

THE UNITED STATES SHIPBUILDING INDUSTRY:
STRUCTURE, CONDUCT, PERFORMANCE

John W. Ward

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THESIS

THE UNITED STATES SHIPBUILDING INDUSTRY:
STRUCTURE, CONDUCT, PERFORMANCE

by

John W. Ward
and
Larkin E. Garcia

March 1975

Thesis Advisor:

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The United States Shipbuilding Industry:
Structure, Conduct, Performance

by

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March 1975

ABSTRACT

Structure, conduct and performance are important elements in the economic analysis of an industry. This thesis identifies and discusses the sub-elements of structure, conduct and performance of the U.S. shipbuilding and repair industry and how these sub-elements interact. A brief history of the industry to the Merchant Marine Act of 1970 is presented. Structure sub-elements are comprised of concentration, production methods, labor, governmental influences, barriers to entry, demand for U.S. Navy and merchant vessels and financing methods. Conduct sub-elements consist of public policies, labor utilization, financing behavior, claims, competition, research and development and conglomerate behavior. Performance sub-elements are identified as productivity, output, profitability, claims impact, and government evaluation. Conclusions and recommendations are included.

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LIST OF ABBREVIATIONS

CDS	Construction-differential Subsidy
COAS	Commission on American Shipbuilding
CONUS	Continental United States
cgrt	Compensated gross registered tons. A measure of shipbuilding output which results from multiplying gross registered tons by established coefficients to indicate the degree of sophistication of a given type of vessel, i.e., weighted gross registered tons.
DWT/dwt	Deadweight tons. The payload to a certain draft to measure carrying capacity.
GAO	Government Accounting Office
GPO	Government Printing Office
grt	Gross registered tons. A common measure of size, reflecting the total volumetric area at 100 cubic feet equal to one grt.
LDT/lwt	Lightweight tons. Weight of the empty ship measured by displacement. (Light Displacement Tons)
MarAd	Maritime Administration
ODS	Operating-differential Subsidy
SCA	Shipbuilders Council of America (Trade Organization)
U.S. flag	Refers to a vessel registered to U.S. jurisdiction

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I. INTRODUCTION

The United States shipbuilding industry has had a long history within which it played an important part in the development of the nation. From the late 1700's, the industry has experienced periods of peak demand where full employment and large profit potential existed, to periods of slack orders, low employment levels and the subsequent disappearance of marginal performers. As line officers in the U.S. Navy, the writers have a natural interest in the shipbuilding industry of the United States and this interest has been further stimulated by recent Navy problems in the area of shipbuilding claims, cost escalation in shipbuilding contracts and general criticisms of the U.S. Navy ship procurement methods.

A. REVIEW OF LITERATURE

A review of past literature on the shipbuilding industry revealed that although many studies had been conducted, none could be identified as having specifically examined and identified the elements of structure, conduct and performance in the shipbuilding industry, a more common method of industry analysis as indicated by Caves in 1972 [1, p.15]. Thus, it was decided to pursue this method of approach.

The initial literature reviewed for this study included the Seapower Subcommittee (Bennett) Hearings of 1970, the report of the Commission on American Shipbuilding of 1973,

and Frankel and Marcus' book on Ocean Transportation.

Letters were also sent to eleven major U.S. shipbuilders requesting information on their current capacity, orderbook, financial data and a brief history of their shipyard(s). In general, the responses were quite good and the addressees, owners and replies are as indicated below:

<u>Shipbuilder (Owner)</u>	<u>Reply</u>
Avondale (Ogden)	No
Bath (Bath Industries)	Yes
Bethlehem Steel	Yes
Electric Boat (General Dynamics)	Yes
Ingalls (Litton)	No
Lockheed Shipbuilding	Negative Reply*
National Steel (Kaiser)	Yes
Newport News (Tenneco)	Yes
Quincy (General Dynamics)	Yes
Sun (Sun Oil)	Yes
Todd Shipyards	Yes

*Reasons stated were proprietary nature of request and pending claims litigation.

Although desirable, we were unable to obtain financial data on the shipbuilding divisions of the large diversified companies due to their reluctance to provide such data and the consolidation of all divisions in their annual reports.

The Maritime Administration (MarAd) was also helpful in providing numerous MarAd documents in response to our order. Finally, many other articles, hearings, texts and government annual reports available locally were utilized, such as references: [5], [10], [29], [35], [41] and [55].

B. PROBLEMS ENCOUNTERED

Although not unexpected, problems were encountered in this study which were of the nature listed below:

1. Data Variation

In many instances, pertinent data was not current or available. Some reports grouped data by calendar years and others by fiscal years. Annual reports by government agencies had delays in publication of up to twelve months and thus, there are tables in this study which could not be reported past FY1973.

2. Shipbuilding and Shipping Industries

The maritime industry includes both the shipbuilding and shipping industries. It was noted that the relationships between these two industries was very close. Maritime data was difficult, but necessary, to separate especially with regard to the Maritime Administration's (MarAd) role.

3. Ship Construction, Repair and Conversion

The shipbuilding industry is generally defined by the Standard Industrial Code (SIC) 3731. This code includes all products and services sold by privately owned establishments which are primarily engaged in shipbuilding and ship repair but also includes conversion and alteration of ships. It was noted that a breakdown of data into the areas of construction, repair, conversion and alteration, would have been too difficult to pursue. Therefore, "shipbuilding" in the context of this study includes all the subordinate activities mentioned above. When areas addressed refer to new ship construction only, this point will be made in the text.

4. Boundaries

It was the original intent of this study to present information for the period 1965-1974. However, due to the variability of data previously mentioned, this was not possible and the writers have attempted to present the most current data available and provide historical data at least back to 1969. Unfortunately, as this study was concluded, the 1974 Seapower Subcommittee hearings on the status of shipyards were just being distributed. Additionally, pertinent annual reports were also being published but were not available for inclusion in this study. It is suggested that these documents would provide excellent sources for updating the information contained herein by interested readers.

5. Limitations

This study has been limited to major shipyards capable of constructing oceangoing vessels with lengths of 475 feet and beams of 68 feet. These dimensions coincide with the dimensions used by the Commission on American Shipbuilding in their 1973 report in which they state that . . . "the Maritime Administration considers shipways of this size to have some value, including mobilization potential" [31, p.23].

C. ORGANIZATION OF THESIS

This thesis first provides a brief history of the U.S. shipbuilding industry. Each element of structure, conduct and performance is then identified and discussed in the follow-on chapters. Finally, conclusions and recommendations are presented.

II. HISTORY OF THE UNITED STATES SHIPBUILDING INDUSTRY

A. EARLY HISTORY

The shipping and shipbuilding industries have played an important part in the development of the United States. During the early history, much of the country's finished goods and industrial products were imported from Europe on wooden sailing ships.

Maritime subsidies, in slightly different form, originated in legislation passed by the First Congress of the United States. In 1789, the Congress enacted the first tariff stipulating a ten percent reduction in customs duties for goods imported in American vessels. It further provided a tonnage tax in favor of American shipping.

In 1845, Congress approved the government's first subsidy when it authorized mail subsidies to steamships with preference to those which could be converted into warships. The subsidies helped to establish shipping lanes to various parts of the world until 1858 when they were discontinued because they were considered an unnecessary drain on the Treasury. By 1850, the United States had the second largest merchant marine in the world, next to England. However, American ships were considered the finest constructed. Throughout this early period the maritime industry was essentially private enterprise.

B. CIVIL WAR UP TO WW I

It was the Civil War that proved to be the turning point for the U.S. Merchant Marine. To avoid losing any further ships, large numbers were transferred to foreign registry with the restriction that those that were transferred would not be permitted to return to U.S. registry.

It was also during the Civil War that steel-hull, steam-propelled ships were first developed. Because the U.S. had not yet acquired the technical expertise nor the productive capability of European countries, American ships were constructed at a much higher cost. The high cost of U.S. ships necessitated large expenditures for capital investment in efforts to increase shipyard productivity. It was a combination of these high capital cost requirements coupled with greater investment opportunities associated with the westward expansion of the United States that made investment in American shipbuilding unattractive. This resulted in the U.S. Merchant Marine declining from a once prominent position to a level in 1914 where only nine percent of the value of foreign commerce was carried on American ships [31, p.18].

Despite Congress' concern to revitalize the merchant fleet, no strong measures were enacted. Most congressional interest in the maritime industry from 1912 through 1914 dealt primarily with antitrust and antimonopoly investigations.

C. WW I THROUGH 1936

The outbreak of war in Europe in 1914 forced foreign nations to withdraw their ships, leaving our ports overcrowded

with cargo with no means of transport. Thus, Congress was forced to enact emergency legislation permitting foreign built ships to be registered in the United States for use in foreign trade.

In 1916, Congress enacted the Shipping Act which included (1) broad powers for acquiring ships through purchase, lease, charter, or building (prohibiting the purchase or charter from a country at war), and for the operation of these ships for commercial purposes; (2) authorization for liner or conference agreements subject to the prohibition of unfair or discriminatory practices and to the publication of rates; and (3) general instructions for the sale or disposal of vessels to U.S. citizens [31, p.19].

A modification to the Shipping Act of 1918 "prohibited the transfer of a U.S. ship to foreign registry or the sale or lease of ships, shipyards, or drydock to a foreigner in time of national emergency" [31, p.19]. It also prohibited using U.S. shipyards for foreign construction.

Through the provisions of the Shipping Act, the United States embarked on a large shipbuilding program which saw the American merchant fleet grow from 6.8 percent of the world's total (gross tons) in 1914 to 22.2 percent in 1920 [31, p.19].

A problem arose at the end of the war in that the Shipping Act failed to provide for the disposal of surplus government-owned ships. To correct this problem, the Merchant Marine Act of 1920 was enacted which set as official policy of the U.S. the establishment and maintenance of a merchant marine of

the best equipped and most suitable types of vessels sufficient to carry the greater portion of its commerce and serve as a naval or military auxiliary in time of war or national emergency, ultimately to be owned and operated privately by citizens of the United States. . . [31, p.19].

Both the Act of 1916 and the Act of 1920 failed to affect appreciably the disposal of ships to private citizens. This motivated Congress to debate such issues as continued government ownership and subsidies. The issues culminated in the Merchant Marine Act of 1928 which "permitted the continuation of government ownership and operation" although the real intent of the Act was designed "to encourage a privately owned merchant marine" [31, p.19].

The main features of the Act of 1928 were: (1) to restrict the sale of vessels or lines of vessels to private interest; (2) to authorize the improvement of existing vessels and to recommend to Congress on the construction of new vessels; (3) to increase the construction-loan fund features; (4) to provide for mail-contract payments on a bid basis; (5) to impose citizenship restrictions on the crews of vessels carrying mail contracts; and (6) to require government officials to travel on U.S. vessels when on official business.

The U.S. merchant fleet's share of the foreign trade continued to decline despite the efforts of Congress. By 1939, it had fallen to about 22%, partly because new ship construction had fallen off again. Presidential and congressional interest resulted in the Merchant Marine Act of 1936.

D. 1936 THROUGH 1946

In addition to terminating the ocean mail contracts, the Act of 1936 established construction and operating differential subsidies, CDS and ODS respectively, for private operators on essential foreign trade routes.

Another important provision of the Act was the establishment of a 500 ship construction program. The program was to span a ten-year period, 50 ships per year. This program proved to be of tremendous value to the U.S. effort at the outbreak of WW II in that it provided an impetus to the required expansion of the shipbuilding industry. By 1946, the U.S. had about 56 million dwt of ocean going merchant vessels, 60% of the total world tonnage [31, p.21].

The Ship Sales Act of 1946 provided for the sale, over a limited period of time, of war-built vessels to citizens and foreigners alike on a fixed price basis [31, p. 21]. This Act permitted short-term charters (at high rates) to U.S. citizens but the charter of war-built vessels to foreigners was not permitted.

E. POST-WW II TO PRESENT

The shipbuilding industry experienced a drastic cutback in production at the end of the war. The reduction in output caused some shipyards to close. However, other companies emerged that were later to become strong competitors (e.g. Avondale Shipyards and National Steel and Shipbuilding Co.).

The United States merchant fleet began to decline in numbers after WW II, primarily due to foreign purchases of

some 1,100 U.S. ships under the Merchant Ship Sales Act of 1946 and also due to revival of foreign shipbuilding and the scrapping of WW II U.S. merchant vessels [8, p.6]. As other nations' fleets and shipbuilding industries became progressively larger, more productive and more competitive, the U.S. flag fleet continued to decline to the point where by 1969, it carried only five percent of the nation's foreign trade as compared to eleven percent in 1960 [47, p.1].

The ineffective attempts to halt this decline in the U.S. maritime industry led to the enactment of the 1970 ammendment to the Merchant Marine Act of 1936. Basically, the 1970 ammendment called for a revitalization of the U.S. Merchant Marine and shipbuilding industry by providing for a large number of highly productive merchant ships of advanced design to be constructed annually, with federal assistance, over a ten-year period. The capacity to add to the merchant fleet each year was to be equal to that of 30 highly productive modern ships, in quantities to permit series production and, when practicable, of standard design. In addition, the 1970 ammendment called for [48, pp.1-2]:

- (1) Multi-year procurement contracts.
- (2) Extending provisions for construction subsidies to ships engaged in all U.S. foreign trade, including those engaged in dry and liquid bulk trade which were previously unqualified.
- (3) Extending operating differential subsidies (ODS) to U.S. bulk carriers engaged in foreign trade.

- (4) Authorizing a ceiling of \$3 billion vice \$1 billion Federal ship construction and mortgage loan guarantees. However, this ceiling has since been increased to \$5 billion.
- (5) Broadening the scope of Construction Reserve Funds.
- (6) Expanding and re-orienting priorities of the Maritime Administration's R&D programs.

Many of the detailed aspects of the 1970 ammendment will be discussed later in this study. However, the new program was expected to have a major impact by stimulating the desire for construction of new vessels in U.S. shipyards.

III. STRUCTURE OF THE U.S. SHIPBUILDING INDUSTRY

A. INTRODUCTION

For the scope of this study, structure of the U.S. shipbuilding industry refers to the economically significant features of the U.S. Navy and merchant ship market which affects the behavior of the U.S. shipbuilding industry which supplies the market. As will be observed throughout this chapter, the U.S. shipbuilding industry's structure is a complex interaction of government and private enterprise with inherently unstable demand. Due to the high costs of labor and material in the United States, the government plays a dominant role in the industry through subsidies, Navy shipbuilding and repair contracts, and public policies. Approximately 90% of the U.S. shipyard industry output since World War II has been attributed to the government either through subsidies for merchant ship construction or Naval vessel construction or conversion [9, p.81].

The United States commercial shipbuilding industry is not a major competitor in the world market. During the period 1967-1971, the United States produced only 1.55% of the tonnage (dwt) and 1.63% of the ships constructed throughout the world [32, p.46]. Almost the entire output of U.S. shipyards is for domestic customers. For example, in 1971 only 2% of the industry's output (482,329 grt) were for export [32, p.85]. In 1972, shipbuilding accounted for only

0.3% of the gross national product, ranking roughly 40th of all U.S. industries in gross sales [32, p.85].

1. Major U.S. Shipyards

The shipbuilding industry in the U.S. today is operating at a much lower level than it did during WW II. During that war, there were 57 private shipyards that were capable of constructing ocean-going ships, while today there are only about 25. However, of these 25 only ten to sixteen have been actively engaged in new construction while the remainder have limited their activities to ship repair.

The U.S. shipbuilding industry has been estimated by both the Department of Commerce (1971) and by officials appearing before the 1970 Seapower Subcommittee (Bennett Hearings) to have been operating at approximately 60% of its current capacity. However, the exact meaning of the term capacity has not always been clearly understood. Capacity, as related to shipbuilding, is generally meant to be a measure of a shipyard's physical assets, such as unused ways or maximum possible employment or equipment or machinery [36, p.9988, 10690-91]. The meaning of capacity as it has just been described relates primarily to input assets that are available for utilization. The output implications of capacity will be described in greater detail in Chapter V dealing with the performance of shipyards.

On the other hand, capability is comprised of human and economic factors that eventually determine the potential use of this capacity. For example, the capability to perform

specific shipyard tasks (e.g. ship alteration) is primarily determined by the mix of skills (e.g. welders, electricians, supervisors) and equipment and machinery employed.

Particular data pertaining to major private and naval shipyards used as sources of information for this study are listed in Appendix A.

B. CONCENTRATION OF THE U.S. SHIPBUILDING INDUSTRY TODAY.

Shipbuilding is an international industry attempting to sell ships to the world's ocean transportation industry. It is a complex industry interwoven with multi-national firms and various forms and types of government protection and subsidies. It sells in a market made uncertain primarily by the unpredictability of the demand for ships. One nation's shipbuilding industry can be its most important commercial enterprise as measured by its contribution to the nation's total GNP, while in others it is commercially insignificant, and/or existing only under heavy government support.

While shipbuilding in general is strongly related to international shipping, the commercial market for the U.S. shipbuilding industry is generally limited to U.S. coastal shipping operators taking advantage of the protective features of the Jones Act, and those shipping companies that wish to take advantage of government subsidizations (i.e. CDS and ODS). One recent study concluded that in 1971 naval vessel construction and repair accounted for 59% of the industry's sales while naval construction represented approximately 67% of the country's new construction [16, p.15].

1. Major Private U.S. Shipyards.

The information presented in this report is based on data obtained from various sources (e.g. published reports, studies, material received directly from most of the contractors) on the ten major private shipyards listed in Table 1. All the firms listed, with the exception of Todd, are subsidiaries of larger corporations. Because of this, sales and profitability information of U.S. yards is difficult to document since individual, unconsolidated financial records are unobtainable.

TABLE 1

MAJOR PRIVATE U.S. SHIPYARDS

<u>Owner</u>	<u>Yard</u>
Bath Industries, Inc.	Bath Iron Works
Bethlehem Steel Corp.	Sparrows Point San Francisco
General Dynamics Corp.	Groton (Electric Boat) Quincy
Kaiser Industries, Inc. & Morrison-Knudson Co., Inc.	National Steel
Litton Industries, Inc.	Ingall's Nuclear S.B. Div. Litton Ship Systems Div.
Lockheed Aircraft Corp	Seattle
Tenneco, Inc.	Newport News S.B. & D.D.
Ogden Corp.	Avondale
Sun Oil Company	Sun Shipbuilding
Todd Shipyards Corp.	San Pedro Seattle

2. Market Distribution

A record number of shipbuilding orders under the Maritime Administration's construction differential subsidy (CDS) program were placed during fiscal 1973 (fiscal year data is usually available in April of the following calendar year). Contracts valued at almost \$1.3 billion were awarded during the year for the construction of seventeen new ships and the conversion of three freighters into productive containerships (Table 2) [50, p.6-7]. It is interesting to note that these contracts constitute the largest investment in commercial U.S. ship construction made in any peacetime year. Factors which may account for this large number of orders include the decision to proceed with the construction of the Alaskan oil pipeline, an active interest on the part of Congress and MarAd to work towards achieving the stated goals of the 1970 Act, and an increased demand for crude oil carriers. Also noteworthy is that the nine LNG's under contract will be the first ships of this type to be constructed in the U.S. They will also carry the lowest CDS rates since the subsidized shipbuilding program was initiated in 1936 [50, p.1]. The low CDS rates may be attributed to the technological advantage of the U.S. in these high technology vessels. This advantage is reflected in lower unit-cost differentials between U.S. and foreign shipyards for the construction of LNG type vessels.

Ten new subsidized merchant ships were completed and delivered during FY1973 (Table 3) [50, p.9].

TABLE 2

CDS CONTRACTS AWARDED DURING FY1973

Shipbuilder	Type of Ship	No. of Ships	Total dwt Tonnage	Estimated Completion Date	Total Est. Cost (1)	Est. Cost to Govt. (CDS) (1)
Newport News	LNG	3	190,380	4/77	\$ 297.6	\$ 76.2
GD (Quincy)	LNG	3	190,800	3/77	268.7	63.7
Bath	RO/RO	1	17,859	6/77	35.3	14.1
Avondale	LNG	3	189,510	10/77	309.1	51.0
Nassco	Tanker	4	358,800	12/76	112.8	41.0
Bethlehem	Tanker	2	530,000	4/77	162.9	66.6
Seatrains	Tanker	1	225,000	3/76	70.6	28.8
Triple "A" Machine Shop	Containership	3*	52,992	5/73	2.3	0.9
TOTAL		20	1,755,341		\$1,259.3	\$342.3

*Conversion

(1) \$ in millions

Source: COAS [50, pp.6-7]

TABLE 3

MERCHANT DELIVERIES FROM U.S. SHIPYARDS DURING FY1973

Shipbuilder	Type of Ship	No. of Ships
Bath	(subsidized) containership	2
GD (Quincy)	seabee	2
Litton (Ingalls)	containership	5
Avondale	lash	1
Todd	(various)	12*
Triple "A"	containership	<u>3*</u>
TOTAL (subsidized)		25

*Conversions

Source: Maritime Administration, 1973 Annual Report, p. 9.

The next table summarizes shipbuilding activity in private yards for both merchant and naval vessels during calendar years 1970 to 1973.

Table 5 is an overview of large merchant ships under construction or on order as of the dates listed and according to type of ship.

Table 6 summarizes, by type, number of ships and total displacement, naval ships under construction or on order in private yards as of January 1, 1974.

In summary, naval construction represented approximately 67% of the nation's new construction in 1971, while naval construction and repair accounted for 59% of the industry's sales. Because of the conglomeration of the industry, individual, unconsolidated financial data was unavailable.

TABLE 4

SUMMARY OF SHIPBUILDING ACTIVITY IN PRIVATE SHIPYARDS
DURING CALENDAR YEARS 1970 - 1973

	1970		1971		1972		1973	
	NO.	TONS	NO.	TONS	NO.	TONS	NO.	TONS
Merchant Vessels								
Under construction Jan. 1	49	1,387,600	49	1,608,800	59	1,818,700*	88	2,892,500
Ordered during year	13	579,500	24	617,000*	48	1,565,200*	41	1,907,200
Delivered during year	13	369,900	14	407,100	19	491,400*	34	886,600
Under Contract on Dec. 31	49	1,608,800	59	1,818,700*	88	2,892,500*	95	3,913,100
Naval Vessels								
Under construction Jan. 1	108	621,260	82	587,737	64	529,121	57	519,679
Ordered during year	6	132,000	15	88,044	14	85,522	7	38,727
Delivered during year	32	165,801	33	146,660	21	94,964	8	32,642
Under Contract on Dec. 31	82	587,459	64	529,121	57	519,679	56	525,764

Notes: Vessels of 1,000 tons and larger; tonnage of merchant ships shown in gross tons; naval vessels in light displacement tons.

*Revised

Source: Shipbuilders Council of America [23, p.31].

TABLE 5

MERCHANT TYPE VESSELS UNDER CONSTRUCTION OR ON ORDER
(1,000 Gross Tons and Larger)

	January 1, 1971		January 1, 1972		January 1, 1973		January 1, 1974	
	NO.	G.T.	NO.	G.T.	NO.	G.T.	NO.	G.T.
Ferry	0	0	2	6,000	7	19,500	4	11,600
Excursion	0	0	1	2,200	0	0	1	4,500
Icebreaker	0	0	1	4,950 dwt	1	4,950 dwt	2	9,900 dwt
Tanker	20	950,500	14	848,000	35	1,551,900	49	2,130,300
Liquid Natural								
Gas Carrier	0	0	0	0	6	450,000	15	1,208,700
Ore/Bulk/Oil	0	0	2	86,000	2	86,000	1	43,000
General Cargo								
Roll on/roll off	0	0	1	15,100	4	60,000	4	60,000
Container	14	271,800	13	253,800	11	218,100	1	27,000
Barge Carrier	13	325,500	15	406,300	11	320,500	6	182,400
Mining	0	0	1	19,400	1	19,400	0	0
Sludge Vessel	0	0	0	0	1	2,600	1	2,600
Fishing	0	0	1	3,200 L.T.	0	0	0	0
Dry Bulk Carrier	2	61,000	8	173,800	9	159,600	11	233,100
Totals	49	1,608,800	59	1,818,700	88	2,892,500	95	3,913,100

Source: Shipbuilders Council of America [23, p.31].

TABLE 6

NAVAL VESSELS UNDER CONSTRUCTION OR ON ORDER
IN PRIVATE SHIPYARDS AS OF JANUARY 1, 1974

TYPE	NO. OF VESSELS	TOTAL LIGHT DISP. TONS
Replenishment Oiler (AOR)	1	12,500
Attack Aircraft Carrier (Nuclear) (CVAN)	2	142,000
Destroyer (DD)	16	80,000
Escort Ship (DE)	3	7,872
Guided Missile Frigate (Nuclear) (DLGN)	5	40,110
Amphibious Assault Ship (Special) (LHA)	5	115,000
Patrol Frigate (PF)	1	2,727
Attack Submarine (Nuclear) (SSN)	<u>23</u>	<u>125,555</u>
Totals	56	525,764

Source: Shipbuilders Council of America [23, p.33].

A record number of shipbuilding orders under the CDS program were placed in FY1973. Nine of the vessels were LNG's which carried the lowest CDS rates since 1936 when the maritime subsidy program was initiated. This is probably due to the U.S. advantage over foreign shipyards in cryogenic technology.

3. Labor Force

Total industry employment at private U.S. shipyards continued at a fairly constant rate during the period 1966-1969 (see Table 7). During the two-year period, 1970-1971, total employment dropped substantially with the exception of the Gulf Coast area where employment has continued to rise since 1967. The large rise in industry employment through the end of the third quarter 1974 can be accounted for, in part, by a revision in the benchmark used for reporting purposes by the Bureau of Labor Statistics [25, p.1]. The effect of the new (1973) benchmark is that the employment

TABLE 7

PRIVATE SHIPYARD EMPLOYMENT - ALL EMPLOYEES
(Yearly Average in Thousands)

Year	Total	North Atlantic	South Atlantic	Gulf	Pacific	Great Lakes and Inland
1966	143.6	52.6	24.8	35.6	20.7	9.9
1967	140.0	48.4	26.1	34.8	20.7	10.0
1968	141.0	46.2	27.0	36.5	22.4	8.9
1969	142.0	45.8	26.0	37.6	25.2	7.4
1970	132.4	43.8	23.2	38.8	20.2	7.9
1971	130.6	40.4	23.3	43.2	16.4	7.3
1972	148.1	39.3	28.9	46.6	15.7	7.6
1973	144.4	40.2	29.8	48.6	17.5	8.4
1974*	156.4	45.7	27.8	50.0	24.5	8.4

*Through the end of the third quarter.

Source: Ernst G. Frankel and Henry S. Marcus, Ocean Transportation, 1973, p. 398.

Statistical Quarterly, Third Quarter - 1974,
Shipbuilders Council of America.

base has been expanded. Expansion is derived from the new definition of employer - one or more rather than four or more employees.

Employment at the naval shipyards (see Table 8) over the last several years has changed much more than the level at private yards. Total employment in naval shipyards has steadily declined during the last seven years.

Table 9 compares the average hourly earnings of production workers in the shipbuilding and repairing industry

TABLE 8

NAVAL SHIPYARD EMPLOYMENT - ALL EMPLOYEES
(Yearly Average in Thousands)

Year	Total	Boston (1) Portsmouth Philadelphia	Norfolk Charleston	Puget Sound San Francisco (2) Los Angeles Pearl Harbor
1968	95.2	28.5	21.7	45.0
1969	91.0	27.6	20.6	42.8
1970	83.0	24.4	19.1	39.5
1971	75.5	20.8	18.5	36.2
1972	70.1	18.7	17.7	33.7
1973	64.5	16.1	17.3	31.1
1974*	64.1	13.8	18.4	32.0

*Through the end of the third quarter.

(1) Boston closed July 1, 1974

(2) Hunter's Point closed June 29, 1974

Source: Statistical Quarterly, Third Quarter - 1974,
Shipbuilders Council of America [25, p.2].

by geographical regions of the country. The Gulf Coast area consistently had the lowest average hourly earnings for the three-year period. Based on the Gulf Coast's three-year average hourly earning rate of \$4.05, the North Atlantic three year average rate was 9.4 percent higher, the South Atlantic rate 10.1 percent higher, and the Pacific rate 24.7 percent higher.

TABLE 9

AVERAGE HOURLY EARNINGS OF PRODUCTION WORKERS IN THE
SHIPBUILDING AND REPAIRING INDUSTRY (1971-1973)

Year	Nation	North Atlantic	South Atlantic	Gulf	Pacific	Great Lakes
1971	\$4.13	\$4.19	\$4.26	\$3.82	\$4.70	\$3.97
1972	4.35	4.36	4.47	4.05	5.13	4.25
1973	<u>4.60</u>	<u>4.73</u>	<u>4.65</u>	<u>4.27</u>	<u>5.32</u>	<u>4.55</u>
3 Year Average	\$4.36	\$4.43	\$4.46	\$4.05	\$5.05	\$4.26

Source: U.S. Department of Commerce, Maritime Administration: Relative Cost of Shipbuilding, June 1974, p.26.

The information compiled in the following table lists the major shipyards and their total employees as of the dates indicated. The employees are then separated into general functional groupings by numbers and percentage of total employees, within the company. Detailed employee data was not available for General Dynamics (Groton-E.D.). In three cases, data was recorded for two successive periods to illustrate significant changes that had occurred within that particular company.

4. Discussion

There are approximately 400 companies engaged in the shipbuilding and repair industry [32, p.137]. Of these, the four largest contractors account for over two-fifths of all sales, while the eight largest firms account for three-fifths of the total business [32, p.137]. The actual period upon

TABLE 10
FUNCTIONAL GROUPING OF EMPLOYEES IN TEN MAJOR SHIPYARDS

Yard/As of (date)	Total Employees	Management/ Administration	Technical/ Engineering	Production	Non-Production
Avondale (6/71)	8,792	141 (1.6%)	513 (6.0%)	6,958 (79%)	1,180 (13.4%)
Bath (6/71)	2,479	152 (6.1)	255 (10.3)	1,788 (72.2)	284 (11.4)
Bethlehem (Sparrows Pt. (7/71))	3,925	165 (4.2)	450 (11.5)	2,950 (75.1)	360 (9.2)
GD (Quincy (7/71))	7,135	606 (8.5)	799 (11.2)	4,871 (68.3)	859 (12.0)
Groton (8/74)	16,400	(Breakdown data not available)			
Litton (Ingalls (4/71))	8,092	845 (10.4)	1,491 (18.4)	5,345 (66.1)	410 (5.1)
Litton (2/72)	7,305	1,154 (15.8)	3,150 (43.1)	2,704 (37.0)	297 (4.1)
Lockheed (6/71)	2,363	26 (1.1)	221 (9.4)	1,716 (72.6)	400 (16.9)
Nassco (6/71)	3,374	37 (1.1)	146 (4.3)	2,811 (83.3)	353 (10.5)
(2/72)	1,951	26 (1.3)	105 (5.4)	1,426 (73.1)	394 (20.2)
Newport News (3/71)	18,453	2,151 (11.6)	4,044 (21.9)	9,849 (53.4)	2,409 (13.0)
(2/72)	23,823	2,626 (11.0)	4,536 (19.0)	13,513 (56.7)	3,151 (13.2)
Sun (6/71)	3,705	156 (4.2)	298 (8.0)	2,922 (78.9)	329 (8.9)
Todd					
San Pedro (7/71)	588	101 (17.2)	26 (4.4)	339 (57.6)	122 (20.7)
Seattle (7/71)	978	68 (7.0)	180 (18.4)	669 (68.4)	61 (6.2)
(2/72)	1,722	65 (3.8)	166 (9.6)	1,427 (82.9)	64 (3.7)

Data Source: U.S. Commission on American Shipbuilding, Vol. III, pp. 367-484; General Dynamics, Electric Boat Division, Current Activities, August 1974.

Table prepared by L. E. Garcia.

which these figures are based is unknown, however the COAS obtained their information for this analysis from the 1972 edition of the Million Dollar Directory. The U.S. shipbuilding industry is considerably less concentrated than the aircraft industry where 70% of the total business is accounted for by the four largest producers [32, p.137].

C. PRODUCTION METHODS

The basic methods for the production of vessels in U.S. shipyards are, with few exceptions, the same conventional methods that have been used in the past. However, in the last few years, most of the major yards have responded to the increased demand for ships by expending large sums of money for expanding and modernizing their facilities. They have also adopted new production techniques in expectation of decreasing costs and increasing productivity.

Production processes, construction costs and periods, and recent advancements in shipyard technology will be discussed in this section.

1. Production Processes

The following is a brief outline of the procedures a conventional shipyard would follow in the production of a merchant ship [2, p.57]:

a. Preparation of schedules, working drawings, templates, and other information for all work to be done.

b. Receipt, storage and advance preparation of material (includes the preparation and prime painting of steel plates).

c. Fabrication: layout and cutting of plates and shapes to desired size and contour (by manual or automatic flame burning); forming or shaping plates, if required.

d. Fitting together and welding of subassemblies or "blocks," consisting of stiffened plate panels or irregular box-shaped components.

e. Erection and welding in place of subassemblies on the building berth.

f. Launching.

g. Installation of machinery and outfit, either at step (d) or later.

The next production process will describe the assembly line method of ship construction used by the Ingalls Shipbuilding Division (Litton) in Pascagoula, Mississippi. This is the process that is being used to produce the DD-963 class destroyers. The company once claimed that this production method would require 30% fewer man hours than would a conventional yard [32, p.98].

To visualize the continuous single-flow concept, the reader is asked to view Figure 1 in conjunction with the following description: steel is brought to the Material Receiving Area (1) by barge, rail or truck and off-loaded into the Material Storage Area (2). The fabrication complex (3), comprised of the Fabrication Shop, Panel Assembly Shop and Shell Assembly Shop, is the first major production area of the facility. From here steel which has been fabricated and assembled into covered and flat panels, flows through

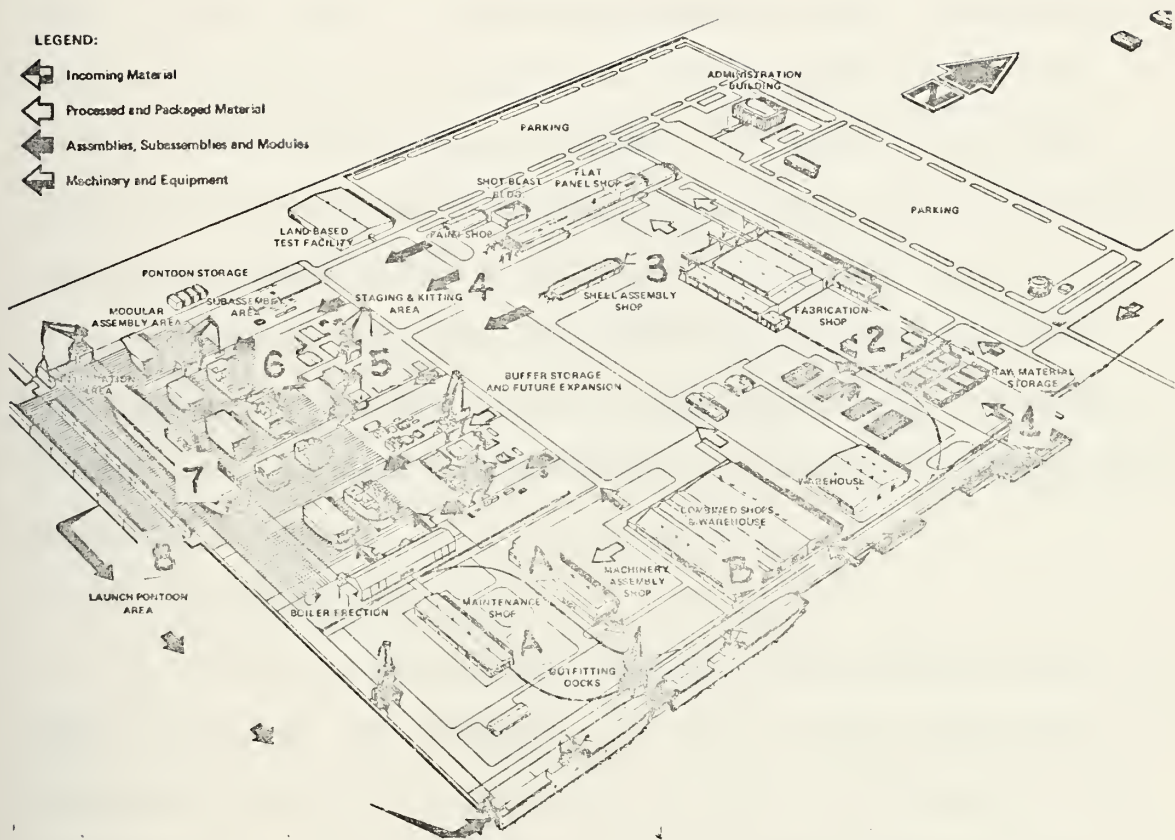


Figure 1. Diagram Model of Ingalls New Shipyard.

the Staging Areas (4) to the Subassembly Areas (5) where they are physically combined with non-structural outfitting kits flowing from the manufacturing shops and warehouse (B) to form subassemblies. These subassemblies, weighing up to 200 tons, move to the Modular Assembly Areas (6), joined together and outfitted to form a complete section or module of the ship. The modules are moved to the Ship Integration Area (7) and mated to form the complete ship. From here the ship is translated to the launch position (8) for side launch. Following launch the ship is towed to the post launch Outfitting Docks (9) for test, dock trials and final outfitting preparatory to delivery [2, pp.111-112].

Modular construction techniques are coming into wider usage by several of the major yards (e.g. Avondale, Litton, Quincy, Todd and Bethlehem) seeking to realize cost reduction benefits.

2. Construction Costs

The major components of unit construction costs are labor, material and overhead. Material costs, generally, are more predictable than labor costs which are significantly influenced by the productivity of the labor force, which, in turn, is susceptible to greater fluctuations for a variety of reasons (e.g. an impending reduction in the labor force, morale problems). Of the three, the least certain variable is the cost of overhead. Labor and overhead account for approximately 40-50% of U.S. total shipbuilding costs, the remaining 50-60% being accounted for by material costs and sub-contracts [32, p.5].

The basic unit construction cost is the total of charges for hull, outfit, and machinery material plus associated labor, overhead and engineering costs. To this unit cost is then added profit, and possibly an allowance for escalation factors, to arrive at the selling price.

The total price of a ship depends to a great extent on the type and size of ship being purchased. For example, a 63,000 dwt LNG costs from \$90 - \$106 million whereas tankers in a range of 35,000 - 265,000 dwt cost from \$20 - \$81.5 million [50, p.73]. Items that will cause the total price to vary include National Defense Features and safety features requirements built into the ship, as well as geographical cost differentials. For example, based on a representative 89,000 dwt tanker with a cost of \$30 million, it was determined that, in 1973, it would cost 4.2% (\$1.27 million) more to construct this vessel in a West Coast shipyard than it would in a yard on the East Coast. The same vessel could be obtained on the Gulf Coast for 3.3% (\$0.98 million) less than on the East Coast [51, p.29]. It is interesting to note that West Coast shipyards, which MarAd found (1974) to be the most costly, have nonetheless managed to obtain a large share of commercial work in the past year. For example, West Coast shipyards had under contract as of January 1, 1974, a total of 33 merchant ships out of a total of 88.

Relationships among cost factors vary with circumstances, including the type of ship and the accounting system used (Table 11).

TABLE 11

RELATIVE COSTS OF MATERIAL AND LABOR BY TYPE OF VESSEL

	Material	Labor and Overhead
Steel harbor tugs (1)	68%	32%
Typical wood fishing vessels (1)	67	33
Typical general cargo ships (2)	48	52
A naval auxiliary ship (1)	59	41
A naval combatant ship (1)	55	45
A naval amphibious ship (1)	53	47
A naval submarine (1)	38	62
A naval hydrofoil craft (1)	35	65
265,000 dwt tanker (2)	45	55
87,000 dwt tanker (2)	52.5	47.5
Ro/Ro (2)	51.5	48.5
LASH and container (2)	50.5	49.5
LNG (spherical) (2)	59.5	40.5

(1) Joseph A. Fetchko, *Methods of Estimating Investment Costs of Ships*, The University of Michigan, June 1968, p.21.

(2) D. M. Mack-Forlist, *Report to the Commission on American Shipbuilding on a Forecast of the Levels of Construction Differential Subsidy in 1976*, March 1973, p.69.

Source: Commission on American Shipbuilding [31, p.106].

3. Construction Period

The amount of time that it takes to construct a ship depends on several factors such as the type and size of ship, productivity of the shipyard, and the availability of material, supplies and labor.

Information obtained from the Navy indicated that it takes approximately 16-26 months between keel laying and builder's trials to construct a Spruance-class (DD-963) destroyer, and about 27-42 months between keel laying and

builder's trials to build a helicopter assault (LHA) ship. The lower of the two figures in both cases listed above was based on the expected construction period for the last ship in that series (e.g. 30th destroyer and 5th LHA). The higher figure represented the expected construction period for the first ships in the series.

Data received from a private West Coast shipyard indicated that it generally takes about 7-8 months after the keel is laid before the ship (tanker) is launched and another 5-8 months before it is delivered. The greatest variation was observed in the period between contract award and keel laying which varied between 11-26 months.

The construction period for tankers constructed in this particular yard varied between 27-38 months. However, the writers would like to caution that this information not be taken as conclusive, but rather that it be used as an indicator.

4. New Technology/Investments

In addition to Litton's new shipyard discussed above and the industry's increased utilization of modular techniques, several other technical advancements and investments in new facilities have been made. Some examples include the following:

- Bethlehem, Sparrow's Pt., has built a large graving dock capable of handling up to 350,000 dwt tankers.

- Avondale has completed a new \$40 million production line for construction of LNG tankers and LASH vessels.
- Newport News is presently developing a new \$106 million yard adjacent to its present site to build LNG tankers. Included in the new facility will be the country's largest building basin (1,600 feet long).
- General Dynamics, Quincy, has expended \$5.5 million for capital improvements, primarily on the conversion of two shipbuilding ways into graving docks.

Considering the large amounts that have been spent on capital improvements in the past few years, it is apparent that the nation's shipbuilding industry considered future business potential profitable. It would be interesting to know what impact the present state of the economy and the world's recent depressed tanker situation has had on the industry's expectations for the future.

D. LABOR IN THE U.S. SHIPBUILDING INDUSTRY

The shipbuilding industry is reputed to be highly labor-intensive. Approximately 42% of the total cost of construction of a standard 89,000 dwt tanker may be attributed to direct and indirect labor [51, p.9]. With a highly complex Naval vessel, the percentage of direct labor cost is even greater. As of December 1973, naval and major private shipyard plant employees totaled 89,415 of which 75,094 were considered production workers [51, p.20]. Total commercial

shipbuilding and repair industry employment and the percentage of production workers for 1969-1974 are shown in Table 12.

1. Skills Required

The shipbuilding and repair industry employs many diverse types of skilled and semi-skilled labor. These skills include pipefitter, welders, shipfitters, machinists, electricians and electronic technicians. In addition, U.S. shipyards employ design, engineering, management and administrative personnel. Most U.S. shipyards utilize the following seven skill levels for breaking down their work force data:

- (1) Management, Administration
- (2) Professional, Engineering
- (3) Professional, technical
- (4) Production, skilled
- (5) Production, semi-skilled
- (6) Production, unskilled
- (7) Nonproduction [32, pp.367-484].

2. Competition with Other Industries

The U.S. shipbuilding and repair industry competes with other industries for its' skilled labor, particularly

TABLE 12

PRODUCTION WORKERS IN PRIVATE U.S. SHIPBUILDING AND REPAIR INDUSTRY; 1969-74 (SIC 3731)

	1969	1970	1971	1972	1973	(Mar) 1974
Total employees (000)	142.9	130.2	128.2	134.5	138.3	148.9
Production workers (000)	117.7	106.3	104.7	107.2	109.7	117.3
Percent Production Workers	82.3	81.6	81.7	79.7	79.3	78.8

Source: Bureau of Labor Statistics

with the construction industry, where wage rates are generally higher.

Although U.S. shipyards attempt to maintain a constant work force despite fluctuations in orders, lay-offs of 50% to 75% of a yard's work force is not uncommon when shipbuilding orders are slack [31, p.25]. In many instances, when the yard attempts to recall their employees after a lay-off, they find that their most productive and highly trained workers have taken other jobs and are lost to their former employer [31, p.25].

3. Union Affiliations

In most of the larger U.S. shipyards, employees are union affiliated. The primary unions representing employees of U.S. shipyards are the Industrial Union of Marine and Shipbuilding Workers of America (UMSWA), The International Association of Machinists (IAM), The International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers, and the International Brotherhood of Electrical Workers [7, p.397].

4. Training Base

Several large U.S. shipyards have their own apprentice schools where it takes about four years to train a man to be a journeyman in the shipbuilding trade [35, p.1215]. There has been a prevalent shortage of skilled manpower in the industry for the past eight years and many shipyards have had to resort to heavy advertising and recruiting programs in an attempt to attract skills from other industries.

5. Total Shipyard Labor Force

A sample of 74,338 employees in major U.S. shipyards taken between April, 1970 and February, 1972 showed a breakdown of the labor force as indicated in Tables 13 through 17 [32, pp.96-7].

E. GOVERNMENTAL INFLUENCES ON THE U.S. SHIPBUILDING INDUSTRY

There are multitudinous public policies which have at least an indirect effect on the U.S. shipbuilding industry. It is the purpose of this section to identify those policies which are considered to be of major importance in the structure of the industry.

There are two government agencies which are primarily responsible for coordination and execution of public policies in the U.S. shipbuilding industry: The Department of Commerce (Maritime Administration) and the Department of Defense (U.S. Navy).

1. Maritime Administration (MarAd)

The first comprehensive peacetime formulation of maritime policy, the Merchant Marine Act of 1936, contained an opening statement of policy which is still in effect [45, p.10]:

Sec. 101. It is necessary for the national defense and development of its foreign and domestic commerce that the United States shall have a merchant marine (a) sufficient to carry its domestic waterborne commerce and a substantial portion of the waterborne export and import foreign commerce of the United States and to provide shipping service on all routes essential for maintaining the flow of such domestic and foreign waterborne commerce at all times, (b) capable of serving as a naval and military auxiliary in time of war or national emergency,

TABLE 13
CLASSIFICATION OF PERSONNEL

<u>Classification</u>	<u>Number</u>	<u>Percent</u>	<u>Range in Percent</u>
Management, administrative	8,867	11.9	1.1 - 22.7
Professional, engineering	5,617	7.6	0.6 - 15.1
Professional, technical	6,436	8.7	1.1 - 28.0
Production, skilled	30,842	41.5	19.1 - 76.1
Production, semiskilled	10,701	14.4	6.5 - 14.4
Production, unskilled	6,865	9.2	0.9 - 17.6
Nonproduction	<u>5,010</u>	<u>6.7</u>	1.5 - 6.7
Total	74,338	100.0%	

TABLE 14
AGE DISTRIBUTION OF EMPLOYEES

<u>Age</u>	<u>Percent of Employees</u>			
	<u>Production</u>	<u>Service</u>	<u>Design and Engineering</u>	<u>Management and Administration</u>
Below 25	21.0	17.4	17.3	15.9
26 - 30	17.8	14.5	17.8	15.9
31 - 40	22.1	19.6	24.7	23.6
41 - 50	17.8	21.1	20.6	22.2
51 - 60	16.1	22.4	16.4	19.5
Over 60	<u>5.2</u>	<u>5.0</u>	<u>3.2</u>	<u>2.9</u>
Total	100.0	100.0	100.0	100.0
Number in Sample	17,669.0	1,176.0	1,098.0	3,843.0

TABLE 15
YEARS OF SERVICE OF EMPLOYEES

Years of Service	Percent of Employees			
	Production	Service	Design and Engineering	Management and Administration
1	42.8	23.9	23.1	23.3
2 - 5	29.3	26.9	38.6	39.1
6 - 10	11.1	17.9	19.2	21.0
11 - 20	11.8	18.7	14.1	12.5
Over 20	5.0	12.6	5.0	4.1
Total	100.0	100.0	100.0	100.0
Number in Sample	669.0	176.0	098.0	843.0

TABLE 16
ESTIMATED EDUCATION LEVEL
OF PRODUCTION WORKERS

Highest Level Attained	
No schooling	3%
Grade school	25
High school (10th grade)	20
High school (graduate)	45
College (some)	5
College (graduate)	2
	100%

TABLE 17
EDUCATION OF EXECUTIVE AND ENGINEERING EMPLOYEES

Category	Sample Size	Highest Level Completed			
		High School	College	Advanced Degree	Technical School
Sales	3	-	67.0	-	33.0
Administrative	438	22.8	54.6	7.3	15.3
Production	1,389	71.2	13.6	1.1	14.1
Planning and Control	1,636	64.9	23.7	0.9	10.5
Estimating	55	14.6	27.3	3.6	54.5
Design and Engineering	753	31.4	50.9	5.8	11.9
Drafting	341	34.9	28.7	--	36.4
Research and Development	9	-	55.6	11.1	33.3

(c) owned and operated under the United States flag by citizens of the United States insofar as may be practicable, (d) 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, and (e) supplemented by efficient facilities for shipbuilding and repair. It is hereby declared to be the policy of the United States to foster the development and encourage the maintenance of such a merchant marine.

The Maritime Administration was formed to carry out the stated policy. According to the Maritime Administrator, the Maritime Administration is charged with the administration of those federal laws which have, as their purpose, the promotion and maintenance of a competitive and efficient merchant marine which is capable of meeting our nation's defense and commercial trade requirements. The MarAd provides assistance to the shipbuilding and ship operating industries in the areas of ship design and construction, promoting use of U.S. flag vessels, development of advanced transportation systems and shipboard equipment, and financial support to eliminate cost advantages available to other foreign shipbuilders and operators. For national security, the MARAD maintains the National Defense Reserve Fleet, supports military operations and assures the adequacy of the shipbuilding mobilization base. Other missions of the MarAd are to provide training for maritime manpower for both peacetime and emergency requirements, and plan for the development of the nation's ports [38, p.60].

a. Construction Subsidies

The Construction Differential Subsidy (CDS) is the primary direct means of subsidization to the U.S.

shipbuilding industry. This subsidy is utilized to offset the difference in costs of U.S. versus foreign ships. Any U.S. shipyard or U.S. citizen may apply for CDS to aid in the construction of a vessel to be used in the foreign commerce of the United States. The CDS is paid directly to the shipyard in the form of progress payments in accordance with the provisions of payment specified in the contract between buyer and builder, as approved by the Secretary of Commerce [45, p.26].

The amount of the reduction in the selling price (CDS) may equal, but not exceed, the excess of the bid of the shipbuilder constructing the proposed vessel (excluding the cost of any features incorporated in the vessel for national defense uses, which shall be paid by the Secretary of Commerce in addition to the subsidy), over the fair and reasonable estimate of cost of constructing that type of vessel if it were constructed under similar plans and specifications (excluding national defense features) in a low-cost foreign shipyard [45, p.28]. Japanese shipyards are normally used for comparison due to their low-cost competitive base. In FY1974, CDS expenditures amounted to \$200,344,000 with all known CDS contracts remaining within the statutory limits of 39%.

CDS payments have a statutory limit of 37% in FY1975 and 35% in FY1976. Only vessels suitable for foreign service and military service in a national emergency can qualify for CDS payments. Vessels built with the aid of CDS

must be registered under U.S. flag for at least 25 years (20 years for tankers and other liquid bulk carriers) [45, p.28].

b. Mobilization Base

Sec. 502(f) of the 1936 Act, as ammended, requires the Secretaries of Commerce and Navy to annually review the existing privately owned shipyards capable of merchant ship construction to determine whether their capabilities provide an adequate mobilization base at strategic points for purposes of national defense and national emergency. If deficiencies are noted, the Secretary of Commerce may, after considering all aspects and impacts, award construction to deficient shipyards in the interest of national defense [45, p.91].

For national defense purposes, the shipyard capabilities needed are based on four requirements: (1) breakout of the National Defense Reserve Fleet, (2) replacement of vessels lost to the enemy, (3) repair of merchant and naval vessels, (4) construction of merchant and naval vessels [31, p.242].

It would be interesting to explore past MarAd/Navy contracts in the shipbuilding industry in order to note any trends in awards to shipyards which were not in a position to maintain an "adequate" base, if determinable.

c. Reserve Fleet

MarAd maintains the National Defense Reserve Fleet (NDRF) in order to provide merchant ships for military operations or commercial shipping crises. Since 1960, the

size of this fleet has steadily decreased from approximately 2,000 ships to 541 in 1973 [50, p.40]. As of June 30, 1973, the status of the Reserve Fleet Ships are listed in Table 18.

TABLE 18
SHIPS IN RESERVE FLEET AS OF JUNE 30, 1973

	Retention	Scrap and Cannibalization	Spec. Proj.	Total
James River, Va.	130	65	4	199
Mobile, Ala.	--	15 ¹	--	15
Beaumont, Tex.	52	21	1	74
Suisun Bay, Ca.	143	107	3	253
Total	325	208	8	541

¹Custodial account only, ships transferred to State of Alabama.

Source: MarAd [50, p.41].

d. Indirect Subsidies

The remainder of MarAd administered policies are considered to be "indirect" in their relationship to the U.S. shipbuilding industry. These policies are primarily oriented toward U.S. shippers, however, they are mentioned briefly in that they have an impact on the demand for shipbuilding and guaranteed payments to the shipbuilders.

(1) Operating Differential Subsidy (ODS). This subsidy is a contractual agreement between the government and a U.S. shipping company engaged in the foreign commerce of

the U.S. Under the ODS program, payments are made directly to the shipper to make up the difference between the operative expenses incurred (wages, insurance, maintenance/repair, etc.) and the same expenses which would have been incurred under a representative low-cost foreign flag operator.

(2) Loan Guarantees/Lease Financing/Insurance of Financing. These forms of indirect subsidies are available to ship operators at attractive terms and are discussed in the Financing section.

2. U.S. Navy

The number of active U.S. Naval vessels has been steadily declining from a maximum of 976 ships in FY1968 to a level of 508 ships in FY1974 [23, p.9]. A major factor in this decline was the need for modernization of a fleet which was increasing in age and obsolescence. Under austere budget levels, only by giving up a large number of older ships was the Navy able to make available the funds needed for modernization [35, p.985]. The Navy ship modernization program has been in effect for several years and in FY1975, it is expected that there will be more ships procured than retired [35, pp.1042-3].

a. Navy Shipyards

The U.S. Navy operates eight public shipyards. At present, these shipyards are engaged only in conversion, repair and overhaul of Navy ships and have not been involved in any new construction since 1967. Only three Navy shipyards now have the capability for new construction

(Philadelphia, Mare Island, and Puget Sound). It has been a stated policy of the U.S. Navy that it does not intend to shift its' shipbuilding from private to Navy yards except as a backup in the event private shipbuilders become saturated with commercial work [24, p.3].

By a controlling provision in the FY1974 appropriation bill, the Navy was directed by Congress to allocate 30% of it's ship overhaul/repair/alterations to private shipyards [23, p.10].

b. Naval Reserve Fleet

The Navy also maintains active Naval Reserve Force (NRF) ships and an inactive Reserve Fleet of "moth-balled" naval ships which are subject to recall for active duty if required. As of June 30, 1974, active NRF ships totaled 68 [35, p.1065]. Additionally, the total number of Navy ships in the inactive Navy fleet was estimated at 768 vessels [57, p.48].

3. Preferential/Protective Practices

These practices are again primarily directed to the shipping industry with an indirect effect on shipbuilding, repair, conversion and overhaul.

a. Military Cargo Act of 1904

This act requires military cargo to be carried in U.S. flag vessels.

b. Merchant Marine Act of 1920

Commonly known as the "Jones Act," it primarily restricts foreign flag vessels from domestic trade in the United States.

c. Cargo Preference Act (PL 664)

This Act requires that at least 50% of all government-impelled cargo be shipped in U.S. flag vessels. The cargo is measured in tonnage and also by revenue. In 1973, the U.S. Department of Agriculture (DOA) and Agency for International Development (AID) shipments accounted for over 98% of all non-military preference cargoes moving under this act [50, p.29].

d. Public Resolution 17

P.R. 17 reserves all Export-Import Banking generated cargoes for U.S. flag vessels unless waived by MarAd [50, p.30].

e. Trade Agreements

Basic U.S. trade agreements are common, particularly in the agriculture theatre. A typical example is the U.S./USSR grain agreement of 1972 which called for 1/3 of the purchased grain to be carried in U.S. flag vessels.

4. Ship Procurement Practices

The details of government procurement practices is beyond the scope of this study. However, a brief comparison of MarAd/Private and Navy practices will be mentioned to provide a general background.

a. MarAd

When MarAd enters into a construction differential subsidy procurement, it allows the buyer and shipyard to negotiate the basic contract. Details of the proposed contract are then evaluated by MarAd representatives prior

to final approval. The approval process includes evaluation of specifications, prices, labor rates, etc. During construction, a minimum amount of contract administration is performed by MarAd representatives.

b. U.S. Navy

Because there is no private buyer, U.S. Navy ship procurements are governed by the Armed Services Procurement Regulations (ASPR). Due to the complexity of Naval ships, most procurements are now conducted through the negotiation process after a series of feasibility studies and conceptual approval. In general, the Navy follows the provisions of DOD INST 5000.1 which calls for cost type contracts where substantial development efforts are involved, usually for design and development of lead ship(s). Fixed-price type contracts are normally utilized for follow-on production runs of a major ship acquisition [6, p.5]. The time required from concept to development varies according to the complexity of the Naval ship involved but in many instances may exceed two years.

5. Other Public Policies

a. Buy American Act

Title 41 of the United States Code, Section 10, requires that manufactured articles, materials and supplies which are purchased for public use must be mined or produced in the United States, and only such manufactured articles, materials and supplies as have been manufactured in the U.S. substantially all from articles, materials and supplies mined,

produced or manufactured in the U.S. The implementing order for Section 10 established a rule that materials were to be considered foreign in origin if the cost of the foreign products used in such materials constituted 50% or more of the costs of all the products used in such materials. An ammendment to the FY1965 Military Appropriations Bill has required that no major component of the hull or superstructure of a Naval vessel may be built in any foreign shipyard. Also, another ammendment in FY1968 prohibits the construction of any Naval vessel in a foreign shipyard for which funds are appropriated [37, p.2297].

Although restrictive in nature, the provisions of the Buy American Act are tighter for the Merchant Marine. Not only must the ship be built in the U.S., but only articles, materials and supplies of the growth, production or manufacture of the U.S. may be used unless they would cause late delivery of the vessel in which case they may be waived by the Secretary of Commerce [37, p.2297].

b. Environmental/Health/Safety/Social Programs

Public policies in this area have had a significant impact in the cost of U.S. ships. A recent study (Todd 1973) estimates an increase of about 13.88% in the hourly billing rate on a vessel due to legislation in these programs [32, p.1121].

c. Defense Production Act of 1950

This act authorizes the establishment of priorities in the performance of Defense contracts and the

allocation of materials and facilities for promoting national defense.

F. BARRIERS TO ENTRY

1. Absolute Cost Barriers

Initial capital investment in a U.S. shipyard is extensive if major oceangoing ships are to be produced.

2. Labor Availability/Training Base

The industry has experienced great difficulty in obtaining skilled labor in many sectors of the U.S. High turnover rates and extensive recruiting programs by major shipyards are prevalent [31, p.25]. Apprenticeship schools at local shipyards are a prime source of labor input, however, turnover rates/layoffs pose a unique problem in maintaining a satisfactory labor base.

3. Profitability

Major U.S. shipyards are subject to low profits and return on total assets. A study conducted by Knight in 1971 revealed the following information for an average major shipyard:

a. It takes roughly one dollar of assets to generate two dollars of revenue per year.

b. Net income after taxes is less than two percent of revenues.

c. Return on total assets is three percent to four percent [32, p.103].

4. Uncertainty of Orderbook

The intense pressure of the Congress in appropriating funds for U.S. Navy shipbuilding programs and occasional cutbacks in both dollars and quantities have established a relevant degree of uncertainty in Navy shipbuilding programs. Long-term programs of multiple ships have been subject to cutbacks with resultant increases in per unit costs.

Fluctuations in shipping demand and the world trade picture adds an additional element of uncertainty to the industry.

5. Government Control

Due to the prevalence of government control in the industry, necessitated by a poor competitive position in world shipbuilding, it is suggested that the depth of government involvement, in itself, discourages new entries. By maintaining more stringent controls over the normal economic structure of an industry, the government may, in effect, inhibit initiative, technical innovation and economic opportunities normally found in other less controlled industries.

G. DEMAND FOR SHIPBUILDING

1. Merchant Ships

Demand for U.S. merchant ships is basically a function of the demand for that type vessel in world or domestic trade. Demand and supply of shipping are subject to large fluctuations of overcapacity and lack of availability. Primary causes of these fluctuations are economic, political and military or strategic factors. World shipping rates tend to

follow the shipping demand and supply relationship and fluctuations in shipping rates indicate the existence of a periodicity of about four to five years. As the costs of shipping are driven higher by demand, new orders are placed with shipbuilders for new construction and expansion efforts are undertaken by the shipping companies. As rates fall, there is a subsequent reduction in new shipbuilding orders and as rates continue to fall, existing ships may be laid up or scrapped [7, p.3].

2. U.S. Navy Ships

Demand for Naval vessels is a function of threat assessments, mission area deficiencies, fleet obsolescence and budget constraints. Shipbuilding programs must be broken down to number and per-unit cost elements in order to present the program to the Congress. Navy shipbuilding programs are normally funded by Congress on a fiscal year-to-year basis.

H. METHODS OF FINANCING

1. Private

The Merchant Marine Act of 1970 was passed in an effort to increase our merchant marine force. To achieve this goal, construction and operating subsidies were extended to the U.S. flag bulk trade, and new financing techniques were developed. The following is a discussion of the different forms of vessel financing that are currently available to U.S. shipping companies.

a. Construction-Differential Subsidy (CDS)

Construction-differential subsidies, discussed in greater detail in Section E, are granted in certain qualified circumstances to prospective ship purchasers (U.S. citizens or U.S. shipyards) to buy an American flag, American-built ship. A change incorporated into the 1970 Act allows U.S. shipyards to apply directly for subsidies. The intent of the change was to encourage shipyard participation in the design of the vessel which would lead to increased economies in construction. In either case, the subsidy is paid directly to the shipyard. Vessels operating under "cabotage" (Jones Act) regulations are ineligible to use this type of financing since they do not experience competition from foreign-flag vessels.

b. Loan Guarantees (Title XI Program)

Generally recognized as being the most successful of all government activities associated with the merchant marine, the Title XI Federal Ship Mortgage Insurance Program (Loan Guarantee) makes long-term debt financing available to shipowners through a revolving insurance fund of \$5 billion dollars, recently raised from \$3 billion. Under this program, the U.S. government insures commercial loans and mortgages to finance a fixed percentage of the actual cost of construction, conversion or reconditioning of American-built and documented vessels above five net tons.

The maximum extent of coverage varies from 75 - 87½% of actual costs depending on the size and intended

use of the vessel, and whether CDS funds were used. The construction loan is insured only for the period of construction, after which the ship must be financed through a mortgage loan which may extend for the economic life of the vessel, not to exceed 25 years. Frankel points out that most foreign countries will finance ships purchased from their shipyards for a maximum duration of seven years [7, p.533].

The major source of income to the Title XI program is the annual guarantee premiums received by the Maritime Administration (MarAd). These premiums are prepaid for the forthcoming year beginning on the day the guarantee contract becomes effective. These payments are from the shipowners to the government. The premium fee is determined by MarAd officials based on the risk that they assume, which is usually based on the company's financial position and operating ability. Construction Loan Guarantee premiums range from 1/4 to 1/2% of the guaranteed debt outstanding, whereas Mortgage Debt Guarantee premiums range from 1/2 - 1% on the outstanding debt.

In general, bonds guaranteed under Title XI receive long-term interest rates comparable to those received by prime credit organizations and other government agencies. Merchant Marine bonds are usually sold at approximately the same rates as are AAA utility bonds [7, p.549]. The government requires that Merchant Marine bonds be sold at 100% of face value [7, p.549].

Though not a statutory requirement, MarAd prefers that the principal of debt guaranteed under Title XI be amortized on a straight-line basis.

c. Capital Construction Fund

The tax-deferred capital construction fund, a form of indirect subsidy, has been in existence since 1947. The purpose of this fund is to provide the U.S. flag operator some form of tax advantage(s) some foreign operators currently enjoy.

The program operates by allowing eligible shipping companies to defer payment of income taxes by depositing ordinary income and/or capital gains in a specially created fund before paying taxes. Taxes remain unpaid as long as this money is used for acquiring new vessels or related equipment. However, the depreciation base of a new vessel is reduced by the amount withdrawn from the fund to purchase it. Thus, taxes are deferred, not exempted, since they are eventually "repaid" in the form of reduced depreciation.

Prior to 1970 only companies receiving ODS were eligible to establish a capital construction fund. However, the law was amended by the 1970 Act to allow any citizen of the U.S. who owns or leases any vessel constructed and documented in the U.S. to establish a fund. The revised structure thereby extended eligibility to non-subsidized companies as well.

d. Tax Incentives

The tax base upon which a company's tax liability is figured is net income. The present tax rate is 22% on

the first \$25,000 plus 48% on any net income in excess of \$25,000. An important significance of this marginal tax rate is in its use in capital budgeting or financing decisions.

The Internal Revenue Code of 1954 allows a company to deduct reasonable depreciation of certain property in establishing its tax base. The Code has established that the guideline economic life for vessels and other similar water transportation equipment is 18 years. The IRS has allowed shipping companies to calculate yearly depreciation using one of the following three methods: (1) Straight line, which allows for an equal depreciation write-off each year; (2) Sum of Years Digits, the "most accelerated" method allowed under U.S. tax law (To take full advantage of this method, a company has to make sufficient income in a given year to cover the depreciation write-off.); (3) Double Declining Balance, an accelerated method that allows for a more rapid depreciation in early years yielding a higher net tax shelter.

All interest payments on company debt as well as lease payments on leased equipment are tax deductible.

The investment tax credit, reinstated by the Revenue Act of 1971, is designed to stimulate investment. Under this law, a steamship company can take as a direct deduction from its income liability 7% of the acquisition cost of a new asset. The percentage of the credit is based on the depreciable life of the asset, the maximum being 7% for assets with depreciable lives of seven or more years.

An important point is that the credit is only valid for the year in which the asset is acquired.

An important tax benefit to shipping companies is that 85% of the dividends earned on corporate securities are exempt from taxation [7, p.527].

A provision of the Merchant Marine Act of 1936 allows a shipping company to trade into the government an obsolete ship for an allowance credit on the purchase price of a new vessel. If a gain or loss is realized in this transaction, it is not recognized for tax purposes. Capital losses can never be deducted from ordinary income as a tax shelter, but they can be carried forward up to five years to offset capital gains.

e. Lease Financing

Lease financing was enhanced by the 1970 Act as a means of attracting additional capital to the industry while generating very low effective interest rates to the operator (lessee) of the vessel. Since transportation companies normally fail to generate large earnings early in the operating life of the assets, many of the tax benefits were being wasted. The leverage lease allows financial institutions to employ the tax benefits (which may have been previously forgone by the ship buyer) and pass the rewards on to the lessee in the form of an attractive lease rate. For example, substantially lower (more than 3%) effective interest rates have been obtained with leveraged leases

than could have been obtained under the Title XI program [32, pp.1015, 1044-47].

2. Defense

Determining whether to enter into a contract financing program can be difficult because the government is functioning both as a procuring agent and as a banker. In the end the decision must be made as to how unstable a contractor must be before the government refuses to accept the risks of financing and, instead, chooses to go to a more expensive contractor.

The following forms of financing are currently available for use by defense procuring agents in providing assistance to government contractors.

a. Private Financing

This is the most preferred method because of minimal involvement on the part of the government. The usual type is the commercial loan obtained by the contractor from a private financial institution. A second type is one in which the defense organization guarantees commercial loans made to defense contractors or subcontractors. These were commonly referred to as "V" loans. The third type is where contractors assign to a lending institution monies due them or to become due them under a government contract thereby making it easier for them to borrow money.

b. Progress Payments

Progress payments are made to a contractor as work progresses on Navy contracts. They are based on either

costs incurred, percentage of completion, or a particular stage of completion. They are used only with fixed-price contracts and fixed-price subcontracts under cost reimbursement prime contracts, providing funds in advance of delivery to help in financing long-lead time procurements. For most procurements, progress payments are based on costs incurred. However, a recent change pertaining to shipbuilding, ship repair, and ship conversion involves progress payment procedures under fixed-price and fixed-price incentive contracts. These new procedures will result in shipbuilding progress payments being based on a combination of costs incurred and physical progress rather than solely on a percentage or stage of completion [43, p.2711]. The patrol frigate and Trident submarine programs were planned to be the first contracts to contain the new progress payment provisions [43, p.2715].

c. Advance Payments

Advance payments are advances of money made by the government to a contractor in anticipation of performance. This method of government financing is least preferred because it imposes the greatest administrative burden on the government.

Advance payments may be made when it is determined that they are in the public interest or to facilitate the national defense (PL85-804).

This method of financial assistance requires the approval of higher authority.

I. TRENDS

1. Nuclear Powered Naval Vessels

For several years, Congress has advocated the construction of surface Navy warships over 8,000 tons as nuclear powered. This desire by Congress was reconfirmed in 1972 when intense pressure was exerted on the Navy to re-commerce its nuclear frigate construction program [34, p.28].

2. Public Shipyards

As previously stated, public shipyards are engaged in repair/overhaul/conversion work only and it does not appear likely they will engage in new construction in the near future. Additionally, the Navy has been directed by Congress to increase its repair/overhaul work in private shipyards to 30%. This percentage is expected to remain a minimum requirement and could possibly increase if more pressure is applied by the industry on Congress.

3. U.S. Shipyard Expansions

Nearly \$500 million has been spent by U.S. shipyards for improvements and modernizations in the past five years. Another estimated \$500 million has either been authorized or committed for new or improved facilities for both private and public U.S. shipyards [23, p.13]. This large amount of capital expansion appears to be the industry's response to increasing demand for tankers and liquified natural gas (LNG) ship orders.

4. Trans-Alaskan Pipeline

Construction of the Trans-Alaskan Pipeline system is planned for completion in mid-1977. As a result of

construction authorization in 1974, there has been a marked increase in demand for U.S. flag crude oil tankers. Under the Jones Act (1920), only U.S. flag vessels may be utilized for the trade from Alaska to CONUS ports. Merchant vessels ordered in 1973 and 1974 were predominantly large crude oil tankers and LNG's reflecting the expected activity when the pipeline opens.

5. Energy Transportation Security Act of 1974

In December 1974, Congress passed a controversial oil preference bill which required, by FY1976, at least 20% of all oil imports to the U.S. be carried by U.S. flag vessels (increasing to 30% in 1977). This bill was pocket vetoed by the President, however it has a strong chance of becoming Public Law this year. The U.S. flag share of oil imports at present is approximately 5%. Passage of the Bill would have a marked affect on the U.S. shipbuilding tanker business. Estimates of from 25 to 30 million dwt would be required to support this legislation. Presently, the U.S. flag fleet has approximately 8 million dwt afloat and production output is about 1 million dwt per year [56, p.29].

6. Labor to Capital Intensive

New technology, capital investment, and a general trend toward series production of standardized ships is moving the U.S. shipbuilding industry from labor intensive to capital intensive.

7. Sales to Other Nations

On August 27, 1974, the U.S. Navy concluded an agreement to sell six new DD-963 destroyers to Iran. Each destroyer will cost roughly \$110 million. Increased activity in defense sales to Middle East nations may call for further Navy ship sales in 1975.

IV. CONDUCT OF THE U.S. SHIPBUILDING INDUSTRY

A. INTRODUCTION

It was the original intent of this chapter to gather individual company conduct data such as bidding, pricing, contracting decisions, etc. However, we were unable to develop sufficient data in this area and thus, of necessity, the concept of conduct in this chapter is more generalized and the careful threads from structure to conduct in the U.S. shipbuilding industry have become clouded.

B. PUBLIC POLICY CONDUCT IN U.S. SHIPBUILDING INDUSTRY

1. MarAd

a. Construction Differential Subsidy

In Fiscal Year 1974, MarAd awarded CDS contracts for twelve new vessels for foreign trade service. A total of \$280.7 million in CDS payments were to be made on these vessels for a total contract price of \$756 million. These payments represent an average CDS payment of 23.4% and no ship was contracted over the 39% CDS limit for FY1974. All twelve vessels were tankers, three of which were rated at 390,770 dwt. As of July 1, 1974, the total number of CDS vessels ordered since the 1970 ammendment to the Merchant Marine Act amounted to 59 oceangoing ships with a total contract value of over \$3 billion [55, p.78].

Data for ships contracted under construction subsidy and total expenditures for CDS appears in Table 19.

TABLE 19
CDS DATA FOR FISCAL 1970-74

FY	New Ship CDS Contracts	Total Under Construction	New Ship Deliveries	Total CDS Expenditures, (Millions) ¹
1974	12	52	15 est.	\$200.3
1973	17	55	10	185.9
1972	21	48	6	143.3
1971	12	33	5	136.7
1970	5	26	7	96.7

¹Includes reconstruction subsidies.

Source: Department of Commerce, MarAd [55, p.81] [50, p.69].

b. Mobilization Base

As noted in Chapter III, the Secretaries of Commerce and Navy are required to annually review shipyards capable of merchant ship construction in order to determine adequacy of the mobilization base. Research efforts to determine if these provisions have recently been carried out have not been successful. However, the Department of Commerce and the Navy do exchange data on most of the private shipbuilding facilities in the U.S.

In 1973, the Commission on American Shipbuilding reported that a recent study by MarAd indicated that the shipbuilding industry had only one-third of the required output capacity for constructing commercial ships in a sustained conflict [31, p.242].

c. Reserve Fleet

During FY1973, 15 merchant ships were placed in the MarAd Reserve Fleet and 143 were sold for scrap or non-transportation use for a total of approximately \$12.6 million. From 1958 through 1973, a total of 2,015 Reserve Fleet vessels have been sold for scrap or nontransportation use for a total of roughly \$128.6 million [50, p.41]. Additionally, the Mobile, Alabama fleet was phased out on April 30, 1973.

During FY1972, MarAd initiated a program to evaluate techniques for rapidly and economically bringing inactive Reserve Fleet "Victory" ships to a ready-for-service status. The technique utilized was to survey the 123 Victory ships in the Reserve Fleet, thus producing a breakout sequence for each fleet, complete reactivation and repair specifications, etc. The survey was completed in FY1973 and according to MarAd the process of activating the Victory ships could now be accomplished at minimal cost and in the least possible time [50, p.41].

d. Other

ODS payments for FY1970 through 1974 are listed in Table 20.

As of January 1, 1975, there were 91 merchant ships under construction or on order from private U.S. shipyards. The orderbook included 74 tankers, 7 intermodal carriers, 7 drybulk carriers and 3 special-type vessels with a total value in excess of \$4.3 billion. Additionally, two merchant vessels were undergoing conversion [46, p.1].

TABLE 20

ODS DATA FOR FY1970 TO 1974

FY	1970	1971	1972	1973	1974
Companies with Long-term Contracts	13	12	16	21	23
Ships Covered	247	206	207	185	177
Total Subsidy Paid (ooo's)	205.7	268.0	235.6	216.8	226.5

Source: Department of Commerce, MarAd [55, p.81] [50, p.69].

2. U.S. Navy

a. Shipbuilding Programs

(1) Tables 21 and 22 list the latest available status of Navy shipbuilding activities.

b. Build and Charter Program

In June of 1972, the Military Sealift Command (MSC) of the U.S. Navy entered into a long-term leasing arrangement of tankers by having private offerors obtain necessary funds for the construction of the tankers, with the Navy guaranteeing that it would lease the vessels for 20 years. The tankers would be manned by M.S.C. civil service merchant seamen and would provide fueling services to U.S. Navy ships. By leasing instead of purchasing, the Navy was able to obtain badly needed tankers through operation and maintenance (O&M) funds whereas they were unsuccessful in obtaining appropriations for construction of their own tankers through Ship Construction and Conversion (SCN) funds [35, p.1106].

TABLE 21
 NAVY SHIPBUILDING ACTIVITY FOR
 CALENDAR YEARS 1970-1973

	1970	1971	1972	1973
Ships Under Construction Jan. 1	108	82	64	57
Ships Ordered During the Year	6	15	14	7
Ships Delivered During the Year	32	33	21	8
Ships Under Contract Dec. 31	82	64	57	56

Source: SCA [23, p.31]

TABLE 22
 NAVAL VESSELS UNDER CONSTRUCTION OR ON ORDER IN
 PRIVATE SHIPYARDS AS OF JANUARY 1, 1974

Type	No. of Vessels	Total Light Disp. Tons
Replenishment Oiler (AOR)	1	12,500
Attack Aircraft Carrier (Nuclear) (CVAN)	2	142,000
Destroyer (DD)	16	80,000
Escort Ship (DE)	3	7,872
Guided Missile Frigate (Nuclear) (DLGN)	5	40,110
Amphibious Assault Ship (Special) (LHA)	5	115,000
Patrol Frigate (PF)	1	2,727
Attack Submarine (Nuclear) (SSN)	23	125,555
TOTALS	56	525,764

Approximate Value of unfinished Naval work in Private Ship-
yards as of January 1, 1974: \$6,650,000

Source: SCA [23, p.33]

As a result of this action, considerable controversy was initiated over the legality of the issue, the costs to the government, and the impact of future decisions of this nature. Basically, leasing to the MSC was not a requirement for specific congressional authorization and approval through the formal SCN appropriation process. A Government Accounting Office (GAO) report in 1973 revealed that at a discount rate of $8 \frac{3}{4}\%$, there was little difference in the present value between leasing and purchasing. However, applying a discount rate above $8 \frac{3}{4}\%$ made the present value of leasing more economical whereas a rate below $8 \frac{3}{4}\%$ made a buy arrangement more economical [35, p.1104].

There appears to be little opposition to the Build and Charter program at the present time, particularly with the manpower shortages and funding restrictions of the Navy. The program consists of nine tankers, each with a displacement of 25,000 dwt. Contractors to build the nine tankers and their prices are listed in Table 23.

TABLE 23
NAVY BUILD AND CHARTER PROGRAM

Contractor	Unit Price	Units	Total Price
Bath	\$16,031,000	5	\$ 80,155,000
Todd	16,595,000	4	66,380,000
TOTAL		9	\$146,535,000

Source: GAO [35, p.1113]

c. Defense Production Act (DPA) 1950

In early 1974, upon advice by the U.S. Navy, the Department of Defense recommended to the Office of Preparedness, the withholding of certain steel priorities for merchant vessel construction under the DPA. Granting defense priorities had become almost automatic in the post WW II excess capacity era and the withholding of priorities by the Office of Preparedness had a marked impact on the U.S. shipbuilding industry. The DOD's interpretation of the DPA in this case indicated that each merchant ship must have a direct military value. As a result of this interpretation, Todd Shipyards, Inc. was denied a steel priority to build 400,000 dwt tankers in a new shipyard in Galveston, Texas. Subsequently, Todd cancelled plans for a \$100 million expansion in its Galveston facility [30, p.28].

Steel shortages and increased interest in commercial contracts by U.S. shipbuilders appear to have been the underlying reasons for this conduct by the Navy. In addition, Avondale shipyard has reported being almost 25% behind schedule in construction of two LNG carriers which were denied steel priorities [30, p.28]. The priorities under the DPA are most important to the U.S. shipbuilding industry in merchant ship construction due to the strict limitations imposed by the Buy American Act which prohibits purchase of foreign materials.

3. General

On 24 January 1975, Newport News Shipbuilding and Dry Dock Co. announced a reduction of about 2000 employees by June 1975. Newport News' president cited the following reasons for the employee reduction:

- a. The present state of the nation's economy
- b. Increased cost of overhead items in 1975
- c. Increased labor costs in 1975
- d. Existing fixed-ceiling-price contracts, which were 90% of present yard contracts, did not fully cover escalating costs
- e. Uncertainty of Navy's future shipbuilding plans because of unresolved budgetary considerations
- f. Continuing necessity to perform costly, and often duplicative, administration tasks
- g. The President's veto of the Energy Transportation Security Act
- h. Delay in construction of new commercial shipbuilding facilities [24, p.1] [19, p.2]

C. LABOR UTILIZATION

1. Total Labor Force

Total U.S. Shipyard labor has been slowly increasing in private U.S. shipyards while a general decrease has occurred in public yards as indicated in Table 24.

On June 29 and July 1, 1974, the Navy closed Hunter's Point and Boston Naval Shipyards respectively. These closures were a result of general DOD cost-reductions through

TABLE 24

TOTAL U.S. SHIPYARD EMPLOYMENT:
ALL EMPLOYEES
(In Thousands)

	1971	1972	1973	1974 (est)
Avg. Private	130.6	138.1	144.4	156.4
Avg. Naval	75.5	70.1	64.5	64.1
TOTAL	206.1	208.2	208.9	220.5

Source: SCA [25, pp.1-2]

the closing of 274 military installations in 32 states and the higher costs of work in public versus private shipyards [23, p.10].

2. Strikes, Walkouts, Union Contracts

In general, U.S. shipyards have been relatively free of labor strikes in the past few years. In 1973, Bethlehem Steel had a nine day work stoppage at its five shipyards. One other Maryland shipyard was idled for a 91 day period before a new contract agreement was reached [50, p.38]. Preliminary information for 1974 indicates two work stoppages for less than one month each in major U.S. shipyards. Labor contracts have been generally negotiated for 3 years but five year contracts have appeared on occasion [31, p.25].

3. Wages

A comparison of shipbuilding and other industry weekly earnings is listed in Table 25. It can be seen from Table 25 that earnings in the shipbuilding industry have not kept pace

TABLE 25

AVERAGE WEEKLY EARNINGS IN SELECTED INDUSTRIES

Year	Shipbuilding	Durable Goods	Aircraft	Mfg.	Contract Construction
1968	\$145	\$132	\$153	\$123	\$165
1969	155	140	163	130	181
1970	158	143	171	134	196
1971	163	153	179	142	213
1972	173	167	193	155	224
1973	178	179	208	165	241

Source: SCA, Bureau of Labor Statistics [25, p.9]

with other industries. This may be due to low profits in the industry and a less stronger bargaining position of the shipbuilding unions.

4. Availability

There is presently a shortage of skilled labor in the shipbuilding industry. A recent study by MarAd in March of 1974 concluded that shortages in the availability of skilled labor would occur in several labor markets with concentrated shipbuilding and repair facilities. Additionally, it was noted that apprentice programs were not emphasized in most private shipyards. Only three shipyards (Bath, Newport News, Electric Boat) had programs of any magnitude. Other conclusions were that the requirements for skilled manpower in U.S. Commercial shipyards would increase eight to twelve percent for the next two years and that a major impediment to planned

shipyard expansions would be significant shortages of skilled labor [35, p.1226].

It has been suggested that many of the skilled shipyard workers are hesitant, even reluctant, to move when laid off. Litton had great difficulties enticing skilled labor to its Ingalls yard in the early 70's and more recently, Charleston Naval Shipyard encountered major problems in filling skill shortages even after two Navy shipyards were closed (Boston, Hunters Point) and the skilled workers at those yards were offered a move at the government's expense [35, p.1215].

Table 26 lists the shipyard turnover rates for 1969-1973. It can be seen that although the separations per 100 employees has been lower in the last two years, so has the number of accessions and there is only a slightly greater average accession per 100 employees (.4) than separation.

D. IMPACT OF FINANCING ON THE SHIPBUILDING INDUSTRY

Nearly all ship construction is financed with borrowed money which may be obtained from either private or federal agencies. Within the last few years, shipowners have utilized U.S. ship financing techniques effectively [23, p.13].

The different financing elements for which data has been obtained and their impact on the shipbuilding industry will be discussed in this section.

TABLE 26

LABOR TURNOVER RATES IN THE SHIPBUILDING AND REPAIR INDUSTRY

Year	Avg. Total Accessions Per 100 Employees			Avg. Separations Per 100 Employees			
	New Hires	Other	Total Avg.	Quits	Layoffs	Other	Total Avg.
1969	5.0	3.3	8.3	3.0	3.7	1.3	8.0
1970	3.7	4.6	7.3	2.2	4.6	1.3	8.1
1971	3.9	4.7	8.6	2.0	5.3	1.3	8.6
1972	3.9	4.2	8.1	2.1	4.2	1.5	7.8
1973	4.8	3.1	7.9	2.7	3.3	1.5	7.5

Labor turnover is gross movement of wage and salary workers into and out of employed status with respect to individual establishments.

Accessions are total number of permanent and temporary additions to the employment role, including both new and rehired employees.

New Hires are temporary or permanent additions to employment roll of persons who have never before been employed in establishment.

Other Accessions are all additions to employment roll which are not classified as new hires, including transfers from other establishments of company and employees recalled from layoff.

Separations are terminations of employment classified according to cause.

Quits are terminations initiated by the employees, failure to report after being hired, unauthorized absence.

Layoffs are suspensions without pay lasting or expected to last at least seven consecutive days.

Other Separations are termination of employment because of discharge, permanent disability, death, retirement, transfers to another establishment of the company, and entrance into the Armed Forces for a period to last more than 30 consecutive days.

Source: Bureau of Labor Statistics

1. Title XI Program

Nearly \$1 billion in ship financing guarantees were approved during FY1973 [50, p.2]. This covered 95 vessels and 450 lighters. At the end of FY1973, a total of 456 vessels and 2,171 lighters were insured under the Title XI program [50, p.9]. The outstanding principal balance on these ships totaled nearly \$2.6 billion.

Several financing guarantee applications had not been acted upon at year's end. These applications involved the construction or conversion of 362 ships and 250 shipboard lighters totaling about \$1.4 billion [50, p.9].

It is interesting to note that of the several billions (in excess of \$35 billion since 1958) guaranteed by the federal government since the inception of the Title XI program (1936), only nine foreclosures have occurred as of March 1973 [44, p.74].

2. Capital Construction Fund

At the end of FY1973, 140 interim fund agreements had been entered into with eligible shipping companies [50, p.11]. It is anticipated that these agreements will result in excess of \$2 billion in new construction and conversion in the next ten years [50, p.11].

Six operators had a total balance of about \$2.9 million in the construction reserve fund at the end of FY1973 [50, p.11].

3. Tax Incentives

In October 1973, the Internal Revenue Service adopted a new Class Life Asset Depreciation Range System (ADR) for

shipyard assets in accordance with the Revenue Act of 1971. The two main provisions include an asset life that can be more firmly anticipated and a realization of significant acceleration deductions through shortened depreciation periods [23, p.15].

4. Discussion

Of particular current interest is the participation of the oil companies in domestic ship construction. Their participation appears to have been inhibited in part by the so-called "grandfather clause" requirement of the current law that requires mixed foreign-flag/U.S.-flag fleets to phase into total U.S. registry if ODS is to be earned on new ships [32, pp.1020-1]. This condition is given as being a major reason why the large international oil companies have shown little interest in purchasing their tankers in the U.S. The advantages enjoyed (e.g. lower operating costs, tax-free environment) by parent firms in the continued operation of foreign-flag vessels appear to outweigh the advantages possible through the U.S. program, with its ODS. It is the authors' opinion that these new tankers will be used in the non-contiguous trade between Alaska and the continental U.S. which makes them ineligible for ODS as stipulated in the Jones Act.

E. SHIPBUILDING CLAIMS

The Armed Services Procurement Regulations (ASPR) defines the term claim as:

a request for adjustment of a single contract involving to a significant extent a 'constructive change' --- i.e., a change based on Government conduct, including actions or inactions, which is not a formal written change order but which has the effect of requiring the contractor to perform work different from or in addition to that prescribed by the original terms of the contract --- or late or defective Government-furnished property or information. Claim does not mean a request for equitable adjustments solely for formal written change orders or price adjustments pursuant to escalation or price redetermination, provisions of Public Law 85-804, or other contract assertions or adjustments not enumerated in the preceding sentence. When claims under two or more contracts arise from the same theory of recovery, such claims shall be treated as a claim within the definition provided above.

Contractor claims for price increases have been a recurring problem in Navy shipbuilding programs and the magnitude of this problem has risen considerably during recent years. Intense interest and concern in the problem has been shown by high level leaders in Congress and DOD. Several hearings and investigations have been conducted in an effort to determine the "why" of these claims [42, pp.1642-3, 1654-61] [35, pp.1249-51].

The most significant factors which contribute to the "why" of contractor claims as brought out before the Subcommittee on Priorities and Economy in Government in May 1970 include the following [41, pp.400-1]:

1. Inaccurate lead-yard plans
2. poorly written government specifications (i.e. inconsistent, ambiguous, deficient, impossible to perform)
3. unanticipated increases in quality assurance requirements

4. Government furnished equipment, drawings and/or information was delivered late or defective
5. Construction change orders and technical directions received from someone other than the contracting officer.

A discussion of both shipbuilder and Navy viewpoints concerning the above listed factors follows. However, the writers would like to mention at this point that both Mr. David W. James, Jr. and Mr. Neil M. Ruttenberg, counsel and deputy counsel (claims) respectively, former Naval Ships Systems Command, have stated that the reason(s) for the claims "cannot truly be found in the shortsighted answers usually heard, e.g. contractors' greed; the development of the 'constructive' change and 'constructive suspension of the work' theories; and allegedly 'poor' contract administration by the Navy bureaucracy; or even the growth of an aggressive, claims oriented, private Government contracts bar" [53, p.2]. They go on to say that the reason is apparent; shipbuilders have failed to make "satisfactory" profits and in some instances have lost large amounts under their Navy contracts. They state the real question is not "why claims?," but rather "why losses?".

1. Inaccurate Lead Yard Plans

DOD Instruction 5000.1 of July 13, 1971, eliminated the Total Package Procurement (TPP) concept, with the implication that contracts for different stages of the procurement could well be expected to be performed by different contractors. It is not uncommon practice for follow-on shipyards to

purchase their working plans from the lead yard because of the high costs involved in preparing their own. Discrepancies in the lead yard plans create disruptions and defective results which increase the shipbuilders' costs. The Navy has been accused of attempting to absolve itself from accepting responsibility for discrepancies in the lead yard's plans by including "appropriate" clauses in the contract. Shipbuilders contend that they should not be expected to absorb the full costs caused by such errors.

2. Poorly-written Specifications

Shipbuilders cite poorly-written specifications as a cause of additional costs. According to shipbuilders, the full meaning of the Navy's specifications haven't been known until after the contract has been awarded. This has been given as one of the reasons why shipbuilders often bid too low. In the end, the initial misunderstanding ends up costing the shipyard considerably more than they had anticipated.

3. Unanticipated Increase in Quality Assurance Requirements

Both the Navy and shipbuilders agree that in the last few years there has been a significant increase in quality assurance requirements. The Navy believes shipbuilders were slow in recognizing the increased requirements and that many of the claims resulting from the increased costs associated with the added requirements could have been avoided if the contract had contained appropriate provisions. Shipbuilders argue that many of the increased requirements should never have been required in the first place and that increased

demands for quality assurance inspections have, too often, been applied indiscriminately across the board.

4. Government Furnished Equipment and Drawings Delivered Late or Defective

Another cause of additional costs frequently brought out is the late delivery of government furnished material or information. Such late deliveries cause delays, ripout and rework. Frequently, late deliveries result when problems arise in the development of new equipment and the contractor fails to receive the necessary material as scheduled.

5. Constructive Change Orders and Technical Directions Received from Someone Other than the Contracting Officer

This is an example of a case where "the right hand doesn't know what the left hand is doing." When a contractor makes any changes to the project without the prior approval of the contracting officer he exposes himself to potential delays, rework and claims. The legal implications of the change are of major importance. The shipbuilder contends that he is trying to satisfy the government's requirements and the Navy argues that the change was not officially initiated.

Given all of the above, it isn't clear that private shipbuilders have conducted themselves in a manner so as to contingency price the contract to insure themselves against undue risks. The reasons are not clear why they haven't taken action to include protective clauses in contracts. Neither is it certain that the inclusion of a contingency clause in a contract would improve the contractor's

performance nor that it would actually reduce the number and dollar value of claims that have been filed against the Navy in the recent past. What is apparent is that the industry, with few exceptions (e.g. Bethlehem), has considered the risks associated with all of the items discussed above to be less desirable than the alternative of possibly going out of business for lack of work, especially when the shipbuilding industry is so heavily dependent on government contracts.

Solutions to the problem(s) are not readily apparent to the writers; however, it is clear that both parties must become more responsive to these problems if they expect to come up with solutions that are equitable to both. Otherwise, the claims problem will only continue to grow.

As of December 1973, claims still remaining to be settled (amount for unresolved claims and the amount of claims on appeal to the Armed Services Board of Contract Appeals (ASBCA)) totaled nearly \$1.3 billion [41, p.2]. The total amount for December 1967 was about \$66 million [41, p.2].

A comparison between outstanding claims over \$5 million as reported by the Navy for two different periods is shown below [42, p.1654]:

	<u>March 1, 1972¹</u>	<u>November 1, 1972¹</u>
Avondale	\$142.2	\$142.2
Bethlehem	53.6	49.1
Defoe	5.4	---
Dillingham	14.2	15.9
General Dynamics	204.6	204.6
Ingalls (Litton)	174.6	---
Lockheed	139.6	139.6
Newport News	111.0	69.1
Total	<u>\$845.2</u>	<u>\$620.5</u>

¹Does not include claims that have been referred to the ASBCA or claims that have been rejected by the Navy.

The difference between the total volume of claims outstanding for the periods listed is attributable to the settlement of some claims but is due primarily to Litton's referral of three claims totaling \$162 million to the ASBCA.

The evident trend in Navy ship construction with respect to both contract award and administration of claims would indicate that, while the government is disenchanted with contractors, so also is the converse true.

In February 1974, an executive from Todd Shipyards Corporation advised Naval Ship Systems Command in a personal letter, the reasons for the private shipbuilding industry's declining interest in Navy new construction programs. He stated that not only do Navy contracts result in greater contractor risk with only minimal opportunities for profit, but the constricting clauses made it difficult to make major capital improvements or satisfy corporate stockholders. Consequently, private contractors were turning more and more to the commercial shipbuilding market. However, it is possible that the pendulum will begin swinging in the opposite direction, gaining momentum as the economic condition of the nation's industries worsens.

While much effort and money has been expended over the last few years attempting to determine the causes of the large shipbuilding claims, it is apparent that such an answer has not yet been found.

F. COMPETITION IN THE U.S. SHIPBUILDING INDUSTRY

Since the end of WW II, there has been unused capacity in shipbuilding in the U.S. in both private and public sectors [16, p.vii]. Primarily because of this overcapacity, but due also to the recent increased demand in ships, there has occurred intensive rivalry within the nation's shipbuilding and repair industry [23, p.17].

Much of the recent demand for ships has been concentrated in large and medium-size tankers, 200,000 dwt and 90,000 dwt respectively, 38,000 dwt cargo vessels and in large LNG's [52, p.16]. The majority of these vessels are within the productive capability of most domestic shipyards, or will be whenever they complete their expansion programs.

In June 1974, the Maritime Administration published a report to Congress on the relative costs of shipbuilding in the various coastal districts of the nation. The report brought out that geographical cost differentials exist among the various regions of the country (see Chapter III, Section C), however, they concluded that the cost differences did not play a significant role in the awarding of contracts. For example, the West Coast, which has the highest costs of any district, on January 1, 1974, had 33 ships under contract, one less than the East Coast, the region which consistently builds the majority of vessels in this country [50, pp.15-17]. Based on this information, MarAd concluded that there now exists shipyard competition on an equalized basis as far as costs are concerned (i.e. geographical cost differentials do

not have an overriding influence in the shipyard selection process).

Table 27 summarizes information pertaining to contracts that were awarded in FY1973 for which CDS had been approved.

TABLE 27
CDS CONTRACTS AWARDED DURING FY1973

Shipyard	Type of Ship	No. of Ships	Total dwt Tonnage	Total Estimated Cost (1)
Avondale	LNG	3	189,510*	\$ 309,060,000
Bath	Ro/Ro	1	17,859	35,337,647
Bethlehem	Tanker	2	530,000	162,918,400
GD (Quincy)	LNG	3	190,800*	268,725,000
National Steel	Tanker	4	358,800	112,760,000
Newport News	LNG	3	190,380*	297,652,500
Seatrain	Tanker	1	225,000	70,603,500
TOTAL		17	1,702,349	\$1,257,057,047

(1) Total contract cost including CDS and National Defense Features, but excluding engineering and change orders.

*125,000 cubic meter liquefied natural gas carriers.

Source: MarAd [50, pp.6-7)

Table 28 contains summary information regarding deliveries from U.S. shipyards during FY1973.

The information contained in Tables 27 and 28 is consolidated in Table 29.

TABLE 28

DELIVERIES FROM U.S. SHIPYARDS DURING FY1973

Shipyard	Type of Ship	No. of Ships Delivered
	<u>Subsidized</u>	
Avondale	Seabee	1
Bath	Containership	2
GD (Quincy)	Seabee	2
Ingalls (Litton)	Containership	<u>5</u>
		10
	<u>Non-subsidized</u>	
Bethlehem	Tanker	4
Sun	Tanker	2
Sun	Ro/Ro	<u>1</u>
		<u>7</u>
TOTAL DELIVERIES		17

Source: MarAd [50, p.9]

The information presented in Table 29 would have been more meaningful if additional data had been available. However, the information listed lends support to MarAd's conclusion that U.S. shipyards are now competing on an equal basis.

In contrast, only one procurement for a new naval ship program was awarded in 1973, the lead ship contract for the patrol frigate (PF) [23, p.27]. U.S. private shipyards delivered eight naval vessels in 1973 (calendar) consisting of one replenishment oiler (AOR), two nuclear powered attack submarines (SSN), and five destroyer escorts (DE).

TABLE 29

SHIPS CONTRACTED FOR AND DELIVERED FROM
U.S. SHIPYARDS DURING FY1973

Shipyard	No. of Ships	Total dwt Tonnage (1)	Total Estimated Costs (2)
Avondale	4	189,510	\$309,060,000
Bath	3	17,859	35,337,647
Bethlehem	6	530,000	162,918,400
GD (Quincy)	5	190,800	268,725,000
Ingalls (Litton)	5	(3)	(3)
National Steel	4	358,800	112,760,000
Newport News	3	190,380	297,652,500
Seatrain	1	225,000	70,603,500
Sun	3	(3)	(3)

(1) Tonnage for ships delivered is not included

(2) Costs for ships delivered are not included

(3) Data unavailable

Source: MarAd [50, p.6-7, 9]

Table prepared by L.E. Garcia

There were 56 naval vessels under construction or contract in private yards as of December 31, 1973 [23, p.31]. Most of the naval ship construction today is concentrated in three private shipyards, namely, Newport News, Ingalls (Litton) and General Dynamics (Electric Boat). All surface nuclear powered vessels are currently under construction or contract at Newport News, whereas most nuclear powered submarines, including Trident, are undergoing construction or are under contract at Electric Boat. Electric Boat is the only major U.S. shipyard that is entirely involved with naval construction. Litton is the sole contractor of the DD-963 class destroyer.

G. RESEARCH AND DEVELOPMENT (R&D)/DESIGN

In the United States, ship research is carried out both by the government, through MarAd, and by the Society of Naval Architects and Marine Engineers, which is largely supported by the shipping and shipbuilding industries. The Navy conducts a large research program, however there is little opportunity for the shipbuilding industry to benefit from Navy technology because most military developments haven't been applicable to maritime use [32, p.142]. For example, unofficial Navy Department estimates (1973) indicate that only about 1-2% of the Navy's annual R&D budget of \$2.5 billion is utilized in Navy R&D projects that might be of any benefit to the shipbuilding industry [32, p.142].

Individual yards carry out their own research, but there appears to be little interchange of information among the

different shipyards. This situation may well result from the intensive rivalry among U.S. yards, or from a fear of becoming involved in antitrust law suits. J. T. Gilbride and J. J. Henry have stated that shipbuilding over-capacity and "short sighted U.S. Government policies" have been detrimental to U.S. shipyard R&D efforts [16, p.vii].

The amounts spent on R&D by progressive U.S. shipyards is seldom more than about $\frac{1}{4}$ % of sales, a level which compares unfavorably with expenditures in other industries which average between 1-2% of sales [2, p.96]. This may only be a reflection of the general economic weakness of the industry than to any other reason.

MarAd's primary R&D objective is to develop new technology that will increase shipyard productivity to a level which will enable the American merchant fleet to be competitive with fleets of other nations [44, p.13]. In search of new construction techniques, MarAd and the shipyards are participating on a cost-sharing basis, 85% government, 15% shipbuilders, in the R&D program [39, p.84].

An effective R&D program requires a continuing active participation by everyone: MarAd, Navy and the maritime industry. Single, one time studies may solve particular problems but they will not produce the information that is essential for achieving the productivity that is desired.

Most merchant ships have been designed in recent years by about six major naval architectural firms [16, p.16]. In the past, vessels were "custom designed" by these firms to

meet the owners' requirements yet be capable of being constructed in most major yards. Once the contract had been awarded, the yard's design team would then prepare working plans retaining the basic design but deviating slightly to adapt their own construction practices. Today, the ship design process is undergoing a change in that shipyards are now working closely with naval architecture firms in the preparation of the final design. In addition to promoting a closer relationship between the two organizations, it also provides an opportunity for the shipyards to benefit from the expertise of the architects who are often thought to be the most creative of the shipbuilding professions [16, p.17].

H. SPECULATIVE CONGLOMERATE BEHAVIOR

In the decade of the 1960's, there was a wave of diversifying corporate acquisitions by firms referred to as "conglomerates." These firms have been characterized as companies whose diversification, either internal or external, involves products whose engineering, design, production and marketing requirements only slightly overlap. The impact of these diversified acquisitions on the economic structure of the U.S. has been a highly controversial issue, particularly with respect to their anti-trust implications. Theories on the behavior of the conglomerate enterprise have been numerous, but supported with little or no empirical evidence. It is the purpose of this study to produce some of the more commonly accepted theories of conglomerate motivation and behavior

and possibly obtain some insight into conglomerate behavior in the U.S. shipbuilding industry.

1. Conglomerate Background

The Federal Trade Commission (FTC) publishes periodic reports of mergers and acquisitions by classification type. Conglomerate acquisitions are basically defined in two ways: first, the broad definition of a conglomerate merger includes those acquisitions which extend the acquiring firm's operations beyond its present product or geographical markets. The second and more restrictive definition includes only acquisitions where the two companies have neither a buyer-seller relationship nor a functional relationship in manufacturing or distribution [17, p.7-11].

Utilizing the broad definition of conglomerate acquisition, from the mid-1950's to 1970 the trend in diversifying acquisitions rose from 52.6% to 84% of large acquisitions in mining and manufacturing (\$10 million or more). Within the narrower definition of the FTC (neither product nor market extension), conglomerate acquisitions rose from 12% of all major acquisitions in 1952-1955 to 40% in 1970 [17, p.11]. For purposes of this study, the narrower definition of conglomerate acquisition will be used.

2. Conglomerate Theory

a. Reasons for Conglomeration

The sudden increase in conglomerate acquisitions appears to have been attributed to two primary reasons. First, the rising threat of antitrust action for horizontal

and vertical mergers and secondly, financial emphasis on the price-earnings multiple [4, p.49]. Other suggested reasons have been; the altruistic urge to help a depressed company recover, recognition of hyperdepressed investment opportunities, and managerial entrepreneurship.

There has also been an analogy proposed between institutionalized investors and conglomerated corporations. While investors were purchasing portfolio diversification through mutual funds, the conglomerates were acquiring a "portfolio" of diversification through acquisitions [26, p.908]. Thus, the large conglomerates were able to absorb the impact of poorly performing subsidiaries through diversification.

b. Conglomerate Objectives

A study of 28 conglomerate corporations by Lynch in 1971 concluded that there were explicitly established and communicated objectives in terms of per-share performance. The successful conglomerate was considered to be mainly interested in motivating and assisting a subsidiary to better manage itself, shielding it from the external environment, helping to provide the necessary resources for improved performance and providing a management philosophy of decentralized authority and responsibility [15, p.285].

The life-cycle of a conglomerate seems to divide naturally in two stages. During the early stage, the top management of a conglomerate seems to be primarily financially oriented. This early period has been identified as the development phase, where the firm is financially vice

product-oriented and its primary objective is rapid growth of earnings. The second phase in the life-cycle occurs as the conglomerate enters maturity and the top management becomes more attentive to product lines with less emphasis on acquisitions [14, p.61].

c. Risk Aversion

The proposition that diversification reduces risk has been widely upheld in conglomerate theory. If a conglomerate should pursue predatory pricing in competition with a firm which is not diversified, there is less overall risk to the conglomerate in the event of failure than to the firm which could lose everything. Risk aversion in large firms is a supportable argument and if it is actually practiced in an industry, the conglomerate would be much more likely than a non-diversified firm to begin price-cutting. (There is no empirical evidence that this is what happens.) A conglomerate may also enter into some markets which are considered too great a risk to other smaller firms due to the amount of capital required. The conglomerate may be in a better position to assume risk, for in the event of failure, there could still be other subsidiaries to offset the loss without serious consequences to the corporation.

3. Sources of Economic Performance

The following lists indicate the prime factors which are considered to contribute to either superior or inferior conglomerate performance:

- a. Superior Performance [5, p.21]
 - (1) Better rationing of capital
 - (2) Better mobilization of internally-sourced capital
 - (3) Lower cost of capital
 - (4) Better allocation of human resources
 - (5) Better succession
 - (6) Full utilization of tax shields
 - (7) Greater managerial accountability
 - (8) Better financial controls
 - (9) Scale economies of staff services
 - (10) Greater cross-industry mobility
 - (11) Ability to obtain synergistic results both operationally and financially
- b. Inferior Performance [13, p.18]
 - (1) Distortion of Corporate goals
 - (2) Non-economic product mix
 - (3) Limited cross-industry transferability of managerial ability
 - (4) Imperfect profit center decentralization
 - (5) Excessive size
 - (6) Excessive preoccupation with growth
 - (7) Top-heavy capital structure
 - (8) Impaired managerial incentives

4. Antitrust Elements of Conglomerate Behavior

A number of objections to conglomerate acquisitions have been raised. These objections essentially consist of

conglomerate practices which conflict with antitrust laws in four basic areas.

a. Cross-Product Subsidization

This conduct refers to the various types of predatory behavior potential of a firm if it uses funds earned in one subsidiary's product line to support activities of other less profitable subsidiary's product lines.

b. Reciprocity in Buying and Selling

Reciprocity refers to the possible pressures that a large conglomerate can exert on other firms for reciprocal buy-sell agreements due to the conglomerate's broad market coverage.

c. Non-Price Competition

This refers to possible effects of conglomerate mergers on the level of concentration of the industries they enter, i.e. through the use of large-scale advertising, etc.

d. Raising Barriers to Entry

It has been argued that through the ability to use all of the aforementioned practices, a conglomerate can enhance its share of a particular market and by so doing, raise the barriers to entry into that industry.

5. Reasons for Acquisitions/Vulnerability of Firms

Several possible reasons for vulnerability to a take-over are [5, pp.21-22]:

- a. Bad or complacent management
- b. Excessive liquidity
- c. Unused borrowing power

- d. Excessive and unproductive plowback of earnings
- e. Large depreciation write-offs resulting in low earnings
- f. Cash flow imbalance
- g. Tax shields for either the acquiring or the acquired company.

6. Conglomerates and the U.S. Shipbuilding Industry

Most of the major U.S. shipyards are conglomerate controlled. Using the restrictive definition of conglomerate acquisitions, Table 30 lists the corporate control, date of acquisition where applicable, and the writers' judgement of the type of acquisition classification.

TABLE 30

CORPORATE CONTROL OF MAJOR PRIVATE U.S. SHIPYARDS

Shipyard	Control	Classification	Date
Avondale	Ogden Corp.	Conglomerate	1959
Bath Iron W.	Bath Industries	Corporation	----
Bethlehem	Bethlehem Steel	Corp.-vertical	-----
Electric Boat	General Dynamics	Conglomerate	----
Quincy	General Dynamics	Conglomerate	1963
Ingalls	Litton Ind.	Conglomerate	1961
Lockheed	Lockheed	Conglomerate	1959
National Steel	Kaiser/Morrison-Knudson	Conglomerate	1959
Newport News	Tenneco Inc.	Conglomerate	1968
Sun	Sun Oil Co.	Corp.-vertical	----
Todd	Todd Shipyards	Corp.-horizontal	----

Source: Commission on American Shipbuilding [32, pp.367-484]

a. Criticism of Conglomerate Controlled Shipyards

Conglomerate control has been sharply criticized in the shipbuilding industry, especially by Admiral Rickover. These criticisms are in four basic areas [34, pp.84-85]:

(1) Profit. Achievement of a profit is the driving force for a conglomerate's division. As a result, shipbuilding has become a "financial game."

(2) Management. Some private shipyards are run by legal, financial and contract experts vice technical managers. These men are proficient with public relations and creative accounting, skilled at dealing with the government, and are not interested in ships per-se but only in making a good profit.

(3) Unsupported Claims. Shipbuilders sometime submit factually unsupported claims which are assertions, judgements and allegations. Some companies also retain specialized law firms to help prepare and prosecute claims against the government. These firms are usually paid according to the amount of money they obtain from the government in each case.

(4) Progress Overpayments. At times, shipbuilders have obtained progress overpayments which were not due and were, in effect, receiving interest free loans from the government.

Once again, much of the criticisms of conglomerates, even in shipbuilding industry, are not backed by empirical evidence.

b. Speculative Issues of Conglomerate Control

A close look at conglomerate control and the general behavior of affiliated shipyards is beyond the scope of this study but is suggested for further study. An attempt will be made to hypothesize some of the elements of shipyard conglomerate behavior with respect to the conglomerate structure and behavioral theories previously mentioned.

(1) Power. Due to the inherent diversity and pure financial position of large conglomerates, their top management would tend to have vast resources of influence and associations in the business and political world. For example, during testimony before the Senate Subcommittee on Priorities and Economy in Government, FY1973, Mr. Roy Ash was sharply criticized for his role in the LHA shipbuilding claim negotiations with the Navy. (It had already been announced that he would leave Litton to assume the duties as the director of the Office of Management and Budget (OMB) [43, p.1916].)

(2) Claims. The fact that the conglomerates can afford and normally keep a full-time staff of lawyers would tend to indicate a stronger emphasis by the firm on legal matters. Together with a driving motive for earnings, it is possible that a shipbuilding conglomerate could concentrate its legal resources on the low-profit shipbuilding subsidiary in order to identify potential areas of "revenue" through the claims process.

(3) Acquisitions. A brief look at the U.S. shipyard acquisitions by conglomerates reveals that three yards were acquired in 1959, a recessionary period, where poor financial outlooks for the shipyards (Avondale, Lockheed, National Steel) may have played a major role in the decision to merge. Additionally, three other shipyards (Newport News, Ingalls, Quincy) were known to have been in some financial difficulties at the time of their acquisition.

(4) Capital Investment. It is worthy of note that Litton was the first of the major shipyard owners in many years to construct a new shipbuilding facility from the ground up. Although there were many undertones of financial and political manipulations associated with the venture, it is doubtful if a non-conglomerate would have undertaken the risks involved.

(5) Maturity. To date, no major U.S. shipyard has changed owners since being acquired by a conglomerate. (The Quincy yard changed ownership from a large corporation (Bethlehem Steel) to a conglomerate (General Dynamics) in 1963.)

An analysis of shipyard acquisitions and associated conglomerate behavior before and after the acquisitions may prove beneficial in order to determine if there is any correlation with conglomerate maturity and is suggested for further study.

(6) Pooling of Interest. Most major shipyard conglomerates use the pooling-of-interest method of accounting

whereby in a merger the asset values of the acquired company are "pooled" with the conglomerate assets at book value. This method provides an advantage in that asset values subject to write-off against income are minimized, and future earnings performance is improved [12, p.645].

c. Case Study

Appendix B of this thesis contains a case study of the acquisition of Newport News Shipbuilding and Drydock Co. by Tenneco, Inc.

V. PERFORMANCE

A. INTRODUCTION

In economic terms, performance is an appraisal of the results of an industry's behavior as compared with some "standard" which has been determined by considering the optimum utilization of resources to achieve the nation's goals. In general, economic goals are efficiency, full employment, progressiveness/innovativeness and equitable distribution of real output among the elements of an industry [1, pp.93-94].

Once again, the threads of continuity from structure-to-conduct-to-performance are clouded in the U.S. shipbuilding industry due to the varying roles played by the government, shipbuilders and shippers. Quantifiable "standards" of performance in the U.S. shipbuilding industry are few. Frequently, subjectivity must be applied in order to provide some means of assessing performance.

It is the intent of this chapter to assess performance where standards exist or are implied and to identify those elements of the industry for which no quantifiable standards are prevalent.

B. EVALUATION OF SHIPYARD PERFORMANCE

The U.S. shipbuilders' performance may be looked upon as an appraisal of how that industry's behavior deviates from the best possible goal attainable. Unfortunately, problems

develop when one begins to compare results that have been achieved against standards that have not been clearly defined or universally accepted. It is also true that some industries have not established standards by which to measure their performance. Such is the case in the shipbuilding industry. This section will investigate the industry's performance as it relates to productivity, output and profitability.

1. Productivity

Productivity may be defined as a measure of how effectively resources such as steel and machinery are converted into ships, (i.e. a measure of the output of a process per unit of input). According to the Commission on American Shipbuilding (COAS), the most preferred method for measuring output is the value-added method, which is "derived by subtracting the total cost of materials (including materials, supplies, fuel, electric energy, cost of resales and miscellaneous receipts) from the value of shipments (including resales) and other receipts and adjusting the resulting amount by the net changes in finished products and work-in-process inventories between the beginning and end of the year" [2, p.15]. A detracting characteristic of the value-added method is that the value of production is arrived at indirectly through price which is subject to fluctuations stemming from spurious expectations of supply and demand, shipyard work and pricing policies.

The writers would like to point out that the former Naval Ship Systems Command (NAVSHIPSYS COM) considered the

use of the value-added concept as being an invalid method of determining the cost of a production worker because of the distortion that resulted from the different methods used by naval and private shipyards in calculating overhead costs. Private shipyards tend to include a greater amount of purchased energy, services and materials in their overhead accounts than do naval shipyards [54, p.11].

Another method used to measure productivity is the compensated gross registered tonnage (cgrt) concept. The use of this method helps characterize to some extent the relative sophistication of ships. The basis for this system is cargo vessels of 5000 dwt and over which have been assigned coefficients of 1.00. Other ships are assigned coefficients according to type and relative complexities of construction. The cgrt is determined by multiplying the gross registered tonnage (grt) by the coefficient for that particular type of ship. The table presented below lists the compensated tonnage coefficients by type of ship [31, p.36].

a. Flowrate

Lester B. Knight & Associates, Inc. developed a flowrate index to determine the utilization of capacity in the shipbuilding industry. The index is based on the relationship between the tonnage of ships under construction at the beginning of the year and the total volume of new construction completed at the end of the year. The significance of this index is that it measures the turnover of the capacity within the industry [32, pp.70-1]. A flow rate of

TABLE 31

COMPENSATED TONNAGE COEFFICIENTS

Types	Coefficient of compensated gross registered tonnage
Cargo	
Under 5,000 dwt	1.60
5,000 dwt and over	1.00
Passenger cargo	1.60
High-speed liners	1.60
Container ships	1.90
LASH	1.90
Tankers	
Under 30,000 dwt	0.65
30,000 - 50,000 dwt	0.50
50,000 - 80,000 dwt	0.45
80,000 - 160,000 dwt	0.40
160,000 - 250,000 dwt	0.35
250,000 dwt and over	0.30
Multiple purpose (all sizes)	0.80
Bulk carriers (including ore/oil)	
Under 30,000 dwt	0.60
30,000 - 50,000 dwt	0.50
50,000 - 100,000 dwt	0.45
Over 100,000 dwt	0.40
Refrigerated cargo	2.00
Fish factory ships	2.00
Gas carriers and chemical tankers (including LRG)	2.20
Passenger ships	3.00
Ferry boats	2.00
Fishing vessels and miscellaneous vessels	1.50

Source: Shipbuilders Council of America, COAS [31, p.36)

200 means that the total volume produced is about twice the tonnage that is under construction at any one time. Table 32 shows the flowrate for a three year period (1968-1970 [32, p.71]).

The writers would like to point out that there is a discrepancy between the data listed in the COAS report and the Shipbuilders Council of America (SCA) 1973 Annual Report. For example, the tonnage of total ships under construction at

TABLE 32

FLOWRATE INDEX (U.S.)

	1968		1969		1970	
	1,000 grt	1,000 cgrt	1,000 grt	1,000 cgrt	1,000 grt	1,000 cgrt
Under Construction	507.90	584.09	710.72	625.43	736.76	707.29
Delivered	367.62	422.76	463.68	408.04	374.91	359.92
*	72	72	65	65	51	51

* Flowrate Index: $\frac{\text{Deliveries during year}}{\text{Tonnage under construction at the beginning of the year}} \times 100$

Source: Commission on American Shipbuilding [32, p.71],
Lester B. Knight & Associates, Inc., Lloyd's
Register of Shipping

the beginning of each of the years listed in Table 32, which was obtained from the COAS report, is less than the tonnage under construction for ships 1,000 grt and larger that is listed in the SCA 1973 Annual Report (page 30). It isn't possible to account for this discrepancy with the data that is available, however, this is an area that requires further attention.

The relatively low flowrate figures are accounted for, in part, by the highly sophisticated products that are manufactured. Low flowrates, however, can also signify low efficiency. That is, only a small portion of the total tonnage under construction at the beginning of the year has actually been completed during that particular year.

b. Labor

The eighteen industries listed below were analyzed in an attempt to gather data for determining labor productivity. Table 33 contains a time series of output per man-hour from 1958 through 1971 for the industries listed [32, p.1169]. During this fourteen-year period, the shipbuilding and repairing industry has increased its labor productivity by 32%. Other industries have shown wider ranges, but in several cases greater overall increases than shipbuilding. The labor intensiveness of the shipbuilding industry is reflected in the low productivity figures. The values are significantly higher for those industries recognized as using mass production techniques (e.g. electric lamps, tires and tubes, motor vehicles).

KEY TO INDUSTRIES TABULATED

1. Shipbuilding and Repairing
 2. Aircraft
 3. Aircraft Engine & Parts
 4. Blast Furnaces & Steel Mills
 5. Electric Lamps
 6. Locomotive & Parts
 7. Machine Tools
 8. Motor Vehicles & Parts
 10. Saw Mills & Planing Mills
 11. Steel Pipe & Tube
 14. Truck Trailers
 15. Steam Engines, Turbines & Gen. Sets
 16. Weaving Mills, Cotton
- New items:
17. Railroad Equipment
 18. All Manufacturing Industry

TABLE 33

INDUSTRY TRENDS - OUTPUT PER PRODUCTION WORKER MAN-HOUR
(1958 Dollars)

Year	1	2	3	4	5	6*	7	8	10	11	14	15	16	17	18
1958	4.62	6.59	8.29	7.92	7.70	7.21	6.05	7.58	3.03	7.48	5.33	9.84	2.49	5.95	6.24
59	5.01	7.07	8.42	8.50	8.46	9.50	6.85	8.15	3.26	8.69	5.64	9.77	2.73	8.06	6.47
60	4.67	8.14	8.11	7.83	9.21	9.63	6.93	8.46	3.08	7.60	5.74	11.25	2.92	7.02	6.66
61	4.83	9.53	8.76	8.26	9.39	9.31	7.13	8.88	3.41	7.29	6.00	11.05	2.99	6.60	6.96
62	5.20	8.75	9.04	8.32	9.17	10.00	7.65	9.93	2.65	7.66	6.92	10.63	3.11	7.78	7.29
63	5.39	10.18	9.94	9.34	9.91	8.63	7.51	10.19	3.86	7.67	6.76	10.57	3.11	7.68	7.75
64	5.28	10.12	11.83	9.49	9.99	8.61	7.79	10.66	4.25	7.24	6.84	11.39	3.46	8.25	8.03
65	5.28	10.12	11.00	10.13	10.06	9.87	8.05	11.24	3.99	8.04	6.71	10.41	3.92	8.36	8.29
66	5.52	9.91	10.51	10.15	10.32	10.90	8.33	11.32	4.14	8.88	6.99	10.39	3.98	9.15	8.45
67	5.75	9.96	10.65	9.81	10.61	13.74	8.45	11.69	4.45	8.51	7.41	11.41	4.05	8.54	8.81
68	5.06	11.44	11.49	9.83	10.98	--	8.34	12.49	4.91	8.64	6.86	11.41	3.93	9.15	9.24
69	5.13	13.61	12.25	9.89	10.38	--	9.24	12.70	4.48	8.23	7.66	10.91	4.20	8.23	9.40
70	5.97	12.42	11.82	9.52	10.32	--	8.33	12.14	4.58	8.01	7.42	13.12	4.20	8.50	9.61
71	6.10	14.11	12.17	10.24	11.45	--	8.76	**	5.65	10.02	--	13.42	4.41	8.99	9.91

* Data for Industry No. 6, "Locomotives and Parts". (SIC 3741) is not reported from 1963 onwards. For this reason, the more general industry group, No. 17, "Railroad Equipment" (SIC 374) has been added.

Data Source: "Annual Survey of Manufacturers," published by the Bureau of the Census, 1970; Commission on American Shipbuilding [32, p.1169].

The Deflators from: "Survey of Current Business," Table 8.8, "Implicit Price Deflators for Private Purchases of Producers Durable Equipment by Type," Periodical, published by the Bureau of the Census, July issues, various years.

Table 34 is a summary of productivity measures achieved by the U.S. shipbuilding industry during the period 1967-1970 [32, pp.126-130].

TABLE 34
 PRODUCTIVITY MEASURES
 1967-1970

		Cgrt per Employee Labor Dollars	Cgrt per Capital Dollars	Cgrt per Labor and Capital (Input (Dollars))
USA	41 - 51	.006 -.008	.022 -.043	.005 -.007

Source: Commission on American Shipbuilding [32, p.130].

c. Discussion

The high levels achieved in American productivity has been the result of capital investment in labor saving installations. Unfortunately, business volume for the U.S. shipbuilding industry did not justify capital investment to increase productivity output. It was only within the last few years that shipyards began to modernize and expand due primarily to the increased ship demand generated by the 1970 Act.

Admiral Rickover, testifying before Congress, cites several examples of poor performance by shipyards resulting in lower productivity. For example, poor management, excessive use of overtime, idleness and loafing, and excessive numbers of employees [33, p.176-180].

It is a hypothesis of the writers that the large investments made by private shipyards within the last few years to modernize and expand their facilities is due primarily to the increased ship demand generated by the 1970 Act.

2. Output

While launchings have been used as a measure of output, it is considered more realistic to base output on tonnage of ships actually completed. Therefore, we shall continue to use the cgrt (described above) as the principal measure of output.

a. Tonnage/Number of Ships

The data contained in Table 35 indicates that during the period 1967 to 1971, the United States produced only 1.55% of the tonnage and 1.63% of the ships constructed throughout the world [32, p.46].

TABLE 35
SHIPBUILDING OUTPUT - 1967-1971

<u>Country</u>	<u>Percentage of dwt</u>	<u>Percentage of Vessels</u>
Japan	50.20%	26.78%
Sweden	8.18	3.91
West Germany	6.93	10.12
Great Britain	5.45	5.75
Norway	3.62	3.62
France	3.62	2.36
Spain	3.32	4.35
Denmark	3.15	1.78
Italy	2.64	2.17
Netherlands	2.20	3.12
Yugoslavia	2.10	1.94
U.S.S.R.	1.62	6.13
United States	1.55	1.63
Poland	1.20	2.94

Source: COAS [32, p.46]

Table 36 contains data summarizing the total number of vessels, and aggregate tonnage, constructed between 1965-1973 [23, p.28].

TABLE 36
U.S. VESSELS DELIVERED (1965-1973)

	No. of Ships		Tonnage (1,000)	
	Naval	Merchant	Naval (LDT) ¹	Merchant (GRT)
1965	18	16	122	180
1966	13	13	74	161
1967	21	13	109	163
1968	16	24	138	329
1969	31	22	160	416
1970	32	13	166	370
1971	33	14	147	407
1972	21	19	95	491
1973	8	34	33	887

¹LDT (Light Displacement Ton)

Source: Shipbuilders Council of America [23, p.28].

Delivery record information on vessels scheduled to be delivered between February 1970 and December 1972 is contained in Table 37 [32, p.740].

b. Discussion

Opportunity cost becomes an important factor when delays or early deliveries occur. Late delivery, whether it results from poor planning or shipyard under -- or over --

TABLE 37

U.S. VESSEL DELIVERY RECORD
2-1-70 to 12-31-72 (Schedule)

On Basis of Original Contract Dates:			
Number of Ships Delivered		Types of Ships Delivered	
Early	0	LASH Vessels	11
On time	0	Cargo	8
1 - 3 months late	2	Sea Barge Clipper	3
4 - 6 months late	1	Container Ship	4
7 - 9 months late	10		
10 - 12 months late	4		
13 - 18 months late	6		
19 - 24 months late	3		
Over 24 months late	0		

On Basis of Revised Contract Dates:

Number of Ships Delivered	
More than 2 months early	0
1 - 2 months early	8
On time	2
1 - 3 months late	7
4 - 6 months late	4
7 - 9 months late	1
10 - 12 months late	1
13 - 18 months late	3
More than 18 months late	0

Source: Maritime Administration, Shipbuilding Progress Report, September 30, 1972; Commission on American Shipbuilding [32, p.740].

capacity, can greatly affect the actual cost of a ship. Contractual clauses normally protect one against income losses. To this loss of revenue, buyers must add the interest costs on progress payments made on the ship. Hence, shipyards which have a reputation for delivering on time are more apt to be in demand by buyers.

3. Profitability

Profitability of U.S. shipyards is difficult to document. Most of the major yards are now owned by large

conglomerates and their individual profit performance is not available. However, six companies provided financial data to the COAS with the provisions that they not be identified and that their data be consolidated so as to prevent anyone from determining its origin. The information presented below is based on this consolidated information.

a. Financial Performance

Table 38 contains cumulative balance sheet data for the period 1967-1971 [32, p.135]. Included are two financial ratios - net working capital and current ratio. It is interesting to note that long-term debt began to increase considerably at approximately the same time ship-yards were beginning to modernize and expand. This is borne out by the fact that the percentage of total assets represented by plant, property, and equipment has grown steadily, from 33% to 41%.

Summarized in Table 39 is data on revenues and income [32, p.136]. While total revenues in 1971 have increased since 1967, net income has decreased. Other significant items are that one dollar in assets generates approximately two dollars in revenue, net income after taxes computed annually, is less than 2% of revenues except for 1967, and the return on assets employed computed annually, is generally 3-4%.

Table 40 contains data on profits as a percentage of sales for the same period [32, p.136].

TABLE 38
SUMMARY BALANCE SHEET (1967-1971)
(1,000)

	1971	1970	1969	1968	1967
<u>ASSETS</u>					
CURRENT ASSETS	\$275,161	\$282,638	\$334,964	\$309,989	\$265,748
PROPERTY, PLANT, AND EQUIPMENT (AT COST) NET	176,583	169,197	162,561	150,135	132,238
OTHER ASSETS	<u>27,366</u>	<u>11,580</u>	<u>8,309</u>	<u>9,126</u>	<u>7,337</u>
TOTAL ASSETS	\$479,110	\$463,415	\$505,854	\$469,250	\$405,323
<u>LIABILITIES AND CAPITAL*</u>					
CURRENT LIABILITIES	\$169,344	\$184,047	\$224,891	\$189,839	\$150,167
FUNDED DEBT - DUE BEYOND ONE YEAR*	56,828	44,784	56,913	57,695	33,150
OTHER LONG-TERM LIABILITIES*	9,918	10,546	8,331	5,711	4,140
CAPITAL (STOCKHOLDERS' EQUITY OR DIVISIONAL OR SUBSIDIARY RENTAL)*	<u>249,960</u>	<u>224,138</u>	<u>215,639</u>	<u>216,005</u>	<u>217,866</u>
TOTAL LIABILITIES AND CAPITAL	\$479,110	\$463,415	\$505,854	\$469,250	\$405,323
<u>FINANCIAL RATIOS/BALANCES</u>					
NET WORKING CAPITAL (CURRENT ASSETS - CURRENT LIABILITIES)	\$105,817	\$ 98,591	\$110,073	\$120,150	\$115,581
CURRENT RATIO (CURRENT ASSETS CURRENT LIABILITIES)	1.62%	1.53%	1.49%	1.63%	1.77%

* Because several of the reporting entities function as divisions or subsidiaries of large corporations, certain balance sheet (liabilities and capital) accounts will not reflect accurate balances.

Source: Commission on American Shipbuilding [32, p.104].

TABLE 39

SUMMARY INCOME STATEMENT, FINANCIAL RATIOS AND INDICES
(1967-1971)

	<u>1971</u>	<u>1970</u>	<u>1969</u>	<u>1968</u>	<u>1967</u>
<u>REVENUE</u>	\$973,607	\$1,037,770	\$945,581	\$712,040	\$844,399
(Some Revenue Other Than From Shipbuilding is Included)					
<u>NET OPERATING INCOME (LOSS)</u>	38,266	15,833	33,546	30,013	39,975
Less: Extraordinary Items, Interest, and Other Nonoperating Income or Expenses*					
<u>NET INCOME BEFORE TAXES (LOSS)</u>	35,423	9,754	28,154	27,688	38,054
<u>NET INCOME AFTER TAXES (LOSS)*</u>	17,967	5,440	12,732	14,082	22,728
NET INCOME (AFTER TAXES) AS A PERCENT OF REVENUE	1.84%	0.52%	1.35%	1.98%	2.69%
RATIO OF ASSET TURNOVER REVENUE TO ASSETS EMPLOYED	2.09%	2.45%	2.27%	1.75%	2.26%
PERCENT RETURN (AFTER TAXES) ON ASSETS EMPLOYED	3.56%	1.25%	3.05%	3.45%	6.08%
<u>ASSETS EMPLOYED</u>					
TOTAL ASSETS BALANCE SHEET	\$479,110	\$ 463,415	\$505,854	\$469,250	\$405,323
ADD: ACCUMULATED DEPRECIATION**	<u>156,213</u>	<u>143,765</u>	<u>136,336</u>	<u>127,852</u>	<u>118,516</u>
TOTAL	\$635,323	\$ 607,180	\$642,190	\$597,102	\$523,839
LESS: CURRENT LIABILITIES	<u>159,344</u>	<u>184,047</u>	<u>224,891</u>	<u>189,839</u>	<u>150,167</u>
ASSETS EMPLOYED	\$465,984	\$ 423,133	\$417,299	\$407,263	\$373,672

*Estimated, as several reporting entities are division operations with no federal income tax computed for the division; in addition no interest expense is carried at this level.

**Reported by all firms except one; and in this case, an estimate was used.

Source: Commission on American Shipbuilding [32, p.106].

TABLE 40

NET INCOME (AFTER TAXES) AS A
PERCENT OF REVENUE (1967-1971)

<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>
2.69%	1.98%	1.35%	0.52%	1.84%

b. Discussion

Analyses of the limited financial data which were made available by the six cooperating yards indicated that the shipbuilding business hasn't been very profitable.

The Department of Defense currently collects profit data by contract which reflect profit-on-cost rather than profit-on-capital [43, p.2741]. It would seem that determining the contractor's profit-on-capital would be more meaningful and of greater relevance than the information that is available under the present system.

Based on the hearings before the Subcommittee on Priorities and Economy in Government of the Joint Economic Committee, conducted November 1973, it is apparent that DOD has been slow to change the reporting system to reflect profit-on-capital. This is borne out by Senator Proxmire's comments pertaining to his having requested this type of information since 1968, without success [42, p.2201]. DOD's response is that they don't have all the necessary data.

C. IMPACT OF CLAIMS ON PERFORMANCE

1. Actual

Substantive evidence as to the effect claims have had on both the government's (Navy/MarAd) and the shipbuilding industry's performance is rather difficult to document. However, several policy changes have resulted as a consequence of the large number of claims that have been filed against the Navy within the last few years. For example, the Navy has established a board of line officer admirals "to pass judgment on large claims" [33, p.62]. Assignment to the board is in addition to the admirals primary duties.

The Navy claim identification clauses were implemented as a result of "constructive changes" made possible by court and board decisions which effectively allowed a contractor not to comply with some of the basic contract requirements. The main purpose of the identification clauses is to regain for the government some of the control of the change process by surfacing the problem as close to the event that caused it, and settling it while all relevant data is readily available.

Another impact of the claims problem is that the Navy's image has suffered by the fact that both Congress and the public are losing confidence in the Navy's ability to perform satisfactorily in the business environment.

As has been mentioned previously in this report (see Chapter IV, Section E), presidents of major shipyards have frequently voiced disenchantment in their relationships with

the Navy. They have gone so far as to imply a preference for non-Navy contracts.

Recent indications (e.g. Patrol Frigate) suggest that more cost plus type contracts will be awarded in the future vice fixed type. Also, the Navy has publicly stated that it will attempt to reduce the number of changes incorporated into new construction vessels, hoping to minimize the claims problem. This policy should result in better thought-out and written specifications, an area that was in need of top level attention.

2. Speculative

As a basic measure of performance, claims could be looked upon as inefficiency on the part of either the contractor or the acquisition/contract administration process of the purchaser. Poor performance on the part of the contractor or "buying in" on a contract at a bid which is unrealistically low could possibly entice the contractor to recover his excess costs, and even some profit, through the claims process. Whether this practice of claims behavior actually exists is speculative and without supporting data. It was noted in Chapter IV, Section H, that the practice of retaining claims lawyers in Washington by the large shipbuilding firms has been criticized by government representatives. Poor performance in government contracting has been previously identified as a major source of claims. It is the opinion of the writers that there is an element of ineffective performance on the part of both parties in most

shipbuilding claims and that such claims reflect adversely on the conduct of the parties during the given contract period.

Performance evaluation of a shipbuilding contractor under risk and uncertainty, particularly during research and development, appears to offer excellent potential for the near future. The ability to identify risk and quantify uncertainty through sophisticated statistical techniques is a process just beginning to become widely accepted. By identifying risk and assessing the levels of uncertainty when a contractor undertakes a difficult project, performance may actually become quantifiable and a "track record" established. Unfortunately, the major drawback in this area has been the "uncertainty" of the initial assessment of uncertainty.

D. GOVERNMENT ROLE IN PERFORMANCE OF THE U.S. SHIPBUILDING INDUSTRY

1. MarAd

As the primary agency for carrying out the policies of the Merchant Marine Act of 1936, as ammended in 1970, MarAd has two basic goals according to the Assistant Secretary of Commerce for Maritime Affairs:

a. To develop a fleet adequate to carry a substantial portion of U.S. trade; the program goal of which is a 17% U.S. flag vessel participation in U.S. foreign trade by 1982.

b. To develop a merchant marine capable of serving as a military auxiliary in time of national emergency and in war [39, p.4].

Through subsidy payments and administration of financing arrangements, the MarAd has sought to achieve these broad goals and also attempted to carry out the objective goal of the 1970 amendment to build some 300 highly productive merchant ships of advanced design over a 10 year period.

As of June 30, 1974, the number of vessels ordered under the 1970 amendment amounted to 59 oceangoing ships subsidized by MarAd. Of the 12 CDS contracts awarded in FY1974, all were for tankers, three of which were rated at 390,770 dwt each [55, p.78].

A program of 300 ships in 10 years calls for an average of 30 ships per year and assuming a two year start-up for the program (which is implied by MarAd), 90 ships should have been constructed by the end of FY1974. However, based on available data, only 43 ships had been delivered as of June 30, 1974 [48, p.12] [49, p.9] [50, p.6] [55, p.78]. Additionally, MarAd announced in 1973 that it had initiated a formula for computing the relative productivity of newer large dwt vessels, as compared to those vessels considered in the 1970 amendment, in order to compensate for the fewer numbers of ships being produced. According to MarAd, application of this formula to the ships produced under the 1970 Amendment resulted in a substantial excess in total dwt over equivalent dwt of vessels originally considered under the 1970 Amendment [39, p.7]. This action is not fully understood, particularly in view of the recent substantial

increase in dwt for tankers (VLCC and ULCC's). Although capable of carrying much greater crude oil to the U.S., these tankers are of questionable value to the military in time of war. Additionally, due to environmental restrictions and inadequate channel depths, there are still no "superports" available in the U.S. to accept these large tankers.

Based on available data, the breakdown of ship types ordered under the 1970 Amendment are listed in Table 41.

TABLE 41
 NUMBER AND TYPES OF SHIPS ORDERED
 UNDER CDS, FY1971-1974

	Total	Tanker	LNG	LASH	Container	OBO	Roll-on/off
1974	12	12					
1973	17	7	9				1
1972	21	16		2			3
1971	12	2		7	3		

Source: MarAd [48, p.11] [49, p.8] [50, p.6] [55, p.78].

It must be noted that the number of ships listed in the above table do not include those ships built without subsidy. Adding these vessels to the total would amount to roughly 110 vessels since the 1970 Amendment. Additionally, a total of 62 ships in Table 41 versus the 59 total previously reported probably reflects some cancellations although no data was available on contract cancellations.

According to the Department of Commerce annual report for FY1974, U.S. flag vessels carried 39.8 million tons of cargo in calendar year 1973. This tonnage represented only 6.4% of the nation's waterborne foreign trade movement [55, p.79]. Table 42 lists percentage of U.S. tonnage carried in U.S. flag vessels since 1967. With the number of U.S. import tonnage increasing in 1973, it is still doubtful that a goal of 17% in 1982 will be realized without legislation such as the Energy Transportation Security Act of 1974 which called for 20% of all U.S. oil imports be carried in U.S. flag ships and was vetoed in December of 1974.

TABLE 42

U.S. FLAG OCEANBORNE FOREIGN TRADE
FOR CALENDAR YEARS 1967-73

	1967	1968	1969	1970	1971	1972	1973
Long Tons Carried in U.S. Ships (millions)	20.5	25.0	19.1	25.2	24.4	27.6	39.8
Percentage of Foreign Trade	5.3	6.0	4.5	5.3	5.3	5.3	6.4

Source: Department of Commerce [55, p.81].

With respect to MaxAd's second basic goal, to provide a merchant marine capable of serving as a military auxiliary in time of national emergency or war, no measurable standard has been identified. During hearings before the Congress in April 1973, the Assistant Secretary of Commerce for Maritime

Affairs stated that he had no ten-year shipbuilding program, per se, but that the MarAd had a one-year program for building and had the necessary applications to support that program [38, p.85]. Further research to determine if, in fact, a long-range merchant shipbuilding program for national defense has since been established has been unsuccessful. Such a program would require a joint effort, at least at the Department of Defense/Department of Commerce level, and fully supported by Congress. It is the opinion of these writers that until a specific long-range shipbuilding program is established for both types and quantities of merchant vessels needed during national emergencies or war, the second basic goal of MarAd will remain ambiguous and valuable tax dollars may be wasted on subsidies for ships which may be either unsuitable or in excess of requirements to meet the goal.

2. U.S. Navy

Attempts to evaluate the performance of the Navy in the U.S. shipbuilding industry have been unquantifiable. The goals of the Navy shipbuilding program are quite basic: To acquire ships in sufficient quantity, at a minimum cost, timely, and meeting minimum specifications.

No quantifiable basis for performance evaluation of these goals appears to exist. However, a comprehensive analysis of cost escalation in Navy shipbuilding contracts does offer some potential in this area, particularly if the escalation is identifiable with its cause(s). During

testimony before the Seapower Subcommittee in 1974, major shipbuilders generally expressed dissatisfaction with the Navy ship acquisition process, particularly with respect to the audit and contract administration areas. Some shipbuilders even indicated a preference for merchant contracts over Navy contracts due to the complexity of the Navy's acquisition process, low profits and degree of involvement by the Navy in the contractor's performance [22, p.37] [9, p.82].

The price of a naval ship is difficult to associate with the benefits obtained therefrom. Determining the utility of an aircraft carrier which costs one billion dollars is, at best, a highly subjective process. It is quite understandable, that the Navy's performance in the shipbuilding industry is best evaluated in time of war when the security of the country is jeopardized. Unfortunately, in such a crisis, the "cost" of a Navy vessel is insignificant compared to the need for optimum performance.

3. Congress

Congress plays a vital role in the U.S. shipbuilding industry as the principal legislative body. Again, no quantifiable measure of performance for the Congress has been readily identified. However, it is suggested that a detailed study of the impact of congressional actions (such as appropriation reductions, new legislation, etc.) on Navy and MarAd shipbuilding programs could provide a basis for performance evaluation. In addition, it is apparent that any deviations

from the basic goals set forth in the Merchant Marine Act of 1936, as ammended, are not only a reflection on the performance of the industry, Navy and/or MarAd, but also on the congressional oversight of these elements. It is noted that the report of the Seapower Subcommittee's recent four month hearing contained the following recommendations:

- a. Require a timetable from appropriate agencies for planned improvement programs in U.S. shipyards.
- b. Reintitute some new ship construction in naval shipyards.
- c. Conduct congressional review of overhaul, repair and maintenance programs on a continuing basis.
- d. Include inflation as a separate item in future shipbuilding contracts, with the government prepared to bear increased cost attributable to unanticipated inflation.
- e. Develop a new system to handle contractual claims.
- f. Terminate open-ended, cost plus contracts for Navy ships.
- g. Remove civilian hiring limitations in public shipyards.
- h. Establish training programs leading directly to shipyard employment and conduct a further review on the status of U.S. shipyards in early FY1976.

Additionally, the report emphasized the need for a firm, five-year shipbuilding program that would enable the Navy to enter the 1980's with a minimum of 600 active ships with a construction target of 35 ships per year [3, p.1].

These recommendations indicate a considerable effort by Congress to identify and attempt to rectify problems in the shipbuilding industry, many of which have been addressed earlier in this study. Although a copy of the subcommittee's full report is not available at the time of this writing, the report will go to the full House Armed Services Committee for consideration. It is felt that final action on the subcommittee's excellent recommendations would provide a valuable input in evaluating Congressional performance in the U.S. shipbuilding industry.

VI. CONCLUSIONS AND RECOMMENDATIONS

A review of the elements of structure, conduct and performance in the U.S. shipbuilding industry which have been presented in this study have led the writers to the following conclusions:

1. The issue of mobilization appears to be the primary reason for the depth of government involvement in the industry. However, the concept of mobilization base today does not seem to be well defined and there also appears to be a lack of coordination and agreement between the Navy and MarAd on this issue. The data presented suggests an apparent lack of a national objective for the shipbuilding industry in terms of long-range shipbuilding programs and the shipyard capacities required to support a mobilization effort.

Based on the current status of the industry, it is not clear to the writers whether a restructuring would be in the best interests of the nation. However, once a mobilization base requirement has been clearly defined the issue of restructuring the industry may then be given serious consideration. It is felt that a restructuring could possibly range from nationalization of the U.S. shipbuilding industry or increased government subsidization to far less involvement by the federal government. In some instances, marginal shipbuilders may be allowed to either function as peripheral firms, be absorbed by the industry or go out of business.

Consideration of the elements discussed above and other data presented has also led to the following additional conclusions

2. As the capacity of the shipbuilding industry approaches full utilization, the existing shipbuilding goals of the Navy and MarAd could become conflicting to the extent that the two agencies approach a rivalry for remaining capacity.

3. The U.S. shipbuilding industry can be considered to resemble an oligopoly of shipbuilders during periods of low demand. As capacity utilization approaches maximum in the industry, rivalries weaken and may even disappear if ship demands exceed capacity levels. In such instances, buyers would place orders based more on shipyard capability, open capacity and delivery estimates rather than price considerations. This is particularly true in merchant vessel orders where construction subsidies would normally cover any increased prices up to the statutory percentage limits.

Additionally, it is felt that the U.S. Navy may be considered a monopsonist in certain areas of the industry when it is the only customer for a shipyard's output (Electric Boat) or the primary source of a shipyard's revenues (Ingalls, Newport News). In such instances, these shipyards may have a monopoly on certain Navy contracts and hence, a bilateral monopoly would exist.

Although a monopolistic firm has a great deal of potential market power, this power tends to be weakened by government involvement and regulation, unstable demand conditions and the countervailing power of the monopsonist.

Bilateral monopolies may lead to intense power struggles by both parties and a general decline in business relationships. It is suggested that recent Navy problems with Newport News and Litton are the result of a bilateral monopoly power struggle.

4. The U.S. shipbuilding and repair industry has not established standards by which its achievements can be measured (e.g. material and labor productivity, output). Without industry recognized standards, it is difficult, at best, to determine the level of performance achieved by the different firms in the industry. Commonly established standards would also provide a means for individual firms to monitor their performance. Performance standards should have been established while the COAS was conducting its study on the shipbuilding and repair industry of the United States. The inclusion of such standards would have enhanced the meaningfulness of the final report which they issued.

5. Existing data does not support the hypothesis that commercial shipbuilding contracts are more profitable than Navy contracts. Shipbuilding executives frequently remark that profit margins on Navy contracts are unsatisfactory (i.e. too low). However, they have been reluctant to provide detailed financial data to support their statements or to justify the assumption that commercial contracts are more profitable. Neither is it clear that the large backlog of merchant ships is due to increased profitability of commercial contracts. The backlog could very well be due to several

factors such as the impetus provided by the 1970 Act and an increased demand for energy carriers, especially since the recent oil embargo and the decision to proceed with the construction of the Alaskan oil pipeline.

6. Skilled labor shortages and insufficient training programs restrict the capacity of most U.S. shipyards. It is not felt that government assisted training programs for shipyard skills would be an effective solution to this shortage as long as it is possible to earn higher earnings for similar skills in other industries. It is conceivable that the shipbuilding labor wage rates could be increased above those of competing industries through increased prices for Navy ships and increased MarAd subsidies. Then, the shipyards could afford to provide better apprenticeship programs with a greater probability of retaining its graduates in the shipbuilding industry. Thus, the government could be considered to be indirectly supporting shipyard apprenticeship training programs.

7. The migratory habits of unemployed shipyard workers, specifically those that have been laid off, are not clearly known. A recent example is what happened when the Boston Naval shipyard was closed. Senior naval officials expected that several of the Boston shipyard workers would seek similar positions in shipyards located further south. However, this exodus south failed to materialize.

8. Existing data does not clearly indicate that the large backlog of ships under contract to private yards has

impacted unfavorably on the Navy shipbuilding program. Delivery date slippages may be attributed more to a shortage of adequately trained personnel and/or material. There doesn't seem to be any evidence to suggest that either personnel or material have been diverted from Navy to commercial shipbuilding projects.

9. A comprehensive integrated R&D program among the Navy, MarAd and industry does not seem to exist. Based on available information, very little coordination in R&D projects or interchange of information takes place among these organizations.

10. The "grandfather clause" requirement of the current law appears to have had an inhibiting influence on the participation of U.S. oil companies in domestic ship construction.

Based primarily on the previous conclusions, the following courses of action are recommended:

1. Major joint research should be undertaken by the Office of Preparedness, Department of Commerce and Department of Defense to determine the mobilization requirements for Navy and merchant ships by type and quantity and also the time required to obtain these vessels.

Once these requirements have been determined, further research should be conducted to determine the amount of shipyard capacity required to support these requirements. Additionally, the demand for ships should be analyzed to determine if it is compatible with established requirements. Where the demand for ships exceeds mobilization requirements,

expansion of the industry is indicated. If the demand for ships falls below minimum requirements, alternative plans should be available such as building required ships under full subsidy and laying them up for future mobilization call-up or lease to private shippers.

2. Conduct more research to determine alternative productive use of skilled shipyard labor during times of slack workload or applying the "firehouse" concept of having skilled labor available but non-productive during slack periods.

3. Standards for measuring the performance of shipyard activity should be established by a committee comprised of representatives from the shipbuilding and repair industry, federal government and educational institutions (e.g. a group similar to COAS). Greater credibility would be accorded the standards (and the possibility of tacit collusion on the part of the industry would be minimized) if they were established by a committee representing different backgrounds and interests. Careful consideration must be given by the committee to insure against direct collusion whereby firms are rewarded for surpassing standards that have been set low. "Reasonable" standards must be set. The performance of the shipyards should be compared against these standards periodically and the resulting information should be forwarded to a central data collection agency such as Maritime Administration headquarters.

4. Increased coordination and interchange of R&D information among the Navy, MarAd and the maritime industry should be conducted through a centralized office established specifically for this purpose. It is possible that the monies that could potentially be saved by avoiding duplicative R&D efforts would be adequate to fund the coordinating office's activities.

5. A thorough study should be conducted to investigate the migratory habits, and influencing factors, of unemployed shipyard workers, by skills. The information resulting from such a study may be of some benefit to both public and private officials in their managerial capacities. The data may provide some insight as to the impact certain decisions (e.g. closing down a particular shipyard or laying off 1,000 employees) may have on the shipyard and the community.

6. The writers do not recommend relaxing the "grandfather clause" requirement at this time because of the large backlog of ships under contract. However, a thorough study should be conducted to determine what the impact would be if this particular requirement were eliminated. If it is determined that the elimination of this requirement would benefit the shipbuilding industry without adversely affecting other national interests, then the requirement should be terminated.

7. Conduct an investigation to determine the feasibility of consolidating the inactive Reserve Fleets of both MarAd and the Navy under MarAd control.

APPENDIX A

MAJOR PRIVATE SHIPYARDS OF THE UNITED STATES

Name & Location	Building Positions			Drydocks			Depth of Water			
	No.	L.O.A.	Width	Type & (No.)	Length	Clear Width	Lifting Capacity (Long Tons)	Yard	Channel	
Avondale (New Orleans, La.)	2	1,200	130	FD (4)	201	64	1,900	17	40	9,000
Bath (Bath, Maine)	11	570	106					35	27	12,000
Bethlehem (Sparrows Point, Md.)	9	720	110	BD (1)	1,200	200		30	21	16,000
Bethlehem (Beaumont, Texas)	2	892	60	FD (1)	651	87	17,500	30	30	4,975
Bethlehem (San Francisco, Ca.)	1	550	100	FD (4)	900	150	65,000	39	30	3,385
General Dynamics (Groton, Conn.)	12	400	50	GD (2) FD (1)	600	88				
General Dynamics (Quincy, Mass.)	1	830	162	BD (3) FD (1)	939	142				
					464	86	10,000	40	30	24,000

APPENDIX A (Continued)

Name & Location	Building Positions			Drydocks			Depth of Water				
	No.	I.O.A.	Width	Type & (No.)	Length	Clear Width	Lifting Capacity (Long Tons)	Yard Channel	Channel		
Litton Ingalls East (Pascagoula, Miss.)	10	638	63	GD (1)	485	85		38	40	9,125	
Litton Ingalls West (Pascagoula, Miss.)	5	5 bays each capable of handling 225 feet long 6,000 ton ship modules; 1 launch pontoon with a 57,000 ton lifting capacity									7,300 (as of 2/72)
Lockheed (Seattle, Wash.)	4	700	100	FD (3)	600	100	17,000	35	30	10,000	
National Steel (San Diego, Ca.)	5	545	85	FD (1)	389	59	2,800	28	28	3,398	
Newport News (Newport News, Va.)	5	882	128	GD (3) BD (2)	862	118		45	50	41,000	
Sun (Chester, Pa.)	5	741	139	FD (2)	775	140	38,000	26	40	35,000	
Todd (Houston, Texas)	1	350	65	FD (1)	558	86	12,000	45	40	20,000	
Todd (San Pedro, Ca.)	3	524	87	FD (2)	598	87	14,000	35	35	5,500	
Todd (Seattle, Wash.)	2	450	65	FD (3)	598	87	14,000	48	45	5,700	

APPENDIX A (Continued)

Notes

FD (Floating); GD (Graving); BD (Building)

All dimensions are shown in feet.

Clear width column, under "Drydocks" refers to width at keel blocks.

Number in parenthesis under "Drydocks" in the "Type & No." column indicate the total number of that particular type of drydock that is/are available in that yard.

All dimensions and lifting capacities listed are those belonging to the largest building positions/drydocks in that particular yard.

Bethlehem (San Francisco) has the largest floating drydock in the United States (65,000 long ton lifting capacity).

* Denotes maximum number of employees under multi-shift mobilization conditions.

U.S. NAVY SHIPYARDS

Name & Location	Building Positions			Type & (No.)	Drydocks		Lifting Capacity (Long Tons)	Depth of Water		**
	No.	L.O.A.	Width		Length	Clear Width		Yard	Channel	
Charleston (Charleston, S.C.)	3	600	90	GD (5) FD (2)	750	140	3,500			7,231
Long Beach (Long Beach, Ca.)				GD (3) FD (2)	1,092	144	4,000			7,320
Mare Island (Vallejo, Ca.)	2	680	105	GD (4) FD (2)	740	92				
Norfolk (Portsmouth, Va.)	2	910	120	GD (7)	1,092	143		40	40	10,422
Pearl Harbor (Honolulu, Hawaii)				GD (4)	1,088	141				5,413
Philadelphia (Philadelphia, Pa.)				GD (5)	1,093	143				10,963
Portsmouth (Portsmouth, N.H.)	4	435	55	GD (3)	741	91		35	40	7,638
Puget Sound (Bremerton, Wash.)				GD (6)	1,152	158		53	45	9,872

U.S. NAVY SHIPYARDS (Continued)

Notes

FD (Floating); GD (Graving); BD (Building)

All dimensions are shown in feet.

Clear width column, under "Drydocks" refers to width at keel blocks.

Number in parenthesis under "Drydocks" in the "Type & No." column indicate the total number of that particular type of drydock that is/are available in that yard.

All dimensions and lifting capacities listed are those belonging to the largest building positions/drydocks in that particular yard.

** Denotes total employees (civilian and military) as of March 1970.

APPENDIX B

EXAMPLE OF A MAJOR U.S. SHIPYARD ACQUISITION: A CASE STUDY OF THE NEWPORT NEWS ACQUISITION BY TENNECO, INC.

On April 25, 1968, both Newport News Shipbuilding and Drydock Co. (NN) and Tenneco, Inc., announced that they were having "consolidation discussions." A week prior to the announcement, a Newport News official had stated that, "friendly interests" had completed purchase of a block of between 25,000 and 50,000 shares of Newport News common stock and the stock had risen to its year high of \$67.75 per share. When the buy order was completed, the stock fell to about \$55.00 a share, where it stood on the day of the consolidation announcement. Additionally, a Tenneco spokesman said that the company had not "recently" purchased a "large" block of NN stock but did not indicate whether Tenneco owned any of the NN outstanding shares of common stock; 1,670,595 shares. NN also announced that its billings (work completed and billed for the quarter ending March 25, 1968, totaled \$74,167,112, an increase over the past years \$60,987,013. Although labor had increased to \$22,134 from \$20,061 for the same period the previous year, NN stated that the company was becoming increasingly aware of higher costs of materials and financing, and was also having difficulty in raising levels of productivity [21, p.7]. A summary of NN revenues, net income and earnings for 1965-1967 are contained in Exhibit 1.

On May 23, 1968, both companies announced that they had agreed in principal to merge. The merger was subject to the approval of NN stockholders and called for an exchange by Tenneco of a \$60, seven-percent, 25-year sinking fund debenture plus a one-half share of Tenneco common for each share of Newport News common stock. As of May 22, NN stock was selling at about \$60.38 and Tenneco at about \$27.88 per share. The Tenneco terms of sale represented about \$74 for each share of NN stock. It is also noted that before the announcement of the agreement to merge, NN had been awarded a major Navy shipbuilding contract for the nuclear powered aircraft carrier Nimitz (CVAN 70) [27, p.11].

On July 25, 1968, NN announced a first half 1968 loss of \$3,460,052 as compared to a net income of \$2,791,007 a year earlier. This loss was a result of recalculating construction costs of several contracts at a considerably higher figure than previously anticipated, and the standard practice of NN was to charge the increases against the quarter in which they become apparent, according to a NN spokesman. Sales for the same period had risen to \$150 million as compared to \$140 million the year before. Additionally, NN announced a deferral of third quarter dividends [20, p.16].

On August 20, 1968, NN stockholders approved the sale to Tenneco in accordance with the previously agreed upon terms. The sale was to be completed by September 3, 1968. At this time, NN outstanding shares were about 1.7 million and the

agreement would amount to a total amount of Tenneco common shares of 850,000 and \$100.2 million in debentures [11, p.5].

On September 5, 1968, Tenneco announced that it had completed acquisition of Newport News for about \$123 million in securities. A compilation of Newport News and Tenneco stock prices as of key dates in the acquisition process are included in Exhibit 2.

Based on the agreement of sale, the results were as follows:

Tenneco Common Stock exchanged:	852,810
Newport News C.S. exchanged:	1,705,620
Tenneco Debentures value:	\$102,338,000

Source: Tenneco Annual Report 1968 [28]

Balance sheet and income data for Newport News are shown in Exhibits 3 and 4.

1. Evaluation

The following points are considered relevant in effectively evaluating the possible motivation of Tenneco for the acquisition and the results:

a. Newport News had a relatively poor year in 1966. Net income was the lowest since 1958, as was net income per common share and dividends per common share.

b. Although 1967 was a "recovery year," announcement of the loss for the first half of 1968 had an adverse impact on the shareholder's attitudes toward the management and future prospects of the company.

EXHIBIT 1

NEWPORT NEWS FINANCIAL DATA 1965-1967 (Millions)

	<u>1967</u>	<u>1966</u>	<u>1965</u>
Gross Income	\$305.3	\$254.1	\$274.8
Net Income (after tax)	6.6	5.5	8.0
Net Income per common stk.	3.95	3.30	4.81

Source: Newport News Annual Report 1967 [18].

EXHIBIT 2

NEWPORT NEWS AND TENNECO STOCK PRICES 1962

<u>Date</u>	<u>Newport News</u>	<u>Tenneco</u>	<u>Event</u>
April 25	\$55.875	\$26.375	Announced discussions
May 22	60.375	27.875	Agreed to merge
June 17	63.000	29.625	Continuity only
July 25	63.375	29.000	NN announces loss
Aug. 19	69.000	26.750	Sale approved by S.H.
Sep. 3	69.250	27.000	Merger completed

Source: Wall Street Journals

EXHIBIT 3

NEWPORT NEWS BALANCE SHEET DATA - DECEMBER 31, 1967 AND 1966

Assets (millions)		Liabilities (millions)	
	<u>1967</u>	<u>1966</u>	
Current:			Current:
Cash	\$ 5.80	\$ 6.23	Bank loans
Accts. Rec.	13.12	6.73	Accts. Payable
Costs incurred and est. profits on contracts in process less billing:	63.01	63.69	Accrued wages, etc.
Inventory	7.15	6.54	Est. Federal and state income and other taxes
Other	.82	.71	
TOTAL CURRENT:	\$89.96	\$83.90	TOTAL CURRENT:
			\$48.09
Fixed:			
Structures, machinery and equipment	\$94.36	\$87.74	Deferred Income Taxes
Less depreciation	49.48	45.77	Stockholder's Equity
Net amount	\$44.88	\$41.97	Common Stock (auth: 3 million, issued: 1,670,595 - 1967 1,668,755 - 1966
Land	2.56	2.47	Capital in excess of stated value
Small tools, etc.	1.87	1.73	Retained Earnings
TOTAL FIXED ASSETS	\$49.31	\$46.17	66.35
TOTAL ASSETS:	\$139.27	\$130.07	\$89.58
			TOTAL EQUITY
			TOTAL LIABILITIES:
			\$139.27

Source: Newport News Annual Report 1967 [18].

EXHIBIT 4

NEWPORT NEWS DATA ON INCOME AND EARNINGS FOR YEARS ENDING
DECEMBER 31, 1967 AND 1966 (Millions)

	<u>1967</u>	<u>1966</u>
Gross Income	\$305.28	\$254.13
Cost of work	<u>293.63</u>	<u>243.00</u>
Operating Income	\$ 11.65	\$ 11.13
Less - Provisions for taxes	<u>5.05</u>	<u>5.63</u>
Net Income	\$ 6.60	\$ 5.50
Retained Earnings at beginning of year	<u>63.59</u>	<u>61.84</u>
	\$ 70.19	\$ 67.34
Dividends paid (\$2.30 per share in 1967) (\$2.25 per share in 1966)	<u>3.84</u>	<u>3.75</u>
Retained Earnings balance	\$ 66.34	\$ 63.59
Net Income Per Share of Common Stock (dollars)	\$ 3.95	\$ 3.30

Source: Newport News Annual Report 1967 [18].

c. Under the Newport News employee common stock option plan, 70,595 shares had been issued by December 31, 1967, at option prices equal to 85% of fair market value. Option prices ranged from \$29.22 to \$47.92 per share. Additionally, as of December 31, 1967, options for the purchase of 29,525 shares of NN common stock were outstanding.

d. Profit ratios for Newport News in 1966/1967 were as follows:

Ratio	1966	1967
Return on Sales (net income/revenues)	2.2%	2.2%
Return on Investment (net inc./tot.assets)	4.5%	4.7%
Return on Capital (net income/common stk)	2.5%	3.0%

e. Newport News was virtually debt free with a debt-to-total assets ratio of .075, debt-to-total equity ratio of .116 and total equity-to-debt of 8.6 in 1967.

f. Retained earnings represented about 74% of total equity for NN in 1967.

g. Fixed assets of NN were stated at cost and were most likely undervalued in 1967.

h. A first look at the security exchange package offered by Tenneco for the sale of NN indicates that Tenneco was willing to pay a premium for the acquisition of NN. This statement is based on the fact that total annual expenditures by Tenneco would amount to the following:

annual interest on debentures	\$7,163,604
dividends on 852,810 shares (1968 rate)	<u>1,091,597</u>
Total annual cost	\$8,255,211

Based on the Newport News net income in 1967 of \$6.6 million, this cost to Tenneco seems excessive. However, it must be noted that debenture interest is a tax deductible expense and dividends are distributions of net income after taxes. Although the tax rate for Tenneco is not ascertainable for 1968 and 1969, assuming a nominal 50% rate, the after tax expense for the acquisition of NN amount to roughly \$4.67 million.

i. Interestingly enough, after acquisition of NN in 1968, Tenneco stated in their 1968 annual report that in accordance with their standard practices, newly acquired subsidiaries' contributions under the "pooling" concept were calculated from the date of acquisition. Thus, in 1968, Tenneco reported revenues of \$97.5 million and income before taxes and shareholder's interest of \$4.5 million for the Newport News division from September 4 through December 31, 1968.

j. Earnings per share of Tenneco common stock are as indicated below:

	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>
Tenneco earnings per share of C.S.	\$1.88	\$1.95	\$2.21	\$2.31

Source: Tenneco, Inc. Annual Report 1968 [28]

k. Tenneco replaced the president of Newport News shortly after acquisition in 1968 and transferred him to the board of directors until his resignation on February 1, 1970.

2. Conclusions

Based on the data presented, it is the writers' opinion that Newport News was in a vulnerable position for being acquired, in that it presented an excellent, low-debt asset which would increase Tenneco's earnings-per-share immediately. In addition, Newport News provided the possibility of a tax write-off which could have been carried into future years income. The relatively low earnings for Newport News in 1966, the announcement of a loss in the first six months of 1968 and the deferring of dividends for the third quarter of 1968 all had an adverse affect on the stockholders confidence in the company. The obvious opportunity to profit by the sale to Tenneco was most influential in the Newport News' shareholders decision to authorize the sale.

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