United States are similarly linked, and the development of marine mass transit should be developed as a viable transportation mode.[2] It

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[1] U. S., Department of Transportation, Urban Mass Transportation Administration, Over-the-Water Program Design, by R. Krzyczkowski, Report No. UMTA-INT-RDC-8-71-1 (December 1971).

[2] Public Law 92-374 ("Hydrofoil Ships"), enacted in 1972, acknowledges the perfection of the hydrofoil concept to the point where large, high speed (over 40 knots) ships may be built for the carriage of freight and passengers. The Act, therefore, permits favorable Federal ship mortgage insurance for hydrofoils and other surface-effect ships which meet minimum speed and horsepower requirements without regard to tonnage.

should be noted that the benefits which could accrue from the development of such a system have drawn the notice of industry and various cities. Hawaii, for example, is studying the Hawaii Environmental Area Mass Transit (HEART) System which will utilize the ocean as the expressway with boats operating on the existing canals and streams for the local loops.[1]

An integrated marine-based transit system contains the seeds of promise for energy conservation and for the solution of a large number of coastal energy consumptive and environmental coastal zone problems of our society. For example, water transportation barge service requires less energy per ton-mile than any other method of freight distribution. Water freight requires 500 BTU's of energy for every ton-mile of freight moved; rail freight requires 750 BTU's per ton-mile; pipelines 1,850 BTU's per ton-mile; trucks 2,400 BTU's of energy per ton-mile; and air cargo 6,300 BTU's per ton-mile.[2] Several studies have also demonstrated the efficacy of a water-oriented mass transit system.[3]

Coupled with the movement of freight and people is the advent of offshore oil terminals and a projected (by the end of the century) 1,000 nuclear power plants, the majority of which, in all probability,

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[1]M. A. Lucas, "Marine Mass Transit for Hawaii, A Case Study," Proceedings of the Marine Technology Society (September 1973), pp. 377-383.

[2]Big Load Afloat (Washington, D. C.: American Waterways Operators, 1973).

[3]See William M. Shultz, "Status of Domestic High-Speed Marine Vehicles for Mass Transit," Proceedings of the Marine Technology Society (September 1973), pp. 409-419.

will be located offshore on floating platforms.[1] What is therefore suggested, is that the surface of the ocean, the coastal zone, and the coastal canals and waterways be reserved for rapid marine transit of goods, services and people between offshore facilities, from offshore facilities to the shore, and between coastal, riverine, and canal communities.[2]

If the marine transit system could be developed on a national scale, it could help solve many urban and industrial problems of the coastal zone.

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[1]U. S., National Advisory Committee on Oceans and Atmosphere, Second Annual Report (Washington, D. C.: Government Printing Office, June 1973).

[2]John P. Craven, "Offshore Platforms and Superports: Technical Considerations," The Oceans and National Economic Development (Washington, D. C.: Government Printing Office, December 1973), pp. 230-232.

Shipbuilding and Ship Repair

In reviewing the shipbuilding and ship repair capabilities of the United States, which, of course, are major components of the maritime industry, discussion will be focused on tankers since they represent the commercial behemoths.

Whereas, in recent history, with few exceptions, American shipyards were building small tankers in the range of 30,000 - 50,000 DWT, the orderbook today for the U. S. shipbuilding industry includes tankers up to and including 265,000 DWT. Additionally, there are applications pending for tankers in the ultra-large category (400,000+ DWT).

Two shipyards -- Bethlehem Steel Corporation, Sparrows Point, Maryland and Seatrain Shipbuilding Corporation, Brooklyn, New York -- are currently engaged in the construction of 265,000 DWT and 225,000 DWT VLCC's, respectively. Bethlehem has recently indicated that 350,000 DWT, or slightly larger, VLCC's may be built at Sparrows Point.[1]

The new facilities in three other yards will be able to accommodate even larger vessels. Newport News Shipbuilding Corporation, Newport News, Virginia will be able to build ULCC's as large as 600,000 DWT. Avondale Shipyards, Incorporated, New Orleans, Louisiana and Sun Shipbuilding and Dry Dock Company, Chester, Pennsylvania could construct 400,000 DWT VLCC's.[2]

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[1]Edwin M. Hood, Speech delivered before the Propeller Club of Newport News, Virginia, 12 December 1973.

[2]Ibid.

Another shipyard -- Todd Shipyards Corporation, Galveston, Texas -- has completed plans for a new facility capable of building ULCC's. In addition, the existing facilities of General Dynamics Corporation, Quincy (Massachusetts) Shipbuilding Division and Ingalls Shipbuilding Division of Litton Industries, Incorporated, Pascagoula, Mississippi, could be adapted for the construction of 225,000 DWT and 265,000 DWT VLCC's, respectively.[1]

With the exception of the SS Manhattan of 110,000 DWT delivered in late 1962, American shipyards have been building the supertankers of yesterday. Today, the U. S. shipbuilding industry is moving into a new era of production capabilities and rapidly moving toward new market opportunities for the supertankers of tomorrow.

The ambiguities of present-day world oil diplomacy notwithstanding, the international demand for tanker transport of oil and gas is not expected to subside. It has been forecast that the world tanker fleet will increase, on a tonnage basis, by 4.7 percent each year until 1990. But the characteristics of that fleet will change considerably. In 1975, it has been predicted that 47 percent of the tonnage of these tankers will be vessels of 150,000 DWT and over. The comparable figure in the same category for 1980 has been placed at 65 percent, and for 1990 at 76 percent. It is interesting to note that, as of mid-1973, there were nearly 500 tankers of 150,000 DWT and over under construction or on order throughout the world. Included were more than 20 ULCC's of 400,000 DWT and over.[2]

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[1] Ibid.

[2] Ibid.

Turning for a moment to the U. S. capability for construction of nuclear-powered merchant ships, at least four of the aforementioned shipyards possess the know-how to build nuclear merchant ships, and at least four U. S. producers of reactors possess the know-how to engage in marine applications of nuclear power. Unfortunately, the technological lead acquired as a result of building and operating the NS Savannah, the world's first nuclear-powered merchant vessel, has been quickly lost by default. Our national follow-up, to date, has been confined to a comparatively low level of study effort. Meanwhile, from the baseline of U. S. nuclear technology, the Japanese and West Germans have been forging ahead. Each has recognized the economic feasibilities inherent in nuclear shipping and has obviously dedicated considerable time and money toward capitalizing on these portents. With the troublesome shortfalls in energy supplies, the legislation now before Congress (H.R. 7694) has a special relevance. Efficient transportation under U. S. jurisdiction and the capabilities to build in our own shipyards, ships of maximum productivity reflecting our superiority in nuclear technology are important to a rational solution of our pressing energy needs. It has been estimated, for example, that to operate a fleet of 300 (the numerical objective of the Merchant Marine Act of 1970) fossil-fueled modern merchant ships over their design lifetime will require more than the estimated resources of the entire commercial Alaskan North Slope oil field.[1] Considering these requirements, passage of H. R. 7694 could well prompt the construction of high speed nuclear merchant ships.

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[1]Subsidies -- Sea Power.

The changing character of the world fleet brings us to the subject of ship repair capability. For maintenance such as routine voyage repairs, vessels may be worked on at a mooring quay, subject primarily to the depth of the water and length of the quay. But for inspection and repair of the underwater portions of a hull, rudder, propeller and propeller shaft, and for scraping and painting a hull bottom, a ship must be made "high and dry." In addition, classification societies require that, for maintenance of class, vessels be surveyed in drydock at specified intervals. On these surveys, the stern, keel, stem, frame or stern post, rudder, and outside plating are cleaned and examined with propellers, streets, and sea chests, together with their strainers and fastenings. The stern bearing clearance is usually checked at this time. Special periodical surveys at four-year intervals also require drydocking, as do some damage surveys. Because of this, the sizes of a repair yard's drydocks and the cranes serving them are the measures of their yard's "capacity."[1]

In at least sixteen countries, existing repair facilities are being built to accommodate ships from 300,000 to 1,000,000 DWT. At present, there are fifteen repair yards with seventeen drydocks of 300,000 DWT capacity or over.[2] (See figure 9)

Unfortunately, the capacity of U. S. private ship repair yards to dry-dock VLCC's/ULCC's is presently limited. No commercial facilities are available on the East Coast, though a drydock capable of lifting 120,000

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[1]Surveyor (New York: American Bureau of Shipping, November 1973), p. 8.

[2]Ibid.

EXISTING AND PROPOSED REPAIR DRYDOCKS

FOR VESSELS OVER 300,000 DWT

Figure 9

Country	Yard and Location	Dock Length (in ft)	Dock Width (in ft)	Maximum Depth over keel blocks (in ft)	Capacity (in dwt)	Status
Bahrain	New yard	NA	NA	NA	400,000	1975 opening
Brazil	New dock Rio area	NA	NA	NA	400,000	NA
Dubai	Dubai Drydock	1,361	243	40	500,000	1976 opening
		1,361	216	40	500,000	1976 opening
		1,722	328	40	1,000,000	1976 opening
France	Terrin Marseilles	1,535	281	NA	700,000	1974 opening
Germany	Blohm & Voss Hamburg	1,149	184	30	300,000	In operation
Grand Canary Is.	New yard	Two docks of 300,000 and 500,000				Possible 1976 completion
Holland	Verolme Rotterdam	1,329	295	35	500,000	In operation
Italy	CNTR/OARN Genoa	1,155	260	33	350,000	NA
	CNTR Palermo	1,220	225	NA	400,000	1975 completion
	SEBN Naples	1,320	240	NA	500,000	NA
Japan	Hakodate Hakodate	1,132	190	26	300,000	In operation
	Hitachi Sakai	1,493	207	36	400,000	In operation
	IHI Aioi	1,115	184	26	300,000	In operation
	IHI Taniyama	NA	NA	NA	1,000,000	1978 opening
	IHI Yokohama	1,174	184	28	300,000	In operation
	Kawasaki Sakaide	1,476	236	27	500,000	In operation
	Koyo Mihara	1,148	184	NA	300,000	1974 completion
	Mitsubishi Honmoku	1,148	190	29	400,000	In operation
	Mitsubishi Koyagi	1,312	328	NA	500,000	In operation
	Mitsubishi Nagasaki	1,155	185	31	300,000	In operation
	Mitsui Yura	1,150	213	33	330,000	In operation
	Nippon Kokan Tsu	1,230	246	30	500,000	In operation
	Nippon Kokan Kiire	NA	NA	NA	1,000,000	Possible 1978 opening
	Sasebo Sasebo	1,214	230	49	500,000	In operation
Malaysia	Malaysia SY Johore Bahru	1,270	264	NA	400,000	1975 completion
Malta	Malta Drydocks	1,260	200	NA	300,000	Construction begins 1974
Portugal	Lisnave Lisbon	1,148	177	34	326,000	In operation
		1,180	177	20	326,000	In operation
		1,706	295	40	1,000,000	In operation
	Setenave Setubal	1,150	180	NA	300,000	1974 opening
		1,485	245	NA	700,000	1974 opening
Senegal	New yard	Three docks from 300–500,000				NA
Singapore	Hitachi-Robin	1,190	215	NA	400,000	1975 opening
	Jurong	1,160	185	NA	300,000	In operation
	Mitsubishi-Singapore	NA	NA	NA	400,000	Possible 1975
	Sembawang	1,260	210	30	477,000	1974 opening
S. Africa	New yard Saldanha Bay	1,340	265	NA	400,000	Possible 1976 completion
Spain	Astilleros Españoles Cadiz	NA	NA	NA	400,000	1974 completion
United States	Todd Shipyards Galveston	1,416	216	33	380,000	NA

NA -- Not Available

SOURCE: Surveyor (New York: American Bureau of Shipbuilding, November 1973), p. 15.

DWT tankers is contemplated at Baltimore, Maryland. None are available on the Gulf Coast, though a repair dock, designed to handle VLCC's up to a maximum of 380,000 DWT is planned at Galveston, Texas. On the West Coast most tankers up to 150,000 DWT and some as large as 230,000 DWT can now be drydocked at San Francisco, California.[1]

Advances in shipbuilding technology are only as valuable as comparable gains in repair yard and drydocking facilities. While the revenue for an active VLCC/ULCC can be considerable, so can its losses when it is tied up waiting for maintenance or repairs. Owners and operators want to be sure that suitable drydocking and repair facilities will be available, when required, for the supertankers they may contemplate ordering.

The U. S. shipbuilding industry has developed the capabilities to build VLCC's and ULCC's. Now the ship repair industry must make its own contribution to the development and operation of the new supertankers. With the increasing size of tankers and the prospect of U. S. offshore terminals, it would be illogical if the ship repair facilities of the United States, recognizing the economic implications, did not keep abreast of these trends.

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[1]Edwin M. Hood, Statement before Committee on Merchant Marine and Fisheries, House of Representatives, 11 July 1973.

Effective U. S. Control (EUSC) Ships

No discussion of the U. S. merchant marine would be complete without mention of the "effective U. S. control" (EUSC) ships.

A major and unresolved controversy centers about whether it would be possible to use, at least for oil imports, the group of ships often referred to as effective U. S. control vessels -- ships registered under foreign flags by U. S. owners who have agreed to make the vessels available during times of emergency. The EUSC fleet exists because, in return for a modest registration fee, the vessel owner is virtually free from U. S. taxation on ship's earnings and from government regulations concerning operations, inspections, and crew-manning. EUSC shipping is also often referred to as "flags of convenience", but U. S. owners of ships under foreign registries prefer the term "flags of necessity."

Many traditional maritime nations -- the United States a notable exception -- have domestic laws that forbid their nationals to own and operate ships under foreign registry. Under U. S. tax laws, ship owners do not have to pay taxes on earnings from foreign shipping subsidiaries unless or until paid as dividends. This is an exception to the normal treatment of a sales or service subsidiary and a major reason why large oil companies have found EUSC arrangements attractive.

The number of U. S. owned tankers under Liberian or Panamanian flags is already significant, but the post war trend of the U. S. oil and metals industries to identify themselves as multi-nationals or international companies has created a further development wherein U. S. owned vessels are registered under the flags of other traditionally maritime nations and operate -- technically, at least, -- in the service of foreign subsidiaries of American corporations.[1]

The EUSC tanker fleet currently consists of 18 million DWT, and, with some 20 million DWT under construction or on order, it is generally recognized that these U. S. owned foreign flag ships have to be considered as a substantial mobilization planning factor.[2]

The EUSC "doctrine of effective control" is based upon contracts and agreements between the U. S. government and owners of flag-of-convenience vessels. The "legal" basis for such contracts or agreements is derived solely from domestic law of the United States; specifically, Section 902 of the Merchant Marine Act of 1936, which gives the government authority to requisition or purchase for government service any vessels owned by citizens of the United States. Requisitioning is permitted only in the event of a national emergency proclaimed by the President.

Unanswered, and untested, however, is the question whether the United States does, in fact, have the "right" to requisition and take control of vessels owned by U. S. citizens but registered under foreign flags.

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[1]Subsidies -- Sea Power.

[2]Report of the Commission on American Shipbuilding (Washington, D. C.: Government Printing Office, October 1973).

There are also other factors to consider. The effective U. S. controlled fleet has been dedicated by the major oil companies mostly to supplying Europe and Japan. This in part is due to the size of the vessels which are too large to call at U. S. ports. This established trade pattern which commits that fleet may not be disrupted easily without serious economic and political repercussions should the U. S. attempt to requisition the fleet in a transportation crisis. Further, any withdrawal of tankers from Europe could have an adverse impact on the petroleum supplies which would support military and civilian needs of the European countries of the NATO Alliance.[1]

The extent of this dedication can be most readily understood by considering that the EUSC fleet carried only 20 percent of U. S. oil imports in 1971. In addition to the U. S. oil imports carried by the EUSC fleet, U. S. flag tonnage accounted for another 4 percent. Therefore, more than three-quarters of U. S. oil imports were carried by foreign ships exclusive of the EUSC fleet.[2]

The security implications of reliance on EUSC and other foreign flag ships are a particular concern to the U. S. Navy. Admiral E. R. Zumwalt, Jr., Chief of Naval Operations, phrased the problem this way:

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[1]Robert J. Blackwell, "Statement on EUSC Vessels," The Oceans and National Economic Development (Washington, D. C.: Government Printing Office, December 1973), p. 254.

[2]Report of the Commission on American Shipbuilding (Washington, D. C.: Government Printing Office, October, 1973).

> The potential for coercion, with or without allies, . . . is ominous . . . Planning for the protection of tankers at sea in the event a threat develops would be greatly enhanced by having large numbers of ships under the U. S. flag in time of peace. The Navy has a greater requirement for merchant ships than is generally recognized. For example, merchant ships are absolutely required to provide the bulk of the DOD sealift and to augment our amphibious forces . . .[1]

To further emphasize the concern of Admiral Zumwalt, it is evident that with rising Defense costs and constrained budgets, the U. S. combat Navy has been forced to drastically reduce its number of active ships -- thus, with the compelling need to concentrate on improving its diminished combat fleet, the Navy is now turning more to the U. S. merchant marine for an increasing proportion of its logistic support.[2] To improve the ability to perform these military support roles, U. S. flag ships are built with national defense features which increase their utility for military employment and their self-defense capability. This includes such features as extra speed, self-unloading capabilities, and strengthened decks.

In concluding, the following points should be considered when evaluating the use of U. S. flag vessels versus EUSC and other foreign flag ships:[3]

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[1]See Subsidies -- Sea Power.

[2]RADM George H. Miller, USN (Ret.), Remarks before The Propeller Club of Charleston, South Carolina, 21 November 1973.

[3]Subsidies -- Sea Power.

- -- Indisputable control of foreign-registered and foreign-manned ships cannot be assured.

- -- The changing profile of the EUSC fleet, with emphasis on very large and specialized oil and bulk carriers, does not include a sufficient inventory of "clean" tankers to carry the exotic aviation, vehicle, and ship fuels used by U. S. military forces.

- -- Lack of national defense features in foreign-built ships denigrates the military potential of the EUSC fleet.

- -- Foreign crews might be unwilling to man EUSC ships during wartime operations.

- -- In the event of war in which the flag of registry is not a participant, the alien nature of the ship and crew precludes immediate deployment to support military operations even if strategically located. Such deployment is possible only when the ship becomes a belligerent, i.e., comes under U. S. or allied registry.

- -- The disruption of EUSC fleet foreign trade patterns might cause serious economic and political repercussions for allied and non-aligned nations.

One fact is clear: the doctrine of "effective U. S. control" is an untested concept. The changing military, political and economic orientation of today's world requires, at the very least, a reevaluation of the EUSC concept.

The Economic Impact

The foregoing examples of the marine transportation system and related industries, while cursory and incomplete, are suggestive of a number of points:

- That while the United States has been up to now a leader in the development of marine commercial technology, the net effect has been primarily one of export of this technology to other nations.[1]

- That a failure to implement this technology under the U. S. flag, and an exploitation of this technology by other nations, has worked to the commercial detriment of the United States merchant marine.

- That a substantial total economy can be developed which is purely marine-oriented.

- That the solution of a number of coastal zone related problems may be inherent in such development.

Certainly many nations have moved extensively to the sea and the coastal zone for benefit of the economy. Figure (10) bears out this relationship. Belgium/Luxembourg, utilizing the deepwater harbor of Antwerp have nearly 50 percent of their gross national product involved in export while the Netherlands, with its "Europort" at Rotterdam, has nearly 40 percent of its gross national product so involved. As "gateway" countries, this proportion is quite understandable.

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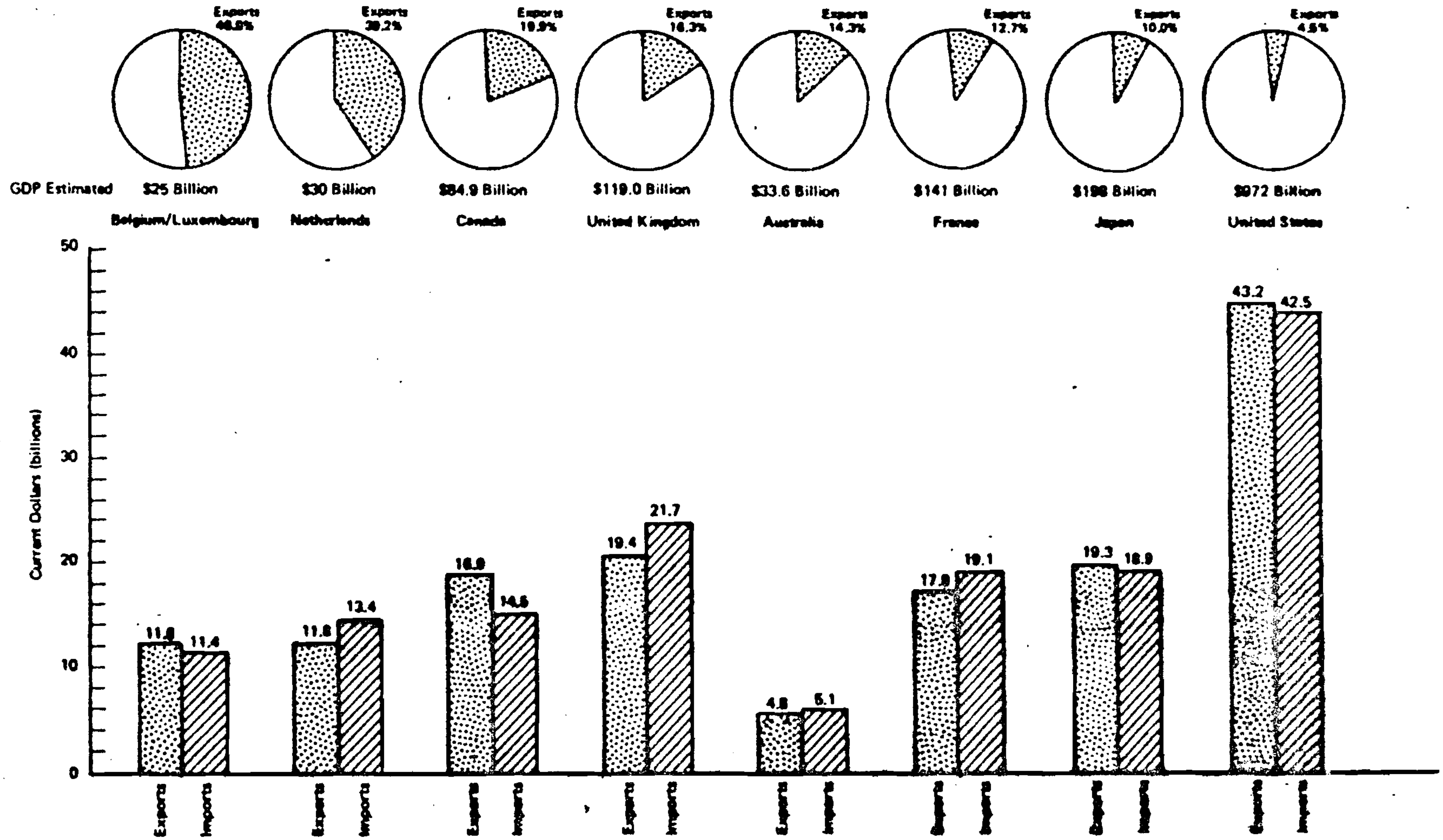
[1]U. S. marine technology which has been exploited abroad includes the containership concept, barge-carrying ships, gas turbines, steam turbines and boilers, automation, modular construction and merchant ship nuclear propulsion. (See Congressional Record (February 1, 1973), pp. E588-589.)

FIGURE 10 **MERCHANDISE EXPORTS AS A PERCENT OF GROSS DOMESTIC PRODUCT, 1970**



SOURCE: U. S., Department of the Army, Corps of Engineers, Institute for Water Resources, Foreign Deep Water Port Developments, vol. I, p. 4-2, (December 1971).

More surprising is Japan. It is well known that Japan imports nearly all of her raw materials and that her export/import balance is favorable. Nevertheless, her exports constitute only 10 percent of her gross national product. In addition, as shown in figure (11), her gross national product has for the past decade been linearly related to her exports. This correlation by itself would not be significant except that its causality seems justified since it has been the conscious effort and expectation of Japanese economists and Japanese government and industry that this would result from the economics of oceanic scale in their basic industries.[1] They recognize that efficiency in hardware production has its benefit in the release of manpower and resources for software productivity. The total is reflected in the make-up of the gross national product and in its growth rate.

Without arrogating to one's self any particular prescience in predicting the effect of an efficient marine-based industry on gross national product, one cannot refrain from commenting on some obvious characteristics of which table (2) is demonstrative. The disproportionate percentage in utilities and commercial activity and government is such that the European market with only one half the total gross national product of the United States has two thirds as much manufacturing, a nearly equal volume of construction, and a slightly larger volume (dollar value) in agriculture. Recognizing the distortions that price and efficiency play in equating these factors it must be concluded that here is a substantial difference in the hardware versus software and services mix of the two societies.

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[1]U. S., Department of the Army, Corps of Engineers, Institute for Water Resources, Foreign Deep Water Port Developments, vol. 3, (Springfield, Virginia: National Technical Information Service, December 1971).

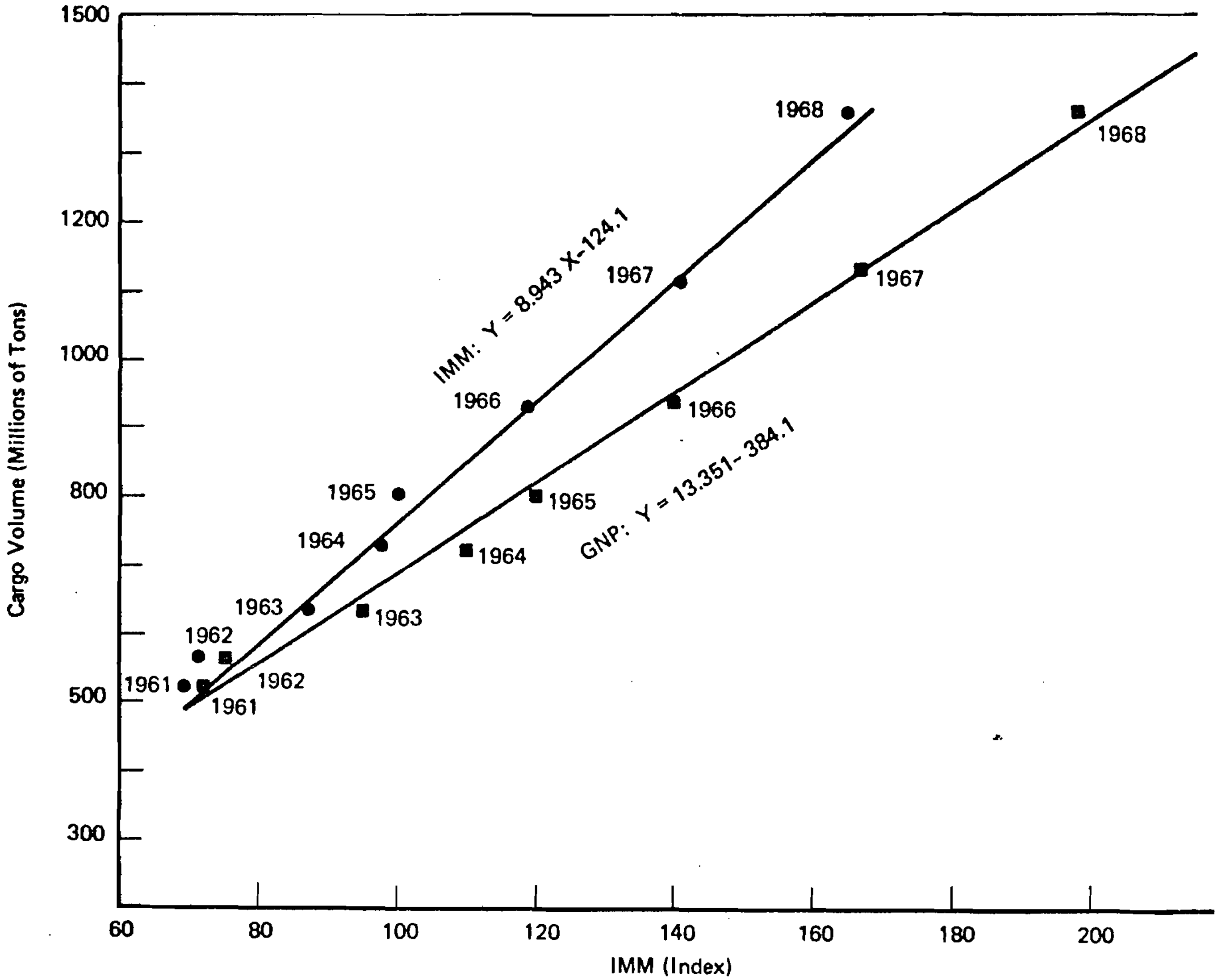

FIGURE 11 **PORT CARGO VOLUME VERSUS GNP AND THE INDEX OF MINING AND MANUFACTURING**

JAPAN

SOURCE: U. S., Department of the Army, Corps of Engineers, Institute for Water Resources, Foreign Deep Water Port Developments, vol. 3, p. G-10, (December 1971).

TABLE 2

NATIONAL GROSS DOMESTIC PRODUCT STRUCTURE -- 1969

	France	Belgium	Netherlands	Germany	Italy	U. K.	U. S. A.
				Percent			
Manufacturing	34.7%	30.4%	30.7%	39.2%	27.3%	34.6%	28.1%
Agriculture	6.6	5.5	7.4	4.3	11.0	3.1	2.9
Construction	10.2	6.6	7.9	6.8	8.0	6.8	4.5
Mining	.9	1.7	1.6	1.8	.7	1.8	1.6
Utilities	1.9	2.2	2.1	2.0	2.6	3.6	2.3
Commercial	36.8	46.4	41.8	36.4	38.5	43.0	46.5
Government	8.9	7.2	8.5	9.5	11.9	7.1	14.1
Gross Domestic Product	100.0	100.0	100.0	100.0	100.0	100.0	100.0
				Billions of Dollars			
Manufacturing	$ 44.9	$ 6.1	$ 7.0	$ 63.7	$ 19.9	$ 32.8	$265.0
Agriculture	8.6	1.1	1.7	7.0	8.0	2.9	27.4
Construction	13.2	1.3	1.8	11.1	5.8	6.5	42.4
Mining	1.2	.3	.4	2.9	.5	1.7	15.1
Utilities	2.5	.4	.5	3.3	1.9	3.4	21.7
Commercial	47.7	9.4	9.5	59.2	28.0	40.8	438.5
Government	11.4	1.5	1.9	15.3	8.7	6.7	133.0
Gross Domestic Product	129.5	20.1	22.8	162.5	72.8	94.8	943.0

SOURCE: Arthur D. Little, Inc., Organization for Economic Cooperation and Development.

Recognizing further that the consumption of energy and materials cannot be met without exogenous import which must in turn be paid for by export of goods and services, then it is suggestive that our ability to meet and expand our needs is a function not only of our national ability to produce foods for export, but is also a function of the relative efficiency and price at which these goods are produced. This relative efficiency may in turn be related to the economies achieved through the scale of marine industry.

The construction and expansion of the deepwater ports, primarily for oil handling and storage and unitized cargo, at Rotterdam, Antwerp, Amsterdam, LeHavre and Dunkirk attest to the idea that this conclusion has been reached by the European community.[1] It is certainly the conclusion of the Japanese.

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[1]Marine Engineering/Log (New York: Simmons Boardman Publishing Corporation, June 1973), pp. 153-226.

Summary

Even though this paper has employed a broad perspective, there appears to be enough evidence to suggest that we examine as a nation the effect of sea-based commerce and industry on the total economy and the substance of the total economy.[1] Certainly it has been the clear policy of the Administration to support and encourage such growth. Yet this policy has been relatively frustrated by factors which have not yet been brought into proper perspective. Although all the causes for the failure of our marine transportation system to flourish on a world scale are not yet fully understood, several factors can be cited as contributory:

-- Marine transportation systems do not operate in a free and competitive situation in the world market. Restrictive carriage and cargo preference, as well as other national policies which have historically been exercised by the more successful maritime nations, preclude U. S. flag competition for world cargo. More and more countries, by some form of preference system, are reserving cargo for their merchant marines.[2] Among the leading nations of today,

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[1]The Second Annual Report (June 1973) of the National Advisory Committee on Oceans and Atmosphere states (p. 5):

> "The decline of the U. S. merchant marine and our growing dependence on foreign bottoms for shipping, long deplored from the viewpoint of national security, deserves also to be looked at from the point of view of the impact on our place in the world economy."

[2]Report of the Commission on American Shipbuilding (Washington, D. C.: Government Printing Office, October 1973).

Russia carries at least 50 percent of her foreign trade in her own flagships; Japan carries 46.6 percent; France, 38.3 percent; Great Britian, 35 percent; Italy, 23.3 percent; Sweden, 22.3 percent; and the United States, without preference support, carries, by comparison, 5.6 percent of its foreign trade.[1]

-- Competing attitudes by various Federal agencies concerning our domestic needs and foreign interests have tended to promote foreign marine transport systems at the expense of our own. The Cargo Preference Act of 1954 generally requires that at least 50 percent of government-generated cargos be shipped on U. S. flag vessels. Unfortunately, while the Maritime Administration is attempting to promote U. S. flag carriage, other agencies (such as Department of Agriculture, Agency for International Development, Inter-American Development Bank, etc.) have administratively interpreted the 50 percent criteria as a maximum rather than a minimum.[2] Moreover, cargo preference has not been effectively employed as a "policy" tool to stimulate domestic shipping.

-- Foreign affiliates of U. S. corporations use their foreign registered fleets to support their oceanborne transportation needs. Therefore, a significant amount of world cargo, particularly energy fuels, is effectively removed from the competitive marketplace. The vested interests of the multi-national corporations serve to inhibit the participation, and indeed the size, of the U. S. flag fleet in U. S. oceanborne commerce.

-- Restrictive, and conflicting, regulatory statutes of Federal regulatory agencies (Federal Maritime Commission and Interstate Commerce Commission) have inhibited the optimized movement of unitized cargos.

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[1] RADM George H. Miller, USN (Ret.), Remarks before The Propeller Club of Charleston, South Carolina, 21 November 1973.

[2] See U. S., Congress, House, Report of the Activities of the Merchant Marine and Fisheries Committee, 92d Congress (Washington, D. C.: Government Printing Office, 1972), pp. 33-34; Sea Power (Washington, D. C.: Navy League of the U. S., September 1973), pp. 16-17.

-- The benefits of industry-wide cooperation in standardization, research, and the exchange of engineering and technical information are significant in other countries, particularly Japan. Similar benefits are largely denied to U. S. shipbuilders because of the possibility of antitrust action by the Government.

-- The environmental protective efforts have tended to create a negative attitude inhibiting our maritime advancement. These efforts have failed to recognize that our growing dependency upon foreign flags coupled with our increasing ocean-borne traffic do not provide the environmental control inherent in U. S. carriage. The concern expressed here relates to ship safety and environmentally designed and constructed transport systems, including offshore terminals and off-shore oil development.

In summary, the revitalization of our marine transportation system is imperative when measured in terms of the benefits to be derived by our economic, political and military needs.

It is obvious that there are both competing and complementary activities at work in the overall marine transportation system. It is equally obvious that these many activities have not yet been adequately defined or articulated, either quantitatively or qualitatively. Also, it must be recognized that the U. S. as a mature technological society, enjoying the highest standard of living in the world, has an initial competitive disadvantage, vis-a-vis other nations. As is the case with many other sectors of the economy, the marine transportation sector has a higher operating cost than similar systems of other nations. But this disadvantage can be substantially reduced, if not altogether removed, with increased maritime productivity -- and the U. S. maritime industry possesses the requisite entrepreneuial and technological acumen.

However, this brings us full circle, for to increase productivity to agree with operating costs and market requirements and competition requires an assured and well established market. If this market is to be realized, it must be, as in other countries, the result of a sustained and positive national policy. Central to this policy is the resolution of the concerns which have been cited throughout this paper.

NEW SHIP TYPE DESIGNATIONS

New ship type designations now in common use include:

ULCC and VLCC	Ultra Large Crude Carriers (400,000 DWT and larger) and Very Large Crude Carriers (200,000 to 400,000 DWT). These liquid bulk supertankers provide very economic transportation. Special areas of concern include the need for expensive port facilities, environmental precautions and efficient management of the vehicle and its interlocked distribution and processing system.
OBO	Ore/Bulk/Ore, a versatile carrier of moderate size (about 100,000 gross tons), that can be rapidly converted to any liquid or dry bulk cargo. Their operations and routes are highly flexible and require efficient scheduling and management.
CONTAINER	These ships carry large interlocked boxes (containers) of pre-packaged cargo. Container ships are the modern, fast packets, demanding rigid scheduling and high utilization. Port facilities are complex and expensive. Loads vary from 300 to 1,000 containers per ship with speeds typically 25 knots and on up to the middle 30's.
LNG	Liquified Natural Gas. These ships are the newest type, designed to transport natural gas in a supercooled liquid form. Costs of these ships may approach 100 million dollars. They have all the aspects of liquid petroleum carriers (pollution potential, scheduling, port facilities) plus many specialized needs of their own.
LASH (or SEABEE)	Lighter Aboard Ship Systems. (LASH is Prudential Lines' design; SEABEE is Lykes' entry.) Lighters (barges) are carried aboard these ships, being loaded and unloaded by onboard elevators. Tugboats handle the barges and deliver them to the destination user. Like containers, they are pre-packed. Ships have very high productive utilization (short in port or cargo handling periods) and do not require specialized port facilities. The LASH system employs barges of about 400 gross ton capacity whereas the SEABEE system uses barges of about 750 ton capacity (one half the size of standard river barges).

RO/RO	Roll-on/Roll-off. Truck trailers are driven on and off ship. In this specialized form of container service, the cargo is pre-packed and can be directly delivered or picked up by truck or by train/truck combinations. Scheduling is important and some specialized port facilities are needed.

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