DOCUMENT RESUME

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The Navy's Ship Support Improvement Project. LCD-78-433; B-133170. September 12, 1978. 50 pp. + 3 appendices (6 pp.).

Report to Rep. George H. Mahon, Chairman, House Committee on Appropriations; by Elmer B. Staats, Comptroller General.

Issue Area: Facilities and Material Management (700).
Contact: Logistics and Communications Div.
Budget Function: National Defense: Department of Defense - Military (except procurement & contracts) (051).
Organization Concerned: Department of Defense; Department of the Navy.
Congressional Relevance: House Committee on Armed Services; Senate Committee on Armed Services. Rep. George H. Mahon.

The Navy's Ship Support Improvement Project is designed to analyze and develop a maintenance system for all Navy surface ship classes. Concepts are being developed to bring about an early improvement in the ships' material condition, extend the operational use of ships, and improve material readiness. The project encompasses four major programs: Guided Missile Frigate Class Support, Engineered Operating Cycles, Intermediate Maintenance Activity Upgrade, and Maintenance System Development. The total cost of the project for fiscal years 1977 to 1983 is an estimated $644 million. Findings/Conclusions: The Guided Missile Frigate Class Support program calls for small crews, modular replacement-type repairs, and progressive overhauls. Potential problem areas that could affect the success of the program include: the data base, a new supply support concept, and adherence to the class maintenance plan. The Engineered Operating Cycle Program is intended to extend the interval between major ship overhauls. Problem areas for this program also involve the data base on which new maintenance and logistics concepts are based. Modernization and improvement activities of shore and afloat intermediate maintenance activities may be premature for the following reasons: intermediate-level maintenance workload needs to be more accurately defined; the Navy needs to determine the most effective way to satisfy intermediate-level workloads; and the impact of changing Navy maintenance concepts needs to be more fully evaluated. It is premature to draw any firm conclusions with regard to the Maintenance System Development Program since it is in the earliest stages. Recommendations: In view of current Navy efforts to obtain funds to upgrade and improve intermediate-level maintenance facilities, the House Appropriations Committee should require the Navy to provide specific evidence demonstrating the need for such facilities. The committee should also require the Navy to report periodically on the results of the various program studies and their implementation status and, if they are not implemented, to explain why. (RRS)

7624

REPORT BY THE

Comptroller General

OF THE UNITED STATES

The Navy's Ship Support Improvement Project

The Navy is currently engaged in a comprehensive, long-term effort to review its ship maintenance strategies, requirements, and resources for all classes of surface ships. Called the Ship Support Improvement Project, the purpose is to develop an overall, integrated ship maintenance system to improve the material condition of ships.

This report to the House Committee on Appropriations gives some insight on the Navy's approach to the $644 million project and identifies several potential problem areas which, unless closely watched, could affect the success of the project. The report also identifies specific project areas where the Navy has not done sufficient work to justify current budget requests.

LCD-78-433
SEPTEMBER 12, 1978

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

B-133170

The Honorable George H. Mahon
Chairman, Committee on Appropriations
House of Representatives

Dear Mr. Chairman:

This report is in response to your October 19, 1977, letter in which you requested information on the Navy's comprehensive effort to improve the material condition of its surface ships by developing an overall, integrated ship maintenance system and an associated contract. Our report points out that although the development of an integrated ship maintenance system is in its early stages, there are several potential problem areas which require close monitoring to assure the success of the effort. One area aimed at modernizing intermediate maintenance facilities has not received adequate analyses to justify proposed expenditures.

As you requested, we did not obtain written comments from the Navy. However, we did discuss matters contained in the report with Navy and contractor officials and their comments have been incorporated where appropriate.

As arranged with your office, copies of this report are being sent to the House Committees on Armed Services and Government Operations and to the Senate Committees on Appropriations, Armed Services, and Governmental Affairs. Copies are also being sent to the Director of the Office of Management and Budget and to the Departments of Defense and the Navy. Copies will be available to other interested parties who request them.

Sincerely yours,

Comptroller General
of the United States

E R R A T A

To the recipients of the Comptroller General's report to the House Committee on Appropriations entitled "The Navy's Ship Support Improvement Project" (LCD-78-433):

At the bottom of page 22, following the word "acceptable," insert:

"level of material condition; that is, a material condition standard for each maintenance critical ship system or piece"

COMPTROLLER GENERAL'S
REPORT TO
THE COMMITTEE ON APPROPRIATIONS
HOUSE OF REPRESENTATIVES

THE NAVY'S SHIP SUPPORT IMPROVEMENT PROJECT

D I G E S T

The objective of the Navy's ship maintenance and modernization program is to sustain enough ships in good condition to meet current requirements.

To carry out this objective, the Navy has adopted a periodic, multilevel approach to ship maintenance which, depending on the type and complexity of the work, places responsibility at three different levels--organizational, intermediate, and depot. In fiscal year 1977 the Navy spent about $3.3 billion at these three levels to maintain and modernize its fleet.

The House Committee on Appropriations was concerned about the size of the Navy's ship maintenance and modernization program and wanted to see if alternate, more cost-effective ways could be found to adequately maintain Navy ships.

The Committee was interested specifically in obtaining information on an ongoing, four-part Navy effort, called the Ship Support Improvement Project, which is designed to develop an overall, integrated ship maintenance system to improve ship material condition.

The Committee also requested specific information on the Navy's selection and use of a contractor--American Management Systems, Inc.--to do the work on one part of the project, called the Maintenance System Development Program.

THE SHIP SUPPORT IMPROVEMENT PROJECT

The Ship Support Improvement Project is designed to analyze and develop a maintenance system for all Navy surface ship classes. Concepts are being developed to (1) bring about an early improvement in the ships' material condition, (2) extend the operational use of ships, and (3) improve material readiness. The project encompasses four major programs: Guided

Missile Frigate Class Support, Engineered Operating Cycles, Intermediate Maintenance Activity Upgrade, and Maintenance System Development. The total cost of the project for fiscal years 1977 to 1983 is estimated to be about $614 million.

The Guided Missile Frigate Class Support program calls for small crews, modular replacement-type repairs, and progressive overhauls. The program is intended to provide operating intervals of about 10 years between major ship overhauls and modernizations. Periodically during the 10 years, the ships have scheduled maintenance performed at Intermediate Maintenance Activities and at shipyards to maintain the ship at an acceptable level of material condition. (See pp. 10 & 11.)

Although it is too early to reach any firm conclusions regarding the effectiveness of the program, GAO identified several potential problem areas which, unless closely monitored, could affect the success of the program. GAO noted that:

--The data base on which several of the new logistics concepts are based and which will be used to evaluate program effectiveness is inaccurate and unreliable. However, the Navy is currently undertaking steps to improve this situation. (See p. 12.)

--A new supply support concept which the Navy considers critical to the success of the new logistics concept must be carefully implemented and monitored to ensure that previously identified material visibility and control problems are eliminated. (See pp. 13 to 15.)

--Close adherence to the class maintenance plan, which is considered essential, will require close and high-level monitoring to ensure that prescribed maintenance schedules are met. (See pp. 15 to 16.)

The second element of the project, the Engineered Operating Cycle program, is also intended to extend the interval between major ship overhauls of several different classes of surface ships. The program involves (1) the development of maintenance requirements based on an engineered review of past performance, (2) a baseline overhaul to each ship, if required, that restores it to a "like new" condition,

and (3) a class maintenance plan which identifies what and when maintenance on ship systems and equipment is to be performed during brief, periodic, restorative actions at intermediate maintenance activities or shipyards. (See p. 16.)

For this program, GAO noted potential problems similar to those described in the Guided Missile Frigate Class Support program. Again, the data systems, on which the new maintenance and logistics concepts contained in the program are based, are of questionable accuracy and reliability. Also, close adherence to the class maintenance plan is essential. Finally, the Navy is implementing the program without having clearly defined what is the current level of material condition of ships in the program, what should it be, and how it is to be maintained. (See pp. 20 to 23.)

The Intermediate Maintenance Activity Upgrade program resulted primarily from an increased intermediate maintenance workload expected to result from the Guided Missile Frigate and Engineered Operating Cycle programs. The program encompasses (1) a modernization and improvement program of shore and afloat intermediate maintenance activities, (2) Navy initiatives to better train its intermediate-level maintenance personnel, (3) studies assessing the need for automated test equipment to detect malfunctions in electronic components, and (4) an experimental program to contract out excess intermediate work to private industry. (See p. 24.)

GAO believes that based on the following observations and on its recent work in this area, 1/ the modernization and improvement program of shore and afloat intermediate maintenance activities may be premature.

--Intermediate-level maintenance workload needs to be more accurately defined. Current workload projections are based on questionable data and are probably overstated. (See pp. 25 to 27.)

1/"The Navy's Intermediate Ship Maintenance Program Can Be Improved" (LCD-77-412, Sept. 23, 1977).

--The Navy needs to determine the most effective way to satisfy its intermediate-level maintenance workloads; that is, how much should be mobile and how much should be shore-based. (See p. 31.)

--The impact of changing Navy maintenance concepts needs to be more fully evaluated since it directly affects what work will have to be done during mobilization and in peacetime. Therefore, expansion of capability and capacity should follow only after the needs are clearly defined. (See p. 32.)

The fourth element of the Ship Support Improvement Project is the Maintenance System Development Program. This program is a long-term study and implementation effort where fundamental changes in the way ship maintenance is accomplished and controlled are being addressed. (See pp. 34 to 42.)

Because the work on the Maintenance System Development Program is only in its early stages, it would be premature to draw any firm conclusions on whether the program will result in an improved ship maintenance strategy. This will depend on the (1) scope of the studies, (2) accuracy of the data used in the studies, (3) reasonableness of proposals generated by the studies in the program, (4) Navy's acceptance of the various proposals, and (5) extent to which the Navy will implement accepted proposals. Presently, only a few studies are in the implementation stage. (See pp. 42 to 43.)

MAINTENANCE SYSTEM DEVELOPMENT PROGRAM CONTRACT

The Navy had three alternatives available to do the Maintenance System Development Program work. It could either contract out the entire effort; do the entire effort in-house; or do a combination of both. Without fully evaluating these alternatives, the Navy chose to contract out the entire effort. (See pp. 44 to 45.)

The prime contractor selected, American Management Systems, Inc., was one of eighteen firms which submitted technical and cost proposals for the program work. Although the contractor's cost proposal was

among the highest submitted, the Navy ultimately chose it because of its technical proposal. (See pp. 45 to 47.)

The original contract was awarded in fiscal year 1976. Since then, two annual contracts have been awarded to the same contractor on a sole-source basis. (See p. 47.)

Work-force capability was considered a prime factor in contractor selection. A brief analysis of contractor staff qualifications and a comparison of current staff capability with that included in the original proposal showed that staff qualifications were adequate and staff capability had not diminished. (See pp. 47 to 49.)

RECOMMENDATIONS TO THE COMMITTEE

GAO's recent report on the Navy's intermediate maintenance program included several observations and recommendations on issues such as (1) work requirements' definition and quantification, (2) alternatives to satisfying work requirements, and (3) impact of changing maintenance concepts on intermediate-level maintenance needs. The Navy generally concurred and promised corrective action.

Although some progress has been made, GAO believes that the Navy still needs better information on and analyses of the above issues before it can establish what type and how much intermediate-level maintenance capability is needed. In view of current Navy efforts to obtain funds to upgrade and improve intermediate-level maintenance facilities, GAO recommends that before acting on future requests for funds the Committee require the Navy to provide specific evidence which clearly demonstrates the need for such facilities. (See p. 33.)

Also, since the cost of the Maintenance System Development Program is substantial and the results of the program could lead to permanent changes in the Navy's ship maintenance system, the Committee should require the Navy to periodically report on the results of these various Program studies and their implementation status, and, if they are not implemented, to explain why. (See p. 43.)

AGENCY COMMENTS

At the instruction of the Subcommittee on Defense, House Committee on Appropriations, GAO did not solicit official written comments from the Departments of Defense and the Navy. However, matters contained in the report were discussed with Navy officials and their comments were incorporated where appropriate.

Contents

ABBREVIATIONS

AMS	American Management Systems, Inc.
CASREPT	Consolidated Casualty Reporting System
DCAA	Defense Contract Audit Agency
DDEOC	Destroyer Engineered Operating Cycle Program
DOD	Department of Defense
EOC	Engineered Operating Cycle
FFG	Guided Missile Frigate
FORSTAT	Force Status Reporting System
GAO	General Accounting Office
IMA	Intermediate Maintenance Activity
INSURV	Board of Inspection and Survey
LSA	Logistics Support Analysis
MSDP	Maintenance System Development Program
PEB	Propulsion Examining Board
POT&I	Pre-Overhaul Test and Inspection
SQIP	Shop qualification improvement program
SSIP	Ship Support Improvement Project
3-M	Maintenance and materiel management system

CHAPTER 1

INTRODUCTION

The objective of the Navy's multibillion dollar ship maintenance and modernization program is to sustain enough ships in good condition to meet current requirements.

To do this, the Navy has adopted a periodic, multi-level approach to accomplishing ship maintenance requirements which, depending on the type and complexity of work, places responsibility at three different levels.

--Organizational-level maintenance is normally the responsibility of ships' crewmembers. Tasks performed at this level include inspecting, servicing, and lubricating equipment.

--Intermediate-level maintenance is done by designated intermediate maintenance activities (IMAs) for direct support of the fleet. Assigned work includes calibrating, repairing, or replacing damaged or unserviceable parts, components, or assemblies; modifying material; and providing technical assistance to ship maintenance personnel.

--Depot-level maintenance is done by shipyards and other designated industrial-type activities. These activities are generally responsible for making major ship overhauls, conversions, modifications, and repairs to end-items and components.

At the end of fiscal year 1978, the Navy is expected to have an inventory of about 452 ships. This inventory includes aircraft carriers, cruisers, destroyers, frigates, submarines, and various combat support ships, such as oilers and ammunition ships. In fiscal year 1977 the Navy spent about $3.3 billion at the organizational, intermediate, and depot maintenance levels to maintain and modernize its ships.

Over 60 percent of the total ship maintenance and modernization expenditures are for standard depot-level maintenance. In fiscal year 1977 the depot program was about $2.1 billion. About 70 percent of this budget is used in naval shipyard facilities and about 30 percent is to pay for contracting with private industry for depot-level ship maintenance.

The House Committee on Appropriations was concerned about the size of the Navy's ship maintenance and modernization program, and wanted to see if alternate, more cost-effective ways could be found for maintaining and modernizing ships.

The Committee was aware of an ongoing, four-phased Navy effort, called the Ship Support Improvement Project (SSIP), which was designed to develop a better strategy for maintaining and modernizing Navy ships. The Committee was interested in obtaining information on this effort. Furthermore, the Committee requested information on the Navy's basis for selecting one company--American Management Systems, Inc. (AMS) --as the prime contractor for one part of the project, the Maintenance Systems Development Program (MSDP).

In addition, the Committee asked us to compare Navy and commercial shipping firm maintenance practices for support ships, such as tankers and cargo ships, and to provide comparative cost data on those ships.

On May 2, 1978, we provided a comprehensive briefing to Committee staff on SSIP and on the contractor selection process. Specific areas discussed included (1) major objectives of the project, (2) Navy plans to achieve these objectives, (3) current status of Navy efforts and future plans, (4) contractual data, and (5) our preliminary observations. Included in this report are the matters discussed at that time. Our work on Navy and commercial ship maintenance practices will be discussed in a separate report.

SCOPE OF REVIEW

We interviewed and obtained documents from Navy and Navy contractor officials. Following is a list of primary locations in our review.

--Headquarters, U.S. Navy, the Pentagon.

--Commander-in-Chief, Atlantic Fleet, Norfolk, Virginia.

--Naval Sea Systems Command, Arlington, Virginia.

--Planning and Engineering for Repair and Alterations Office for Amphibious Ships and Craft, Norfolk, Virginia.

--Defense Contract Audit Agency, Alexandria, Virginia.

--American Management Systems, Inc., Rosslyn, Virginia.

CHAPTER 2

THE SHIP SUPPORT IMPROVEMENT PROJECT

The Navy is engaged in a comprehensive, long-term effort to review its ship maintenance strategies, requirements, and resources for all classes of surface ships. The purpose of the effort, referred to by the Navy as the Ship Support Improvement Project, is to develop an overall, integrated ship maintenance system to improve and maintain ship material condition.

EVOLUTION OF THE PROJECT

The driving factor behind the establishment of SSIP was the Department of Defense's (DOD's) and the Navy's long-standing concern over the material condition of its fleet of surface ships. It was recognized that, although Navy ships were receiving "thorough" overhauls since 1968, performance of the Navy's intermediate and organizational maintenance levels was not adequate to maintain the ships during its operating cycle and resulted in an inadequate material condition, especially on surface ships. 1/

In recognition of these problems, the Chief of Naval Operations established as a major Navy priority the development of "* * * a comprehensive program to promote an early improvement in the fleet's material condition." SSIP was established as the main, long-term initiative associated with this objective.

The project started in February 1974, when the Secretary of Defense and the Navy jointly determined a need to develop an integrated, engineered, reliability-centered ship maintenance strategy. Concept development and engineering funds to carry out that task were granted in July 1975.

In December 1974, the Chief of Navy Operations designated the project a major project because of its technical complexities and high-level interest, and merged the project with other ongoing Navy programs dealing with material condition, such as the Engineered Operating Cycle (EOC) program

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1/See app. I for a discussion of some of the "long-standing ship maintenance problems" recognized in the Navy. The appendix discussion is excerpted from the Navy's fiscal year 1977 Program Objective Memorandum.

the Intermediate Maintenance Activity Upgrade program, and the Guided Missile Frigate (FFG-7) Class Support program. The organizational plan for the project was referred to as "RED E" and later retitled the Maintenance System Development Program. PMS-306, located in the Naval Sea Systems Command, was assigned as the project office. It is responsible for the planning and development effort associated with the four programs.

PROJECT GOALS AND OBJECTIVES

The goal of SSIP, as currently defined, is to develop an overall, integrated ship maintenance system to improve and maintain ship material condition. The project is expected to improve the Navy's understanding and actual performance of all aspects of ship maintenance, from requirements definition through facilities improvements. The effort recognizes ship maintenance throughout the life cycle of ships. The objectives of the project are to:

--Clarify and refine the Navy's current ship maintenance policy.

--Integrate and coordinate other Navy ship maintenance programs.

--Provide support for classes of ships designated for new Engineered Operating Cycles.

--Engineer improvements to existing techniques, methods, and facilities.

The goals and objectives of the project will be accomplished via four separate yet interrelated efforts.

--FFG-7 Class Support program.

--EOC program.

--IMA Upgrade program.

--MSDP.

A brief description of each program follows.

FFG-7 Class Support Program

The Guided Missile Frigate Class Support program consists of life-cycle maintenance support procedures for the

FFG-7 class ships. This ship class was designed for limited operational manning, with limited self-maintenance capacity relative to earlier ship designs and with a specific maintenance policy. Integrated logistics support capabilities, such as component rework, supply support, and tailored technical documentation to support a component change-out versus an onboard ship repair concept, and a special information system (Logistic Data System) are being developed. The first ship of the FFG-7 class was delivered to the Navy in late 1977. (See ch. 3 for more details.)

Engineered Operating Cycle program

The Engineered Operating Cycle element of the project involves the development of plans and procedures to support the extension of the nominal period (cycle) between regular ship overhauls. This program involves (1) the development of maintenance requirements based on an engineered review and past performance, (2) an introductory (baseline) ship overhaul plan that specifies all ship repairs and reliability alterations required prior to entering the new cycle, and (3) a class maintenance plan which identifies when and what maintenance on ship systems and equipment is to be performed. This program applies to 127 surface combatant ships of several ship classes.

In 1977, 15 FF-1052 class ships entered baseline overhaul. By 1984 about 260 ships, or about 50 percent of the Navy's total fleet of ships, are expected to be covered by an operating cycle program such as EOC, FFG, or a previously developed system for submarines. (See ch. 3 for more details.)

IMA Upgrade program

This element of the project is designed to improve the Navy's ability to adequately support maintenance requirements for existing ships and future ship maintenance policies such as FFG and EOC. The Upgrade program involves modernization and improvement of shore and mobile IMA facilities to improve workflow, working conditions, and maintenance personnel training. The program also includes an effort to assess a need for better test equipment to detect malfunctions of shipboard electronic components and an experimental program to contract excess IMA work to private industry. (See ch. 3 for details.)

FFG-7
NEW CLASS OF GUIDED MISSILE FRIGATE

MSDP

MSDP is a Navy development and implementation effort where fundamental and long-term changes in the way the Navy accomplishes and controls ship maintenance are being addressed. The basic goal of the program is to develop an integrated ship maintenance system to imporve the material condition of surface ships.

To accomplish this goal, the program is being approached along three paths: first, to improve allocation of resources to measure the impact of changes upon material readiness and to improve the ship maintenance management and control functions in the Navy; second, to develop procedures to more accurately define preventive and corrective shipboard maintenance requirements; and third, to identify and implement improvements in the actual delivery of maintenance in such areas as shipyards, the supply system, maintenance manpower planning, and training.

The Navy, through the use of a contractor, is identifying and analyzing problems and developing recommendations for improvements in the above areas. Based on these analyses, the Navy plans to implement improvements to the ship maintenance system where appropriate. (See ch. 4 for more details.)

The Navy considers the EOC, the FFG-7 Class Support, and the IMA Upgrade programs to be short- to intermediate-term programs; that is, they are expected to be completed and implemented by the early to mid-1980s. MSDP, however, will probably not be completely implemented by the mid-1980s although certain tasks may be completed and implemented before that time. As of August 18, 1978, the Navy estimated the total cost of the programs, between fiscal years 1977 and 1983, to amount to about $0.6 billion. Projected personnel increases amount to about 640 people. Analysis of the cost totals revealed the following breakdown.

Project Costs (note a)

Program	FY 77	FY 78	FY 79	FY 80	FY 81	FY 82	FY 83	Total
	(millions)							
MSDP (note b)	$ 5.1	$ 8.9	$ 8.8	$ 10.8	$ -	$ -	$ -	$ 33.6
EOC (note c)	4.7	13.3	17.3	14.9	17.9	25.5	37.3	130.9
FFG	6.0	15.7	27.0	53.5	53.1	58.6	66.4	280.3
IMA	6.9	12.0	50.9	58.0	52.7	15.4	3.5	199.4
Total SSIP	$22.7	$49.9	$104.0	$1[illegible]	$123.7	$99.5	$107.2	$644.2

a/ Data Source: July 1978 Five-Year Defense Plan with budget revisions through August 18, 1978, as provided by PMS-306.

b/ Includes early implementation costs in fiscal year 1979-80.

c/ Does not include ship overhaul costs.

A significant portion of SSIP is expected to be done by contractors. To date, contracts amounting to about $47 million have been awarded.

In the remainder of the report, we will address the following topics for each of the four program elements of the Ship Support Improvement Project.

--Major objectives of the project and Navy plans for achieving these objectives.

--Current status of the project and future plans.

--Contractual data.

--Observations.

Additionally, since the Committee expressed special interest in the selection of AMS as the prime contractor for the MSDP portion of the project, we have provided information on this area. This is discussed in chapter 5.

CHAPTER 3

THE SHIP SUPPORT IMPROVEMENT PROJECT: A DISCUSSION OF PROGRAMS WELL UNDERWAY

As previously discussed, the Ship Support Improvement Project merged several ongoing Navy programs designed to improve the material condition of surface ships with a long-term study and implementation effort designed to effect fundamental changes in the way ship maintenance is accomplished and controlled by the Navy. Two of the ongoing programs, the Guided Missile Frigate Class Support program and the Engineered Operating Cycle program, have been designed to provide a structured approach to maintenance support for selected classes of ships. This approach includes scheduled, periodic, preplanned ship maintenance availabilities at the intermediate and depot levels and improvements in the logistics support system. The third program which was ongoing, the Intermediate Maintenance Activity Upgrade program, is designed to provide the intermediate maintenance support thought to be necessary to implement FFG-7 and EOC as well as other Navy ships maintenance programs.

For the FFG-7 program we noted:

--The data base on which several of the new logistics concepts are based and which will be used to evaluate program effectiveness is inaccurate and unreliable. However, the Navy is currently undertaking steps to improve this situation. (See p. 12.)

--A new supply support concept, which is critical to the success of these new maintenance concepts, must be carefully implemented and monitored to ensure that previously identified material visibility and control problems are eliminated. (See pp. 13 to 15.)

--Close adherence to the class maintenance plan, which is considered essential, will require close and high-level monitoring to insure that prescribed maintenance schedules are met. (See pp. 15 to 16.)

In the EOC program, we made similar observations. In addition, the Navy is implementing the program without having clearly defined what the current level of material condition is for ships in the program, what should it be, and how it is to be maintained. (See pp. 20 to 23.)

Concerning the IMA program, we believe that based on the following observations, implementation of facility improvements may be premature.

--IMA workload needs to be refined. Current projections are based on questionable data and are probably overstated. (See pp. 25 to 27.)

--The Navy needs to determine the most effective way to satisfy its IMA workload; that is, with mobile or shore activities located overseas or in the United States or a combination of both. (See p. 31.)

--The impact of changing Navy maintenance concepts and of the long-term efforts of the Ship Support Improvement Project and the Maintenance System Development Program need to be more fully evaluated. (See p. 32.)

GUIDED MISSILE FRIGATE CLASS SUPPORT PROGRAM

A phase of the SSIP program extending maintenance strategy planning to new surface ships is the FFG-7 program. When considering the design in 1971 for a new class of guided missile ships that were to be introduced into the fleet, the Chief of Naval Operations determined that they would have to include certain goals of increased operational availability, combined with minimized shipboard manning, that is, 90 percent availability and 185 shipboard accommodations. While a precise definition for availability has not been developed, the Navy expects that the time a ship is not at a depot or IMA facility will be about 12 percent more than current ships. The 185 accommodations include a helicopter attachment of about 35 people. The remaining 150 crew members are about 100 fewer than a current ship of similar size and mission.

Fifty-five ships are expected to be built under the FFG-7 program. The first ship was delivered to the Navy in the fall of 1977.

The total cost of the SSIP planning and support of the 55 ships projected to be in the program for fiscal years 1977 to 1983 is about $280 million.

The Navy's goal of increased operational availability was to be partly achieved by minimizing the amount of time for depot maintenance, while at the same time, decreased manning called for deemphasis of organizational maintenance. Both

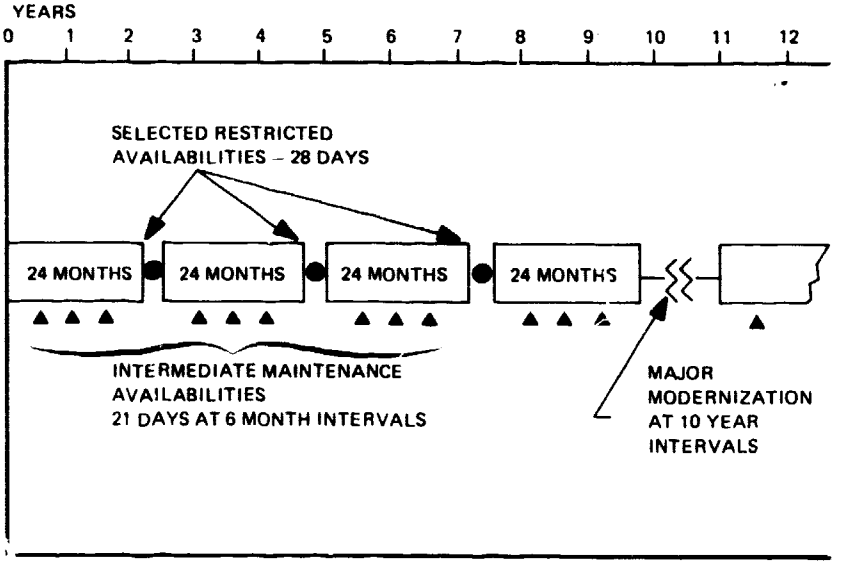
of these actions placed a heavy emphasis on intermediate-level maintenance support and on repair of components at component rework facilities. (See p. 25.) To achieve these objectives, the Navy devised a nontraditional concept of maintenance for this ship class, which involves modular replacement of repairable components (modular change-out) and progressive overhauls.

Modular change-out, designed to reduce repair workloads and to decrease shipboard manning, is built around individual components which are highly standardized and accessible for removal. This has not been true in the past, causing increased shipboard time for inplace tearing down and repair of critical equipment. Now the component is removed and replaced, and the damaged component is sent to an IMA or depot for repair. In addition, use of state-of-the-art technology, such as gas turbine engines, rather than high maintenance boilers, and particular maintenance emphasis on ship design and arrangements is expected to permit a reduced level of shipboard maintenance requirements.

The progressive overhaul concept places the ship on a 10-year cycle and does not involve the lengthy overhauls regularly performed at 3- to 4-year intervals. Instead the ship is brought into the depot every 24 months for about 4 weeks to receive specifically planned maintenance and alterations. These availabilities are augmented by 3-week periods at IMAs every 6 months. Only at the end of the 10-year cycle are major modernization actions taken. This cycle is illustrated in the following chart.

FFG-7 CLASS OPERATING CYCLES

PROGRESSIVE OVERHAUL



IMPLEMENTATION OF FFG

Success of the FFG program depends on several key factors relating to the ability of program managers to first project and later adjust maintenance and supply requirements, to assure that these maintenance requirements are met, and to monitor the effectiveness. Ultimate achievement of the FFG goals depends largely on the suitability and accuracy of feedback information to carry out the above functions. The Navy has stated that the Maintenance and Materiel Management system (3-M) is a major vehicle for collecting the necessary historical or program effectiveness data on maintenance. However, we previously reported that some of the current difficulties with maintenance management arise from the questionable accuracy of 3-M data. A Navy sponsored study in 1975 1/ also pointed out that the 3-M system was neither designed nor capable, without substantial change, of providing data to support the reliability, maintainability functions of these program in SSIP.

Navy officials commented that since that 1975 study, the Navy initiated several actions to improve 3-M reporting for the FFG-7. These actions which include full maintenance reporting and expanded equipment identification coding are currently under evaluation using feedback data obtained from the first ship in the program, the FFG-7. We were told that the Navy also has undertaken programs to (1) upgrade the 3-M hardware in the Fleet--an existing bottleneck to efficient feedback--(2) develop procedures to reduce time-consuming shipcrew paperwork, and (3) redesign the Intermediate Maintenance Management System which provides feedback on the work accomplished at the intermediate level.

Furthermore, Navy officials stated that besides feedback from the 3-M system, the FFG-7 will use information from its Consolidated Casualty Reporting System (CASREPT), Board of Inspection and Survey (INSURV), and Force Status Reporting System (FORSTAT). These systems are described on page 21.

Logistics support analysis

A key system being developed to support FFG class ships is the Logistics Support Analysis (LSA). To obtain detailed information for IMA and depot planning, the Navy is conducting extensive engineering and logistics support analyses for

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1/ PMS-306 Surface 3-M MDCS System Utilization Study (Jan. 24, 1975.)

selected electronic, combat systems, hulls, and mechanical and electrical equipment to determine their failure rates and effects and, through a logic process, the Navy is determining the support they require. Based on this analysis, a preventive maintenance plan is developed, the corrective maintenance requirements are estimated, and the level of repair--organizational, intermediate, or depot--at which maintenance is to be performed is established. Given these maintenance requirements, the logistics support, that is, repairable components, skills, tools, and technical documentation, required at each level of maintenance, is determined. All of the data developed based on these analyses is recorded in the LSA file.

According to the Navy, the LSA file is kept current, based on operational data from the 3-M and other data systems and other sources discussed above. Using equipment failure rate data and parts usage information, support requirements are analyzed and updated as necessary, and maintenance actions to be performed are detailed. The upgraded LSAs are then used in connection with the initial engineering analysis in building the LSA file for each subsequent ship entering the fleet. Over the life cycle of the ships the file update is to be maintained current to update the class support plan.

So far, most of the work on the LSA system for the second ship in the program, the FFG-8, 1/ has been completed. The remaining work is expected to be completed by June 1979.

Supply support

Success of the new ship maintenance policy depends largely upon an accurate statement of maintenance requirements and a responsive supply system which must make available the piece parts, modules, and repairable components to achieve the turnaround time necessary to accomplish the required ship maintenance operations during the relatively short ship availability periods in the ship's engineered operating cycle.

To translate the FFG support requirements into fully responsive supply support at all maintenance levels, the Navy plans to:

1/ The data is based on FFG-7 configuration with FFG-8 modifications. The SSIP program is building support for the class starting with the FFG-8. The FFG-7 will be backfitted in the early 1980s.

--Establish the initial range and depth of stock items that must be available in the Navy Supply System to support the FFG class ships.

--Develop a repairables management and control system which provides visibility and control over material.

--Establish procedures to determine the range and depth of piece parts necessary for repair operations at the organizational, intermediate, and depot repair levels.

Limited work has been done on these objective. However, information we obtained indicates that the Navy is planning to expand the use of a supply support concept, called the operational support inventory, to provide FFG supply support. 1/ According to the Navy, a major feature of this concept is that the inventory is protected from normal supply requests. The protection, however, is not total: priority requests for items causing a nonoperational condition on a ship will override the system and be issued from the operational support inventory.

We asked the Navy why this inventory concept was under consideration rather than continued use of the existing system. We were told that it was considered because the Navy supply system could not support FFG program needs on a "business as usual" basis because (1) the FFG maintenance philosophy requires that specified maintenance be accomplished when specified, (2) to accomplish specified maintenance, all required material must be immediately available, (3) the number of preplanned IMA availabilities scheduled for ships in both the EOC and FFG programs is substantially larger than under the current Navy ship maintenance strategy, and (4) the time frames in which work during these IMA availabilities is to be accomplished (21 days) is shorter than under the current system (4 to 6 weeks). A Navy officials commented that the ramifications of maintenance deferral magnified the importance of stock availability during periods of FFG intermediate maintenance.

Since stock availability at the shore IMAs apparently is critical to the success of the FFG program, it is

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1/ The same system is also applicable of EOC ships and has been used in Navy aviation maintenance since 1975.

imperative that the Navy establish an effective material management system at the shore IMAs to control material resources. Key to such a system is having valid information on current and projected demand for materials, material on-hand, in-process, and on-order. The Navy's proposed solution to this requirement is to position operational support inventory level at shore IMAs, closest to the point of use, to support maintenance needs and monitor material availability centrally at the Navy Inventory Control Point. Material usage and inventory data input at the shore IMAs is presumed to be accurate. This, however, has not always been the case. For example, in our recent report on naval shipyards, 1/ we noted a lack of accurate data. We asked the Navy how it planned to insure that the information reported at the shore IMAs was valid. We were told that with the exception of limited physical inventories, the Navy planned to rely on the integrity of its supply personnel to provide accurate material data.

We believe that this may not be sufficient. It appears that the proposed actions treat only the symptoms but not the underlying causes of the problems noted previously in this area. In our opinion, the Navy needs to employ continuing and more rigorous command surveillance at all levels to insure that these problems are overcome. This was recommended in our report on naval shipyards. The Navy agreed to this recommendation.

Control of maintenance actions

Close adherence to the class maintenance plan is considered to be essential to the effectiveness of the FFG program to prevent the backlogs previously encountered in maintenance of surface ships. To assure that Fleet Commanders follow the plan, the Chief of Naval Operations has directed that rigid controls be placed when and where the maintenance is performed. A "plan of use" has been issued to achieve these controls. Such requirements have not been the normal method followed for surface ship maintenance, and close monitoring of its effectiveness is essential.

In discussing these controls with fleet maintenance officials, we were told that this program gives the Fleet Commander a better tool with which to plan and schedule

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1/ "Naval Shipyards--Better Definition of Mobilization Requirements and Improved Peacetime Operations Are Needed" (LCD-77-450, Mar. 31, 1978).

maintenance of the ships under his command. The Fleet Commander must consider the maintenance requirements and the operational commitments when scheduling ship employment. In the past, without a formal Navy plan of use and a class maintenance plan, large backlogs in deferred maintenance at the different maintenance levels have often occurred. For example, in our report on the Navy's ship overhaul and repair program for fiscal years 1972 and 1973, 1/ we found that in fiscal year 1972, 20 percent of the ships scheduled for overhaul were unable to receive it due to operational commitments. If this percentage of maintenance action deferrals continues with the FFG program, the effectiveness of the program will be adversely affected. This, in turn, may lead to questions about the usefulness of some of the new logistics support concepts developed for the FFG program.

Navy officials agreed that in order for the FFG program to be fully effective, prescribed maintenance schedules have to be met. They commented that since this practice is relatively new to the Navy, the Navy expects to educate some fleet personnel on the importance of meeting the schedules.

ENGINEERED OPERATING CYCLE PROGRAM FOR SURFACE SHIPS

A second element of SSIP currently underway is the EOC program for surface ships. The Navy stated that the objectives of this program are to achieve an early improvement in the material condition of ships designated for EOC development. These ships are then to be maintained at an acceptable level of material condition and show an increase in operational availability, both at an acceptable cost. The projected total cost as of fiscal year 1977, for planning and support of the 127 destroyer-type ships currently in the program, was estimated to be about $131 million through fiscal year 1983, of which approximately $25 million was for development contracts. 2/

According to the Navy, the EOC program was developed to improve maintenance practices on existing surface ships and is to complement other similar programs developed for submarines and new FFG surface ships. (See app. II for the

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1/ "Management of Ship Overhaul and Repair Programs" Fiscal Years 1972 and 1973" (B-133170, June 7, 1973).

2/ See app. II for a list of ship classes in the EOC program.

historical development of EOC programs.) Ships are to be introduced into the EOC program by ship class, and a separate plan for each ship class will have to be developed based on experience from already established EOC programs.

Based upon experience with the submarine EOC program and the early phases of the Surface Ship EOC program, the Navy is establishing and documenting procedures and guidelines for general EOC development. Each ship class undertaken for EOC analysis may vary from the specified procedures based on the peculiarities of the class. The EOC planning is structured in three phases--a 1-year initiation phase, a 2-year development phase, and an implementation phase that extends through the remaining life of the ship classes involved. A brief description of what the Navy is currently doing or planning to do during each phase follows.

During the initiation or feasibility determination phase (see fig. 1), ship data such as ship operating time, scheduled maintenance time, and data associated with equipment and system failures is collected, and objectives constraints, for example, costs and shipboard staffing that will guide the EOC program, are defined. The current status of the ship's material condition and its overhaul maintenance strategy are assessed. Alternative maintenance strategies are identified and, from them, the preliminary EOC maintenance strategy is defined. The existing and proposed maintenance strategies are compared and analyzed and the feasibility of adopting an EOC program is evaluated.

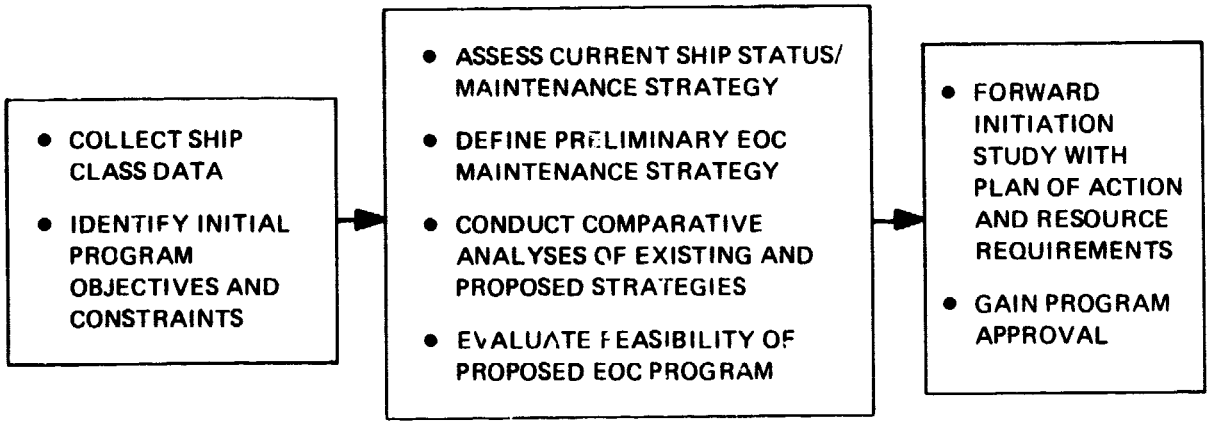

FIG. 1 IMPLEMENTATION PHASE PROCESS

During the development phase (see fig. 2) detailed engineering efforts are undertaken to develop specific approaches for the EOC strategy. The preliminary plan is used as a guide during this phase. Pertinent, detailed technical, operational, and experience data is assembled and, from this data, critical equipment and systems are selected, beneficial technical and Fleet Modernization Program alterations are identified, and maintenance requirements for pre-EOC overhauls, called baseline overhauls are developed. Detailed systems engineering analyses are performed on selected critical maintenance equipment, that is, equipment that has historically been the greatest maintenance burden to the class, with specific restorative and corrective maintenance requirements identified in the development of a class maintenance plan. Standards of material condition assessment and program effectivenss are developed to permit the analysis of the effectiveness of the EOC program and to modify the efforts as necessary. Finally, a management plan is developed to provide guidance in program administration, planning, execution, and support. Together, these elements constitute the EOC plan that is to be implemented.

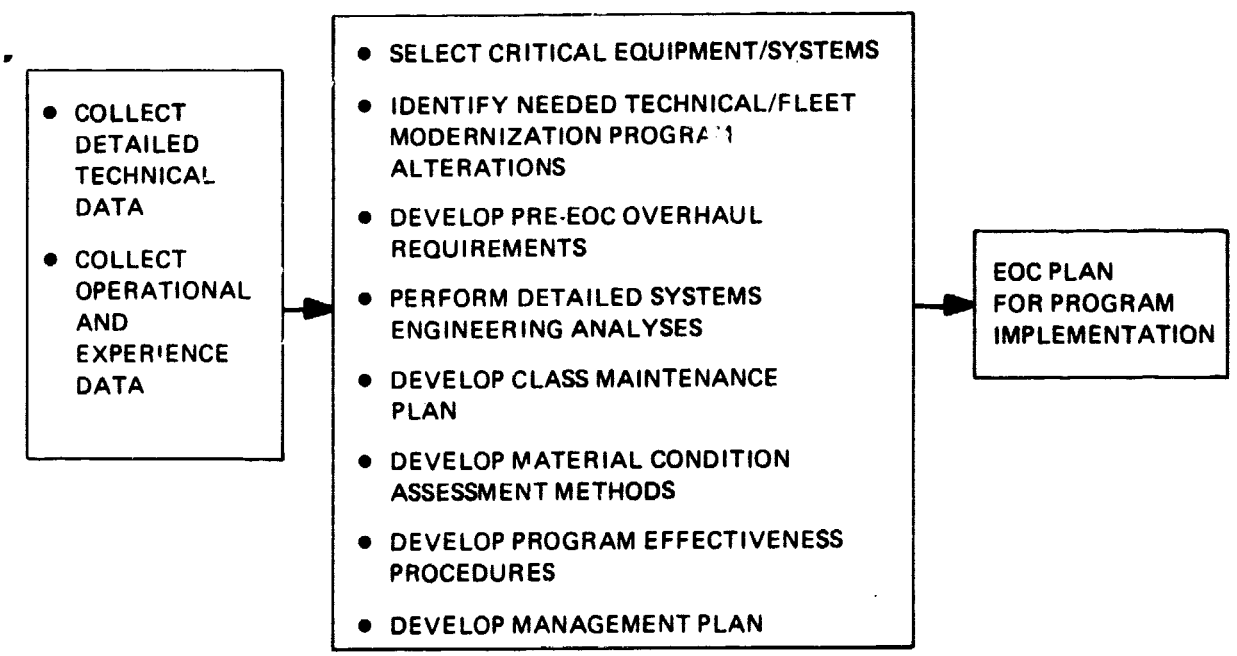

FIG. 2 DEVELOPMENT PHASE PROCESS

During the implementation phase (see fig. 3), each ship will be given a pre-EOC overhaul (if required) before entering its Engineered Operating Cycle. This baseline overhaul differs from a regular ship overhaul in that its work package is designed to restore a ship to a known level of material condition, as defined during the development phase. This is to be a level that has all known problems corrected and outstanding maintenance work accomplished to help in sustaining the material condition during the cycle.

According to the Navy, once a ship has completed its pre-EOC overhaul and has entered its Engineered Operating Cycle, it will have an individual ship's maintenance plan developed for it. As a ship proceeds through its operating cycles, maintenance and modernization tasks from its individual ship plan are to be updated on the basis of the lessons learned from other EOC programs, other ships of the class, trend analysis of ship equipments, and tests and inspections performed on ship systems.

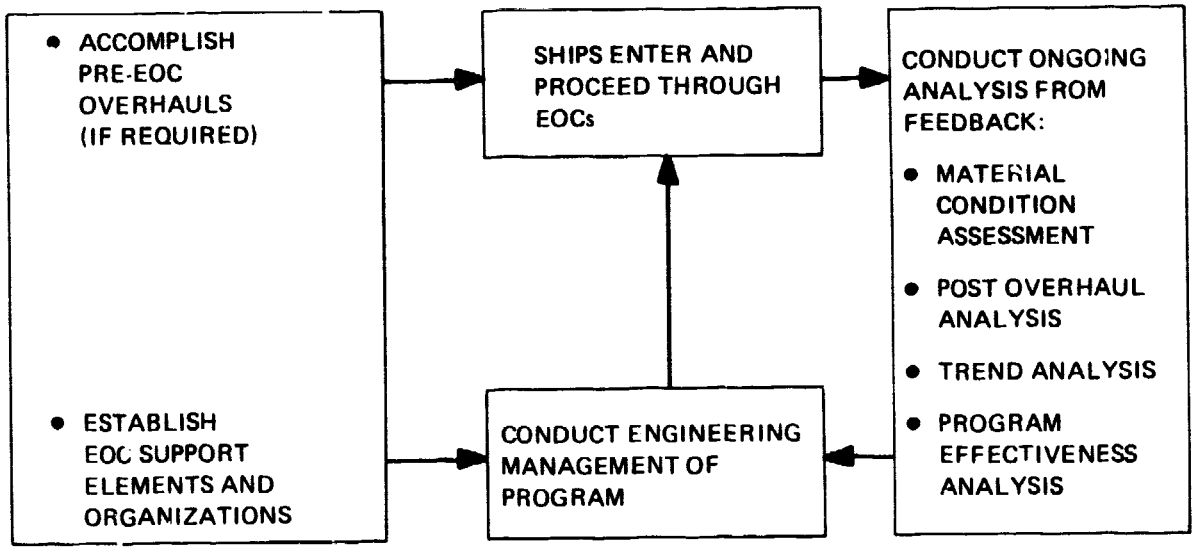

FIG. 3 IMPLEMENTATION PHASE PROCESS

The initial EOC program for surface ships applies to destroyer-type ships and was to serve as a focus for development of an improved maintenance strategy for all surface ships. Future programs are planned to expand the EOC concept to other classes of ships, that is, amphibious

ships, carriers, and frigates. The feasibility studies for amphibious ships have been completed; however, due to budget limitations, the Navy has not provided development and implementation funds for any EOC effort beyond the destroyer program. The Navy plans to review this program this fall.

We noted that segments of the total SSIP are interwined. For example, increased intermediate level workload requirements under the Destroyer EOC and the FFG-7 programs were used as a partial justification for upgrading IMA facilities. Workloads for other ship classes (not yet in a directed EOC program, such as the amphibious ships) were maintained on a current, historical basis. Thus, a change in EOC programs is likely to change the IMA workload requirement. The impact of the EOC program on the IMA program is discussed later in the chapter.

Assessment of the program

Operational change, such as the one resulting from implementation of the EOC program, is an accepted method of improving operations; however, improved management does not automatically result from such a change nor do benefits automatically accrue.

To determine whether the EOC program is going to meet its designated objectives, we identified and evaluated some of the factors which we believe are necessary to effectively implement the program. The factors include:

--A clear definition of what level of material condition is acceptable.

--An accurate and reliable data base to develop maintenance requirements.

--An effective material condition assessment and equipment monitoring program to determine a ship's actual level of material condition.

--Adequate system discipline to insure that required maintenance actions are carried out in a timely fashion and at an acceptable level of quality.

We observed the following regarding these factors:

1. The Navy currently does not have an overall material condition indicator which could be used to define an adequate

level of material condition for ships. However, various indicators of material condition do exist. They include:

--The Navy's Force Status Reporting System--a system which reports a ship's readiness status by means of (1) a rating indicating the capabiity of a ship in performing each of its assigned missions (M-rating), (2) a rating indicating the overall mission readiness of a unit (overall C-rating), and (3) ratings indicating the readiness status of personnel, equipment and supplies onhand, equipment readiness, and training (resource C-ratings).

--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 equipment.

--Pre-Overhaul Test and Inspection (POT&I)--an inspection prior to overhaul to identify needed repairs.

--Propulsion Examining Board (PEB)--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 CASREPT should not be used alone to measure the effect of ship overhaul om material condition because casualty reports are special events, influenced by many factors other than material condition (e.g., area of operations). In addition, the method of casualty reporting is inconsistent and may even be used as a way to justify additional supply support.

Other drawbacks were reported in the Navy's general plan of action for the Maintenance System Development Program. To illustrate, the plan of action noted that the FORSTAT C-rating suffers from being the ship captain's subjective rating of his own ship's readiness status and from being too aggregated. Regarding the INSURV inspection results, it reported that the

results suffer from being a detailed technical inspection for the purpose of determining repairs needed. Similar observations were made regarding the CASREPT and Propulsion Examination Board reports. In recognition of these shortcomings, MSDP is to come up with a better set of indicators than those used to define an acceptable level of material condition for ships entering the EOC program, but full results appear years away. 1/

2. The Navy's data base for developing maintenance requirements is inaccurate and unreliable. Navy officials told us that the Navy partly used historical data derived from the Maintenance and Material Management system to develop maintenance requirements for baseline overhauls and the class maintenance plan. However, as pointed out in a Navy sponsored report on the 3-M system, 3-M data was inaccurate and unreliable. (See p. 12.) The report recommended that the existing data base should be validated and the system be revised to provide additional data, such as all preventive and corrective maintenance staff-hours per ship, so total maintenance requirements could be determined. We found no evidence which suggested that this was done. Since the Navy has not taken aggressive actions to improve the accuracy and reliability of the 3-M data, reliance on this data could lead to potential misjudgments in engineering the maintenance requirements for EOC ships.

Navy officials commented that the Navy was aware of the inaccuracy and unreliability of the 3-M data prior to the beginning of the EOC program. But, instead of waiting for corrective actions discussed in the FFG-7 program, the Navy relied on available 3-M data coupled with CASREPT feedback, material usage information, expanded POT&I and INSURV baseline conditon inspections of the combatant ships in the EOC program, and information available from other sources to establish EOC maintenance requirements. According to the Navy officials, this action was necessary to preclude delays to the EOC program.

3. The Navy has recognized that effective maintenance management over an extended ship operating cycle depends on a continuous material condition assessment and equipment monitoring program and has taken steps to accomplish this with the help of site teams and a central technical group. However, problems with defining what constitutes an acceptable

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1/ The Center for Naval Analyses is also studying this area. Its study is scheduled to be completed in March 1979.

of equipment, will hinder accomplishing these objectives. Navy officials agreed that establishing material condition standards is difficult. They stated that these areas will be discussed with technical personnel from the Fleet in the near future.

4. Fulfilling predetermined maintenance requirements may not be as effective as planned because of potential conflict between fleet operational commitments and predetermined maintenance schedules. As in the FFG program, the Navy believes that EOC program effectiveness depends upon closely following prescribed maintenance actions contained in the class maintenance plan. To insure that this is being done, the Chief of Naval Operations has issued an instruction requiring Fleet Commanders to prepare directives for implementing the specifics of the class maintenance plan.

High backlogs of deferred maintenance at all maintenance levels attest to the fact that many maintenance actions have not been accomplished at prescribed time periods. Fleet maintenance officials told us that, as in the FFG program, the class maintenance plans are considered to be practical guidance which will assist the Fleet Commanders in scheduling maintenance actions and in accomplishing the maintenance necessary to maintain a ship's condition.

The concept is untried and will have to be closely monitored to determine if operational or scheduling problems continue to arise which will hinder the achievement of EOC goals.

INTERMEDIATE MAINTENANCE ACTIVITY UPGRADE PROGRAM

The Navy considers the intermediate-level of maintenance to be an essential element of the Navy's overall fleet maintenance program. It believes that without the maintenance support provided by the 29,000 sailors manning the IMAs--25 afloat IMAs and 9 shore IMAs--the fleet maintenance program cannot be accomplished properly.

To enhance the contribution of this resource element, the Navy is currently seeking congressional approval to expand current IMA capacity and capability by modernizing and improving certain afloat and shore IMA facilities. The Director of the Chief of Naval Operations Ships Maintenance and Modernization Division told the House Appropriations Committee on March 22, 1978, that increasing IMA workload will necessitate upgraded facilities. Furthermore, the Director stated that the Upgrade program would be accompanied by (1) a comprehensive IMA personnel training plan, (2) studies assessing the need for automated test equipment to detect malfunctions in electronic components, and (3) an experimental program to contract excess IMA work to private industry.

The Navy projects the total cost of the IMA program, fiscal years 1977 to 1983, to be about $200 million. 1/ A breakdown of the total, by program element, is shown later in this section.

IMA requirement projections

The driving factor in the Navy's IMA Upgrade program was several Navy studies which projected that the Navy would experience significant IMA workload increases between fiscal years 1975 and 1983. The IMA workload trend, in man-years, is shown below.

	Fiscal year				Percent workload increase
	1975	1979	1981	1983	1975 to 1983
IMA workload (man-years)	15,000	20,958	21,136	20,988	39.9

1/ Planning and development contracts associated with the program are estimated to amount to about $20 million for fiscal years 1973 to 1984. This total does not include a 6-percent architect and engineer fee associated with each military construction project.

Reasons given by the Navy for the workload increases included:

--During the 9-year period the total ship surface fleet would increase from 217 to 280, a 29-percent increase.

--There has been a designed reduction in manning levels on FFG class ships, as compared with other ships, and a corresponding maintenance concept has been built around this reduction. (See p. 10.) This concept is expected to result in an increased workload at the intermediate level of maintenance.

--The Chief of Naval Operations directed the introduction into the EOC of 127 destroyer-type ships. Implicit in this concept (54 versus 37-month operating intervals between ship overhauls) is an increased demand for maintenance at the intermediate level.

--The fleet commanders identified significant backlogs of deferred maintenance and these backlogs were projected to be growing by at least 10 percent per year.

Workload projections are questionable

On May 15, 1978, and several times thereafter, we asked the Navy for documentation supporting their workload projections. Although we received some general workload information, the data was not specific enough to allow us to accurately assess the reasonableness of the projections. However, the information provided and Congressional testimony given by Navy officials identified the methodology used by the Navy to arrive at their workload projection. The Navy stated before the House Appropriations Committee on April 11, 1978:

"* * * IMA workload projections are based on historical data since 1975 which has established what work the IMAs were accomplishing by ship class. This was adjusted for current and projected force levels changes by subtracting IMA workload for ships being retired and adding projected requirements for new ship acquisitions. This is further adjusted by the engineered IMA requirements for those ships entering engineered operating cycles * * *"

From the above testimony it is apparent that the Navy's projections of IMA requirements are primarily based on historical data and estimates. Thus, with exceptions of projections for EOC and FFG-7 type ships which project IMA

requirements based on engineered workload analyses, the Navy assumes that work performed in the past will be performed in the future. This approach to establishing IMA requirements projections depends heavily on the IMA management information system which documents and accumulates IMA direct or productive staff-hours charged for ship maintenance.

We have previously identified problems with the Navy's management information system. In an earlier report 1/ on the Navy's intermediate ship maintenance program, we concluded that the Navy's IMA information system lacks adequate controls to insure accurate and reliable input data and that existing data resulted in overstated IMA requirements projections. Although we were unable to determine on a total basis the degree of the overstatement, specific examples showed it could be substantial.

A House Appropriations Committee Investigative Staff Report issued in November 1977 also made similar observations. It concluded that IMA requirement projections needed further justification.

Furthermore, as previously mentioned, a large percentage of the total projected IMA requirements is based on engineered analyses conducted as part of the Navy's EOC and FFG-7 programs. However, as previously mentioned, these analyses are only in their early stages and have yet to be validated. As a result the effect that the EOC and FFG-7 programs will have on future IMA workloads is uncertain.

The Navy agrees that requirements projections could be further refined and has taken some actions to do this. It believes that by 1985, the Navy will have a "defined" IMA workload. However, it believes that regardless of the accuracy of current projections, requirements in the outyears will unquestionably be greater than they currently are.

We believe that much could and should be done to refine IMA requirements now, especially because of extensive Navy plans to upgrade its IMA facilities. Areas of concentration

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1/"The Navy's Intermediate Ship Maintenance Program Can Be Improved" (LCD-77-412, Sept. 23, 1977).

should include (1) establishing procedures to prevent unnecessary or uneconomical work from being done at the IMAs and (2) improving the existing management information system to reflect the actual time spent by ship personnel, both productive and unproductive. This was recommended in our previously mentioned report on the Navy's IMA program.

Navy plans to meet projected IMA requirements

The Navy believes that its projected need for increased IMA support could best be met by a program which would maximize the productivity of IMA resources. Past Navy studies had shown that productivity at the IMA level was hindered by obsolete and inadequate industrial facilities and equipment, marginal personnel skills (training), skill mixes inconsistent with requirements, and less than adequate management tools. To improve the productivity of its existing IMAs, the Navy has developed plans to:

--Modernize and improve (1) five existing shore IMAs located at Mayport, Fla.; Pearl Harbor, Hawaii; Norfolk, Va.; Charleston, S.C.; and San Diego, Calif.; and (2) eighteen afloat IMAs--5 destroyer tenders, 4 repair ships, and 9 submarine tenders--to improve workflow and promote good, healthy, and safe working conditions. Typical facility improvement projects include items such as (1) building new maintenance shops, (2) consolidating or rearranging existing ones, and (3) obtaining some new plant equipment. The total cost of this upgrade effort for fiscal years 1977 to 1983 was projected to be about $164 million.

--Improve maintenance personnel capabilities by providing for (1) industrial management training of IMA managers, shop supervisors, and ship superintendents; (2) industrial training in unique skills not available from other sources; and (3) development of an IMA shops procedures manual and on-the-job training of maintenance personnel by qualified teams of technicians. The total cost of the training program for fiscal years 1977 to 1983 was projected to be about $27 million.

--Provide improved support and test equipment for testing printed circuit boards for IMA and electronic rework facilities. Total program cost: about $9 million.

In addition since a comparison of the Navy's IMA workload projections with projections of available IMA manpower indicated that not enough people would be available to do all the intermediate-level maintenance work, the Navy decided to institute a pilot program for fiscal year 1979 to contract the projected overload of intermediate-level maintenance work to private industry. The new feature in the pilot program is that specific shop overload work items, rather than entire ship work packages, will be contracted for. The dollar value of the contract program between fiscal years 1979 to 1983 is expected to range from a low of about $43.8 million in fiscal year 1979 to a high of about $81.2 million in fiscal year 1980.

Improvement of maintenance personnel capabilities and an assessment of the need for better test equipment appear to be reasonable objectives because of reported deficiencies in this area. For example we noted in our report on IMA operations (see p. 26) that the low quality of personnel assigned--expressed in terms of rank, completed tours of duty, and service school completion--hindered IMA productivity. Better personnel training, as planned for by the Navy, would be a good first step to overcoming reported personnel quality problems.

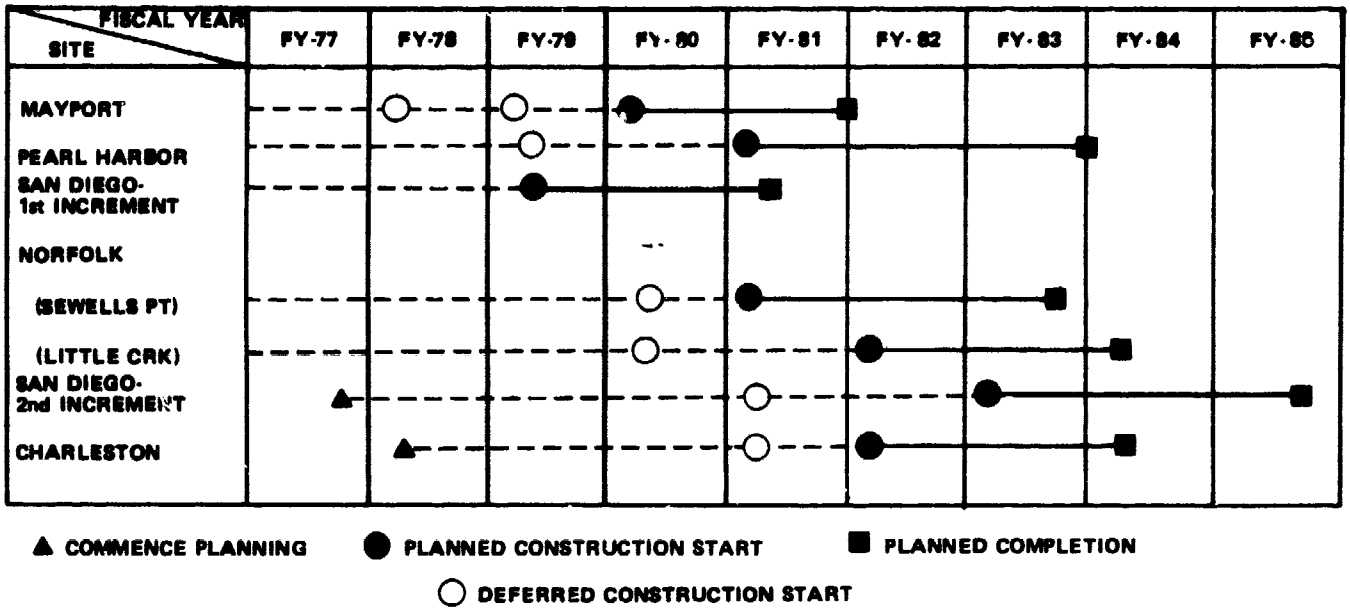
Concerning the two other productivity improvement programs, their validity depends largely on the reasonableness of the workload projections and on such other issues as (1) the impact of changing maintenance concepts and strategies on IMA needs and (2) where IMA requirements can best be satisfied; that is, afloat IMAs, shore IMAs, or a combination of both. These issues are addressed on page 31.

Current status of the IMA Upgrade program and future plans

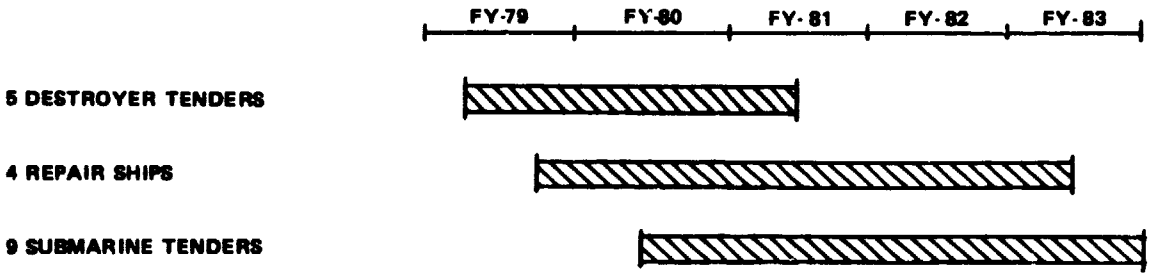
As shown in the charts on the next page, the shore IMA and tender upgrade programs are well underway. Planning for most of the five shore IMAs to be modernized will be completed by fiscal year 1981. Procurement of industrial plant equipment began at a low level in fiscal year 1977. Work on all shore IMAs is expected to be completed in fiscal year 1984. 1/

1/These dates were recently revised due to congressional deferral action on the fiscal year 1979 Military Construction Program.

SHORE IMA UPGRADE PROGRAM SCHEDULE



AFLOAT IMA UPGRADE PROGRAM



The situation is similar for the tender program. By the end of fiscal year 1978, tender modernization needs will have been identified for most of the 18 tenders scheduled to be upgraded and two of the tenders are scheduled to undergo regular overhauls starting in fiscal year 1979. During these overhauls identified modernization needs will be accomplished. The Navy expects to have modernized most of its tenders by the early 1980s.

Progress has also been made in the IMA personnel training program. A shop qualification improvement program (SQIP) which provides for technical training in 17 selected repair skills areas, such as pump and electric motor repair, has been developed. According to the Navy, initial results of the SQIP program are encouraging. They indicate substantial improvements in both written and practical skills scores. This is shown in the following table.

RESULTS OF SQIP EXAMINATIONS

	INITIAL SCORE	FINAL SCORE	IMPROVEMENT
ELECTRIC SHOP: (SAMPLE SIZE 188 PERSONS)			
WRITTEN EXAM	52	80	28
PRACTICAL	*22	90	68
PUMP SHOP: (SAMPLE SIZE 181 PERSONS)			
WRITTEN EXAM	62	83	21
PRACTICAL	72	92	20

*NOTE: MOST MEN DID NOT KNOW HOW TO REWIND MOTORS

According to the Navy, the SQIP program will transition from PMS-306 to another Navy organization in fiscal year 1979 for continued execution.

The support and test equipment engineering program is just getting started. Work requirements are in the process of being defined. Then, analyses to determine at what level of maintenance, that is, depot, IMA or organizational, identified requirements will be accomplished. Finally test equipment to satisfy the requirements will be procured for the applicable levels of repair. This latter task is projected to be accomplished from fiscal year 1981 to 1983.

Other issues to be considered

Besides IMA workload projections, two other issues and their impact on the IMA upgrade program need to be considered either before or during implementation of the program. These issues include (1) how IMA requirements can best be satisfied by afloat IMAs, shore IMAs, or both, and (2) the impact of changing maintenance concepts and strategies, such as the long-range portions of the Ship Support Improvement Project, on IMA needs. Factors such as the role of IMAs in war and peace, and the cost of doing work at different IMAs are integral parts of such issues.

In our report on IMAs (see p. 26) we found that the Navy had not adequately addressed these issues. For example we observed that the Navy (1) had done very little to determine its wartime IMA requirements, (2) had not considered the use of allied ship repair capabilities in war planning, (3) had not established a wartime role for most of its shore IMAs, and (4) had not adequately matched wartime needs with peacetime requirements. We recommended that such efforts be undertaken to insure that the optimum maintenance activity effort could be determined and minimum necessary afloat and shore IMA capacity could be defined. Furthermore, the previously mentioned 1977 House Appropriations Committee Staff report on shore IMAs noted that the Navy did not consider either the capabilities and capacities of private shipyards or the possibility of making greater use of naval shipyard or Naval Air Rework Facilities for special needs. The report recommended that the Navy and private industry work together to determine what total intermediate maintenance capacities and capabilities are available along with the acquisition of special labor skills required.

We also reported that the Navy should carefully assess the impact of changing maintenance concepts, such as the long-term ship maintenance strategy reassessment effort, on IMA maintenance requirements. This is expecially important since (1) we had obtained preliminary data on the application of the Integrated Logistics Support concept for the Navy's Mark 48 torpedo 1/ and on the extended submarine overhaul cycle that indicated that actual demands on IMAs would probably be less than originally estimated and (2) certain changes proposed as part of the long-term Navy effort to reassess its current ship maintenance strategy could affect IMA maintenance needs. For example, one major task of this long-term Navy effort is to improve productivity at the IMAs and shipyards. If the productivity of the IMAs is increased, the amount of available IMA capacity would also increase. This additional capacity, in turn, could be used to satisfy increased requirements, given the same facilities and equipment.

Concerning the first issue, a Navy official stated that since our report was issued, the Navy had completed a study 2/ which addresses many of the points raised in our report.

We briefly reviewed this study and found that although progress was made in certain areas, such as considering attrition of ships, some of the same problems noted in our previous report still existed. For example wartime requirements, which were used as a basis for justifying total IMA needs and the mix of shore IMAs to afloat IMAs, were again based on unrefined and possibly overstated peacetime requirements, and the ship maintenance capability of our Allies was again not considered in determining how and where wartime requirements could best be satisfied.

In addition, we noted that the Navy still sizes its shore IMA structure on its need to support its sea-to-shore rotation program. According to the Navy, this program was established to provide meaningful shore billets for personnel

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1/"Why Improved Navy Planning and Logistic Support For the Mark-48 Torpedo Are Essential" (LCD-76-451, May 9, 1977).

2/"Mobile Repair Facility (MRF) Force Level Requirements Study" (Presearch Inc., Oct. 24, 1977).

who spend a disproportionate amount of time at sea. The personnel have skills which, for the most part, are needed only on board ships. The shore IMAs allow these persons to work in their skill areas while on shore duty. Additional shore billets also improve the sea-to-shore rotation ratio, which reduces family separation time, improves morale and, it is hoped, improves the retention of these skilled persons.

Although this program was established for commendable reasons, more work needs to be done to determine the impact of personnel assignment alternatives discussed in our previous report on IMAs and the House Appropriations Committee Investigative Staff report on the number of shore IMAs in the Navy. In our opinion, prior to sizing the shore IMAs, the Navy needs to have a good handle on its maintenance requirements--both wartime and peacetime, and how and where these requirements can best be satisfied--at shore IMAs, afloat IMAs, or both. Although the Navy has made some progress in defining its IMA maintenance requirements, additional work, as noted above, is needed to accomplish this task.

The various issues described above were discussed with the Navy. Their and our positions have not substantially changed since our last report on IMAs.

RECOMMENDATIONS TO THE COMMITTEE

In our recent report on the Navy's intermediate maintenance program, we made several observations and recommendations on issues such as (1) work requirements' definitions and quantifications, (2) alternatives to satisfying work requirements, and (3) impact of changing maintenance concepts on intermediate-level maintenance needs. The Navy generally concurred and promised corrective action.

Although some progress has been made, we believe that the Navy still needs better information on and analyses of the above issues before it can establish what type and how much IMA maintenance capability is needed. Because of current Navy efforts to obtain funds to upgrade and improve intermediate-level maintenance facilities, we recommend that before acting on future requests for funds, the Committee require the Navy to provide specific evidence which clearly demonstrates the need for such facilities.

CHAPTER 4

THE SHIP SUPPORT IMPROVEMENT PROJECT: THE LONG-RANGE EFFORT

While the programs discussed earlier identified some areas where opportunities for immediate improvements to the Navy's surface ships existed and where improvement actions could be implemented, several previous Navy and DOD studies indicated that these efforts might not be sufficient and that a major, integrated engineered development effort was needed to make basic changes to the way the Navy is currently accomplishing ship maintenance. (See app. I.) This effort, the Maintenance System Development Program, is discussed in this chapter.

THE MAINTENANCE SYSTEM DEVELOPMENT PROGRAM

MSDP was initiated in response to problems of inadequate material condition of surface ships. Also, ship maintenance costs were growing rapidly, suggesting changes in existing ship maintenance practices. In 1974 DOD and the Navy decided to develop an integrated, engineered, reliability-centered ship maintenance strategy to improve its ship maintenance functions and activities and thereby achieve an appropriate level of material condition on surface ships. The initial, or study phase of the program, started in fiscal year 1976, is currently projected to cost about $34 million and is programed to be completed by the end of fiscal year 1980. Navy officials told us that implementation of major study proposals is to follow but may take many years to complete; however, some study proposals can and are being implemented at lower Navy command levels.

The work of MSDP is proceeding in three phases: (1) a review of the current ship maintenance system to identify significant problem areas, (2) an analysis of major problems and the development of improvements, and (3) a decision to implement improvements.

Although various parts of the program are currently in different phases, the Navy believes sufficient analytical work has been done on the first two phases to suggest that current Navy systems and procedures, with modification, could provide a better and more integrated ship maintenance system.

Because the work on MSDP is only in its early stages, it would be premature to draw any firm conclusions on whether the program will result in an improved Navy ship maintenance strategy. However, we did make some preliminary observations which are shown on page 42.

Program areas

Three major areas containing nine different elements were identified by the Navy as needing improvements: maintenance requirements determination, maintenance management, and maintenance support engineering.

Maintenance requirements determination focuses on planned and corrective maintenance; maintenance management is concerned with the process of programing and allocating resources to maintenance, the management of ship maintenance by classes, the information systems that provide data on fleet readiness and maintenance problems, and organizational issues related to maintenance. Maintenance support engineering addresses supply, repair, manpower, training, and test equipment. A brief description of the Navy's objectives and actions for each element contained in the three major program areas follows.

Maintenance requirements

The goal of the maintenance requirements determination effort is to revise ship maintenance plans and resource requirements to achieve three results.

--Only do the planned maintenance that is necessary to maintain good equipment reliability.

--Restructure corrective maintenance tasks to maximize equipment availability within existing resources.

--As a result of these two efforts, increase ship and equipment availability.

To accomplish these objectives, the Navy has modified for application to ships a reliability-centered maintenance logic which has been successfully applied to aircraft. Basically, the logic focuses planned maintenance on ship and crew safety and mission combat capability. All other planned maintenance is ended unless a major cost savings can be seen by doing planned maintenance. Planned maintenance tasks based on this logic and newly developed corrective maintenance procedures based on a similar logic are currently

being prototype-tested on the FF-1053, the U.S.S. Roark. If the test proves to be successful, the new procedures will be tested on several more ships. By 1980 the Navy hopes that this will lead to a general specification for shipboard and off-ship maintenance which incorporates both reliability-centered planned maintenance and new engineering for corrective maintenance.

Maintenance management

The objective of this program element is to restructure maintenance resources, organizations, and information systems in such a way that appropriate information is provided to the proper Navy management level to achieve better control over the ship maintenance program.

The Navy believes that this needs to be done because several previous Navy studies showed that (1) the Navy is currently unable to effectively relate maintenance resources to either ship material readiness or material condition, (2) existing organizational interfaces in the Chief of Naval Operations hinder the development of clearly defined ship maintenance goals and identification of depot and intermediate-level maintenance resources required to satisfy requests generated by different Navy sponsors, (3) different lines of responsibility exist for maintenance support and execution--basically responsibilities are divided between the Navy's shore establishment and the fleets--better coordination is necessary, and (4) current information systems containing maintenance-related data are not coordinated and integrated to provide relevant, timely, and accurate information.

Actions underway in the resource area include work on development of adequate measures of material condition; identification and tracking of all the resources programed, budgeted, or spent for ship maintenance; and redesign of the current maintenance resource allocation process to make it more responsive; and development of revised formats for the maintenance and modernization annex to the Navy's Program Objective Memorandum. Finally, an approach to relating resources to ship material condition is being developed.

The Navy projects that the major goal in the resource area of developing resource/material condition linkages will not be completed until fiscal year 1980. However, several improvements to the Navy's current maintenance programing, planning, and budgeting system will be ready for implementation during 1978. In fact, we were told that the Navy has

developed and partly implemented a new format for the fiscal year 1979 and 1980 annex D of the Navy's Program Objective Memorandum which provides greater visibility over resources spent or projected to be expended by the Navy. We tried to assess this Navy action by obtaining supporting documentation. The Department of Defense, which handles requests for information related to Program Objective Memoranda would not provide us with annex D of the Navy's fiscal year 1979 Program Objective Memorandum. However, we were provided with exerpts from this document. This information was not sufficient for us to determine whether the Navy action had resulted in an improvement.

Actions underway in the organizational area include the development of recommendations for improving the Navy's command structure for maintenance and the development of an improved organizational structure for managing the Navy's ship maintenance programs on a ship-class basis. Work on these projects is expected to be completed during 1978.

Actions in the information area include a study of current data systems in the Navy, data needs for management of ship classes, for identification and analysis of maintenance problems, and for measuring ship material condition. The actions, which are expected to be completed during 1978, are projected to provide a base for revising and integrating maintenance information systems, which will begin in fiscal year 1979. Also, according to Navy officials, a system concept for revision of the Navy's 3-M IMA reporting system is currently under development.

Maintenance support engineering

The Maintenance Support Engineering Area focuses on supply, repair, manpower and training, and technical issues where improvements and better coordination are required to improve maintenance.

Supply

The goal in the supply area is to reduce the time spent awaiting parts at all maintenance levels. According to the Navy, this was desirable because there have been several past instances where needed maintenance actions could not be done in a timely fashion due to a lack of parts. The Navy hopes that improvements in this area will reduce the amount of downtime of ship systems.

To achieve such improvements, the Navy is assessing alternate stock models which will provide for changes in quantity and location of stocked parts to improve responsiveness. 1/ Furthermore, to reduce supply delays and to increase supply efficiency, work is being done to evaluate the benefits and costs of capitalizing repairables into a Navy stock fund, to assess improvements needed in the management to reparable items, and to facilitate material being requisitioned and delivered.

Work on the capitalization study has been completed and recommendations to implement study results were forwarded to top Navy management for approval. Navy officials, however, told us that the study's recommendations are controversial and that the Navy is currently reviewing which of the study proposals should be implemented or if they should be implemented at all. We were told that a decision concerning implementation is scheduled to be made in September 1978.

An assessment of problems in the repairables management and supply flow procedures areas is scheduled to be done by September 1978.

Repair

The goal in the repair area is to reduce the time a ship is not operationally available due to industrial availability requirements. Navy data shows that this has been a significant problem in the past and appears to be getting worse.

The Navy believes that this goal can be achieved in several ways. One, by increasing the efficiency of the naval shipyards and intermediate maintenance activities both in planning and production effort and second, by improving ship availability scheduling. In addition MSDP is supporting two ongoing efforts--the enhancement of the intermediate maintenance management system, which is the management system aboard tenders (3-M reporting) and the automation of the ship alteration and repair package program, which provides the planning baselines for ship overhauls and feedback on work accomplishments.

1/Navy officials added that one version of these models, although not through the testing stage, is currently being used to compute financial requirements for spares for the PHALANX weapon system.

Work on the IMA and naval shipyard effort started in April and June 1978, respectively, with a survey effort which reviews current studies and improvement programs related to IMA and shipyard management and scheduling techniques to discover what improvements have been proposed, attempted, or installed. The survey is also designed to develop a detailed plan for more necessary analyses and design of improvements in management and scheduling techniques and tools. Work on improving the existing tender maintenance management system is expected to be completed in late 1979 while the automated ship alteration and repair package is expected to be completed in September 1978.

We briefly reviewed the current scope of the repair effort and had no difficulties with it. However, we were told by personnel from the Navy's prime contractor for the MSDP program that substantially expanding the scope of the IMA/naval shipyard effort is being considered because this area offers the potential for significant improvements. While additional effort in the IMA/naval shipyard area may be warranted, we believe that the Navy should first consider implementing recommendations made by past Defense, Navy, and GAO studies on IMA/naval shipyard operations. GAO reports pertaining to this area are listed in appendix III.

Navy officials told us that although a significant amount of funds had been earmarked for this effort in fiscal year 1979, the amount of money actually spent and the way it would be spent (whether on more problem definition, problem solving, or assistance in implementing already-made recommendations) would depend on the findings of the current baseline study.

Manpower

The objective in the manpower area is to insure that enlisted maintenance personnel at the organizational and intermediate maintenance level make a maximum contribution to the ship maintenance system.

The Navy believes that this goal can be partly achieved if weaknesses in the ship manpower document methodology are overcome. 1/ These weaknesses, which had been previously

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1/The ship manpower document is the basis for staffing requirements to which Navy manpower managers must respond and for justifying manpower needs during the budget process.

identified in work done by the Navy Fleet Manpower Policy Study Group and the current Navy Manpower Planning System, included (1) no provision for basing staffing requirements on peacetime conditions, (2) crude methods for estimating manpower requirements for corrective and facilities maintenance, (3) lack of mechanisms for considering alternative mixes of manpower and other resources, and (4) validation difficulties.

Actions to overcome these and other manpower weaknesses include studies (1) to develop a process which can effectively match shipboard maintenance workload with crew capability, including the development of improved methods to estimate maintenance workloads; (2) to assess and improve existing training for maintenance skills; and (3) to develop appropriate policies and procedures to better use shipboard manpower. The initial efforts on these actions are scheduled to be completed during 1978 and all the work is expected to be completed during fiscal years 1979 to 1980.

Technical support

The Navy's goal in the technical support area is to improve the support in two areas--the management of general purpose test equipment throughout the Navy and the delivery of technical support to ships from Navy engineering activities.

Actions to be completed this fiscal year will include a report on methods to determine general purpose test equipment requirements, how to maintain a test equipment inventory management system, and procedures for developing consolidated budget requirements for test equipment. Work on the second area is expected to begin the next fiscal year.

Implementation procedures

According to the Navy, one of the objectives of the MSDP program is to develop specific recommendations for implementation throughout the life of the program. A limited number of these proposals have been implemented, such as restructuring annex D of the Navy's Program Objective Memorandum for fiscal years 1979 and 1980. The Navy identified some other studies that may soon be implemented, such as the study on capitalization of repairables, provided that the Navy agrees with the study proposals.

Currently, the Navy uses the following step-by-step process to review the MSDP products and implement them. First, a peer review of the analysis is conducted. This is done through a planning review committee which has been established to help the project manager (PMS-306) review the planning and products of the program. This committee is composed of selected representatives from various Navy organizations. Second, when an MSDP study presents a recommended change, various Navy organizations review the proposed change and either approve, disapprove, or comment upon it. Third, once recommended changes are approved, implementation plans will be reviewed by appropriate Chief of Naval Operations organizations. Once approved, implementation in most cases is expected to be done by the Navy organization responsible for that area.

Navy officials told us that until recently, this general process for review and approval of study recommendations was done informally. However, because most studies are reaching the completion phase, the Navy has begun plans to make the process more formal. They have prepared an instruction which assigns responsibility for the technical approach of the program to Deputy Chief of Naval Operations for Logistics and assigns review responsibility to other Navy organizations. According to Navy officials, the instruction detailing the formal process is in final review and should be issued shortly.

Resource requirements

The total projected cost of the MSDP program for fiscal years 1976 to 1983, as projected in fiscal year 1977, was about $40 million, all of which is for contracts or direct support to implementing activities. Current projections show that this total has been reduced to about $34 million for fiscal years 1977 to 1983, assuming that the effort will conclude, as currently programed by the Navy, at the end of fiscal year 1980. Information we obtained, however, indicates that due to a cut in funds in fiscal year 1979, it is possible that the MSDP program cannot be completed by 1980 without reducing the scope or objectives. No firm estimate has been developed for additional funding required to complete the MSDP program as currently planned. The total project cost does not include future cost of implementing proposals developed by the program, that is, those implementation actions not supported during the current program life.

The actual amount of contracts let by the Navy between fiscal years 1976 and 1978 amounts to about $14.3 million; about $11.1 million of that total was assigned to one

management consulting firm, American Management Systems, Inc., about $2.2 million to Lockheed California Company, and the remainder was spent on miscellaneous tasks. AMS is the prime contractor for the total analytical effort of the program except for the shipboard maintenance portion which is handled by Lockheed. Of the $14.3 million in the AMS contracts, $5.6 million have been used to subcontract certain technical portions of the program. The basis for selecting AMS as the prime contractor is discussed in chapter 5.

PRELIMINARY OBSERVATIONS

The Maintenance System Development Program, as currently planned, is a complex and ambitious undertaking. It involves work on various functions and activities, most of which are interrelated. Since many of the issues addressed in the program have been or are currently being addressed in Defense, Navy, and our studies; careful research and coordination with these efforts is required to avoid duplication of work and unpromising avenues of analysis.

While the Navy appears to have done a credible job in identifying problem areas and in defining major task objectives to improve these areas, its implementation of study proposals resulting from reviews of these areas is proceeding slowly. So far, of the many studies being worked on, only a few are ready for implementation. These include (1) a test of the reliability-centered maintenance concept aboard ship, (2) a supply study related to capitalization of repairables, and (3) an improvement effort involving the Navy's current maintenance programing, planning, and budgeting system.

Of these, the first one is underway, the second has been transferred to a Navy inhouse group for final disposition, and the third is being gradually implemented over several years. Whether study recommendations involving sensitive or controversial areas, such as streamlining the Navy's command structure to facilitate effective ship maintenance management, will be implemented remains to be seen. The ultimate cost of implementing approved study proposals is still unknown.

Furthermore, the MSDP program, as well as other SSIP efforts, appears to rely heavily on inaccurate and unreliable data. No major efforts to validate or improve the data base were apparent. Such validations or improvements

are necessary to insure that conclusions reached on the basis of existing data are credible.

There is also a question of whether all the MSDP efforts should be done, and if so, how extensive they should be. For example, any increases in the current scope of the IMA/naval shipyard study in the planning and production area appears questionable because of the many previous studies in these areas.

Navy officials commented that several studies in addition to those shown above are ready for implementation. Additional studies include (1) an improved supply model that maximizes operational availability of ship systems and equipment, (2) a maintenance management information system, (3) a costing and scheduling model for ship overhauls, (4) a management plan for completing work on the ships' equipment configuration accounting system, and (5) a computer system for making sure that ship alterations, upon installation, will be provided the necessary logistics support. We were told that the first has already been applied to calculation of fiscal years 1979 and 1980 spares budget requirements for contractor support of the PHALANX weapon system; the second and third are in the final stages of computer programing, and the last two should be improved for implementation by the end of this fiscal year.

We did not review these studies.

Regarding our observation on the inaccuracy and unreliability of the data base used, Navy officials told us that as part of the MSDP program, a more careful analysis of existing raw data is being undertaken. Furthermore, plans are being made to develop data collection and analysis systems which are quicker and portray more accurately what is actually happening and are more useful for all levels of management.

RECOMMENDATIONS TO THE COMMITTEE

Since the cost of the MSDP program is substantial and the results of the program could lead to lasting changes in the Navy's ship maintenance system, the Committee should require the Navy to periodically report on the results of the various program studies and their implementation status, and if they are not implemented, to explain why.

CHAPTER 5

INFORMATION RELATED TO THE MAINTENANCE SYSTEM DEVELOPMENT PROGRAM CONTRACT

The Committee was interested in obtaining information pertaining to the Maintenance System Development Program contractual efforts. Because of the long-term nature of MSDP, the annual award of a contract and the projected total contract cost (about $34 million), the specific Committee interest involved alternatives for accomplishing the MSDP work, the contractor selection process, and the impact the contract has had on the selected contractor's business.

ALTERNATIVES FOR ACCOMPLISHING THE MAINTENANCE SYSTEM DEVELOPMENT PROGRAM WORK

The Navy had three alternatives available to do the MSDP work. It could contract out the entire effort; do the entire effort inhouse; or have a combination of both, such as going to a series of direct contracts and integrating the entire MSDP effort inhouse.

The Navy selected to contract out the entire MSDP effort. Three reasons for hiring a management consulting firm to do the work were spelled out in testimony given by the Director of the Navy's Ship Maintenance and Modernization Division of the Chief of Naval Operations before the House Appropriations Committee.

> "* * * First, to obtain a thorough analysis by specialists in the management field; second, to obtain a fresh, unbiased look at our (ship) maintenance practices; and third, to take advantage of the available business management talent in formulating improvements to this multi-billion dollar business."

The Director went on to say that:

> "* * * the prime contractor for the analytical effort is American Management Systems, Inc., who subcontracts to other firms for various portions of the study, and who integrates the whole study * * *."

Navy officials told us that the other alternatives were also considered but were deemed impractical. One reason given for not doing the work in-house was that while the Navy had the essential management and technical skills to do the job, the skills were not resident in one single command nor readily available to be diverted to the project in the short time required.

Concerning the option of accomplishing the contract via a series of direct contracts, the Navy rejected this approach because it did not feel that the current Navy management team involved in the Ship Support Improvement Project could perform the integration with its current resources, and splitting up the various tasks related to the MSDP effort would be counter-productive to an integrated output. Centralizing the function with a contractor was felt to be more desirable.

Since all of the above reasons were subjective, we asked the Navy if it had any "hard" facts to support its decision. It had not. Because the size of the contract was so substantial, we tried to develop some information on how mu of the cost could have been avoided if the Navy had chose another alternative. A Defense Contract Audit Agency official stated that based on data contained in one of the three contracts accomplished by the prime contractor to date, over 25 percent of the $4.6 million cost was related to integrating the work of different subcontractors. A portion of this cost could have been avoided if the Navy had used a series of direct contracts. Part of the costs avoided would be offset by the cost of performing the integration effort in-house.

Navy officials commented that as the study and integrative portions of the effort are completed and solutions to specific problems are found, the proportion of direct contracting will increase.

CONTRACT PROPOSAL AND BASIS FOR CONTRACTOR SELECTION

Sixty-two firms were invited to submit technical and cost proposals for the MSDP effort; only 18 firms actually submitted proposals. The solicitation specified that the Navy would use the following criteria to evaluate each offer. The criteria are listed in order of priority.

--Depth of understanding the work required as reflected by the offerors' work statements and technical proposals.

--Offerors' selection of personnel, both management and technical, and their specific qualifications and credentials.

--Corporate background, experience, and expertise as related to the description of work.

--Organizational structure for project management.

--Location and adequacy of facilities.

--Offerors' cost proposals.

--Completeness, accuracy, and thoroughness of the total proposal--technical and cost.

The offerors were also told that the soundness of the technical proposal would be the primary basis for final contract award.

A three-member Navy panel reviewed each technical proposal using the following criteria and weights to assign scores to each offeror.

Criteria	Relative weight
Understanding of objectives	35
Personnel qualifications	35
Experience in related areas	10
Facilities--location and adequacy	10
Organization for project management	5
Proposal quality, accuracy, and completeness	5
	100

In the judgment of the Navy panel, American Management Systems, Inc., the contractor selected, scored much higher than its nearest competitors in the areas of personnel and understanding of objectives. Scores given to the selected contractor in the remaining areas were about equal to those of its competitors. In the final analysis, the selectee's total score was 28-percent higher than its nearest competitor.

The cost proposals were evaluated separately from the technical proposals. The proposals ranged from a low of $262,000 or $27,300 per man-year to a high of $960,000 or $99,800 per man-year. AMS submitted an offer of $715,000 or $74,300 per man-year. The chosen contractor was higher than 15 of the 18 cost proposals submitted. Although the chosen contractor obviously did not submit one of the lowest offers,

he was ultimately selected by the Navy on the combined basis of his technical and costs proposals.

Since the original contract was awarded, two annual contracts have been awarded and plans call for additional contracts through 1980. The first contract was, as discussed, awarded on a competitive basis while subsequent contracts were awarded on a sole-source basis, because of the expertise developed during execution of the first contract. Navy officials added that the learning process and startup time for an analysis as broad in scope as the Maintenance System Development Program would have required at least six months and awarding the contract to another contractor would have unduly delayed the work effort. While no mention was made of the possibility that the successful offeror could be used as a sole-source in the following years, we were told by the Navy that this is not unique and all experienced contractors should have been aware of this potential.

INFORMATION ON AMERICAN MANAGEMENT SYSTEMS, INC.

In response to the Committee's interest in obtaining information on the selected contractor and on the impact the MSDP contract had on its operations, we (1) obtained contractor work force and revenue data, (2) compared revenues generated by the MSDP contract to total contractor revenues, and (3) compared current staff qualifications and skill mix with those included in the original proposal submitted in 1976. We obtained the following information.

The contractor was incorporated in February 1970 to provide consulting services in developing computer-based information and analysis for planning and management. Since that time, their total yearly revenues have grown from $0.5 million to $21 million, with the most growth (in dollars) coming during 1976 and 1977 ($7 million to $21 million); however, the percentage growth rate was higher in the 1970 to 1974 period. Between 1970 and 1977, their work force grew from 25 to 414. See chart on the following page.

Contractor Work Force and Revenues: 1970-77

	Full-time employees	Part-time or temporary employees	Total	Total revenues (000 omitted)
12/31/70	23	2	25	$ 555
12/31/71	49	1	50	1,278
12/31/72	85	4	89	2,241
12/31/73	178	4	182	3,492
12/31/74	240	7	247	6,602
12/31/75	202	5	207	7,239
12/31/76	289	10	299	12,321
12/31/77	396	18	414	21,195

Although the Navy contract is one of the company's largest single contracts, it does not appear to be the prime reason for its rapid growth because it does not represent the major source of its revenue as shown below.

Comparison: Navy Project Versus Total Revenues (1976 to Present)

	1976		1977		Jan. to Apr. 1978	
	(000 omitted)		(000 omitted)		(000 omitted)	
Total company revenue	$12,321	100%	$21,195	100%	$8,084	100%
Navy project revenues	1,246	10.1%	5,779	23.7%	1,216	15%

The contractor performs a wide range of work, and currently, this contract is its only work as a prime contractor for a defense organization.

Because personnel qualifications weighed heavily in contractor selection, we looked at the skill mix of project personnel listed in the original proposal, those who actually worked on the contract, and those currently working under the latest sole-source award.

Of the 19 professional staff listed in the original proposal, which was used as a justification for the contract award, nine actually worked on the contract. Contracting officials told us that of the remainder, four people employed by a subcontractor to do maintenance management-related work were not used as anticipated because the company and the Navy decided to do this work through another

subcontractor; the others were information system specialists who were not used due to a change in emphasis initiated after work was begun.

Of the analysts working on the project in July 1976, only 31 percent are still involved. Company officials told us that such a large turnover is not unusual for a long-term project such as the MSDP effort because (1) some people always leave the company and (2) the company has a policy to rotate, over a reasonable period of time, a significant portion of the personnel assigned to the project to prevent becoming "mentally stale." To illustrate this, company officials provided us with data on another long-term project also begun in 1976 which showed that only 32 percent of the original staff assigned to that project was still involved in it. In comparing the current staff qualifications and skill mix with those included in the original proposal, we noted that both groups included senior analysts with various backgrounds, including defense-related experience, systems analysis, engineering and computer science. The mix of senior to junior staff also does not appear to have diminished.

OTHER INFORMATION

We also contacted the Defense Contract Audit Agency (DCAA) to discuss the results of an audit it had previously performed on the original contract proposal. DCAA officials told us that they had reviewed direct labor, overhead, and general and administrative expenses contained in three American Management Systems, Inc., contract proposals. These reviews did not disclose any major concerns with the contract.

DCAA officials also informed us that they planned to do a more detailed review of the MSDP contract, called a "costs incurred" audit later in the year. Such an audit assesses the allowability, allocability, and reasonableness of direct and indirect labor costs incurred by the contractor in performing the contract work.

OBSERVATIONS

While we have found no apparent reason to question the selection or operations of the current contractor, we believe that the Navy should have, as a matter of good management, more fully assessed the alternatives before issuing this contract. A formal assessment of the alternatives would have permitted the Navy to compare the true costs of using

a single prime contractor in place of building the central Navy staff to perform either the actual tasks or to assume the functions of integrating the tasks of several direct contracts. Because the costs of the current contracts may reach more than $34 million, and over 25 percent of these costs may be associated with integration efforts, the potential for substantial savings would indicate the need for formal documentation of these trade-offs.

APPENDIX I

NEED FOR AN INTEGRATED, ENGINEERED MAINTENANCE STRATEGY 1/

For the past several years the Navy has advocated the funding of thorough overhauls as a key to upgrading the material condition of the fleet, where the role of the thorough overhaul is to provide a ship capable of being maintained by dedicated men. Significant dollars have been appropriated and applied. However, it is increasingly clear that thorough overhauls alone will not sustain material condition between overhauls. Additional, comparable effort is required in the other areas where maintenance is performed if the Navy is to deliver the needed improvement in the material condition of the fleet.

Overall, Navy ship maintenance is uneven. In the Submarine Force, maintenance appears generally to be effective with promise for still more improvement. However, the material condition of many Navy surface ships is not acceptable.

The Navy ship maintenance strategy appears unclear and requirements are not adequately defined, with inadequate information feedback or controls to identify emergent problems. Many officers and enlisted maintenance men appear ill-trained and ineffective in the maintenance function. Finally, several programs aimed at correcting one or another aspect of these problems are underway, but are not necessarily coordinated.

At the ship's force level, officer training and experience for maintenance and engineering appear inadequate. The skill levels of enlisted maintenance personnel are demonstrably low. Compliance with preventive maintenance requirements is low and has been so noted in Board of Inspection and Survey proceedings. The Navy is faced with a situation of increasing technology and decreasing real capabiilty. The relative self-sufficiency of a combatant ship is changing in character, due partly to increasing umbilicals from the ship to CONUS component rework and increasing dependence on maintenance by outsiders, such as Mobile Technical Units, contractor technicians, and other such personnel. Finally, the planning and quality of work are often inadequate.

1/ As adapted from annex D of the Navy's fiscal year 1977 Program Objective Memorandum.

APPENDIX 1

Several repair functions have declined in the intermediate maintenance activity echelon. In destroyer tenders IMA capability has largely degraded to essentially hull, machinery, and electrical repair effort, as the technical complexity of the destroyer has outstripped the personnel skills and equipment of the tender. Ordnance, electronics, and sonar repair support required at the IMA level are being provided by shore-based technical assistance personnel who are stretching their current missions.

Mobility in war and peace provides the justification for tenders. The total maintenance strategy for the war deployment of destroyer forces is supported by the Navy's ability to deploy nine fully capable destroyer tenders with the combatants in the event of conventional war. Many of the current tenders are not capable of satisfying their war roles which include continued intermediate maintenance, correction of battle damage, and component repair necessary to compensate for diminished or interrupted CONUS transportation channels. Tenders are needed because of the peacetime requirement for mobile intermediate maintenance and because they are the Navy's fundamental maintenance base for war deployment. The Navy is responsible for insuring that tenders justified by war roles can satisfy those roles. The Navy also is obligated to insure a maximum return from these assets in peacetime. The age of many tenders is a recognized problem and all tenders suffer personnel problems, being inadequately staffed in terms of numbers and skills.

Repair technicians already assigned to shore IMA activities as well as unfilled billets in those programs are vital assets that can be applied to the emerging maintenance requirements. The Navy's shore intermediate maintenance activities are generally underequipped. Furthermore, they are not skill balanced and the need exists to provide certain skills other than those of the deprived ratings to achieve a productive balance of intermediate maintenance-level capability and capacity. The shore IMA activities are not systematically tasked, resulting in time and skill wastage.

Operational imperatives frequently curtail both the frequency and duration of availability, and maintenance time lost is not made up. A directly related problem is represented by the uneven workloading of the tenders, resulting in economic loss. Finally, the planning and estimating function, the quality assurance function, and the quality of the product itself are uneven in the intermediate maintenance activities.

APPENDIX I

At the depot level the backlog of deferred ship overhauls is growing and the Navy is faced with yard periods of long duration caused by large repair packages, limited industrial capacity, and long material lead times. These difficulties are forcing a reexamination of operating cycles. Aggravating these problems is a phenomenon of divergent pressures. On one hand the overhaul community is pressed for tighter standards and improved planning and quality assurance. On the other hand, they are pressed for cheaper means to achieve the necessary refit and restoration.

At the same time, shipyard skills are deteriorating. These technical skills are currently in demand across the board in the total national economy. Also many shipyard journeymen are retiring and apprentices' input is inadequate to replace them. Product quality and quality assurance functions are often criticized in shipyard overhauls.

Component rework is another aspect of depot maintenance. Component rework umbilicals are not merely a possible option. Dependence on them is a growing fact. There exists a wide proliferation of rework points in the ordnance and electronics systems, presenting a management and integration problem. On the other hand, the Navy enjoys only limited dedicated rework capability for machinery and electrical systems. Across the board, there appears to be an increasing need for planned replacement of nonmaintainable components. The surface Navy suffers from uneven performance in component rework cycles in the areas of carcass return, rework turn-around-time, and component losses in this loop. The continued existence of such problems constitutes a vulnerability to disciplinary budget cutting and thus jeopardizes both the funding of replacement components and of the repair funds themselves.

There is a growing need for component rework to contribute to the reduction of the overhaul duration and to improve material condition between overhauls by providing the ability for refit and restoration, and modernization by change-out as opposed to overhaul in-place. In this area also, product quality and the quality assurance function itself require improvement.

In summary, it can be said that the Navy's present capacity, capability, and management of maintenance do not support the Fleet's needs for war readiness or for peacetime operations. A major integrated, engineered corrective program appears needed, calling for changes in training, attitudes, management, facilities, and systems.

HISTORY OF ENGINEERED OPERATING CYCLE PROGRAMS 1/

Development of new ship maintenance strategies began with the establishment of the Nuclear Powered Ballistic Submarine (SSBN) System Maintenance Monitoring and Support Program in 1970. The initial program objectives were to determine the feasibility of extending the interval between shipyard overhauls for SSBN submarines to a time compatible with the period between refuelings of the new long-life reactor cores and to provide the necessary logistics support to ensure the credibility of the resulting Extended Operating Cycle. In February 1974, the Chief of Naval Operations approved the SSBN Engineered Operating Cycle program under the System Maintenance Monitoring and Support concept. Full implementation occurred for all SSBNs during 1977. For Nuclear Powered Attack Submarines (SSN), the Submarine Extended Operating Cycle Program began in 1972 for all SUBSAFE SSN 594 Class and later SSNs. The operating cycle was extended from 43 to 70 months for these ships.

In 1973 the Chief of Naval Operations made the Commander, Naval Sea Systems Command, responsible for investigating the feasibility of adopting extended overhaul cycles for cruiser/destroyer classes of ships. As a result of that study the Destroyer Engineered Operating Cycle (DDEOC) Program was undertaken in August 1974 to develop a detailed maintenance strategy and implementation plan to support a lengthened operating cycle, selected at that time to be 54 + 6 months. The DDEOC Program now includes the FF-1052, DDG-37, CG-16, CG-26, DDG-2, DD-963 classes.

A maintenance concept similar to EOC was approved in 1971 for a new class of ships, the FFG-7, which included long cycles based on engineering analysis. In addition, the design constraints called for significantly reduced shipboard manning. The traditional surface ship maintenance strategy has been modified for their ships to a shift in emphasis from piece-part replacement to modular and subassembly replacement, with a greater reliance on rotable parts. (See p. 10.)

Current status of EOC programs

Among the numerous EOC programs scheduled and in various stages of development and implementation, all have common goals, similar support, and interface requirements.

1/As adapted from a draft program initiation study report for an amphibious Engineered Operating Cycle, June 1978.

These similarities offer the advantage of established support organizations, plans, and techniques for the establishment of new EOC programs. A general, phased process for development and implementation of EOC requirements for any specified ship class has been produced. Prior experience in submarine and destroyer EOC programs was liberally applied in the structuri] of a uniform process to be applied to all candidate ship classes. Present planning provides for engineering maintenance requirements and procedures to improve and maintain material condition via EOC programs for 50 percent of the fleet by 1984. The remaining 50 percent are surface ships of a variety of ship classes that are potential candidates for the development and implementation of EOC programs. The status of existing EOC programs as of June 1978 is shown in table 1.

Table 1

Current EOC Program

Ship category	Ship class	Status
SSN	SSN 594, 637, & 688 classes	First implementation in 1972 Final implementation projected in 1981
SSBN	SSBN 616, 627, & 640 classes	First implementation in 1971 Final implementation in 1977
DDEOC	FF-1052, DDG-37, CG-16/26, DDG-2, & DD-963	First implementation in 1977 Final implementation in 1984.
Lo-Mix	FFG-7, a/PHM-1	First implementation in 1977 Final implementation in 1988

a/A patrol hydrofoil ship which, like the FFG-7, is being designed for limited manning and self-maintenance capability.

APPENDIX III

OUR PRIOR REPORTS RELATING TO MATTERS DISCUSSED IN THIS REPORT

Number	Date	Title
B-133170	June 7, 1973	Management of Ship Overhaul and Repair Programs, Fiscal Years 1972 and 1973
B-118733	Aug. 5, 1974	Industrial Management Review of Puget Sound Naval Shipyard
B-133170	Dec. 17, 1974	Survey of Planning for Ship Overhauls
LCD-76-406	Mar. 15, 1976	Improvements Needed in the Navy's Fleet Modernization Program
LCD-76-451	May 9, 1977	Why Improved Navy Planning and Logistic Support for the Mark-48 Torpedos Are Essential
LCD-76-237	June 7, 1977	Submarine Supply Support Costs Can Be Greatly Reduced Without Impairing Readiness
FPCD-77-76	Apr. 8, 1977	Changes in Navy Ship Overhaul Practices Could Improve Fleet Capability and Crew Effectiveness
LCD-77-412	Sept. 23, 1977	The Navy's Intermediate Ship Maintenance Program Can Be Improved

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