



COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

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B-133170

March 15, 1978

The Honorable John C. Stennis
Chairman, Committee on Armed Services
United States Senate

Dear Mr. Chairman:

This is an interim response to the interest displayed by your staff in our ongoing work on the Navy's ship maintenance program.

We reported on how the Navy's intermediate ship maintenance program could be improved (LCD-77-412, September 23, 1977), and have discussed with your staff our work on naval shipyard operations which is scheduled to be issued as a report to the Congress in the near future. We also discussed possible additional efforts involving the Navy's ship maintenance program.

Your staff informed us that it would be helpful to them if we could provide (1) an assessment of the baseline data the Department of Defense plans to use in its report to the Congress on relating material readiness requirements for ships to resource needs and (2) a description and comparison of Navy and commercial ship maintenance strategies.

We found that the state-of-the-art in defining, measuring, and reporting readiness is in a state of flux. Improvements have been made, and further actions are underway; however, since these actions will not be completed in the near future, the Department of Defense plans to rely on material readiness measurement systems currently in place to satisfy the requirements of the 1978 Defense Appropriation Authorization Act. On the basis of previous GAO reports concerning readiness, we believe that the data developed by the Navy on ship material readiness do not meet the requirements set forth in the Authorization Act (Enclosure I contains more detailed information which was also discussed with your staff on February 17, 1978).

With regard to ship maintenance strategies, we found that there is no adequate material readiness reporting system or an overall measure of material condition for ships; therefore, it is not possible to precisely evaluate the effects of differing maintenance strategies and the concomitant impacts on maintenance costs and performance of operating ships, subsystems, and components. (See Enclosure II for details).

In the coming months, we plan to gather costs incurred by the Navy to maintain selected support ships over a number of years and compare these costs to the costs incurred by commercial shipping companies to maintain their fleets. We also plan to obtain costs and performance data for key ship systems and shipboard components for different ship classes which may provide a basis against which future cost and performance information could be compared. We will keep you apprised of these efforts.

Sincerely yours,


Deputy Comptroller General
of the United States

Enclosures - 2

ENCLOSURE I

READINESS--ITS RELATIONSHIP TO MAINTENANCE

For the past several years, Defense funding for readiness has been subjected to increased scrutiny by the Congress. Operation and maintenance costs are considered to be areas where some flexibility and potential for cost reductions exists. Thus, there have been greater demands from the Congress for justification of the operation and maintenance budget requests for activities affecting readiness. A completely satisfactory justification has been difficult because of the Department of Defense's inability to analytically link resource to readiness levels.

Recent congressional action on Defense's fiscal year 1978 appropriation request emphasized the need for Defense to be able to more closely relate resources to the costs thereof. More specifically, the Senate and House Armed Services Committees placed the following requirements in the 1978 Department of Defense Appropriation Authorization Act.

"Sec. 812. The Secretary of Defense shall submit to the Committees on Armed Services of the Senate and House of Representatives, not later than February 15, 1978, a report setting forth quantifiable and measurable materiel readiness requirements for the Armed Forces, including the Reserve components thereof, the monthly readiness status of the Armed Forces, including the reserve components thereof, during fiscal year 1977, and any changes in such requirements and status projected for fiscal years 1978 and 1979 and in the five-year defense program. The Secretary of Defense shall also inform such committees of any subsequent changes in the aforementioned materiel readiness requirements and the reasons for such changes. The budget for the Department of Defense submitted to the Congress for fiscal year 1979 and subsequent fiscal years shall include data projecting the effect of the appropriations requested for materiel readiness requirements."

During the hearings on this act, the Secretary of Defense stated that a detailed report on the materiel readiness of the Armed Forces was beyond the capability of the existing readiness reporting and measurement systems.

Subsequent to passage of the Defense Appropriation Authorization Act on July 30, 1977, the Secretary of Defense issued, on November 2, 1977, a memorandum to the Armed Services which established a DOD Management Steering Group to prepare the initial readiness report to the Congress and to develop a comprehensive long-range plan of action that would

- insure that DOD has meaningful and consistent measures of force readiness and the factors contributing thereto, including both materiel and personnel readiness;
- provide for periodic measurement and reporting of that readiness as necessary;
- develop the analytic tools necessary to relate resource inputs to resulting readiness;
- provide for tracking and projection of resource inputs necessary for these analyses, including the relevant weapon system operating and support costs;
- identify and recommend mechanisms to improve DOD's control over the application of resources that influence force readiness; and
- identify any changes in service management or organization that would enhance DOD's capability to assess and manage the readiness of its combat forces.

According to a DOD official, this steering group met once and established a report preparation working group which was tasked with the preparation of the initial readiness report to the Congress. Guidance given to the services by this group specifies that, for the selected weapon systems, material readiness indicators should be used which were in use by the services in October 1976. Efforts to date have concentrated on the initial readiness report to the Congress. DOD will begin to develop a long-range plan which will ultimately result in a detailed material readiness report to the Armed Services Committees.

On February 24, 1978, we received information on the data DOD had submitted to the Congress on Navy ships. It showed that for ship material readiness, DOD used data contained in the Navy's Force Status Reporting System (NAVFORSTAT) to satisfy the requirements set forth in the 1978 Defense Appropriation Authorization Act. Based on previous GAO reports dealing with the NAVFORSTAT System, we believe that this data will not meet the requirements specified in the Act.

If the Navy is to evaluate applications of funds to readiness, however, some better measure is required. We believe an overall material condition indicator might be the most readily available proxy measure.

MEASURES IN USE

The Navy currently has no overall material condition indicator. However, various indicators of material conditions do exist. These include:

- The Consolidated Casualty Reporting System - a system for reporting shipboard equipment failures where the effect of the failures infringes on the reporting unit's ability to perform its assigned mission(s).
- Board of Inspection and Survey - periodic inspections of the condition of shipboard equipments.
- Pre-Overhaul Test and Inspection - an inspection prior to overhaul to identify needed repairs.
- Propulsion Examining Board - periodic inspections of the condition of propulsion systems.

Each of these systems was developed to meet specific needs. Navy studies indicate that each system has advantages; however, there are drawbacks that detract from their usefulness as a single materiel condition indicator. For example, a 1976 Aeronautical Radio Research Corporation study concluded that the Consolidated Casualty Reporting Systems should not be used alone to measure the effect of ship overhaul on material condition because

casualty reports are special events, influenced by many factors other than material condition, e.g., area of operations. In addition, it was found that the method of casualty reporting is inconsistent and may even be used as a way to justify additional supply support.

Various past Navy studies have suggested numerous alternatives for measuring the overall material condition of ships. The studies continue. The Navy is currently engaged in a multi-million dollar program to improve its maintenance strategies and institutions, including readiness and material condition measuring systems, but full results appear years away.

ENCLOSURE II

A COMPARISON OF NAVY AND COMMERCIALSHIP MAINTENANCE STRATEGIES

The Navy spends a tremendous amount of money and effort keeping ships up-to-date and combat ready. The rapid rate at which maintenance costs have increased while the number of ships has decreased has been a major concern to the Congress as well as the Navy. In fiscal year 1972, the Navy spent about \$1.4 billion to maintain and modernize a fleet of 654 ships. In fiscal year 1978, the cost of maintaining and modernizing ships is estimated to increase to about \$3.0 billion, while the fleet is expected to decrease to 462 ships. About half of the fiscal year 1978 expenditures are scheduled for overhauling ships. As a result of these rising costs, the Navy is faced with determining if there are less costly maintenance strategies which could be used while at the same time assuring the desired level of fleet readiness.

The allocation of resources to the retention and restoration of effectiveness of a ship ideally should be based upon measures involving her ability to enter combat, to fight effectively, and to survive. As discussed in Enclosure I, the Navy is currently unable to measure material readiness for ships in a form which is useful for the allocation of funds.

Although the necessary readiness measurement system is not available for selecting the best strategy, certain commercial maintenance practices are being adopted by the Department of Defense. For example, the Navy, for certain of its aircraft, adopted a commercial maintenance concept. Similarly, the adoption of certain commercial ship maintenance practices to Navy ships that closely correspond to commercial equivalents, such as tankers, cargo ships, etc., may offer opportunities to reduce maintenance costs while still maintaining the same level of readiness.

The following sections deal with alternative ship maintenance strategies. It will be seen that commercial ship operators and the Navy have different maintenance philosophies: commercial operators repair as needed, but seldom overhaul ships, while the Navy frequently overhauls ships to maintain a high state of readiness.

NAVY MAINTENANCE STRATEGY

The Navy uses a cyclic, three-echelon maintenance strategy 1/. The present Navy policy on ship overhaul, OPNAVINST 4700.7E, states that "regular overhauls shall be planned to provide for accomplishment of all outstanding repairs and major maintenance necessary to insure reasonably reliable material readiness and succeeding operations during the operational cycle."

In addition to planned overhauls, ships undergo periodic repairs called restricted and technical availabilities.

Ships are scheduled for overhaul in accordance with an established timeframe. Certain classes of ships are overhauled as frequently as every 3 years, while other classes may operate up to 10 years between overhauls. According to the Navy, overhaul durations and frequency is based upon technical information, engineering judgment, operating experience, and modernization requirements. Navy officials have stated that these factors are regularly being analyzed and restudied from operational, material, and design standpoints to determine if a change is required. For example, the Navy recently completed work on a program involving nuclear ballistic missile submarines which changed the overhaul duration and frequency from 14 and 72 months, respectively, to 16 to 120 months. Similar analyses are currently being conducted for destroyers.

1/ Ship maintenance is performed at organizational, intermediate, and depot level. Organizational-level maintenance consists of shipboard maintenance and is accomplished by crewmen. Intermediate maintenance, performed by tenders, repair ships, and Fleet Maintenance Assistance Groups, is also accomplished by Navy personnel. Depot maintenance, performed at shipyards, is accomplished primarily by civilians. Basic Navy ship maintenance policy is to do ship maintenance work at the lowest practical and effective level.

The following table shows selected overhaul operating cycles used by the Navy in planning overhaul schedules since 1962. Aircraft carriers, for example, are currently overhauled every 4 years, and the overhaul normally lasts 9 months. The actual overhaul duration may vary depending upon the amount and scope of industrial work and overhaul activity workload. Further, the operating time will also vary depending on operational commitments, homeport policy, and shipyard availability.

SHIP OVERHAUL DURATION/OPERATING CYCLES

<u>TYPES</u>	<u>1962</u>	<u>1967</u>	<u>1970</u>	<u>1977</u>
CVA Attack Aircraft Carrier	4/32(4/28)*	6/35	9/48	9/48
DLG Guided Missile Frigates	3/33(3/24)*	4/37	4/37	9/54
SSBN Fleet Ballistic Missile Submarines	8/32	8/32	13/60	a/
LKA/LPA/LSD Amphibious Cargo Ships/Amphibious Transports/ Dock Landing Ships	2/24(2/34)*	3/33	4/40	5/40
LST Tank Landing Ships	2/21	3/37	4/44	4/44
AD/AS Destroyer Tender/ Submarine Tender	2/23	3/48	3/48	5/48
AE Ammunition Ships	2.5/24	3/37	4/48	5/48
AO Oilers	3/24	3/27	4/48	5/48
AR Repair Ships	3/33	3/48	3.5/48	4/48
ASR Submarine Rescue Ships	3/30	3/37	3/37	4/37
ATF Fleet Ocean Tugs	2/20(2.5/24)*	2/30	3/37	3/37

*() INDICATES DIFFERENT CYCLE FOR CINCPAC SHIPS

4/32 = 4-month-long overhaul every 32 months.

a/ For Polaris submarines the figures are 14/72. For Poseidon submarines, they are 16/120.

Budgeting constraints and operating commitments have forced departures from current periodic policy by increasing intervals between overhauls. In fact, currently, there are 40 ships exceeding the prescribed cycle 1/.

Planning for overhaul and repairs

The Navy's planning for overhaul and repairs has evolved into a complex process that constantly involves balancing funds and work requirements in an ever-changing environment, and insuring that long lead time, special order materiel is available for the overhaul. Planning for repairs begins approximately 18 months before the overhaul with inspections, updating the ship's computerized list of deferred maintenance projects, the Current Ship Maintenance Project. Navy specialists plan the overhaul with assists from commercial planning companies.

A Pre-Overhaul Test and Inspection is used to identify the repairs required during the overhaul. This inspection is often scheduled at sea where ship operations take priority. The inspectors consider whether equipment is likely to operate without failure until the next overhaul years later. Inspectors may recommend that repair be accomplished on machinery that is already operating at design capacity. For example, on one overhaul package, we found that, although 11 main feed pumps met specific Navy performance criteria, one was still recommended for extensive repairs. The written equipment deficiencies and repair recommendations are assembled into a Ship Alteration and Repair Package that identifies the work to be accomplished during the overhaul. This document provides the basis for estimating the overhaul cost.

A Work Definition Conference is held approximately 4 to 6 months before the start of the overhaul and is the single most important pre-overhaul planning event. It is normally conducted aboard ship and includes representatives of the type commander, planning activities, and key members of the ship's force. At this time, the Ship Alteration and Repair Package is finalized and a decision is made as to the amount of work to be done by the ship's force, the shipyard, or to be deferred to future smaller overhauls due to lack of funds.

1/ Commonly referred to as maintenance backlog.

COMMERCIAL SHIP MAINTENANCE STRATEGY

Commercial shipping firms are using a maintenance strategy that minimizes the time support ships such as tankers or cargo ships spend in shipyards for maintenance and repairs.

Commercial shipping firms accomplish ship maintenance and repairs that can be placed into two broad categories--voyage repairs and non-voyage repairs. Voyage repairs are those performed while the ship is underway or at dockside while handling cargo. Non-voyage repairs are those accomplished in a shipyard during which time the ship is not available to haul cargo.

The policy of the commercial firms is to bring a ship into a shipyard for non-voyage repairs every 2 years for a period of 5 to 7 days. During this period, this ship is drydocked. Two factors drive this policy:

- (1) The American Bureau of Shipping (ABS) requires a biennial survey that necessitates drydocking the ship, and
- (2) The ship's hull normally requires biennial preservation maintenance that also necessitates drydocking.

Maintenance and repairs are, to the extent practical, performed during drydocking, periods of cargo loading and unloading, and while the ship is underway. To illustrate how little time commercial ships are drydocked, we reviewed the voyage history file for a 16 year old cargo ship and found that during this period it had been drydocked 10 times and was unavailable for operations only 71 days.

During this phase of our work, we did not obtain sufficient cost and performance data to make a valid comparison between Navy and commercial maintenance strategies for the different types of support ships, i.e., tankers, cargo ships, etc. In the next phase of our work, we plan to obtain cost and performance data to make such a comparison.