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Naval and Merchant Fleet Coordination: A New Maritime Strategy

W. Gibson Carter
University of Rhode Island

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NAVAL AND MERCHANT FLEET COORDINATION:
A NEW MARITIME STRATEGY

by
W. Gibson Carter

A supervised writing submitted to the Faculty of the University of Rhode Island in partial satisfaction of the requirement for the degree of Master of Marine Affairs.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

Signature: [Signature]

1 May 1972

Directed by
Dr. L.M. Alexander
Director, Marine Affairs Program

Approved: [Signature]
Abstract of
NAVAL AND MERCHANT FLEET COORDINATION:
A NEW MARITIME STRATEGY

The military sealift requirements of the Department of Defense and the cooperation of the Merchant Marine in times of crises, national emergencies and wars are well known. The current trend toward increasing international trade, problems of inadequate U.S. flag commercial shipping fleet and further reductions in the size of the active and reserve naval fleets, require that some cooperative effort be considered in a normal peacetime environment as well as in a crisis role.

The majority of the ships of the U.S. Navy and Merchant Marine are well over twenty years old and are inefficient and uneconomical to operate. Positive steps are being taken to improve the quality of each fleet within the overall budget constraints.

It is obvious that the Merchant Marine and Naval fleets could provide stronger support to common national objectives if they worked in concert rather than independently as has been normal practice.

The Secretary of Defense and the Secretary of Commerce have recognized this and are making some progress in conducting joint merchant-naval operations and a study of other requirements. This paper proposes several administrative, operational and hardware oriented concepts which will have
the effect of making the Merchant Marine and Naval forces a team operation and more responsive to routine operations and a national crisis. An acceptance of these concepts should cause the operation of both fleets to be more efficient and productive.
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NAVAL AND MERCHANT FLEET COORDINATION:
A NEW MARITIME STRATEGY

CHAPTER I

INTRODUCTION

**Seapower.** Power at sea is a combination of many factors. Ships of war are the first to come to mind for many people. There is much more to seapower. Seapower is a matter of access across the oceans to launch military expeditions, to supply bases in time of war, or to exploit the comparative advantages of trade in time of peace. The heart of seapower may be the merchant fleet when considered in its broadest perspective.

International alliances and questions of rights at sea are external matters of policy and interests and are very much affected by a nation's maritime strength. The United States relies on ocean transport for at least eighty strategic materials that cannot be found or produced in sufficient quantity in the country. Industry is dependent on overseas sources and this resource deserves protection. The United States is clearly a seapower as indicated by its geography. Power has been derived from the sea and policy should always contribute toward the maintenance and increase of this element of power.

The United States has allowed its Merchant Marine and combatant Navy to grow obsolete and diminish in size while other problems such as recovery from the Vietnam conflict and demands of domestic social issues have been given higher
priority. As one looks to the future, the importance of strength at sea and the necessity for maintaining it will not diminish. The oceans will persist as the main channel by which goods will move. The seas will also continue to be vital to military uses as in the past, both in terms of marginal conflicts and of the strategy of deterrence.

The relationship between the Navy and the Merchant Marine has become severely strained in recent years. In an effort to carry on a war on a peace-time basis, the Navy has attempted to provide merchant type ships and services for its own purposes. The co-existence of a naval merchant fleet in addition to a commercial fleet has accelerated an unfortunate and unhealthy condition. The historical precedent was for the employment of commercial ships to provide logistical support for the Navy. Since the U.S. Navy provided some of its own supply support, regardless of the reason, this has been considered unfair competition by most segments of the maritime industry.

Military and civil maritime problems should be viewed in different perspectives and the military should make a special effort to understand the commercial shipping position. The problem of cooperation between the military and civilian maritime forces cannot be dismissed as easily as one of the officers in command in a purely military setting. It may be recalled that the separate military services were organized under the Joint Chiefs of Staff and Unified Commands in order to operate more efficiently. The requirement for a common policy and
accepted doctrine of the functions of the separate services in the way the nation should use the Armed Forces, made the practical exercise of cooperation necessary.

It is the purpose of this paper to point out that it is just as logical that the U.S. merchant and naval fleets have a clear understanding of their contribution to the goals in national policy. With a better understanding of the purpose of all maritime assets, one may take the initial steps toward effectively contributing to and pursuing common goals in support of national interests.

The aim of effective employment of naval and merchant fleets should be based on the experiences of past crises and not have to be relearned. The questions of management of merchant shipping in World War II, waste in committing tonnage to priorities less than urgent, undischarged ships and other misuse of resources are discussed in an authoritative book, Merchant Shipping and the Demands of War (London: Her Majesty's Stationery Office and Longmans, Green and Co., 1965), by C.B.A. Behrens.

The author had access to official documents of sources such as the War Shipping Administration of the United States and the British Minister of War Transport. As one can see from a few remarks by the Minister of War Transport reproduced in Appendix I, an attitude of cooperation, joint planning, training and an understanding of another agency's limitations and capabilities is necessary for efficient operations.
Obviously these lessons had to be relearned by the U.S. in Korea and Vietnam. The British relearned the same lesson in the Suez crisis in 1956 when that operation revealed an incredible shortage of transport capability, equipment, stores and logistic support management ability.6

There is some evidence that primarily because of budget constraints, concern and discussion among the leaders of this nation, is taking place regarding maritime goals and coordination of the agencies with oceanic responsibilities.

National Attitude Toward Marine Affairs. The recognition of the need to make some improvement in the management of ocean resources, defense, transportation and trade in competing in the world market has been slow. The existing and programmed strength and composition of U.S. naval forces is rooted in the national objectives of the nation. The President and other leaders have indicated that the U.S. is a leader of an alliance of inter-oceanic communities that have major maritime interests and depend on use of the seas. He has also stated that the U.S. will play a more active leadership role in carrying out the growing responsibility for the maintenance of a liberal world trade environment.7

There appears to be a favorable disposition both in and out of Government, toward correction of the conditions of obsolescence which have existed in many segments of the commercial and naval fleets.
The Chairman of the House Merchant Marine and Fisheries Committee has given a consensus of the feelings of Congressional, Government agency, business and maritime labor and management feelings toward promotion of the U.S. maritime industry. He is of the opinion that the hearings on an analysis of the whole area of U.S. flag vessels, merchant ship role in national defense, availability of cargo and all the factors related to successful ship operations are long overdue.8

As a result of this progressive attitude toward shipbuilding, and modernization of the ocean fleets, there is considerable support for a substantial naval and merchant shipbuilding and conversion program. A ten year $50 billion shipbuilding and conversion program to modernize the U.S. Navy has been proposed.9 When one considers the obsolescence and effectiveness of the fleet as well as the change in relative strength between the Soviet Union and the U.S., a good case can be made in justification of a program of this magnitude. Reality suggests that the appropriations for the naval construction will be something less than $4 or $5 billion annually, but the attention gained is encouraging.

The enactment of the Merchant Marine Act of 1970 provided the vehicle for a revitalization of the Merchant Marine. This legislation was the first major updating of the national maritime policy in three decades.10 It could not have come about without the support and cooperation of the Congress. The
urgency and sense of optimism with which this broadly-based program was instituted could be regarded as a major factor in reviving the U.S. commercial fleet and an indicator as to the level of future commercial activity.

**Merchant Act of 1970.** The Merchant Marine Act of 1970, restructured and redirected the U.S. maritime policies to provide a constructive program to restore the U.S. to the rank of a leading maritime power. As an indication of the status of the fleet which required such drastic action, in 1950 42 percent of U.S. foreign trade was carried in American flag ships, and in 1970 this figure fell to 5.6 percent. 11

The objectives of the new maritime policy and program are:

- a. To develop a modern and efficient American merchant marine capable of carrying a substantial portion of U.S. trade.
- b. To provide military shipping support in times of national emergencies.
- c. To improve the productivity and competitiveness of shipping and shipbuilding industries.
- d. To encourage the application of advanced technology, innovative management and aggressive marketing programs.
- e. To provide a firm foundation and direction for growth and stability of the shipping industry. 12

A substantial part of the 1970 Act deals with building the equivalent of 300 highly productive merchant ships of
advanced design. These ships will be built with Federal assistance over a ten-year period. Government and industry have been asked to work together to rebuild the merchant fleet. As a target goal, the construction of 25 general cargo ships, three dry-bulk carriers, and two tankers each year during the 1970's is envisioned.13

The new building program will provide an improved system of construction differential subsidies. These payments will reimburse American shipbuilders for that part of the total ship cost which exceeds the cost of building in foreign shipyards. These subsidies will allow the U.S. shipbuilders to sell their ships at world market prices for use in competition with foreign trade despite their higher costs.

In this new plan, maritime research activities of the government will also be enlarged and redirected. Emphasis will be placed on practical applications of technological advances. The joint participation of government and industry in cooperative and cost-sharing programs is encouraged in the areas of new developments and research projects.14

The results of the first year after the enactment of the 1970 Merchant Marine Bill was disappointing. The country was experiencing a period of economic uncertainty and business was generally at a slow pace. Assistant Secretary of Commerce for Maritime Affairs, Andrew E. Gibson, who acts in the sub-cabinet as Maritime Administrator, had hoped to accelerate the implementation of the new shipbuilding program. Start up problems
along with the poor earnings of American flag operators resulted in some difficulty in arousing interest in new construction. 15

A summary status of the active U.S. flag merchant fleet and ships under construction and conversion as of February 1972 is presented in Table I of Appendix II.

U.S. Naval Forces. The appropriations for U.S. Navy ship construction for the 1972 fiscal period was slightly in excess of $3 billion. 16 Most of this money will be committed to programs started in earlier years such as submarines, missile ships and general purpose destroyers. The amount remaining for new ship construction will be cut further by the impact of inflation on labor and material in the complex ongoing weapons and electronics systems.

In order to modernize and remain within budget constraints, the U.S. Navy is committed to reducing in size to a smaller, high-quality combatant fleet. The Chief of Naval Operations has stated that because of an inadequate budget to procure, operate, and maintain both warships and auxiliary ships, the Navy will be increasingly forced to rely on the Merchant Marine. 17

The size of the U.S. Navy in recent years and the continued progressive reductions are illustrated in the following tabulation:

<table>
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<tr>
<th>Fiscal Year</th>
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<tr>
<td>1968</td>
<td>976</td>
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<tr>
<td>1969</td>
<td>886</td>
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<tr>
<td>1970</td>
<td>796</td>
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<tr>
<td>1971</td>
<td>710</td>
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<tr>
<td>1972</td>
<td>657</td>
</tr>
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<td>1973</td>
<td>594</td>
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With a decision to concentrate on warships as a result of low budget levels the Navy will have to carefully weigh the risks inherent in depending on another agency for logistic support. The present capability to substitute merchant ships for Navy replenishment and auxiliary ships is poor and inadequate. It is believed to be a capability that can be acquired in a relatively short time frame however. Given a sincere desire, which the budget has provided, and some understanding on the part of the Navy and the Merchant Marine, there seems no reason why the support functions of the Navy cannot be provided by merchant ships and crews. The auxiliary ships of the Navy are in fact merchant hulls fitted out for naval use and manned by uniformed sailors, so there are no fundamental changes.

Aside from the logistic support functions of the combatant naval forces, the Navy is responsible for providing and protecting sealift forces. A former Commander of the U.S. Navy's Military Sealift Command has described the capability of the combatant Navy, the air strike forces, and the mobile ground troops stationed around the world as of very limited value if there is no capability to support their operations.19

The primary mission of the Military Sealift Command (MSC) is strategic sealift. This sealift force is a Navy fleet and has area commands located in Oakland, Bremerhaven, Yokohoma and Brooklyn. This organization is responsible for the movement of military cargo throughout the world and as such is the
single manager operating agency for all Defense Department sealift. 20

In normal peacetime operations as well as national emergencies, the MSC relies heavily on ships of the U.S. Merchant Marine. The MSC has a small nucleus of government-owned ships which are configured to carry outsize cargo and deliver material to remote parts of the world where no commercial service is available. Other government-owned ships are special purpose vessels such as cable layers, oceanographic research and special project vessels to support space flights.

The MSC controls the operations of a fleet consisting of 128 government-owned ships and 113 commercially chartered ships. 21 Table II of Appendix II provides an analysis of the American shipping potentially available to the command.

As the Defense Department's only immediately responsive sealift force, the command is contingency-oriented. To develop capability for wartime expansion, MSC relies primarily on the Merchant Marine. The Merchant Marine may provide services from its active operating ships or from the National Defense Reserve Fleet (NDRF). For instance, during the Vietnam conflict MSC had 170 activated ships from the NDRF which operated as a part of a controlled fleet of 600 ships during most of that period. 22 It is common knowledge that 98 percent of the material support for that conflict was carried by sealift under the supervision of the MSC. 23
In its role of sealift, the MSC is involved in developing new types of sea delivery systems. Included in this category are containerization of cargo, use of intermodal systems, roll-on, roll-off vessels, innovative port and management techniques and the design of ships which can serve multiple mission requirements of the military services.

The National Defense Reserve Fleet. The National Defense Reserve Fleet (NDRF) is composed of deactivated ships placed out of service and maintained in storage fleets by the Maritime Administration of the Department of Commerce. Most of these ships are not economically competitive and are at least twenty-five years old.

Table III in Appendix II shows the trend in the numbers of ships maintained in the fleet since the bulk were provided at the close of World War II. These ships represent a marginal sealift capability because of their deteriorating material condition, slow speed and antiquated cargo handling capability.24 Because of the inferior operating characteristics and excessive reactivation costs, only 381 of these vessels are considered suitable for reactivation to meet national shipping emergencies.25 The existence of this reserve fleet has enabled the U.S. to augment sealift capabilities during emergencies and leave the active merchant fleet on their normal operations.

With the majority of new construction and conversion of commercial shipping taking advantage of the economy of various
forms of containerization and intermodal transport, it may be expected that the present NDRF break-bulk ships will soon be replaced with the retired container ships. A summary of the ships currently under construction or conversion was seen in Table I, Appendix II. It should be noted that all new construction freighters are of a container configuration.

The expanding number of container ships in the maritime industry will dictate that Department of Defense planning adapt to this mode of sealift. One can now appreciate the concern of the Navy in "owning" its own ships for logistic support of combatant forces and its sealift forces for traditional break-bulk, immediate sealift capability in response to national emergencies.

It is clear that the Navy is willing to trade naval auxiliary ships in order to have a better combatant fleet. Some consideration must now be given to operational capabilities, procedures and command and control of this new concept of supporting the fleet with commercial vessels.

In the role of sealift, the Navy and Department of Defense planners should welcome the fact there are some modern, fast hulls in existence and figure out schemes to take advantage of the capabilities of the barge and container ships. The most rapid response in sealift will be in use of those ships that are in service and operating. All signs indicate the majority of dry cargo vessels will be of the modern, economical inter-modal variety.
An analysis of the proposed budget for fiscal 1973 shows increased funds for federally sponsored marine programs including shipyard activity. Table IV, Appendix II summarizes funds for recent naval and commercial ship construction.

Two new positions in the Navy have been established to assist in meeting the responsibility of the Merchant Marine to provide for national defense and serve as a naval and military auxiliary. A senior naval officer is assigned as Special Assistant to the Maritime Administrator for consultation in joint matters. The Commander, Naval Ships System Command, has been assigned an additional role in commercial shipbuilding. He will coordinate shipbuilding programs and ship characteristics in order to satisfy Department of Defense requirements.

The Navy Department should maintain a close relationship with the maritime industry if there is to be a smooth and efficient transition to normal operations with the commercial fleet. Some possibilities for a U.S. Naval and Merchant Marine unified effort in the pursuance of common goals will be explored.
CHAPTER II

MERCHANT MARINE AND ITS ROLE AS A NAVAL AUXILIARY

Commercial Ships as Naval Auxiliaries. The Merchant Marine Act of 1936 declared that it was a policy of the United States to develop and maintain a merchant marine adequate to meet the trade and defense requirements in peace and war. The Merchant Marine Act of 1970 provided the administrative and financial programs which will enable the Maritime Administration of the Department of Commerce to create a strong, competitive American Merchant Marine to carry out that policy.

Now that the Navy is concentrating on combatant forces and relying on the civilian vessels for auxiliary support functions, another need for the ships the new Merchant Marine Act can provide is established. In January 1972, the President did announce a new contract for nine 25,000 deadweight ton tankers. These tankers will be built in private yards, operated by civilians but chartered to the Navy to meet a military requirement for shallow draft tankers.

The Navy and Department of Defense has been concerned about the physical size and draft of the tanker fleet. The trend toward supertankers to take advantage of the commercial aspects has caused problems in maintaining a flexible posture in contingency planning. Some supertankers can be used, but many ports of the world and some naval operations cannot accommodate large tankers.
The last of a series of four tankers with a capacity of 37,000 deadweight tons each were delivered to the Navy in January 1972. These ships are civilian operated and modern in every respect; they have reduced crew manning with bridge control to the engine rooms, crew comforts and are highly automated.

These ships are privately owned, civilian manned and are under charter to the MSC which was described earlier. Some of the auxiliary fleet oilers manned by the Navy will be replaced by the service of these new tankers as they are delivered and demonstrate the skill to carry out the task of fleet re-fueling.

During the past few months a number of merchant marine tankers with civilian crews have exercised with the naval operating forces at sea and established the feasibility of this technique. This logistics technique increases the availability of fuel in distant waters for the warships and significantly increases the combat potential of those ships. When proven, this concept may be applied to any logistic service or auxiliary ship.

To complement the tanker fleet the Navy would like to obtain the service of the Multi-Purpose Cargo Ships (MPS). These vessels would be specially designed to be compatible with the commercial unit load (container) equipment. The MPS would be manned and under charter much the same as the tankers.
presently in use and allow additional old naval auxiliary service force ships to be withdrawn from the active fleet. These ships would be available for rapid deployment in the event of a contingency and would have the additional advantages of not being in competition with commercial interests.

Desirable Military Characteristics. The Merchant Marine Act of 1936 provides for the Department of Defense to pay for national defense features required in ships which will be considered as military auxiliaries. Some of the military features desired not only require additional expense in construction, but also cause the operator additional operating expense. Some ships in the fleet have two engine rooms because of a defense requirement. These ships are more expensive to operate because of the duplication of personnel and loss of cargo space. The operating expense of a military requirement provided in a vessel is an exception but certainly a disadvantage to the operator.

Some military requirements such as a speed requirement may have international implications. A purely commercial design ship may have a top speed of 18 knots. In order to operate with a fast naval task force and take advantage of protection forces, it is desired to have a speed of at least 21 knots in all ships. The Department of Defense will pay for the cost of the additional speed provided in the ship. The operator of this ship will have an economic advantage over
the other commercial operators because of his speed advantage. The temptation of an operator to compete with the schedule of a ship having a defense subsidy speed capability may be strong and could result in economic suicide.

These types of problems are not new but are seldom discussed. If the replenishment of naval vessels at sea on a regular basis, or forming any part of an Army or Marine assault force is envisioned, a high quality, high performance ship is required. The capabilities may also provide a commercial economic advantage over competitors for the ship operator.

In addition to the damage control and speed characteristics discussed, other military characteristics which should be considered for installation on new construction or conversions under the arrangement for payment by the Department of Defense are:

a. Installed communications equipment compatible for operations with the naval forces.

b. Transfer at sea stations. Equipment and fittings for transfer of fuel and cargo at sea.

c. Helicopter landing platforms for all ship types; tankers, transport, container ships and multi-purpose.

d. Command and control facilities on selected ships. A command complex built in standard containers for placement on a container ship could provide the service at sea, be moved ashore at an objective area and moved back afloat upon completion of operations.
e. Heavy-lift boom capability for selected ships or ship types for unique heavy military cargo not suitable for containers or barges.

This program may be expected to accelerate as the Merchant Marine proves competent, cooperative and adaptable to operating with the naval fleet. A civilian special assistant for transportation to Navy Assistant Secretary for Installations and Logistics is optimistic about the new shipbuilding program and the use of those ships. He is convinced that people in the fleet will provide new, innovative and creative ideas for effective use of these assets.6

Training and Manning. In 1964, "Operation Steel Pike I" was undertaken by a team consisting of Navy, Marine Corps, and Merchant Marine Forces. One hundred and forty-one ships, combatant, non-combatant, and merchant, carried 22,500 marines and 180,000 measurement tons of material from the East Coast of the United States to an operating area off Spain. At the completion of this exercise the Secretary of the Navy reported that in any size assault, reliance would be on the Merchant Marine.7 Current thinking considers integrated naval and merchant fleet operations on a continuous training cycle.

U.S. Navy ships have become increasingly complex and personnel availability is steadily decreasing. These factors among others, have contributed to the need for reducing operating costs of naval and merchant ships. There can be many
things which cause a high ship operating cost. Often the largest single item is the crew.\textsuperscript{8}

In the case of the Navy, it is possible for the crew to contribute the major portion of the operating cost. If all costs are considered, the Bureau of Naval Personnel has determined that the yearly costs can range from $4,400 for a seaman to $80,000 for an officer of the rank of Captain.\textsuperscript{9} The Navy or Merchant Marine cannot afford to decrease its effectiveness, but resources are limited and efficient use of the people is a necessity.

The Federal Maritime Commission Chairman, Helen Bentley, has urged realistic manning standards for new U.S. flag ships.\textsuperscript{10} Crew size should fulfill the needs of the ship and particularly in the case of the merchant ships, should represent a realistic ratio of manpower to vessel equipment.

The Navy and Maritime Administration are conducting a series of feasibility tests in the use of Merchant Marine vessels with civilian crews in direct support of warships. The normal crews on commercial vessels may be limited when problems of maintaining several transfer stations are encountered. In two exercises in the Pacific conducted by merchant tanker crewmen who are not ordinarily involved in this type operation, their ability proved equal to the task. In fact they demonstrated highly professional seamanship and quickly adapted to the new problems.\textsuperscript{11}
The Navy and the Merchant Marine are natural partners. They share a common environment, common professional practices, common operations, common manpower sources and common dangers. Achieving the goal of building the Merchant Marine to be an effective naval auxiliary will take human resources as well as physical ships.

An interchange program of personnel on the operating ship level as well as the transportation management level between the commercial world and the Department of Defense would be helpful. Each would bring an understanding of the problems of their agency or industry and return with a better knowledge of the requirements and problems of the other. Personnel with this type experience can avoid many problems in the transportation field or initiate programs to solve problems with a much improved chance of success. Cooperation and dialogue between military departments and the commercial marine industry will assure that the demands of national security will be met.

Worldwide Command and Information System. In 1971 there were approximately 50,000 ships in the world larger than 100 gross tons. Over half of these ships are general cargo and passenger vessels, about one quarter are fishing vessels and the remainder are tankers, ore and bulk carriers and miscellaneous types. It is estimated that there are 11,632 vessels at sea on any typical day.12
The maritime shipping industry has an image of being slow to accept change, but this is currently changing. The industry is highly competitive and ship movements are often not reliably reported if reported at all. Published movements of fishing vessels are non-existent, military ship movements are generally not made public, and many commercial carriers do not desire to publish routes and destinations for fear of revealing information to a competitor.

To consider a worldwide, international data center in the near future is unrealistic. However, a worldwide information system for the U.S. flag fleets appears to be reasonable and perhaps would eventually be accepted by allied nations.

The precedent for such an organization has been set. One existing international program is the World Meteorological Organization. The U.S. center, located in Washington, D.C., and managed by the National Oceanic and Atmospheric Administration (NOAA), provides a wide range of environmental data to all nations participating in the program. NOAA has brought many of the Federal ocean and environmental agencies together including the Navy-administered National Oceanographic Instrumentation Center. This program could provide great assistance to the maritime world.

Considerations such as safety at sea, weather prediction, search and rescue and mutual support of flag fleets, associated and friendly fleets could be enhanced. The Navy and some
private consulting firms have practiced the art of simple weather routing for several years.\textsuperscript{14}

The Navy calls the system Optimum Track Ships' Routing (OTSR). The details of a ship's performance are known for various weather conditions. Based on the prognostic weather and wave charts, ship optimum routing may be calculated for a voyage and the ship advised of desired changes in route as the voyage progresses.

This relatively simple exercise of using all available data has saved an average of fourteen hours in voyage time for MSC ships in ocean crossings. This is estimated to be a saving of two million dollars each year. Shell oil tankers in the Atlantic have saved an average of eighteen hours per voyage.\textsuperscript{15} Other savings include a reduction in heavy weather damage to the ship's structure, cargo and passenger or crew comfort.

It is envisioned that for specific naval tasks such as refueling of ships, the information center could provide a ship in need of fuel with a description of the tanker nearest which contains the desired fuel type and a capability to provide such a service. Perhaps the Navy could be the leader in such a program now that it is seriously in the role of cooperating with the U.S. commercial flag fleets. Centralized information may be provided even though one may not necessarily have command or control of a vessel. If the United States is to grow to meet the ocean challenge of the future it seems
clear that there should be a central information system concerning her afloat units. Ship time and lives saved, aside from the economic savings which may be realized, could provide incentive for adoption of such a concept.

Consolidation, cooperation and integrated systems within government and internationally are key words in the world of today. They also apply to methods of improving ocean transportation. In the next decade it is anticipated that the number of ships on the oceans will increase by forty percent. These will be larger and faster ships than those presently known. Part of this increase is not in total numbers, but is due to the efficiency and a savings in turn around time in port. The more efficient ships will spend more time at sea each year as compared to inport days.

The most dense concentration of vessels will continue to be in the approaches to Europe. Traffic in the Western Pacific and Indian Ocean will increase. The traffic through the Strait of Malacca is expected to approach that of Dover Strait. All this is bound to have profound effects on navigation, safety, communications and the maritime industry in general.

As ocean traffic lanes and patterns are accepted and "freedom of the sea" is diminished, the potential of a unifying, coordinated central information system will become apparent. The Navy, within the umbrella of NOAA in its role as an oceanographic and charting agent, could provide a direct economic
and indirect social service to the United States in this type of operation.

The U.S. maritime comeback that is commencing can be successful if all parties; Defense, shipbuilding, unions, operators and concerned government agencies work together in making all beneficiaries of new technology, and not the victims of it. The Navy can do much more than "live with it"; it could provide the leadership.
CHAPTER III

SEALIFT AND INTERMODAL TRANSPORT

Potential of Commercial Sealift for Military Use. The Merchant Marine is a commercial operation and depends on profits to remain in existence. Competition is keen in marine transportation and operators have found that such a high degree of efficiency and productivity is required, it has resulted in specialized ships. The vessels used in the dry cargo trade are generally called "container ships," although the term is inclusive of several types of specialized ships utilizing intermodal transport. Whether they are roll-on/roll-off, partial or full container configurations, or lighters aboard ship, the dramatic change is in the methods of packaging the cargo in a form which will reduce handling costs.

The ships may get larger and faster, but the fundamental character of the ocean going displacement type of ship is not expected to change. Innovations and technological advances in containerization should be expected to continue to change in an evolutionary manner as more economically sound adaptations are found.

New developments are often considered to render existing material obsolete. They may merely present a degree of superiority in performance or a departure in design. Rarely has a new invention made existing equipment obsolete at once. The
obsolete is still worth considering in a summation of the relative power among nations. In the subject of shipping under discussion, it should be observed that the "container revolution" is moving so fast, one cannot make plans to use current shipping assets and then set them aside figuring the problem of utilizing these ships is solved. The maritime industry is expanding and modernizing. U.S. flag container ships presently carry sixty percent of the world's container trade and with additional ships as a result of the new maritime policy, this will increase.3 The potential military users of these ships would be negligent if they did not adapt plans to new innovations and work with the industry in utilizing the capability of the modern intermodal transport systems.

Roll-on, Roll-off. Some military cargo such as tractors, buses, heavy construction vehicles, and other type truck or wheeled vehicles find themselves in the special position of odd and oversized cargo. When compared to the much more productive and successful standardized shipping container they do present a problem. The best answer for this type cargo is the roll-on/roll-off container ship.

This vessel handles containers on deck and anything that can be pushed, pulled or driven aboard is loaded into the vessel over a stern or side ramp. The rolling cargo may be loaded or discharged at a pier, barge alongside or any type platform.

This vessel has military application in an amphibious assault follow-on echelon when poor beach or pier facilities may be all that is available.
The speeds of second generation combination roll-on/roll-off container ships will be approximately twenty-four knots. This speed is compatible with the modern naval amphibious task force of twenty knots.

The computer capability in this ship could be useful in operations involving routing, scheduling, and other integrated requirements. It may also be used in providing the port terminals, ship and task force commander information on the location of cargo and the availability of space in his ships.

**Container ships.** The primary aim of the pure container ship is to move goods as quickly and cheaply as possible. The container reduces the number of times a piece of general cargo is handled and facilitates intermodal transfer. Ideally this system forms the nucleus of a total transportation system which has specially designed terminals and equipment for the loading and unloading of ships and the transporting, sorting, and storing of various containers. Indications are this is the type of transportation that will be in operation in the commercial shipping industry in the immediate time period and the near future. It provides advantages and some serious disadvantages for a role in providing transport for national defense emergencies. The facts are that these are the types of ships that are operational and soon will be in the NDRF as the industry changes and builds other modifications. The Department of Defense planners should think and plan positively
in adapting to this type cargo movement and quit bemoaning the shortage of the physically and economically obsolete break-bulk ship.

There are startling advantages of container versus conventional break-bulk operations for the military operator as well as the commercial carrier. Shipping companies have been quick to invest in various types of container ships. With a given container size for the same slot utilization aboard ship, total costs decline as ship size and speed increases. This has driven ship speed up to about twenty-five knots. Above this speed, twin screw propulsion is required and costs increase.6 This particular impact is favorable as it would apply in the field of military logistics.

All types of container ships will have to be used in a resupply phase in future emergencies. As container ships become more prevalent and a severe shortage of break-bulk ships exists for defense use, perhaps more will be known about how to take advantage of the intermodal container and its transport vehicles in satisfying military needs. The intermodal transportation system vehicles may include ships, trucks, railroads, aircraft and port handling equipment.

Aside from the cargo functions, an opportunity exists for adapting military requirements to utilize the containerization mode of transport for special purposes. Containers could be modified for use as barracks or berths for troop transport,
dining and galley spaces, command and communication centers, mobile power stations, repair shops and other support facilities. These standard containers may be rigged for liquid filled tanks, flat bed platforms, ammunition stowage and other adaptations while maintaining their overall dimensions. The trailer industry has made significant advances in this type service with portable classrooms, on site repair shops, power packages, food service, sanitary units and traveling libraries. 7

Marine units for defense use would be of standard size with corner fittings for handling. They would be furnished with all essential services such as electricity, lighting, refrigeration, water, etc., depending on the intended use.

Three major advantages quickly appear. Many ships will be compatible with the transport of these specialized containers which are devoted to defense needs, the container units may be lifted ashore by helicopter from ships underway, and of particular importance, the units may be returned to the U.S. after use in some overseas contingency.

Operational helicopters commonly found in the fleet can presently lift only loads of up to ten tons. Development contracts are in progress for a heavy-lift helicopter capable of lifting up to twenty-seven tons. 8 This helicopter will handle any container or military vehicle requiring short distance air lift.

The shipping strain brought on by the Vietnam conflict forced the Navy to experiment with shipping ammunition in
containers. Containers, loaded topside, subject to heavy weather encountered during the voyage removed all doubts as to the feasibility of shipping munitions in containers for fleet use. Perhaps data, experience and confidence gained in this exercise will encourage defense management to explore advantages of other types container delivery. Given the capability of heavy helicopter lift, containers may be used for routine supply and stores transfer at sea from commercial ships much like the civilian tanker refueling operations.

**LASH and SEABEE.** The development of Lighter Aboard Ship (LASH) and Sea Barge (SEABEE) carriers is a new departure in the handling of all types of cargos. The system offers possibilities to avoid the traditional problems of port congestion and shows promise for military application.

For the layman, the scene of a bustling port or harbor facility has been the traditional symbol of thriving seaborne trade. For the ship operators and the military commander, these scenes typify port congestion, delay, additional expense and loss of some alternatives to the military planner. The two barge carrying types of vessels, LASH and SEABEE, provide floating cargo holds which may be pre-stowed, ready to be loaded aboard the mother ship.

The floating holds which are barges or lighters, may be lifted aboard and discharged from the ship using the ship's own equipment. The basic difference between the two systems is the manner in which the ship loads and discharges the barges.
LASH uses an overhead traveling crane to handle her barges and SEABEE uses a submerged elevator to pick the barges out of the water and a horizontal rail system with self-powered dollies, called transporters to move the barges fore and aft.\textsuperscript{10}

Among the advantages of these systems is the ability of the mother ships to load and unload barges in roadsteads or estuaries, away from dock and piers. Marshalling barges at various locations within a port and then moving them by tugs out to deeper water eliminates the problem of harbors too shallow to accommodate deep draft ships.

This capability translates directly into advantages for use of these ships as military auxiliaries in the defense role. The barges may be loaded and sealed, towed to a marshalling site or dispersed for unloading at various locations without regard for the location of the mother ship.

The barges for both the LASH and SEABEE systems are compatible with the container mode of shipment. Containers may be placed in the barges or on top of the upper layer of barges when loaded aboard ship.\textsuperscript{11} All benefits discussed in the use of the full or partial container ship also apply to the barge systems.

Figure V and Table VI in Appendix II show the expansion in the trade routes and numbers of LASH ships expected to be operational in the near future. There is a two-fold benefit that should not be overlooked when considering the defense shipping problems. The commercial operators and seamen will be familiar
with a large amount of the world's ocean and ports. They will also have a considerable number of ships at their disposal. It is recognized that the commercial flow of goods cannot stop and let defense have all the shipping, however, there is a valuable contribution that this total LASH organization and others similar to it can make if properly utilized.

Defense planners should get their imaginations to work and coordinate with the commercial industry through all avenues possible in applying this new technology and operational experience to defense purposes when and if the need arises.

Future Shipping Trends. The need to transport an annually growing bulk of goods for more people is a basic assumption if conditions of living in the world are to follow the rising path which is the vague universal ideal. It seems that for the foreseeable future the ship will remain as the vehicle for the bulk of world trade.

The volume of shipping recorded and predicted for world trade is summarized in Table VII, Appendix II. It can be observed that as the population doubles, the shipping capacity will quadruple. The U.S. will have its fair share of the merchant marine required to carry this trade if the present mood for maritime affairs continues.

The benefits of marine transportation whatever its immediate political objective will be subject to rapid changes as a result of economic competition and the resulting constraints.
on ship configurations for high productivity. Innovations in the maritime industry and government are resulting in programs showing that a modern and efficient Merchant Marine can be built and maintained.

The Navy as the Department of Defense representative for the defense sealift requirement has the legislative requirement and the inroads for a truly working relationship with the maritime industry. It is now up to interested people in the organization to plan with the Maritime Administration, Department of Defense and the Federal Maritime Commission. No one should be caught by surprise in problems which may arise out of new systems such as the proposed rigid tug-barge system, the transitional container ship.

The tug-barge concept for ocean shipping has emerged which allows the propulsion plant and living quarters (the tug) to pick up and release barges (the ship) by fitting into a notch at the stern of the vessel. Savings in ship manning levels, dead time in port for the propulsion unit, and versatility for the operational and maintenance schedule of the tug units are envisioned. Are the defense officials coordinating with industry in order to make plans compatible with use of such equipment or to be even aware that problems may be emerging in the future should something like the rigid tug-barge tanker be alongside a destroyer for refueling?

Military logisticians are considering a multi-purpose vessel, the transitional container ship. This vessel would
be particularly well-suited to much of the MSC dry cargo shipment. It would have the ability to operate efficiently with break-bulk, pallets, unit lifts for containers or any combination. For commercial operators it would have the ability to switch trades from break-bulk or containers as the shipping rates changed. To be a real asset the ship must be worth chartering and competitive in a commercial trade.

Multi-purpose cargo vessels are operating in the British trade. A typical ship can carry 620 containers and bulk, lumber or cars. The ship has cranes, large hatches and collapsible tween decks for added flexibility.

One wonders if such a ship were constructed by the Department of Defense, would it have the advantage of having had the commercial shippers' input in the design? If there is a real need for shipping for defense purposes, recall it's only ready if operational, and it will be operational only if it is commercially competitive.
CHAPTER IV

SUMMARY AND CONCLUSIONS

The administration is well aware that policies and strategies more compatible with the realities of the U.S. strategic-geographic environment and the current challenge will require considerable adjustment. The low profile of the Nixon Doctrine, for example, visualizes a phase down of the U.S. military presence on Asian territory. As strength on land is phased down, the burden of presence and support for the area may be taken up only by somewhat comparable strength based at sea. This will also be true in other areas around the world.

With nearly three-quarters of the U.S. Merchant Marine and nearly half the U.S. Navy composed of ships twenty years of age or older, a strong justification for the construction of modern, efficient ships to replace old, inefficient vessels is logical.

U.S. geography and the compelling national survival problem clearly suggests that the national budget should emphasize sea forces. An understanding that seapower is a mix of naval, merchant, fishing, scientific fleets and the shore based training, building and repair facilities for their support is essential. The extent to which these forces successfully compete with other governmental activities and are guided by common supporting and cooperative policies will determine the quality of U.S. strength at sea for years to come.

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There is room for improved efficiency in the use of the resources devoted to all the agencies concerned with national defense and to seapower in particular. There is a growing demand to rethink and restructure administrative, organizational and practical operating relationships in order to maximize the amount and quality of defense received in return for investment.

With the advent of the nuclear age, a tendency developed to discard the traditional roles in matters of national defense and related areas. Adding to the difficulties of national security are the social programs in competition for a good share of the national budget. The problem, now and in the foreseeable future, is a simple one of cost in relation to the total federal budget.

Realism suggests that annual appropriations for naval construction and merchant shipbuilding will be something less than the documented requirements for defense and commercial interests. It is inconceivable that the U.S. will resort to allowing all U.S. exports and imports to be carried by the ships of other nations. It is also unlikely that the U.S. will depend on allied nations to protect U.S. shores and preserve U.S. interests at sea. Putting all these points together, one can see a slow but increasing level of activity in U.S. maritime industry.

Events have shown that rather than diminishing in importance, merchant ships have become more than ever a measure of
national security and economic well being. Other nations, notably the Soviet Union, have threatened to remove the U.S. as a leading seafaring nation. Until recently, it appeared they may succeed. The situation has changed with the adoption of the new ten year, three hundred ship construction program. This new fleet of ships can be utilized to a greater degree in support of this country if there can also be some degree of mutual support and coordination in the operation and employment of the naval and merchant fleets. New ideas in the employment, management, construction, capabilities and technical innovations in U.S. shipping invites the opportunity for improved and expanded roles for both military and commercial national maritime influence.

In addition to improving the national defense, the U.S. maritime fleet can, for the first time in decades, have a strong economic position in competition with foreign flag fleets. The U.S. stands to benefit both in terms of national defense and balance of payments.

Shipbuilding budgets have not been sufficient in recent decades to maintain and modernize the U.S. Navy. With the compelling need to modernize its aging combatant fleet, the Navy has now turned to the U.S. Merchant Marine to provide an increasing proportion of its logistic support. This is accepted as normal procedure in times of emergency. With some planning and understanding on the part of the merchant and naval leaders,
this program can be successful and could lead to a routine mode of operation for the U.S. merchant and naval fleets of the future. The Navy and Maritime Administration are presently conducting joint exercises to permit naval combatant ships to fuel at sea from a commercially manned tanker. If this concept proves successful the Department of Defense and Navy could be expected to provide additional support for merchant shipbuilding.

An adequate U.S. Merchant Marine will provide a large reservoir of ships, which could be converted quickly to military logistic support functions. Planning, training and operations together on a routine basis could only increase the effectiveness of joint Navy-Merchant Marine forces in a national emergency.

In addition to the routine logistic support, the Merchant Marine can provide forces for naval combat augmentation. Even if provided unlimited shipbuilding funds today, the Navy would find it impossible to build the additional combatant support ships needed to meet all naval requirements associated with a major emergency in the 1970's. The Navy would be compelled to turn to the Merchant Marine, as has been done in the past for the large number of various support capabilities needed to perform combat tasks.

The traditional role of the Merchant Marine's military support function is sealift. Sealift is the great bulk of all
the military supplies and equipment needed to sustain and operate military forces and installations overseas. New shipping technology such as barge carrying ships, full and partial container ships, rigid ocean tug-barge combinations in addition to the coordinated management and control innovations allowing these fleets to operate together in times other than national emergencies is a new breakthrough in maritime affairs. This coordination can directly enhance the potential of both fleets.

The more the Navy is accustomed to utilizing standard merchant shipping and merchant crews in peacetime training and support operations, the more efficient the combined role will be in a crisis. There is an agreement between the Secretary of Defense and the Secretary of Commerce which addresses this problem. It is recognized that the more the government agencies use the U.S. flag commercial fleet, the more they will encourage private investment in the additional merchant fleet capacity desired.

With the U.S. flag shipping carrying less than five percent of the volume of U.S. trade, it appears more needs to be done to strengthen knowledge and capacity for peaceful maritime competition. The expansion and competition of the Russian merchant marine and navy on all oceans has helped in justifying a new shipbuilding program.

For the foreseeable future, the Navy will have to depend on the support of existing merchant hulls as it shifts from
naval auxiliary vessels to merchant ship support. Aside from a basic military capability such as speed, damage control, communications, and hull fittings, these ships will be of commercial design. The Department of Defense and the U.S. Navy in particular will have to tailor its plans, stowage and usage to make the best use of what capability the commercial shipping industry has to offer.

In the containership trade, military equipment and stores will have to be adapted to accept the capability that presently exists and is expected to exist as the industry adapts to remain in competition. Concepts in utilizing the LASH and SEABEE vessels offer a challenge to the military planners. Along with the physical accommodation to blend the commercial carrier to military use, a central information system providing such data as routes, cargo and mission would give the national command authority a decided advantage in the event of mobilization of any scale. Once the naval and merchant fleets gain a feeling of real mutual support and respect for one another's role, the coordinated fleets should prove far more valuable than the sum total of independent capability.

Other seagoing industries such as the fishing fleet could be envisioned as a valuable asset in an expansion of the concept of a coordinated maritime plan to be utilized by the national authority in the growing international effort.

The future appears certain to be an era of rapid change and adaptation to new operational and logistic concepts. The
intermodal container and utilization of the merchant fleet on a peacetime basis will impact on every function in the management of naval resources. The concept of civilian and commercial support of operational naval forces can be extended to the manning of repair and depot ships at advanced bases or in continental U.S. home ports.

Eventually the naval fleet can be joined by hundreds of new and improved vessels of various types. The creation of a strong U.S. flag merchant fleet will make it possible to be free from dependence on foreign flag vessels for shipping. A stronger maritime position may be obtained through a development of integrated marine resources planning. The U.S. can be in a position to deliver commercial cargo to any point in the world or support any naval force using modern, compatible U.S. ships; merchant and naval in joint operations.

The door is open for innovations that will increase the efficiency of both the operational forces and the logistic support ashore. Hardware technology has provided many new tools and it remains for management technology to provide new operational tools. In this instance, efficiency, and increased productivity can result in a military-industry team effort in meeting the maritime challenge.
NOTES

Chapter I


12. Ibid.


21. Ibid.

22. Ibid., p. 42.


Chapter II


15. Ibid.


17. Ibid., p. 187.

Chapter III


BIBLIOGRAPHY


"MSC Delivers Ammo at Subic Bay in Containers for 7th Fleet." Sealift, September 1971, p. 8-9, 22.


APPENDIX I

STATEMENT OF THE

MINISTER OF WAR TRANSPORT
Excerpts from a personal letter from Lord Leathers, Minister of War Transport to the Imperial General Staff during World War II

... We are now embarking on a series of amphibious operations in which merchant ships, carrying troops and equipment actually sail into the battle line. Nor is this a temporary phase. Even after Germany is conquered there are bound to be innumerable combined operations throughout the Pacific and Indian Oceans. Merchant shipping has become a fourth service so far as major combined operations are concerned. This development makes it imperative that I and my Department should be more closely integrated with the joint military planning organization than has been the case in the past.

... The Joint Planning Staff is aware of the relation of shipping to strategy, but I am not convinced that those engaged in planning are equally alive to the needs of the situation. It is not only that we have not always been consulted, more often it is that we have been consulted too late. Plans are laid and decisions taken and we are asked to provide shipping to fit in with these plans. This we have usually been able to do but at an unnecessary sacrifice. If we had been present in the earlier stages of the planning, before the outlines crystallized or any decisions were taken, we would, I am certain often been able to suggest modifications, which while acceptable from the military angle, would still have effected a real economy of shipping. If we know in time there are all sorts of ways in which we can minimize the strain on our carrying capacity. We can work suitable ships into position. We can make modifications in the time-tables for meeting other demands. We can arrange to carry deck cargo or span deck tankers (which we specially provided in anticipation of needs - an example of what can be done by informed foresight). We can carry useful flattening or cut out ballast. There are innumerable permutations and commutations which would in their cumulative effect achieve a substantial saving in shipping ...

TABLE I

STATUS OF AMERICAN MERCHANT MARINE
1 FEBRUARY 1972

TOTAL U.S.-FLAG MERCHANT FLEET (1000 GROSS TONS AND OVER)

<table>
<thead>
<tr>
<th>Active</th>
<th>Passenger/Cargo</th>
<th>Freighter</th>
<th>Tanker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Privately Owned</td>
<td>11</td>
<td>376</td>
<td>226</td>
</tr>
<tr>
<td>Government Owned</td>
<td>--</td>
<td>17</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>393</td>
<td>229</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Under Construction</th>
<th>Passenger/Cargo</th>
<th>Freighter</th>
<th>Tanker</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Privately Owned</td>
<td>0</td>
<td>25*</td>
<td>17</td>
<td>15</td>
</tr>
<tr>
<td>Government Owned</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
<td>25*</td>
<td>17</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Undergoing Conversion</th>
<th>Passenger/Cargo</th>
<th>Freighter</th>
<th>Tanker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Privately Owned</td>
<td>0</td>
<td>14*</td>
<td>3</td>
</tr>
<tr>
<td>Government Owned</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
<td>14*</td>
<td>3</td>
</tr>
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</table>

Construction and Conversion Total - 74

*Containerships

### TABLE II

**U.S. CONTROLLED MERCHANT SHIPS**
*(1000 GROSS TONS AND OVER)*

<table>
<thead>
<tr>
<th>Merchant Type</th>
<th>Total No. Ships</th>
<th>U.S. Flag</th>
<th>Foreign Flag</th>
<th>NDRF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Cargo</td>
<td>899</td>
<td>409</td>
<td>116</td>
<td>316</td>
</tr>
<tr>
<td>Passenger/Cargo Transport</td>
<td>60</td>
<td>15</td>
<td>6</td>
<td>39</td>
</tr>
<tr>
<td>Tankers</td>
<td>588</td>
<td>265</td>
<td>288</td>
<td>35</td>
</tr>
<tr>
<td>Military Aux.</td>
<td>259</td>
<td>259</td>
<td></td>
<td>259</td>
</tr>
<tr>
<td><strong>Total (All Types)</strong></td>
<td><strong>1806</strong></td>
<td><strong>689</strong></td>
<td><strong>410</strong></td>
<td><strong>651</strong></td>
</tr>
</tbody>
</table>

U.S. Controlled Merchant Fleet consists of American flag vessels and selected U.S. owned vessels under flag of convenience registry. Foreign flag ships under "Effective U.S. Control" are provided War Risk Insurance from the U.S. Government.

Source: Military Sealift Command Data Sheet MSC-3C dated 29 February 1972. MSC Form 3110/6 (11-70).

II-2
<table>
<thead>
<tr>
<th>Date</th>
<th>Total Ships</th>
<th>Date</th>
<th>Total Ships</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>2277</td>
<td>1969</td>
<td>1017</td>
</tr>
<tr>
<td>1960</td>
<td>2000</td>
<td>1970</td>
<td>1027</td>
</tr>
<tr>
<td>1965</td>
<td>1594</td>
<td>1971</td>
<td>860</td>
</tr>
<tr>
<td>1968</td>
<td>1062</td>
<td>1972</td>
<td>651*</td>
</tr>
</tbody>
</table>


### TABLE IV

**SHIPBUILDING BUDGETS**

(Millions)

<table>
<thead>
<tr>
<th></th>
<th>FY-71</th>
<th>FY-72</th>
<th>FY-73</th>
</tr>
</thead>
<tbody>
<tr>
<td>Navy Shipbuilding</td>
<td>$2465.4</td>
<td>$3328.9</td>
<td>$3564.3</td>
</tr>
<tr>
<td>and Conversion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Navy Ship Repair and</td>
<td>750.0</td>
<td>856.0</td>
<td>920.0</td>
</tr>
<tr>
<td>Alteration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Merchant Ship</td>
<td>187.5</td>
<td>229.7</td>
<td>250.0</td>
</tr>
<tr>
<td>Construction</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** "Shipwork in FY-73 Budget Nearly $5 Billion," *Shipyard Weekly* (Washington: Shipbuilding Council of America, 3 February 1972, p. 1.)
A LASH trade route, linking major world ports has been established. The 22 LASH ships operated or on order will serve ports in North America, South America, Europe, Asia, Africa and Australia.

Establishment of this worldwide LASH service offers greater benefits for shippers and operators because the standard dimensions of LASH lighters permit efficient interchange from ship to ship and trade route to trade route.

**TABLE VI**

**LIGHTER ABOARD SHIP (LASH) GROWTH CHART**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Ships (operating or on order)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1969</td>
<td>1</td>
</tr>
<tr>
<td>1970</td>
<td>4</td>
</tr>
<tr>
<td>1971</td>
<td>8</td>
</tr>
<tr>
<td>1972</td>
<td>15</td>
</tr>
<tr>
<td>1973</td>
<td>19</td>
</tr>
<tr>
<td>1974</td>
<td>24</td>
</tr>
</tbody>
</table>

**TABLE VII**

**WORLD SHIPPING CAPACITY AND WORLD POPULATION**

<table>
<thead>
<tr>
<th>Year</th>
<th>Shipping Capacity (1000's gross tons)</th>
<th>World Population (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1939</td>
<td>61</td>
<td>2000</td>
</tr>
<tr>
<td>1958</td>
<td>114</td>
<td>2800</td>
</tr>
<tr>
<td>1965</td>
<td>154</td>
<td>3000</td>
</tr>
<tr>
<td>1984</td>
<td>244 ?</td>
<td>4000</td>
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