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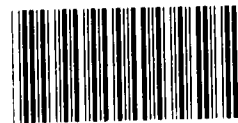
GAO

Report to the Chairman, Committee on
Armed Services
House of Representatives

March 1986

NAVY MANPOWER

Improved Ship Manpower Document Program Could Reduce Requirements



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United States
General Accounting Office
Washington, D.C. 20548

National Security and
International Affairs Division

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March 27, 1986

The Honorable Les Aspin
Chairman, Committee on Armed Services
United States House of Representatives

Dear Mr. Chairman:

On April 18, 1985, you requested that we conduct a comprehensive analysis of defense manpower requirements programs to assist your committee in assessing the services' stated manpower needs. In partial response to your request, we have evaluated the Navy's ship manpower document program. This report describes how the Navy determines the number and types of positions needed to operate ships and raises a number of questions concerning the rigor and realism of the processes used. We are recommending that the Navy take steps to improve its ship manpower program by requiring (1) the use of more rigorous work measurement methods, (2) adjustment of the conceptual model so that it is based on assumptions which more nearly correspond to how the Navy plans to operate in wartime, and (3) adequate documentation and review.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 5 days from the date of the report. Then, we will send copies to the Chairmen, House Committee on Government Operations, Senate Committee on Governmental Affairs, House and Senate Committees on Appropriations, and Senate Committee on Armed Services; the Secretary of Defense; the Secretary of the Navy; and the Director, Office of Management and Budget. Copies will also be made available to other interested parties upon request.

Sincerely yours,

Frank C. Conahan
Director

Executive Summary

Navy personnel will cost almost \$34 billion in fiscal year 1987, a third of the Navy's budget. At the request of the Chairman, House Committee on Armed Services, GAO is reviewing the process the Navy uses to determine its manpower needs. This report is concerned with one part of that process—the Ship Manpower Document (SMD) program, which determines ship-manpower requirements.

This report examines whether the SMD program has the necessary rigor and realism to accurately identify the minimum number and grade levels of enlisted positions in each occupational group that would be needed aboard surface ships at sea in wartime.

Background

The Navy established the SMD program in 1966. At the end of fiscal year 1984, the program covered 91 percent of all active Navy surface ships, establishing requirements for an estimated 171,000 positions.

In implementing the SMD program, the Navy uses a manpower modeling system whereby a ship's required combat capability and basic assumptions about how the Navy plans to operate in wartime is translated into a conceptual model which, in turn, is simulated on computers. As input to the conceptual model, the Navy uses the ship work load (the operational and maintenance tasks which assigned ship personnel would have to perform in wartime) and staffing standards (the amount of time and skills needed to perform these tasks). The resulting outputs are known as ship-manpower requirements.

Results in Brief

The number of enlisted positions the Navy says it needs to operate and maintain its surface ships is questionable because of the lack of rigor in the methodology the Navy uses to measure work load and to establish and validate standards, the lack of realism in some of the assumptions incorporated by the SMD model, and the failure to maintain documentation.

The degree of inaccuracy of the Navy's manpower requirements, and the impact of this inaccuracy on ship operations and the Navy's budget, is hard to determine precisely. However, GAO's review, as well as several past studies, indicates that some requirements are underestimated, decreasing readiness, and that others are overestimated, increasing costs. On balance, the net effect appears to be an overstatement of needs.

Principal Findings

The current requirements generated by the SMD program lack credibility for three major reasons.

Methodology Lacks Rigor

First, the methodology of the SMD program lacks the necessary rigor. In measuring work load and setting standards, for example, SMD analysts seldom observe the work actually being done, and they make no methods-improvement studies (examinations of actual work in order to identify unnecessary, duplicative, and inefficient procedures). Consequently, most of the current standards are unconfirmed reflections of what ship personnel say they do and may not reflect what they would do if they were working as efficiently as practical. (See ch. 2.)

SMD Model Needs Refinement

Second, the SMD system does not meet recognized criteria for sound modeling. Most seriously, it does not always correspond to the reality being modeled. (See ch. 3.) After reviewing the enlisted manning requirements for two destroyers, GAO found that changing the SMD system to better reflect how the Navy operates and plans to operate in wartime could result in reduced requirements for these two ships. (See ch. 4.)

Little Documentation for Current Standards Exists

Third, insufficient documentation exists to support the initial establishment of the standards or the changes that have since been made to them. Also, the documentation for the SMD modeling system or for changes that have been made to it is insufficient. As a result, errors are difficult to detect and correct. (See pp. 17 to 19, 22 to 23 and 50 to 51.)

Recommendations

GAO supports the Navy's efforts to establish reliable manpower requirements and believes that the SMD program provides the basic foundation to accomplish this goal. However, GAO believes that a number of aspects of this program need to be reexamined and revalidated. Accordingly, GAO makes a number of recommendations to the Secretary of the Navy. (See pp. 39 and 54.) The most important of these are summarized below:

- Require that standards be established and validated through as rigorous a process as practical, including direct observations of work actually being performed or simulated.

- Require that methods-improvement studies be conducted where practical and feasible before establishing and validating standards.
- Adjust the SMD conceptual model so that it more accurately reflects how the Navy plans to operate during wartime.
- Ensure that the basis for the standards and the SMD modeling process are adequately documented and that a proper audit trail of changes is maintained.

Agency Comments and GAO Evaluation

DOD provided GAO with official comments on a draft of this report. (The full text of DOD's comments is in app. III, beginning on p. 72.) These comments have been incorporated as appropriate. In general, DOD either agreed or partially agreed with most of the findings of this report, and Navy actions to address most of the problems were outlined. While DOD disagreed with some of the specifics of GAO's recommendations, it did agree to improve the documentation supporting the program and to study or revalidate many of the program's assumptions and allowances.

Also, while agreeing that implementing GAO's recommendations could reduce manpower requirements, DOD was concerned that this reduction cannot be translated into end-strength or budget reductions. DOD's basis is that it has never received full funding of its requirements. While a one-to-one correlation between reduced requirements and the budget or end strength may not be possible, GAO believes that reducing requirements can lead to savings. DOD's annual budget request is based on the requirements that the SMD program and other systems determine. More accurate requirements could result in lower budget requests because the calculated shortfall—requirements minus budget request—would be smaller, or resources could be better allocated to areas with the greatest valid need. The Congress also uses the services' statements of requirements in evaluating DOD's budget request.

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Abbreviations

CM	Corrective Maintenance
CNO	Chief of Naval Operations
DCNO	Deputy Chief of Naval Operations
DOD	Department of Defense
FM	Facilities Maintenance
ISEA	In-Service Engineering Agent
MDS II	Maintenance Data System
MRPA	Make-ready and put-away
NAVMEC	Navy Manpower Engineering Center
NAVMEP	Navy Manpower Engineering Program
NAVSEA	Naval Sea Systems Command
NMRS	Navy Manpower Requirements System
OPNAVINST	Naval Operations Instruction
OUS	Own Unit Support
PM	Preventive Maintenance
RCM	Reliability Centered Maintenance
ROC/POE	Required Operational Capability and Projected Operational Environment
SHMD	Shore Manpower Document Program
SHORSTAMPS	Shore Requirements, Standards, and Manpower Planning System
SMD	Ship Manpower Document
SNAP II	Shipboard Non-tactical Automated Data Processing
SQMD	Squadron Manpower Document
SRB	Selective Reenlistment Bonus
WS	Watch Station
3-M	Navy Maintenance and Material Management System

Introduction

The size and composition of the military work force is an important issue to the Administration and Congress as they seek ways to build up national defense while controlling costs. Consequently, these decision-makers need to be assured that all funding requests for military positions are credible and justifiable.

One reason for concern about DOD work-force requirements is that the number and quality of personnel directly affect military readiness. Much of our ability to withstand the numerical superiority of our potential military adversaries is due to our more sophisticated weapon systems. However, without the right number and kinds of positions and people to operate and maintain these costly systems, our military capability would be greatly diminished. According to Department of Defense (DOD) estimates, human errors account for at least 50 percent of the failure of major systems.

Another key reason for concern about manpower¹ requirements is cost. For fiscal year 1987, 4 to 5 million DOD personnel are estimated to cost over \$125 billion—about 46 percent of the President's budget request for DOD. In a system this large, even a small improvement in the way the work force is managed can yield substantial dollar savings. A variance of only 1 percent in staffing equates to over \$1 billion per year.

The need for a cost-effective work force will become even greater in the next decade because of a smaller recruitable population and an increasing demand for more technical staff. While the traditional recruitable population is expected to decline by about 20 percent by 1995,² technological advances in weaponry will require more higher-quality recruits to fill more highly skilled positions. Therefore, recruiting the number of quality personnel necessary may become increasingly expensive.

¹"Manpower," in the context of military personnel management, is a generic term used to refer to the demand for workers, regardless of gender. In this report, "manpower requirements" refers to positions and "personnel" refers to actual people.

²Based on changes to projected U.S. population ages 18 to 21 between 1983 and 1995, per U.S. Bureau of the Census Current Population Reports, Series P-25, No. 704, "Projections of the Population of the United States: 1977 to 2050" (Washington, D.C.: GPO, 1977).

Importance of Accurate Requirements to Navy

A cost-effective work force is important to the Navy for a number of reasons. First, Navy personnel costs are a significant portion of its budget. In fiscal year 1985, these costs are estimated to be over \$30 billion, about 33 percent of its total budget. Even a small increase in Navy personnel can cause this cost to rise significantly.

Second, the Navy is in the midst of expanding its fleet from 535 ships in 1982 to 600 deployable battle force ships by 1990. This expansion creates a requirement for an estimated 49,300 additional active manpower positions (from fiscal year 1984 through fiscal year 1990) to provide crews and essential support to routinely deployed naval units. At fiscal year 1986 pay levels, these additional personnel will cost at least \$1.1 billion annually.

Third, the number of manpower positions required on many Navy ships has grown so much that there are not enough bunks to accommodate them. This growth has occurred as a result of additional equipment and weapon systems being added to ships and originally installed systems being upgraded with systems of greater capability. Our analysis of berthing capacity on 344 deployable Navy surface ships active as of July 1984 revealed that approximately 60 percent of these ships will have exceeded berthing capacity by fiscal year 1986. Since the Navy's policy during peacetime is to not "hot bunk" (i.e., assign more personnel to a ship than that ship has available bunks), growth of position requirements in excess of peacetime personnel berthing capacity can have adverse effects on readiness.

Navy Manpower-Determination Programs

In response to congressional concern about the size and cost of the Navy work force, the Navy has established three separate programs to determine work-force requirements. In 1966, it established the Ship Manpower Document (SMD) program to determine position requirements needed to operate ships. In 1969, it established the Squadron Manpower Document (SQMD) program, which documents position requirements for the Navy's aviation squadrons. In 1976, it established the Shore Requirements, Standards, and Manpower Planning System (SHOR-STAMPS),³ which documents both military and civilian position requirements for the Navy shore establishment.

³In June 1984, the name of this program was changed to the Shore Manpower Documents (SHMD) program.

In June 1984, the Navy incorporated these three programs into the Navy Manpower Engineering Program (NAVMEP). NAVMEP is administered by the Deputy Chief of Naval Operations (DCNO) for Manpower, Personnel and Training, with the assistance of the Navy Manpower Engineering Center (NAVMEC) located in Norfolk, Virginia, and several NAVMEC manpower engineering detachments geographically dispersed in Navy population-intensive areas.

We have reviewed or are in the process of reviewing each of the three Navy manpower requirements-determination programs. The SHORSTAMPS program was the subject of two previous reports, one in 1980,⁴ the other in 1985.⁵ The SMD program is the subject of this report. We are currently examining the SQMD program, which is expected to be the subject of a future GAO report. When this last assignment is finished, GAO will have completed a comprehensive review of the processes the Navy uses to determine its manpower needs.

SMD Program

The stated purpose of the Navy's SMD program is to determine the minimum number and quality of positions needed aboard ship in an at-sea wartime environment. Since deployed ships must be ready to carry out their mission, manpower requirements are based upon the most manpower-intensive contingency, which is full combat capability. Therefore, determining a ship's wartime manpower requirements also provides for the ship's peacetime requirements.

At the beginning of fiscal year 1984, the SMD program covered 91 percent of all active Navy ships, and established requirements for an estimated 171,000 positions. In implementing the SMD program, the Navy uses a manpower modeling system whereby a ship's required combat capability and basic assumptions about how the Navy plans to operate in wartime is translated into a conceptual model which, in turn, is simulated on computers. As input to the conceptual model, the Navy uses the ship work load (the operational and maintenance tasks which assigned ship personnel would have to perform in wartime) and staffing standards (the amount of time and skills needed to perform these tasks) that identify the number of positions needed to accomplish a given amount of work. The resulting output is a determination of the number and types

⁴The Navy's Shore Requirements, Standards, and Manpower Planning System (SHORSTAMPS)—Does the Navy Really Want It? (GAO/FPCD-80-29, Feb. 7, 1980).

⁵Navy Manpower Management: Continuing Problems Impair the Credibility of Shore Establishment Requirements (GAO/NSIAD-85-43, Mar. 7, 1985).

of positions needed to operate a given ship during wartime. This determination is known as a ship's manpower requirements and is recorded on an SMD.

A ship's work load falls into five major categories: watch stations (WS), own unit support (OUS), preventive maintenance (PM), corrective maintenance (CM), and facilities maintenance (FM). Watch stations are ship positions responsible for staffing essential ship systems, subsystems, and equipment—such as engineering, ship control, and weapons. OUS involves administrative, resupply, food service, medical, utility, and special evolution tasks aboard ships.⁶ PM involves the scheduled maintenance of ship equipment. CM involves maintenance necessary because of the malfunction of equipment. FM involves the cleaning and sanitizing of all habitable areas and the preserving of the ship's hull, decks, superstructure, and equipment against corrosion and deterioration.

The work load and the staffing standards for each of these areas varies according to the condition of readiness the ship is to maintain. The conditions of readiness are condition I—battle readiness, condition II—battle readiness with limited action, condition III—wartime cruising readiness, condition IV—peacetime cruising readiness, and condition V—in-port readiness. Full manning at condition III (wartime cruising) is generally the most demanding because it calls for three shifts in order to staff each watch station needed to meet mission requirements 24 hours a day. Thus, at condition III, each watch station equates to three people. (See app. I for a detailed discussion of the SMD process and further explanation of the conditions of readiness.)

According to manpower experts, to be effective, a manpower modeling system such as the SMD program should involve

- a rigorous determination, through sound work measurement techniques, of the required ship work, the time and kind of skills needed to perform that work, and the minimum manpower needed, and
- a realistic representation, through computer modeling techniques, of how the Navy plans to operate during wartime.

⁶Evolution tasks aboard ship are those that require a significant number of ship personnel to work together on a temporary basis. Some examples of evolutions are refueling, reprovisioning, and anchoring.

Objective, Scope, and Methodology

This review is part of a series of reviews we initiated to evaluate the processes used to determine manpower requirements across DOD. During the course of this work, the Chairman, House Committee on Armed Services, requested that we examine the soundness and rigor of the manpower-determination processes. This report is a partial response to that request.

The objective of this review was to determine whether the processes used in the SMD program are able to accurately identify the number and kind (occupation and grade) of ship manpower needed for national defense. Specifically, we evaluated the rigor of the techniques the Navy uses to measure work load and to set standards, the adequacy of its documentation, and the degree to which the conceptual model realistically depicts the way in which the Navy plans to operate in wartime. Our scope was limited to the way in which the Navy uses the SMD program to determine its requirements for enlisted positions, which comprise the majority of a ship's work force. We conducted our audit work from April 1983 to February 1985, in accordance with generally accepted government audit standards. (App. II describes our objective, scope, and methodology in greater detail.)

More Rigor Needed in Determining Ship Work Load, Standards, and Requirements

The Navy needs to determine its ship-manpower requirements through as rigorous a process as practical. Our use of the term “rigor” connotes carefulness, diligence, and thoroughness in data collection and analysis, though we do not mean to imply that all data needs to be 100 percent accurate and exact. We consider acceptable rigor to involve

- collecting the right kinds of information from appropriate and reliable sources,
- taking due professional care to check and validate that data to ensure that it is reasonably accurate,
- using the data appropriately, being mindful of any limitations or caveats necessary for its proper interpretation, and
- documenting what was done and how it was done.

The Navy recognizes this need for rigor in its guidance promulgating the SMD program, which states that requirements are established through “rigorous application of accepted industrial engineering techniques” in order to determine the minimum number and type of positions needed aboard ship in an at-sea wartime environment. However, we found that certain techniques the Navy uses are subjective and unreliable and, consequently, lacking the rigor stipulated in the SMD guidance.

Specifically, we identified weaknesses in the work measurement methodology used to determine the number of enlisted positions needed for staffing watch stations, performing preventive and corrective maintenance, and performing administrative support aboard ship. We found that the methodology used to develop, validate, and document the work load and requirements for these areas was not sufficiently objective and reliable. Further, we question the use and accuracy of allowances applied to preventive and corrective maintenance and administrative work loads, and the support for paygrade-distribution tables used in the SMD methodology to determine overall organizational grade requirements of enlisted positions aboard ship by rating category.

Problems With Procedures Used to Determine Watch Station Requirements

Because watch station (ws) manning accounts for a large portion (18 to 46 percent) of a ship’s total manpower needs, it is especially important that rigorous procedures be used to determine ws standards, which are the basis of ws requirements. Our review of the way in which the Navy determines the number needed in each occupation indicates that the Navy’s procedures need to be improved. Specifically, we found that

- documentation (audit trail) maintained in support of ws standards is lacking or incomplete, and
- development and validation of these standards is seldom based on rigorous on-board analyses of ship operating procedures that include direct, systematic observations and methods-improvement studies.

Poor Documentation Discredits Validity of WS Standards and Perpetuates Weaknesses

Documentation for ws standards is lacking in spite of the fact that SMD implementing instructions state that an audit trail is to be maintained for each standard developed. According to these instructions, documentation must be adequate to establish the need for manning each watch station, and must allow analysts to determine the minimal skill levels and qualifications needed to effectively perform required tasks. However, we found that the documentation maintained in support of the ws standards was generally lacking or incomplete.

Documentation of the way in which standards are developed, reviewed, and updated is important so that the basis for these standards can be examined during future evaluations. Without this documentation, analysts cannot adequately reevaluate ws requirements. Inadequate documentation can camouflage not only weaknesses in original determinations, but also variations of position needs caused by changes in methods of operation, ship configuration, or work-space arrangements.

Effective manpower management is highly dependent upon the existence of accurate, up-to-date information. In the absence of available documentation concerning the need and rationale for various positions, outdated requirements are likely to be perpetuated.

The ws standards now in the NAVMEC data base were initially established in 1974, when the Chief of Naval Operations (CNO) approved the initial standards en masse. In July 1980, after the Navy Manpower Requirements System became operational, ws standards in the data base were ratified as approved standards by the CNO. This then became the baseline to which changes to the ws standards were to be made. According to SMD program officials, these standards were based on validations dating back to the 1960s or on policy statements and procedures manuals dating back to the early 1970s.

To test the adequacy of ws documentation, we reviewed the condition III (wartime cruising) enlisted ws standards developed for the USS Peterson (DD-969), a Spruance class destroyer. The Peterson's SMD provided for

55 condition III watch stations requiring 165 enlisted personnel working on a 3-shift basis to operate these stations 24 hours a day.

We checked the supporting documentation to see if it (1) described ws tasks, (2) identified how the watch station was essential to the ship's mission, (3) described the effects of not manning the watch station, and (4) contained comments of the analysts or others, recommending establishment or continuation of the watch stations. This information is requested on the Watch Station Analysis Form, which the Watch Station Data Management Branch Handbook says is to be used when establishing new watch stations or initiating a change to existing standards.

We also checked to see whether the documentation was adequate to support the methodology, assumptions, and judgements used in establishing these standards. This information is important because it can provide guidance in future revalidations of these standards.

We found that the documentation for only 8 of the Peterson's 55 watch stations fully supported the need for the ws requirements. The documentation for 12 other watch stations was incomplete and provided only some of the information that could establish a need for the watch stations. The support for another 30 watch stations consisted mainly of correspondence from NAVMEC, headquarters, or fleet officials, which merely stated their approval of a watch station standard and provided essentially no analysis. No documentation was provided for the other 5 watch stations.

One example of the effect of poor documentation can be seen in the validation of ws requirements for technicians to operate a communication system known as the "outboard." The standard, approved in 1982, provided for five condition III outboard watch stations. In 1984, NAVMEC reviewed and reevaluated the manpower requirements needed to operate the outboard system. Based on reviews aboard three different ships, NAVMEC concluded that the previous ws standard for the outboard was generally accurate. However, we found that poor documentation of the development of the original standard perpetuated errors in the ship's subsequent reviews because documentation did not adequately explain the methodologies used or the assumptions made.

During conversations with Navy operating officials about the need for the five watch stations, we were told that one supervisory watch station

was not required and that one other station would be operated by augmentees¹ when needed. Hence, ship personnel were needed to operate only three of the five watch stations. Later, after we discussed this matter with NAVMEC officials, they also concluded that the standard overstated the requirement by two watch stations (six people) and recommended a new standard to eliminate those stations. While good documentation cannot totally replace the need for on-site operational audits, we believe that the analysts might have identified the overstated outboard ws requirements in earlier validations if the original documentation had shown how augmentees and ship personnel would be used to operate the system.

Questions concerning the composition of repair teams is another example of a problem related to inadequate documentation. The ws standards for the Spruance-class (DD-963) destroyer provided for manning 77 watch stations to operate three repair teams in condition I.² Of the 77 watch stations, 51 have specific responsibilities assigned—such as electrical repairman and hoseman, with the remaining 26 being designated as utilityman positions. However, the DDG-2 Adams-class destroyer, with the same three repair teams, requires only 14 utilityman positions. On the Adams-class ship, two of the three repair teams have the same number of condition I watch stations with specific responsibilities assigned, but require 12 fewer utilityman positions than needed on the Spruance-class ship. The third repair team, while differing in the number of positions assigned with specific responsibilities, requires the same number of utilityman positions. We could find no documentation supporting the need for the utilityman positions aboard either ship, nor could we determine the logic used in establishing repair team requirements. If documentation had existed for the condition I utilityman requirements, this inconsistency might be explained. Without documentation, however, these condition I requirements are questionable.

**On-Board Ship
Determination of WS
Requirements Lacks
Acceptable Rigor**

Another problem with the procedures the Navy uses to determine ws requirements is that ws standards—the basis of the requirements—are seldom based on rigorous on-board analyses. SMD implementing instructions and guidelines for ws analysts call for on-board observation of ship-operating procedures when (1) no ws standards exist or (2) the ws

¹ Augmentees are additional personnel assigned to the ship by operational commanders during certain operational situations to enhance the outboard system capability.

² In condition I, each watch station corresponds to a single position unlike condition III where each watch station requires three positions.

Data Manager has determined that the current standard requires validation due to revisions in ship mission/tasking or major equipment or structural changes aboard ship. These documents provide guidance as to how the on-board observations are to be performed. However, our review disclosed that the prescribed degree of rigor is seldom reached in determining ws requirements.

First, the SMD implementing instructions state that ws standards are to be developed and validated by direct observation, as well as by interviews with ship personnel. However, based on discussions with NAVMEC officials, we learned that during on-site visits analysts rarely observe ws work actually being done. That is, they rarely observe ws work when the ship is at sea or simulations of the work when the ship is in port. Instead, they rely mainly on information obtained from their interviews with ship supervisory personnel.

Second, although the instructions state that individual ws requirements are to reflect the interrelationship of ws functions and cannot be defined independently of total ship manning, analysts generally make no systematic observation of total ship operations. We believe that systematic observations of total ship operations, either at sea or in simulation, are necessary because changes of varying degrees in type of equipment or its configuration occur fairly routinely during the life cycle of a ship. These changes could cause substantial quantitative and qualitative differences in ws requirements.

Third, the instructions mention that methods studies, which determine the most efficient ways of performing given tasks, coupled with other work measurement techniques, permit a finite determination of the minimum numbers and skills required.³ However, analysts do not routinely perform methods-improvement studies. Failure to determine the most efficient and economical way of performing ship operational functions will perpetuate any existing inefficiencies in the way ship operations are carried out.

The lack of rigor in the way ws work load is now determined was illustrated by the way in which analysts reviewed ws requirements aboard the Mount Whitney (LCC-20), an amphibious command ship. We observed that, while the ship was in port, the analysts interviewed ws supervisors, concentrating mainly on those ws standards with which the

³The instruction implementing the new NAVMEP program also stresses the importance of performing methods-improvement studies.

supervisors indicated they had problems. During this time, they observed no simulations of actual ship operations. In fact, validations were generally made in work centers that were shut down for routine maintenance.

In one work center, for example, ship personnel had a difference of opinion over whether a WS position was needed to operate a video camera. The work center supervisor stated that the watch station was not required because the camera is not used due to its poor quality. However, according to the analysts, the department head told them that the ship planned to use the camera during condition I. The analysts made no effort to investigate the need for the camera or to determine whether the camera was or could be used as designed, but accepted the statement of the department head and retained the WS requirement. If the analysts had observed this watch station in operation, they would have been able to make their own assessment.

We asked NAVMEC officials why analysts did not request the ship's crew to perform a simulation of the work done at the various watch stations they evaluated. These officials said that analysts did not need to do so because they were generally aware of how ships operate. We believe that, while this may be true for analysts who have worked on a particular class of ship, it was not true in this case because of the specialized mission of this ship and the fact that none of the analysts had previously served on an amphibious command ship.

We believe that it is unlikely that the few WS analysts the Navy has could have sufficient working knowledge of all the various watch stations aboard the large variety of Navy surface ships to be able to determine minimum manpower requirements without observing firsthand how operations are performed. At the time of our review, NAVMEC had only 10 individuals serving as WS analysts to cover the entire Navy surface ship force, consisting of about 70 classes of ships. In many cases, the equipment, as well as its configuration, differs so greatly within each ship class that individual ship SMDs need to be prepared.

The Navy's lack of rigor in developing and validating WS standards is further illustrated by the way the initial WS standards for the Iowa-class battleship were developed. According to the NAVMEC officials in charge of the NAVMEC survey team, the analysts performed a one-week survey of WS requirements aboard the USS New Jersey (BB-62) while the ship was in port. These officials said that the survey was similar to the WS survey we observed aboard the USS Mount Whitney. One of these

officials estimated that analysts prepared documented task analyses supporting about 10 percent of the ship's condition I and III WS requirements. The remaining requirements were established by using standards previously developed for other ship classes having the same equipment.

Since this was NAVMEC's initial effort to validate WS standards for the Iowa-class battleship, we question NAVMEC's reliance on standards developed for other ship classes. We believe that an in-depth survey, including direct observation of the ship's operations to identify minimum requirements, is necessary for the first ship in a class. Even though much of a ship's equipment might be the same as that found on other ships, the configuration of the equipment may be sufficiently different to necessitate a different-sized work crew to operate it.

SMD program officials agree that the degree of rigor applied in performing on-board validations could be improved, but see NAVMEC to be limited by the number of analysts available or able to perform this work. Also, they said that limited resources and ship-deployment schedules limit the opportunity NAVMEC analysts have to visit ships operating at sea.

Problems With Procedures to Determine OUS Requirements

Positions for own unit support (OUS) account for the second largest portion of a ship's total manpower needs (14 to 27 percent). Consequently, it is also important that rigorous procedures be used to determine the standards on which OUS requirements are based. Our review of the way in which the Navy determines the number of OUS positions needed indicates that the Navy's procedures could be improved. Specifically, we found that

- documentation (audit trail) maintained in support of OUS standards is generally lacking;
- little progress has been made in developing new standards; and
- the methodology used to collect new OUS data has weaknesses.

Poor Documentation Discredits Validity of OUS Standards

The Navy has little documentation for most of the OUS standards in use today. Data used to develop these standards was reportedly gathered from about 75 to 100 ships in the early 1970s. Since then, various changes have been made to the standards, and shipboard procedures and policies have changed significantly. Yet, SMD officials could provide no documentation to support the development of these standards or the changes that have been made to them over time.

**Navy Has Made Little
Progress in Developing New
Standards**

The Navy has long recognized the need to update and validate OUS standards, but, in our opinion, its progress in doing so has been slow. In 1977, the CNO directed the Navy Manpower and Material Analysis Center, Pacific, to validate the OUS standards used in the SMD program. The Center studied OUS work load for approximately 20 different enlisted ratings on 5 different ship classes. In 1978, the Center reported substantial differences between measured OUS work load and the established OUS standards and recommended that new standards be developed.⁴

In December 1979, the CNO approved a project to validate or develop new OUS standards. According to project goals, the Navy was to have validated 70 percent of the standards by the end of fiscal year 1984. However, as of October 1984, it had validated or developed new standards for only 4 (7 percent) of 56 enlisted occupations having varying degrees of OUS responsibilities aboard ship. The latest project goals were to have 70 percent of the standards completed by the end of fiscal year 1985, with the remaining 30 percent to be completed in fiscal year 1986.

Responsible SMD program officials stated that they have not made greater progress in developing the new standards because they lack adequate manpower to do so and still meet other commitments. For one thing, according to these officials, producing SMDs using existing or interim standards is given a higher priority than developing the new OUS standards. These officials also report that increased requests to complete special research projects have further detracted from the time they have available to develop the standards.

**Methodology Used to
Collect New OUS Data Has
Weaknesses**

Our review also disclosed weaknesses in the methodology the Navy uses to collect OUS data. To validate or develop new OUS standards, the Navy developed a measurement plan for gathering OUS work load data from a statistically selected sample of 42 ships. This plan designates operational audit, which is an acceptable industrial engineering method, as the primary method for gathering this data. However, we found that OUS analysts overrelied on one operational audit technique—that of interviewing ship personnel—and rarely substantiated the resulting information by the use of the other techniques. Furthermore, the measurement plan does not require the use of methods-improvement studies. Without

⁴Facilities Maintenance/Own Unit Support (FM/OUS) Standards Validation, Vol. 1, Background, Work Measurement, and Summarized Findings (Navy Manpower and Material Analysis Center, Pacific, Report No. 188-77, May 1978).

such studies, the new OUS standards will reflect "what is done" rather than "what should be done."

Inadequate Use of Operational Audit Techniques

The first problem with the Navy's methodology for collecting OUS data is that it has made inadequate use of operational audit techniques.

Although the measurement plan stipulated that a number of operational audit techniques would be used to gather OUS data, we found that analysts relied mainly on interviews with ship work-center supervisors and crew members on the sample ships. They did little to supplement these estimates by observing work being done or analyzing ship records and files, which are also key components of operational auditing.

The measurement plan says that operational audit will be the principal method of gathering OUS data. A sound operational audit approach integrates a combination of techniques in order to obtain complete and valid data.⁵ These techniques include the following:

- Task analysis through a review of regulations and personnel and operation manuals to determine the various tasks that individuals aboard ship are expected to perform.
- Observation of ship operations and the work being done by qualified individuals to determine what tasks are required, how and how often these tasks are undertaken, and how much time is required to complete the various tasks.
- Review of historical information (reports, records, and other documentation) to determine how much work has been done in the past and how many resources in terms of quantity and quality were required to complete this work.
- Interviewing supervisors and workers to obtain their best-judgement estimates on what tasks are undertaken, how often they are done, and how long it takes to complete each task.

Using a combination of these techniques is essential because one alone seldom results in accurate and complete data.

⁵Bradford Cadmus, Operational Auditing Handbook, New York: Institute of Internal Auditing, 1964; Corine T. Norgaard, "Operational Auditing: A Part Of The Control Process" (Management Accounting, Mar. 1972, pp. 60-63); Francis X. Dolan, "Audit Surveys in Operational Auditing" (Federal Accountant, Dec. 1973, pp. 79-82); Walter S. Wikstrom, Manpower Planning: Evolving Systems, New York: The Conference Board, 1971; SHORSTAMPS Staffing Standards Development, Application and Maintenance Procedures, Chief of Naval Operations Instruction 5310.14A, Sept. 15, 1981.

The OUS measurement plan of the SMD program indicates that personnel interviews should be supplemented by a critical examination and observation of work actually being performed. While interviews aimed at familiarizing the analyst with the operation and its background are necessary, interviews alone are not enough. In ascertaining facts, analysts must go beyond opinions and estimates. They must also verify how the operation actually functions through firsthand observation, review of records, and testing. However, we found that, in order to gather OUS work-load data, analysts used the interview technique almost exclusively and seldom used that of observation.

When we accompanied OUS survey teams aboard two ships to observe how they collect OUS data, the analysts never evaluated the accuracy of data provided them during interviews by observing ship operations or OUS tasks being performed by crew members. Also, we interviewed the 12 analysts whose principal job is OUS measurement, and they stated that they primarily use the interview technique to collect OUS data. Although 7 of the analysts said that they do occasionally make limited observations of work actually being performed, they could provide no examples or documentation to support that they had done so. Furthermore, we were unable to find any reflection of such observations in their work papers.

Relying on interviews for information on work-load data can be misleading because, as one authority on manpower planning points out, people's memories are untrustworthy.⁶ We noted that, during some OUS analysts' interviews, the crew members seemed frequently to be obviously guessing at answers to questions. In addition, their answers often lacked consistency. Some answers were based on actual experience while others were based solely on what the crew thought they would do in certain hypothetical situations.

The OUS measurement plan also indicates that personnel interviews should be supplemented by a check of records and files on-site. However, in our review of OUS working papers, we found no evidence that analysts reviewed historical information from ship files to collect actual OUS work-load data—such as the number of meals served, purchase-order requisitions cut, or personnel files updated—in determining administrative work load. In addition, the forms used to collect data for

⁶Walter S. Wikstrom, *Manpower Planning: Evolving Systems*, New York: The Conference Board, 1971, p. 15.

the 42 sample ships contained no requirement for the analysts to obtain this information from available ship records.

During the time of our review, the Navy began to use revised OUS data-collection forms which direct analysts to review ship records and files in order to collect and document various work-load data related to enlisted ratings having a heavy OUS work load, such as Personnelman, Yeoman (administrative staff), and Storekeeper.

Methods-Improvement Studies Are Not Performed

Another problem with the Navy's methodology for collecting OUS data is that OUS analysts perform no methods-improvement studies to identify inefficiencies in the way OUS work is accomplished. In essence, the OUS measurement plan instructs the analyst to record what has happened or is happening rather than to record what should be happening. Measuring work load in this manner is likely to perpetuate inefficient procedures by including them in the new OUS standards.

In February 1985, DOD issued instruction 5010.37, describing DOD's policy with regard to efficiency reviews. The efficiency-review program is a structured approach to performing methods-improvement studies, and involves examinations of actual work processes and work flows in order to identify work or methods which may be nonessential, duplicative, or otherwise inefficient. Without such studies, historical inefficiencies may be incorporated into standards, resulting in overstated manpower requirements.

The DOD instruction states that it "applies to all organizations, both fixed-site and deployable, for peacetime and wartime planning." While imposing certain specific requirements on noncombat organizations, the instruction goes on to state that the "same policies and procedures should be used when practicable in combat units or organizations."

In addition to DOD's policy, OPNAVINST 5310.22, the Navy's instruction which sets up the NAVMEP organization to oversee the Navy manpower program, provides a background discussion on why efficiency reviews should be integrated with the requirements-determination process. The Navy instruction gives no indication that it is not applicable to combat organizations or the SMD program.

We believe that efficiency reviews are particularly useful in OUS activities, where much of the work is administrative in nature.

Problems With Procedures Used to Determine Preventive and Corrective Maintenance Work Load

Preventive maintenance (PM) and corrective maintenance (CM) are two other important elements of a ship's operation and represent a significant portion of a ship's high-skilled work load. Past Navy studies have concluded that the SMD process overstates the man-hours required to perform PM while understating CM man-hour requirements.⁷ Our review disclosed that the Navy

- does not have a reliable historical data base of PM and CM accomplished on its ships;
- is unable to provide documentation substantiating to what extent engineering analysis was used to develop the data on PM work load and to validate its currency and reliability;
- is using invalid ratios to estimate ship CM work load.

Navy Lacks Data on Actual Maintenance Work Accomplished

At present, the Navy has no reliable historical data base on the amount of PM and CM accomplished on its ships. In an attempt to collect data on actual PM and CM performed, the Navy established the Maintenance Data System (MDS) in 1964, as a part of its Maintenance and Material Management (3-M) system. However, the Navy significantly reduced these maintenance data requirements after the fleet complained about having to document and collect this information. Today, no PM data and only a small portion of CM activity is collected and reported through the 3-M system.

In July 1980, the CNO authorized the development of an integrated software system to supersede the MDS component of the 3-M system. This new system, the MDS II, is expected to enable the Navy to take advantage of new ship- and shore-based computer technology, such as the Shipboard Non-tactical Automated Data Processing (SNAP II). One of the requirements outlined in the CNO's authorization letter was that the MDS II collect the man-hours utilized in both PM and CM. This data would provide a base upon which to build an SMD that would clearly reflect the work-force requirements for maintenance. According to an official with what was then the Naval Material Command, the Navy will use the MDS II to collect complete PM and CM work-load data after the system has been designed, implemented, and installed on all ships designated for the system. This official indicated that the Navy has already incorporated the CM data-collection component in the MDS II, but is still in the process

⁷A number of our findings are similar to those of past Navy studies. We were unable to ascertain why the Navy did not act on these studies because of the absence of documentation and the lack of a "corporate memory" resulting from the frequent turnover of Navy personnel in the manpower area.

of designing the component for the collection of PM data. He anticipated full implementation of the MDS II by late 1986. In its comments on a draft of this report, DOD stated that this capability will not be fully implemented until fiscal year 1991.

PM Man-Hour Requirements May Be Overestimated

Several Navy studies have suggested that the data the SMD program now uses to determine necessary PM man-hour tasks may be inaccurate and, as a consequence, the resulting manpower requirements overestimated. This data is provided by the Naval Sea Systems Command (NAVSEA) through the Planned Maintenance System, a part of the 3-M system. For each piece of equipment, NAVSEA develops Maintenance Requirement Cards. These cards state the specific PM tasks to be performed, the estimated number of man-hours by skill required to complete each task, and the estimated frequency with which each task should be performed (frequency level). Maintenance card data is used to calculate average weekly PM work load by required skill for each work center aboard ship.

A number of studies have found required PM work load to be overestimated. For example, a January 1971 study of shipboard maintenance by the Navy Manpower and Material Analysis Center, Atlantic, found that some PM tasks were accomplished in less time than estimated, and the Center recommended a reevaluation of the estimated PM man-hours allotted.⁸

Similarly, in 1983, the Naval Ship Weapon Systems Engineering Station tested the accuracy of man-hours estimated to perform PM required on one of its weapons systems. This study was part of an overall evaluation of how well fleet personnel performed PM for this system aboard two DD-963 Spruance-class destroyers. The report results showed that the actual time to complete the required PM tasks was 54 percent less than the man-hours estimated.⁹

In 1977, as a part of the Ship 3-M Improvement Program, a 3-M policy committee stated a long-standing concern about the accuracy of shipboard maintenance manpower requirements. To determine the accuracy

⁸Work Study Report, Ships Planned Maintenance System Work Load Analysis (Navy Manpower and Material Analysis Center, Atlantic, Report No. 53, Jan. 1971).

⁹NAITD Seasparrow Surface Missile System, DSOT/PMS Investigation (Naval Ship Weapon Systems Engineering Station, Jan. 1984).

of data regarding PM man-hours, the CNO directed that this data be validated for six critical maintenance ratings. In response, the Navy Manpower and Material Analysis Center, Pacific, analyzed 2 years of PM data collected from 52 Pacific Fleet ships. Their study found that, in the majority of work centers, SMD manpower requirements overstated—by as much as 37 to 63 percent—the number of man-hours required to accomplish PM. The study concluded that either the maintenance man-hour estimates were inaccurate or that the SMD methodology incorrectly used those man-hour estimates, particularly those associated with situation maintenance.¹⁰

Special Problems in Determining
Situation Maintenance
Requirements

Situation-maintenance requirements account for approximately 20 to 30 percent of a ship's total PM work load. These maintenance tasks are dictated by specific operational occurrences—unlike other PM tasks which are performed on a more fixed time schedule, such as daily, quarterly, or annually. Examples of situation requirements are maintenance actions required after a specified number of hours of operation, before cold weather operation, or before prefiring tests.

Situation-maintenance requirements are especially difficult to quantify. First, they are accomplished on an as-required basis rather than on a fixed calendar schedule. Second, the maintenance cards do not clearly indicate how often this work is done.

To determine how often situation PM requirements would need to be done in an at-sea at-war environment, analysts translate situation-maintenance requirements into specific calendar periodicities (regular intervals) in order to compute weekly PM man-hour estimates. According to two NAVMEC officials, the analysts base their translations on their personal experience and judgement or on the opinion of others. Using such a subjective means to estimate this work load increases the likelihood that inaccurate data will result. Using historical data would be a more appropriate approach.

Accurately determining how often situation maintenance would be done is made even more difficult by the wording on the maintenance cards. According to an August 1983 NAVSEA point paper on situation maintenance, the wording on these cards does not clearly explain the desired frequency level or required time. This paper points out that wording

¹⁰Manpower Requirements for Planned and Corrective Maintenance (Navy Manpower and Material Analysis Center, Pacific, Report No. FWP-092, Feb. 1978).

such as “when in port” or “accomplish when increased pressure is observed” does not provide adequate guidance for estimating required man-hours. We reviewed 145 situation-maintenance requirements associated with 20 critical systems on the Spruance-class ships and found that 75 (52 percent) stipulated no frequency level whatsoever.

Preventive Maintenance Man-Hour Estimates Not Documented or Validated

Another problem with the way PM requirements are determined is that PM man-hour estimates are not documented or validated. SMD manpower officials assume that PM man-hour estimates are based on engineered standards and, therefore, do not attempt to validate the accuracy of this data. However, officials with NAVSEA and its contractors differed on how PM estimates were actually determined. Furthermore, our review disclosed that the Navy was unable to provide documentation to substantiate the methods used to develop the PM data or to validate its currency or reliability for a sample of systems aboard Spruance-class destroyers.

To ascertain the degree that industrial engineering techniques were used in developing PM man-hour estimates and frequency levels, we interviewed Navy officials concerning the development of the maintenance cards for the 20 critical systems installed on Spruance-class destroyers. Navy officials and contractors responsible for developing PM work-load requirements for the 20 systems offered differing responses on how the time estimates were derived. Some officials said that the PM time estimates were derived by industrial engineering techniques, such as time study, while others stated that the PM time estimates were based on the personal judgement and experience of individuals responsible for establishing the estimate.

While DOD’s comments on this report indicated that PM estimates are documented to the level required by the DOD standard, we could find no documentation supporting the development of these PM work-load requirements. Navy officials said that supporting documentation is kept in files maintained for each shipboard system by either a NAVSEA Support Center, a Navy In-Service Engineering Agent (ISEA), or the contractor responsible for developing PM work-load requirements and supporting documentation. We reviewed contractor history files and other available documentation at the NAVSEA Support Center in San Diego and interviewed officials from five different ISEAs and three different contractors. However, we were unable to find any documentation showing how the PM man-hour estimates and frequency levels associated with the 20 systems were derived.

Invalid Ratios Are Used to Estimate CM Work Load and Manpower Requirements

The SMD program determines CM work load and manpower requirements by applying hourly ratios of PM to CM. Over the past 15 years, various Navy and GAO reports have objected to the Navy's using these ratios to compute CM requirements. Navy studies have concluded that these ratios are invalid and generally underestimate ship CM work load and personnel requirements. However, the Navy has not yet corrected this problem.

According to one SMD official, the Navy uses fixed hourly ratios of PM to CM to compute the bulk (more than 90 percent) of the CM work load used in deriving SMD manpower needs. Before 1968, a 4:1 hourly ratio of PM to CM was used to estimate CM work load for all systems and equipment aboard ship. Since 1968, the Navy has used a 1:1 hourly ratio of PM to CM to estimate CM work load for most electronic systems and equipment and a 2:1 hourly ratio for most nonelectronic systems and equipment. In using these ratios, the Navy is saying that for electronic items 1 hour of CM is required for every 1 hour of PM, and for nonelectronic equipment 1 hour of CM is required for every 2 hours of required PM. The Navy could provide no documentation to explain and support the methods, data, and assumptions used in developing these ratios.

Several studies have disagreed with the Navy's use of ratios to determine CM. In a 1977 report, we pointed out that the use of these ratios assumes that, as PM increases, CM increases at the same rate. Such an assumption runs counter to logic since it implies that performing more PM increases, rather than decreases, CM requirements and that, if PM were decreased to zero, CM would also decrease to zero.¹¹

In 1978, the Navy Manpower and Material Analysis Center, Pacific, reviewed the validity of the PM-CM ratios and found no apparent mathematical relationship between PM and CM that would predict CM hours when PM hours are varied.¹² The Center also found that, with the exception of one rating, most work centers reported more CM work hours than those projected by the use of the PM-CM ratios. The study suggested that CM work load should be an independent element rather than an element dependent on the amount of PM performed.

¹¹Development and Use of Military Services' Staffing Standards: More Direction, Emphasis and Consistency Needed (GAO/FPCD-77-72, Oct. 1977).

¹²Manpower Requirements for Planned and Corrective Maintenance (Navy Manpower and Material Analysis Center, Pacific, Report No. FWP-092, Feb. 1978).

In 1980, the report of a private contractor for NAVSEA also stated that the PM-CM hourly ratios have no analytical basis, are intuitively suspect, and are repudiated by limited relevant historical CM data.¹³

The need for the Navy to abandon these ratios for estimating CM work load and substitute the kind of data expected to be produced by the MDS II system has increased because of recent changes in its philosophy and procedures for determining PM work load. The Navy is in the process of implementing a new PM concept called Reliability Centered Maintenance (RCM). Under the RCM approach, the Navy will intentionally cut back on the amount of preventive maintenance performed in an effort to increase the availability and operability of equipment. According to preliminary estimates, the RCM approach will reduce PM requirements aboard ships by 25 to 40 percent. Applying the PM-CM hourly ratios to the lower PM requirements will also reduce the estimated CM requirements for these ships. According to Atlantic Fleet officials, the PM-CM hourly ratios combined with the lower PM requirements have reduced SMD manpower requirements to unacceptably low levels.

The Accuracy and Use of Allowances Is Questionable

The Navy currently adds two allowances to its estimates of the time required to do maintenance and OUS work aboard ships. However, the Navy is unable to document the basis for these allowances or to verify their accuracy. Moreover, we believe that the use of these allowances is inappropriate and double counts work load for PM, CM, and OUS, thereby resulting in excess work-force requirements.

The first allowance added is a 30 percent make-ready and put-away (MRPA) allowance, which is applied to the estimated weekly PM work load. Make-ready time is the time needed to obtain necessary tools, materials, and manuals. Put-away time is the time needed for cleaning up and returning the tools and manuals. Second, the Navy adds a 20 percent productivity allowance, which allows for nonproductive time, to the estimated work hours for PM (after the 30 percent MRPA allowance has been applied), CM, FM, and OUS.¹⁴ According to Navy officials, the productivity allowance is a composite of an average 15-percent relaxation allowance and a 5-percent contingency allowance.

¹³Improving the Protection of Shipboard Corrective Maintenance Manhour Requirements, First Report (Systems Research and Applications Corporation, Sept. 1980).

¹⁴Since we did not specifically review how FM work-load requirements are derived, we are unable to comment on whether the nonproductive allowance should be applied to FM.

Chapter 2
More Rigor Needed in Determining Ship Work
Load, Standards, and Requirements

SMD program officials could not provide documentation showing when and how these allowances were derived. According to one SMD official, the productivity allowance was developed before 1970 and was based on studies of private industry as well as on activity sampling on several classes of ships. However, a 1969 Naval Personnel Research and Development Laboratory report states that the MRPA allowance was based on limited facts to expedite promulgation of SMDs.¹⁵

Several Navy studies conducted in the early 1970s have challenged the accuracy of these allowances. Two Navy studies reported that the 30-percent MRPA allowance was excessive and should be revised.¹⁶ These studies found that maintenance workers utilized only 12 to 14 percent of the actual PM task time for MRPA. A later Navy review recommended that a study be conducted to increase the precision of this allowance in order to vary the allowance by ship class and work area rather than using one Navy-wide allowance.¹⁷ Similarly, a 1974 Navy study found that the overall 20-percent productivity allowance was not appropriate for all surface ships and all shipboard working environments and recommended that it be varied by Navy rating and ship type.¹⁸

The use of allowances is an acceptable industrial engineering technique only when used in conjunction with raw productive time reliably measured by engineering techniques such as time-and-motion studies or work-activity sampling. However, applying allowances to times based only on analysts' personal judgement and experience, workers' estimates of the time required to complete each task, or historical records is inappropriate because it is likely to result in a double counting of time. To avoid such double counting, instructions for preparation of the staffing standards for SHORSTAMPS (now called the SHMD program), specifically direct analysts not to add allowances to man-hour estimates developed through operational audit techniques unless the actual task time can be accurately determined.

¹⁵Analysis of Made-Ready/Put-Away Allowance for Preventive Maintenance Requirements, Ship Manning Document (SMD) Program (Personnel Systems Research Department, Naval Personnel Research and Development Laboratory, Nov. 1969).

¹⁶Work Study Report, Ships Planned Maintenance System Work Load Analysis (Navy Manpower and Material Analysis Center, Atlantic, Report No. 53, Jan. 1971) and Work Study of USS Forrester (CVA-59) and Embarked Air Group (Navy Manpower and Material Analysis Center, Atlantic, Report No. 59, 1970).

¹⁷Computation of Maintenance Manning Requirements (Navy Manpower and Material Analysis Center, Pacific, Report No. 81, Aug. 1971).

¹⁸Productive Allowance (Navy Manpower and Material Analysis Center, Pacific, Report No. 137A, Aug. 1974).

The Navy is unable to support that its raw PM, CM, and OCS man-hour estimates were developed by precise engineering methods and, therefore, include no nonproductive or MRPA time. The work measurement techniques that the SMD program analysts use provide only gross time estimates and are, therefore, too imprecise to measure raw productive time alone. The effect is that nonproductive, preparation, and cleanup time is likely to be double-counted.

The use of allowances for nonproductive and MRPA time increases ship manpower requirements. For example, we found that, for one DD-963 Spruance-class ship we reviewed, adding these allowances to PM, CM, and OCS work loads resulted in an additional 12 enlisted positions being required for the ship.

SMD Paygrade Staffing Tables Need to Be Revalidated and Documented

In addition to determining quantitative manpower requirements, the SMD program also determines qualitative requirements in terms of occupation and paygrade (rank). The Navy's enlisted occupation standards have been developed from data obtained by surveying enlisted personnel in specific ratings. These surveys are conducted on a cyclic basis and are incorporated into the Navy Enlisted Manpower and Personnel Classifications and Occupational Standards Manual.

The SMD program uses staffing tables to show the grade mix of enlisted positions required for all work centers aboard all ships. These tables impose a pyramidal ranking organizational structure for each work center in order to provide supervision and career-advancement opportunities designed to maximize retention. If the staffing tables list a richer grade mix than the initial rank determination, as set forth in the occupational standards manual, the tables override the manual. Because the tables are used in the determination of the rank of enlisted positions needed on ship, they influence the cost of ship staffing and, therefore, should be verifiable.

The Navy could not provide us with documentation to justify or support the development of the staffing tables or the changes that have been made to them. SMD officials do not track how often the tables override initial grade determinations made by analysts in establishing requirements and set forth in the paygrade manual. However, we found that the staffing tables assigned a higher rank requirement to 65 (20 percent) of 323 enlisted positions on our sample ship, the USS Peterson, which suggests that the tables may not reflect the minimum grade mixes that would be required on a ship in an at-sea wartime environment.

Support for Staffing Tables Is Lacking

Documentation for the original staffing tables and for changes that have since been made to them is lacking. The original staffing tables were developed around 1972 and were based on a survey of enlisted rank mixes existing on a number of ships. According to SMD officials, these tables have been revised over time to meet changes in fleet needs. However, the Navy did not adequately document either the development of the original tables or the subsequent changes to them. Therefore, in our opinion, it cannot now assess the adequacy of the tables without performing a complete revalidation. We believe that such a revalidation is necessary since 1972 was toward the end of the Vietnam era, and the tables probably incorporate the higher grade mix that is typical during the latter stages of a conflict.

Staffing Tables May Not Reflect Minimum Wartime Requirements

The SMD program is supposed to establish minimum wartime manpower requirements based on the number of watch stations and actual or projected work load—without consideration for funding constraints or the availability of personnel. However, the staffing tables may not reflect these minimum requirements because the Navy modifies various enlisted paygrade requirements based on the perceived need for career pattern and advancement opportunities, which are designed to maximize retention. The staffing tables sometimes override the occupational standards manual.

We identified a number of examples where the CNO changed the career path of certain enlisted occupations by increasing their grade structure in an effort to aid recruitment and retention in those occupations. For example, the CNO directed that the SMD program requirements for Electronic Warfare Supervisor be changed from paygrade E-6 (1st class petty officer) to E-7 (chief petty officer). The reason given for the change was the CNO's concern over the "health and welfare" of the enlisted electronic warfare ratings that lacked E-7 and E-8 paygrade positions at sea. For 11 other highly technical enlisted ratings, we were told that, in 1982, the CNO used a similar rationale in directing that the staffing tables be revised to place a chief petty officer (E-7 rank) rather than a petty officer first class (E-6 rank) in charge of a shipboard work center with six positions assigned. The effect of such changes based on recruitment and retention concerns is that the SMD does not always reflect the minimum rank required to man a ship's watch stations and to accomplish its work load in an at-sea wartime environment.

We are not arguing that increasing grades is an improper way to deal with recruitment and retention problems. However, we believe that

making changes to the SMD is an inappropriate way of implementing a higher grade structure to enhance career opportunities. The reason for this is that higher rank requirements resulting from temporary retention needs are likely to become embedded in the SMDs as minimum requirements and not changed when such retention incentives are no longer required.

Once higher grades become a part of the SMDs, they also become part of the personnel target which the Navy is trying to achieve. Therefore, the higher grade structure can have long-term effects on retention-incentive programs, such as the Selective Reenlistment Bonus (SRB) program, by indicating a need for bonuses to retain higher personnel levels when those manpower levels may no longer be valid.

Need for More and Better Analysts

Two factors which have likely contributed to the Navy's lack of rigor in measuring work load and developing and validating standards is that it has relatively few analysts, and those that it does have appear to lack adequate training and experience as manpower analysts.

Several Navy officials told us that the Navy has too few analysts. They said that they would like to spend more time on surveys than they now do but are unable to do so because they have too few analysts. Although NAVMEC plans to double its work force in the WS area, some NAVMEC officials believe that even this increase will be too small to allow frequent on-board validations.

In questioning the quality of OUS work-load data collected aboard two ship classes in 1983, one high Navy official blamed these quality problems on the lack of training and experience of the analysts collecting the data. Furthermore, Navy officials told us that manpower personnel lack adequate training as analysts. As a result, some are unable to correctly perform operational audit procedures and methods-improvement studies. In the past, enlisted personnel assigned to the SMD program were required to attend an 8-week management engineering course to receive training as analysts. However, some Navy officials, and analysts themselves, have complained that the training does not properly prepare participants to work as analysts. As a result, WS analysts are no longer required to attend this training. NAVMEC officials told us that they are reviewing the training needs of their analysts and plan to establish a new training program that is more relevant to the type of work SMD analysts do.

Finally, the Navy's manpower analysts are relatively inexperienced. For example, NAVMEC officials told us that, of 21 military personnel working as WS and OUS analysts, only 1 had any prior experience as an analyst. Furthermore, analysts remain in these positions for a relatively short period of time—usually 2 to 4 years. When we interviewed 11 military OUS analysts, we found that the average time they had each spent in their positions was 1.2 years. As a result of this short tenure, these personnel tend to be inexperienced as manpower analysts both individually and collectively.

Conclusions

We support the Navy's effort to establish accurate manpower requirements through the SMD program and believe that the SMD program provides the basic foundation to accomplish this good. However, our review of this program leads us to conclude that the program needs to be reexamined and revalidated. Our review found that many of the Navy's ship-manpower requirements are based on unnecessarily subjective means of measuring work load and developing standards, and are not, as stated in the SMD-program guidelines, established through a rigorous application of industrial engineering techniques.

We found that the weaknesses in the SMD program methodology include

- inadequate or no documentation supporting the development and validity of
 - (1) existing standards for watch stations, shipboard PM, and OUS work load,
 - (2) allowances for nonproductive time and MRPA time applied to estimated productive work load, and
 - (3) paygrade distribution tables used to determine overall grade requirements;
- inadequate on-board measurement techniques that rely primarily on subjective judgement to determine or validate WS standards and to collect work-load data for developing new OUS standards;
- unsupported standards used to estimate OUS work load;
- invalid ratios used to estimate CM work load;
- lack of methods-improvement studies to determine whether tasks being done are actually necessary and are done using the most efficient work methods;

- questionable allocation of allowances applied to imprecise productive work-load estimates for PM, CM, and OUS, resulting in possible double counting of work load; and
- questionable adjustments to paygrade distribution tables, which may result in higher than minimum wartime grade requirements.

We believe that shortages of analysts and their lack of adequate training and experience are likely contributors to the inadequate methodology used to establish and validate requirements for watch stations and OUS. Also, in our opinion, the lack of data on actual PM and CM maintenance time contributes to lack of credibility in the Navy's stated ship manpower needs. As the Navy develops a data base of actual PM and CM time requirements, we believe that the need for adding allowances will disappear.

What impact this lack of rigor in the SMD program has on ship operation and the Navy's budget is hard to determine precisely. However, our review, as well as several past studies, indicates that some requirements are underestimated, decreasing readiness, and that some are overestimated, increasing costs.

The lack of rigor is also likely to have an additional impact. Because Navy descriptions of the program indicate that the requirements are established and validated through "rigorous application of accepted industrial engineering techniques," decision-makers in the Department of Defense and the Congress could be misled into believing that the Navy's ship-manpower requirements have been more reliably determined than they have been.

Recommendations to the Secretary of the Navy

In order to improve the soundness and rigor of work-load measurement and standards development and increase the confidence of administration and congressional decision-makers in the Navy's manpower requirements, we recommend that the Secretary of the Navy

- commit the necessary analytical staff resources both in number and experience and provide adequate training to the analytical staff to ensure that improved methods will be used to determine SMD manpower requirements;
- reexamine on a systematic basis the adequacy and accuracy of all WS standards used in the SMD process;

- require a more rigorous and comprehensive on-board ship validation—including observation of the crew functioning in an operational environment or simulation and analysis of ship supporting records. This is especially important for new ship classes and for ships that have undergone extensive alteration in terms of new equipment and configuration changes;
- ensure that the justification and basis for WS and OUS standards are adequately documented and that a proper audit trail of changes to these standards is maintained;
- expedite the development of the new OUS standards;
- identify areas of ship operations where methods-improvement studies are practical and feasible and begin a program of conducting these studies;
- expedite the development of both a PM and CM data base for establishing SMD maintenance work load and work-force requirements by ensuring that the MDS II is
 - (1) developed properly to incorporate both PM and CM data-collection components,
 - (2) implemented in a timely manner, and
 - (3) used by the fleet to accurately report actual PM and CM work-load data;
- consider suspending the addition of the MRPA allowance to estimated PM work load and the nonproductive allowance to PM, CM, and OUS work-load estimates until the Navy is able to measure these work loads using more precise methods; and, if allowances are used in the future, develop documented support for the accuracy and justification for their use; and
- validate the paygrade staffing tables to establish wartime grade (rank) requirements and develop documented support for their use.

Agency Comments and Our Evaluation

While disagreeing with specific aspects of several of our findings, DOD concurred with all of our recommendations.

With regard to WS requirements, DOD disagreed that the determination of these positions is lacking in rigor. DOD indicated that WS analysts are “shipboard operationally experienced personnel” who conduct extensive prior analysis of WS requirements. In addition, DOD cited the fleet-review process as providing additional rigor as well as containing many of the elements of the methods-improvement study process.

We do not believe that ws analysts can do a credible job of "prior analysis" in the absence of documentation. Since the rationale for the existing ws requirements does not exist, we see no way the ws analysts can do much other than ratify what already exists. We also do not see the fleet-review process as providing an adequate substitute for methods-improvement studies since the reviewers are not trained in methods analysis, and they also lack sufficient documentation.

DOD did not concur that application of the 30-percent MRPA allowance is inappropriate. In support of its position, it referred to a 6-month study aboard two ships in 1972, although neither DOD nor the Navy could provide us with a copy of that study. During our audit work, however, we came across a summary of the preliminary findings of that study, dated November 1973. The summary reported that, as a percentage of PM, MRPA was found to be 26 percent on one ship and 12 percent on the other, and went on to state that "preliminary indications tend to support a decrease in the 30 percent of PM currently used in [SMD]documents."

In addition, while DOD responded that it believes that the MRPA allowance is being applied to raw productive time and that it is a "usefully accurate adjustment" to the overall ship PM manhours required, it did not offer any evidence to substantiate the statement that PM is determined through industrial engineering techniques measuring only raw productive time. Since our visits to a number of contractors and Navy in-service engineering activities did not reveal any evidence showing how PM is actually determined, we continue to believe that the use of the MRPA allowance is inappropriate and likely to result in double counting.

Concerning the 20-percent productivity allowance, DOD concurs that its application, in addition to the MRPA allowance, could result in double counting. DOD stated that the application of the allowance would be suspended as of December 31, 1985.

While concurring that documentation on the development of the staffing tables is lacking, DOD did not agree that deviations from occupational standards were attributable to attempts to improve retention in certain occupations. DOD stated that staffing tables which list a richer grade mix than supported by the occupational standards are necessary to provide for adequate span of control and supervision. DOD also stated that changes resulting from the use of the staffing tables cannot become embedded in statements of minimum position requirements.

We agree that the Navy needs to build its rank-structure requirements to provide for supervision and span of control, but we believe that transitory needs arising from retention problems in specific occupations should not be allowed to become embedded in the SMDs. We also believe that DOD is incorrect in stating that staffing tables are not affected by retention and career-advancement needs. According to the SMD implementing instructions (OPNAVINST 5310.19), "the overall paygrade structure in the Navy is influenced by a system that gives consideration to career patterns and advancement opportunity which in turn are designed to maximize retention." Also, DOD provided no evidence to refute the CNO documents we referred to, which cite recruitment and retention as specific reasons for increases in the grade structure of certain occupations. We continue to believe that the danger exists of perpetuating higher grade structures prompted by temporary retention problems. Future Navy occupational surveys are likely to pick the grade of sailors that are typically authorized in these positions; consequently, over time, the higher grades resulting from the application of the staffing tables are likely to become permanent.

Despite these disagreements, both DOD and the Navy were very responsive to our recommendations. DOD stated that it either had taken or would take action to

- commit necessary resources to the SMD program by
 - (1) conducting a study by September 1986 to determine how many analysts are needed and, in the interim, committing additional personnel to analyst positions,
 - (2) providing increased continuity and reduced turnover by using civilians in certain key positions,
 - (3) establishing personal qualification standards for analysts by October 1986, and
 - (4) improving the training program for manpower analysts;
- systematically reexamine and update documentation for all WS positions during fiscal years 1986 and 1987 and to issue an OPNAV instruction by October 1986, requiring the maintenance of adequate documentation;
- determine the feasibility and cost-effectiveness of shipboard observations of actual or simulated operations based on an ongoing study which is scheduled for completion by September 1986.
- continue improvements made since late 1983 in the documentation of OUS standards and OUS data collection and to monitor progress in annual CNO reviews of the SMD program, starting in fiscal year 1986;

Chapter 2
More Rigor Needed in Determining Ship Work
Load, Standards, and Requirements

- expedite the development of new OUS standards with a target-completion date for all standards of fiscal year 1990;
- complete a study by September 1986 to identify those areas of ship operations and administration where methods studies are expected to be practical and cost-effective and to determine at that time the schedule for conducting recommended studies and what additional resources will be recorded;
- continue their efforts to establish an empirical data base for PM/CM with projected completion in 1990—the Navy applying, in the interim, all cost-effective refinements recommended by a Center for Naval Analyses study to be complete in June 1986;
- conduct a study of the MRPA and productivity allowances starting in April 1986 and estimated to be completed by September 1987—with an interim suspension of the application of the 20-percent productivity allowance as of the end of 1985; and
- continue the revalidation and documentation of staffing tables with completion of all staffing-table revalidation during fiscal years 1986 to 1990.

SMD Modeling System Needs Refinement in Order to Improve Accuracy

It is important that the SMD manpower modeling system for determining ship-manpower requirements be based on a realistic portrayal of how the Navy plans to operate in wartime. A high degree of realism is necessary because fewer ship positions than actually needed in an at-sea wartime environment could have a detrimental impact on readiness, while more positions than needed could have an impact on the Navy budget. To attain this realism, the Navy developed its SMD manpower modeling system, through which the wartime scenario—required readiness conditions for combat capability and the way the Navy plans to operate in wartime—are translated into a conceptual model, which, in turn, is simulated on computers.

The required combat capability is derived from the Required Operational Capability/Projected Operating Environment (ROC/POE) statement developed for each ship, which describes the capabilities a ship is expected to possess and sustain under various conditions of readiness. (See app. I, pp. 62 to 63.) The basic assumptions about how the Navy plans to operate during wartime can be derived from such documents as Navy instructions, regulations, policies, and Naval warfare publications. Examples of basic assumptions are the standard Navy workweek, ship operating methods, and Navy strategic concepts.

We found, however, that the SMD modeling system does not meet several of the key requirements for valid modeling in that the model does not accurately reflect some of the scenario's underlying assumptions; the SMD computer simulation does not always reflect the assumptions of the conceptual model; documentation of the system and changes to it are poorly maintained; and Navy decision-makers do not always understand the assumptions of the SMD model. In addition, we believe that the SMD-system management controls need to be strengthened to monitor the program and keep it up to date.

SMD System Does Not Meet Some Criteria for Sound Modeling

The SMD modeling system does not meet some generally accepted criteria for sound modeling. Models of systems must meet certain criteria in order to ensure that their depictions are valid and useful.¹ First, the model must reasonably conform to the system or operation being modeled. Second, documentation of the model design and any subsequent changes should be maintained, and that documentation should be complete, clear, and current. Third, those who utilize the model should thoroughly understand the assumptions upon which it is based. Fourth,

¹Guidelines for Model Evaluation (GAO/PAD-79-17, Jan. 1979).

as discussed in Chapter 2, the data used in the model must be accurate and complete.

SMD Model Does Not Reflect Some of the Scenario's Basic Assumptions

The first way in which the SMD conceptual model fails to meet the requirements for sound modeling is that it does not reflect some of the scenario's underlying assumptions. For example, the Navy's strategic concepts indicate that, even during wartime, not all ships will be deployed at any one time, and the ROC/POE instruction provides for an in-port readiness condition. However, the SMD conceptual model assumes that all ship-board maintenance will be done at sea. The model also uses a workweek-availability factor that incorporates some conditions which are not expected to occur in wartime. In addition, the model does not take into account the fact that watchstanders can and do perform some maintenance while on watch at sea. These differences pose potentially significant consequences for the credibility of SMD-generated requirements since they lead to some of the Navy's ship-manpower requirements being higher than necessary.

SMD Model Based on Invalid Work-Load Cycle

One way in which the SMD model fails to realistically reflect the scenario's assumptions is that the model does not recognize that some ship-board maintenance will be done in port. Since ships will, in all likelihood, have two separate work phases—one at sea and the other in port, the SMD model should reflect that fact, and wartime work loads for ship maintenance should be similarly differentiated. The model, however, according to NAVMEC officials, treats all ship-board maintenance as if it will be done at sea. Although some ship-maintenance tasks are performed only at sea and others only in port, many may be performed either at sea or in port. NAVMEC officials told us that a number of the tasks which can be accomplished in either place are generally done in port. They said, for example, that tasks designated to be done annually, semiannually, or quarterly are generally accomplished in port. By treating the entire work load as if it would be done at sea, the SMD model inflates the at-sea work load, thereby inflating ship-manpower requirements.

Removing in-port tasks from at-sea maintenance work load will reduce manpower requirements aboard ship. However, the Navy lacks sufficient data to allow us to calculate the exact degree of this inflation. But for PM, one NAVMEC official estimated that roughly 20 percent of the total work load needed in one deployment cycle would be performed in port

during wartime. Other NAVMEC officials agreed that this estimate is reasonable. The 20-percent estimate includes tasks that are designated to be done only in port and those annual, semiannual, and quarterly tasks which we were told would generally be performed in port. If the 20-percent estimate is accurate, reducing the at-sea PM work load by that amount would eliminate 3 positions aboard a Spruance-class ship and 7 aboard an Adams-class ship. Removing in-port tasks from at-sea maintenance work load would also increase shore requirements. However, on shore the Navy has a number of options for meeting in-port maintenance needs—such as shore-based personnel, ship's company, reserves, contractors, and transients. Such options are likely to be less expensive than having the manpower permanently assigned to a ship when the need exists only when the ship is in port. Even if the removal of in-port tasks did not lower cost, we believe that it would still be worthwhile on bunk-constrained ships because it would free bunks for personnel needed at sea.

We believe that NAVMEC needs to analyze all maintenance tasks thoroughly, examining specifically those that can be performed either in port or at sea in order to eliminate in-port tasks from the at-sea work load.

**SMD Model Based on an Invalid
Workweek Standard**

A second way in which the SMD conceptual model fails to realistically reflect the assumptions of the wartime scenario is in its questionable workweek standard. First, the model's workweek standard specifies fewer man-hours than actually used to perform required tasks at sea, and it allows up to 11 hours of Sunday free time. Since required manpower is determined by dividing work load by the workweek standard, the effect of using a lower workweek standard is to increase manpower requirements. In addition, the SMD model does not identify an in-port workweek.

The accuracy and documentation of workweek standards has been questioned in the past by GAO,² the Navy Audit Service,³ and the Navy Personnel Research and Development Center.⁴ For example, the Navy Audit Service reported in 1979 that the Navy standard workweek was developed in the Vietnam era without input from ship commanders and that no documentation exists to support it. Based on interviews with ship personnel aboard various ships, the Navy Audit Service and the Navy Personnel Research and Development Center found that ship personnel routinely worked more hours than the standard specified.

Another problem with the model's at-sea workweek standard is that the SMD instruction allots 3 hours of free Sunday time⁵ for watchstander positions and 11 hours for non-watchstander positions. Some Navy officials have stated that these amounts of Sunday free time are unrealistic for a wartime scenario and should be reduced. For example, the Director of the Surface Warfare Division told us that 1 hour of Sunday free time per week would be more realistic of actual planned conditions. During our review, SMD officials began to consider reducing Sunday free time in the model's workweek. We believe that the Sunday free time could be changed without changing any other variable or assumption now used to compute manpower requirements.

Changing Sunday free time to 1 hour weekly would reduce ship manpower requirements considerably since it would increase the total number of man-hours available to get the work done. For example, the manpower requirements aboard a DD-963 Spruance class ship would be reduced by 10 positions and the DDG-2 Adams class ship would be reduced by about 19 positions.

Still another problem with the model is that it is based solely on an at-sea workweek standard, instead of providing both an at-sea and an in-port standard. The Navy has established a peacetime in-port workweek

²Estimates of Available Hours for Military Personnel in Wartime Distorts Force Requirements and Planning (GAO/FPCD-80-6, Dec. 11, 1979).

³Review of Navy Military Strength and Manpower Management (Naval Audit Service, Audit Report C37128, April 10, 1979).

⁴Navy Personnel Research and Development Center, Investigation of the Navy Workweek at Sea (Special Report 76-2, Sept. 1975); and Workweek of Shipboard Enlisted Personnel During In-Port Periods (Special Report 76-5, Dec. 1975).

⁵The use of the term "free time" does not mean to imply that this is the only time available to the sailor for personal use. The workweek standard allots 13 hours a day for sleeping, messing, and attending to personal needs.

standard, thus implicitly recognizing that an in-port workweek standard is necessary to manage manpower properly. But it has not established an in-port workweek standard for wartime.

Clear differences exist between at-sea and in-port manpower needs. At sea during condition III, longer hours are required in order to man watch stations around the clock and to complete all normal maintenance, support tasks, and administrative duties. Past studies have found that ship commanders often have sailors work longer hours even when not at condition III, in the interest of avoiding problems which could result from boredom and confined living. During the in-port phase, the Navy tries to provide its crew members greater opportunity for training and for rest, leave, and liberty. But it currently cannot determine how many crew members it needs to keep onboard to meet wartime in-port work-load requirements because it has not defined how many hours they will work.

SMD Model Does Not Account for
Work Performed on Watch

A third way in which the SMD conceptual model fails to realistically reflect the scenario's assumptions is that, for most ships, it makes no allowance for the PM and CM performed by watchstanders while on watch. As a result, the model inflates ship-manpower requirements.

Work on watch occurs either when equipment at a watch station that has no back-up becomes inoperable and requires CM, or when PM can be combined with watch duty. According to Navy officials, these conditions are also expected to occur in wartime. However, the SMD conceptual model does not deduct maintenance work performed by watchstander positions during watch duty from the maintenance work load which is used to derive non-watch position requirements. This inflates the maintenance work-load requirements for non-watchstander positions and, therefore, inflates position requirements for the ship.

Past Navy studies have reported that watchstanders do perform both PM and CM while standing watch. In an August 1971 study, the Navy Manpower and Material Analysis Center, Pacific, pointed out that a considerable amount of PM work is accomplished by personnel on watch and that the determination of WS and PM work-load requirements fails to recognize this. The report stated that this problem results in double counting of PM man-hours.⁶

⁶Computation of Maintenance Manning Requirements (Navy Manpower and Material Analysis Center, Pacific, Report No. 81, Aug. 1971).

Again, in August 1980, the Navy Manpower and Material Analysis Center, Atlantic, reported in a letter to the CNO that the SMD model does not correctly account for CM performed on single-system equipment aboard ship. According to this letter, numerous shipboard systems, which have no suitable back-up systems, must be operable in a condition III environment. Thus, when these systems become inoperable, the watch stations disappear, and CM begins. However, SMD methodology assigns a full workweek to every valid watch station for these systems, and then adds to these watch requirements whatever CM is derived from the PM-CM ratio. The Center reported that this is an extreme case of double counting of work load.

If work on watch were incorporated into the SMD model, manpower requirements would be more accurate. Navy manpower officials told us that they plan to assess the extent of work performed on watch and to include such work in future validations of the SMD system.

SMD Computer Simulation
Does Not Reflect
Assumptions of the SMD
Conceptual Model on FM

Another way in which the SMD system does not meet the criteria for sound modeling is that the computer simulation differs from the conceptual model in its basic assumptions regarding facilities maintenance (FM). Consequently, the validity of FM requirements generated by the SMD system is questionable.

The conceptual model assumes that some general housekeeping tasks, such as sweeping, cleaning, or painting, will be shared, or "floated," among the various ship divisions. However, this assumption is not reflected in the computer simulation.

According to the SMD conceptual model, to determine how many positions a ship needs to carry out FM, analysts first determine the total amount of work that needs to be performed (WS, OUS, PM, CM, and FM); they next determine the number of positions needed to man the watch stations and to perform the ship's PM, CM, and OUS. Then, they compute how much of the FM work load these positions can also perform within the established workweek standard. Since most FM tasks are nonspecialized, they can be performed by personnel from different occupational specialties and from different divisions and departments of the ship. For example, FM which no one in X Engineering Division has time to perform can most likely be floated to someone in Y Engineering Division having excess capacity to perform this work. The SMD guidelines state that additional positions are to be generated only after the floating of excess

unconstrained work load (work that can be performed by anyone, which includes FM) has been exhausted.

However, the SMD computer simulation of the model has not incorporated the requirement for the floating of excess FM work load. Instead, the computer simulation restricts FM performance within specific occupational specialties within each division, and it bars any floating of FM from department to department or from division to division within a department. As a result, it creates additional manpower requirements for divisions having excess FM, even when positions from other occupational specialties or from other divisions could do this work.

Manpower officials have acknowledged that restrictions on FM are improper and have agreed to reallocate FM within a department. They are currently making this adjustment manually and estimate an average reduction of 3 to 4 positions per ship. We believe that reprogramming the computer to float FM would reduce the manpower requirements by more than this. For example, simulating such an adjustment on our two sample ship classes reduced requirements by 9 positions for ships of the Spruance class and 5 for those of the Adams class. Even greater reductions in manpower requirements could be achieved if FM were floated across departmental lines.

Documentation of the SMD System and Changes to It Is Not Adequately Maintained

The SMD system also does not meet the criterion of proper documentation. Accurate, clear, and complete documentation is vital to any modeling system, but is especially important to the SMD program, where military staff turn over frequently due to routine reassignment. Without adequate documentation, flaws in the programming of the computer model are difficult to detect.

We identified significant weaknesses with the documentation supporting the computer simulation of the SMD model. First, the initial system with its many subsystems and complicated set of programming instructions was not adequately documented. Second, changes to the system have also been poorly documented.

Formal specifications for the original computer system of the Navy Manpower Requirements System do not exist, and NAVMEC has not maintained an adequate audit trail of changes in policy over time. For example, in 1984, the Navy Manpower and Material Analysis Center, Atlantic, reported to the CNO that there was no central repository of changes for the SMD program that could be accessed by all required

users. Rather, such changes were kept in manual paper-oriented files at different sites. These filing systems result in misfiled, lost, or misplaced correspondence. They further reported that the lack of comprehensive file coverage may cause erroneous manpower analyses and development of incorrect SMDs.

The effects of poor documentation can be seen in the example of facilities maintenance. While we found that excess FM was not being transferred as directed by the SMD conceptual model, some operational officials and manpower program officials were under the impression that it was being floated among divisions. By interviewing the individual responsible for reviewing and approving changes to draft SMDs, we learned that he had changed the policy regarding the floating of FM work load to prevent FM from floating among divisions, as a result of a verbal request from the SMD program office. This change was never officially documented by either the requestor or the reviewer and might not have shown up in any validation of the system. Because the change was undocumented, operational officials and some manpower program officials remained unaware of the change and of how it was increasing manpower requirements.

Some Navy Decision-Makers Do Not Understand the Assumptions of the SMD Model

Finally, the SMD modeling system does not meet the requirements for sound modeling in that some responsible Navy decision-makers do not understand the model's assumptions. An example of the lack of full understanding about how SMDs are determined can be seen in the case of the Navy's Reliability Centered Maintenance (RCM) program. The RCM program involves a different approach to maintenance where the amount of PM performed is reduced in order to increase the availability and operability of equipment and, as a side effect, make more maintenance-crew time available for CM. However, reduction of the PM work load automatically reduces the time available for CM since CM work load is determined by a ratio being applied to PM work load. A Navy official told us that the impact of these changes in maintenance policy on SMDs is not clearly understood and that the effect of maintenance requirements on position levels is not a consideration.

SMD System Lacks Some Necessary Management Controls

We believe that a key contributor to the problems in the SMD system described above is some lack of effective monitoring and control. In particular, we see a need for more effective review of the ROC/POE statements and improved communication among system participants.

Navy Has No Formal Plan for Reviewing and Updating ROC/POE Statements

SMD analysts use the ROC/POE statements to determine which shipboard systems must be manned, and to what extent, to perform wartime missions. ROC/POE statements describe the capabilities a ship is expected to possess and sustain under various conditions of readiness. The Navy needs a formal plan for reviewing and updating these statements because some of them overstate the minimum degree that systems must be manned to accomplish required tasks. These overstatements translate into inflated position requirements.

ROC/POE statements are developed by Deputy Chiefs of Naval Operations for Warfare, not by SMD program officials. Until the early 1980s, these statements were typically written in general terms and were not kept up to date. As a result, they sometimes resulted in manpower requirements that were higher than necessary to operate a ship.

In the early 1980s, Navy officials became concerned with the growing number of positions that the SMD process determined were required to operate ships. Because of berth constraints, the Navy became increasingly less able to staff some ships to the levels required by the SMDs. Consequently, reported personnel readiness ratings were being lowered aboard bunk-constrained ships.

Navy officials, therefore, started to critically analyze some ROC/POE statements to make certain that the tasking requirements were realistic and valid. Initial reviews produced some reductions in ship-manpower requirements, such as the elimination of a requirement to continuously man an underwater battery fire control system in Condition II, thereby reducing requirements by 4 to 7 positions per ship for all frigates, destroyers, and cruisers.

Although such efforts seem worthwhile, the Navy has no formal plan to ensure that all classes of ships are included in the reviews. At present, even when a ROC/POE statement is corrected for one class of ship, the correction is not necessarily made for other classes of ships with similar systems. For example, one surface warfare official, upon reviewing the taskings for 5-inch guns in one class of ships, found that a change in wording from "as required" to "manned with off-station personnel or as an evolution" reduced manning requirements by 6 positions. The Navy official, however, did not make the same change to other classes of ships having this system.

The Navy has no formal plan to ensure that the ROC/POE statements are periodically reviewed and updated. Navy guidance for the development

of ROC/POE statements requires that these statements be kept current. In addition, Navy directives require an annual review of all Navy instructions, which would include ROC/POE statements. However, the Navy has no mechanism built into these guidelines that would verify that ROC/POE statements are, in fact, kept current and reviewed periodically to eliminate unnecessary positions.

In addition to lacking a formal plan to review ROC/POE statements, criteria against which the ROC/POEs could be evaluated to ensure efficient manpower-requirements determination is also lacking.

Communication Among System Participants Needs Improvement

The SMD system could also benefit from management controls that would further communication among system participants. The scenario on which the system is largely based consists of the plans, regulations, and policies developed by the DCNOS, while the model and its computer simulation are produced and maintained by SMD program staff under NAVMEC, and the resulting authorized position requirements are utilized by operational commanders in the fleet. To ensure proper manpower determination, SMD-program staff must understand the assumptions of the scenario, and operations officials must understand how the SMD program operates.

We found that the communication among these officials is not always effective. Earlier in this chapter, we discussed various problems with the SMD model or its computer simulation, which we believe illustrate that operational officials in general do not understand the SMD model and how it works. In our opinion, these problems might not have arisen if operational officials had been aware of the assumptions incorporated in the SMD model and were able to communicate effectively about them.

Conclusions

We believe that, given the importance of SMD manpower requirements to the Navy's planning and management of resources, it is imperative that these requirements be as realistic as practical. However, our review of the SMD system identified certain problems in its modeling that preclude it from achieving the desired level of realism. As a result, ship-manpower requirements may be higher than they need be. Furthermore, the use of computer modeling to derive these questionable requirements could mislead decision-makers within DOD and the Congress into believing that they are more valid than is actually the case.

Recommendations to the Secretary of the Navy

We recommend that the Secretary of the Navy

- require that the SMD model be reviewed and adjusted so that it more accurately corresponds to how the Navy plans to operate during war-time, specifically that it
 - (1) reflects the amount of ship maintenance done in port,
 - (2) allots no more Sunday free time than would be allotted in wartime,
 - (3) introduces a wartime in-port workweek and work-load standards, and
 - (4) ensures that work accomplished during watch duty is not being double counted;
- ensure that the computer simulation of the SMD model is corrected to allow FM work load to float across occupation, division, and department lines;
- require that management and users are provided with a properly documented description of the SMD modeling process;
- require that ROC/POE statements be thoroughly and critically analyzed on a periodic basis, with the objective of eliminating unnecessary tasking requirements, and that criteria for making this analysis be provided;
- improve the management of the SMD program to reduce the likelihood of future problems by
 - (1) establishing a monitoring system that will periodically review the SMD system, model assumptions, and documentation for currency, accuracy, and completeness, and will include reviews of SMD assumptions by operational officials, and
 - (2) improving communications, especially between Navy operating officials and SMD-program staff, by providing the operating officials with a channel for notifying SMD staff of changes in scenario assumptions and a basic understanding of the processes of the SMD system.

Agency Comments and Our Evaluation

While DOD agreed only partially with the findings in this chapter, it concurred with most of the recommendations and partially concurred with the others.

DOD disagreed with our conclusion that the SMD program does not meet some of the key requirements for valid modeling. Specifically, DOD disagreed with our observation that the SMD model does not reflect how the Navy plans to operate during wartime, noting that the SMD model

reflects the wartime readiness condition cited in OPNAVINST C3501.2G that requires 60 days of continuous wartime steaming. We agree that the 60-day steaming condition is the major assumption regarding how ships will operate during wartime. However, OPNAVINST C3501.2G also provides for an in-port readiness condition, which is not taken into account by the SMD model. In this condition, personnel are on board at all times to meet anticipated in-port needs and to perform in-port functions as prescribed in the ROC/POE. In addition, the Navy's strategic concepts publications state that ordinarily 30 percent of the fleet will be in port in a reduced operational status and that, even during times of crisis, only about 50 percent of the fleet will be deployed overseas. Since this represents a significant amount of time for a ship to spend in port, we believe that the SMD model should take in-port time into account.

DOD agreed that any maintenance work load associated with tasks that cannot be accomplished at sea should be removed from the SMD model and stated that the Navy will identify and remove any such work load by January 1986.

With regard to our findings on the floating of excess FM work load, DOD concurred that, at the time we did our audit work, the SMD computer model did not incorporate the requirement for floating excess FM work load across division lines. DOD stated that the SMD model was updated to allow FM to float across division lines in June 1983 and that this policy had been correctly applied by manual methods at the time of our review. The June 1983 date cited by DOD appears to be in error. During our review, we obtained documentation which shows that the Navy did not change its policy to float FM across division lines until almost a year later, after we had pursued the matter with Navy officials in April 1984. The documentation we obtained consists of (1) a memo from the head of the SMD Quality Control Office, stating that the policy of moving FM work load across division lines would be effective on May 1, 1984, and (2) a summary of fleet-review comments for a ship, acknowledging the change in FM work-load distribution, effective May 1, 1984. In addition, we continue to believe that the manual adjustment being made by the Navy is an inadequate remedy and that requirements would be reduced even further if the computer were reprogrammed to make the adjustment automatically.

DOD also disagreed with our finding that the SMD system and changes are not adequately documented. While DOD's comments cite a number of procedures for maintaining documentation, the documentation we were shown during our audit was clearly inadequate.

DOD agreed that, at the time of our review, not all Navy decision-makers fully understood the SMD process. It stated, however, that instructions were available describing the system and that the Navy was revising the instructions to further refine the SMD system description. Further, the Navy plans to send key manpower officials to a new Ship Manpower Requirements Training Course for specific training in the SMD process.

DOD also agreed with our finding that, at the time of our review, formal plans requiring specific, periodic ROC/POE review and update were not in effect, but stated that such plans have since been put into effect.

DOD only partially concurred with our recommendations. DOD stated that the SMD model will be adjusted by September 1986 to reflect only 3 hours of Sunday free time for both non-watchstander and watchstander positions in order to standardize Sunday free time for the two position categories. DOD stated that it would not further reduce Sunday free time to the 1 hour we used as an example in our report since we made no analysis to support such a reduction. We agree that we did not provide analytical support for the 1 hour, and we did not intend to imply that the Navy should grant only 1 hour. Rather, we were advocating that the SMD model should allot no more Sunday free time than would be allotted in wartime.

DOD concurred with our recommendation that work on watch should be accounted for. It stated that some of this work was already being accounted for in SMDs and that an evaluation was underway, to be completed by late fiscal year 1987, to identify additional work on watch that could be accomplished without harming wartime readiness.

DOD did not concur with our recommendation that a wartime in-port workweek and work-load standard should be introduced into the SMD model, nor did DOD concur that the SMD model should be adjusted to reflect the amount of ship maintenance done in port. DOD stated that the adjustment should not be made because the entire SMD process is based on being at sea for 60 days during wartime, not in port. For the reasons stated on page 55, we continue to believe that the SMD model should be adjusted.

DOD partially concurred with our recommendation that the SMD model be modified to float FM across occupational, division, and department lines. DOD stated that floating FM work load across ship department lines without constraint was impractical since department heads are individually responsible for assigned space condition and safety; therefore,

responsibility for FM had to follow departmental lines. DOD noted, however, that the SMD FM-measurement plan is being used manually to identify "common use areas" where FM can float across department lines without compromising authority and responsibility. Full automation of the SMD model to float FM will be accomplished by September 1987.

DOD concurred with our recommendation that managers and users be provided with a properly documented description of the SMD process and stated that by October 1986 revised and updated instructions would be issued. DOD also stated that a training course would begin in January 1986 to provide in-depth information for Navy manpower officials and managers.

DOD also concurred with our recommendation for periodic review of ROC/POES, stating that Navy instructions were modified in September 1985 and that further amplification is expected by October 1986.

DOD concurred with our recommendation to establish a monitoring system and improve communications among manpower officials. DOD stated that an initial in-depth review of the SMD program is underway and that standards for future annual CNO reviews will be determined by September 1986. DOD also said that communications are being improved.

Examples of How Refinements in Methodology, Assumptions, and Programming in the SMD Program Could Reduce Wartime Manpower Requirements

In chapters 2 and 3, we question the Navy's ability to accurately determine the quantity and quality of enlisted positions required aboard ship due to (1) weaknesses in the methodology the SMD program uses to measure shipboard work load and (2) the various problems with the SMD program model, where the assumptions and programming used do not realistically reflect expected or existing operating conditions.

In order to provide an illustrative example of the potential impact that correcting these problems could have on manpower requirements, we recomputed the requirements for two sample ships, using a revised set of assumptions. We found that requirements on these two ships could be substantially reduced. However, as discussed in the previous chapters, DOD does not agree with all the assumptions we used. Also, statistically accurate projections cannot be made from these two ships to all the ships in the Navy.

Examples of Potential for Reducing Manpower Requirements

After reviewing the enlisted manning requirements on the USS Peterson, a Spruance-class destroyer, and the USS Hoel, an Adams-class destroyer, we estimate that these requirements could be reduced by 19 and 48 positions, respectively, by

- changing the way FM work load is allocated aboard ship,
- eliminating the nonproductive and MRPA allowances, and
- adjusting the standard workweek to reflect likely wartime conditions by reducing Sunday free time to 1 hour.

We arrived at these estimated reductions by running a number of trial solutions through the SMD computerized model (except for FM work load, which had to be done manually). The following sets of assumptions were used in this analysis:

A. The MRPA allowance (discussed in ch. 2, pp. 32 to 34) was eliminated.¹

B. The productivity allowance (discussed in ch. 2, pp. 32 to 34) was eliminated on PM, CM, and OUS work loads.²

¹Our rationale for eliminating the MRPA was that the Navy has been unable to demonstrate that the base time estimates, to which the allowances were applied, do not already include the factors accounted for by the allowances.

²Our rationale for eliminating the productivity allowances was the same as that for eliminating the MRPA allowances.

**Chapter 4
Examples of How Refinements in
Methodology, Assumptions, and
Programming in the SMD Program Could
Reduce Wartime Manpower Requirements**

C. At-sea PM work load (discussed in ch. 3, pp. 45 to 46) was reduced by 20 percent to provide for PM accomplished in port.

D. Sunday free time (discussed in ch. 3, pp. 46 to 47) was reduced from 11 hours for non-watchstanders and 3 hours for watchstanders to 1 hour for each group, increasing the standard workweek from 66 hours for nonwatchstanders and 74 hours for watchstanders to 76 hours for both groups.

E. FM work load (discussed in ch. 3, pp. 49 to 50) which can be performed by anyone was absorbed by department positions.

F. All the above assumptions were combined. (In general, the total is less than the sum of A through E because the different assumptions interact with each other to affect work load and position requirements calculations. For example, manpower reductions resulting from assumption D would be less after the work load had been reduced by assumptions A and B. Further reduction of manpower positions aboard the USS Peterson was limited by the number of positions needed to operate condition I battle stations.)

In table 4.1, we show the extent to which ship manpower requirements would be reduced aboard two ships based on these assumptions.

Table 4.1: Ship Manpower Reductions Based on Various Assumptions

Assumption set	Manpower reductions	
	USS Peterson	USS Hoel
A Elimination of MRPA allowances	4	9
B Elimination of productivity allowance on PM, CM, and OUS work loads	8	21
C Reduction of at-sea work load by 20 percent	3	7
D Reduction of Sunday free time to 1 hour	10	19
E Absorption of FM work load by department positions	9	5
F Combination of above assumptions	19	48

Because of the lack of sufficient data and questions regarding the data which does exist, we were unable to assess the degree to which correcting the remaining problems discussed in chapters 2 and 3 would have increased or decreased manpower requirements on these two ships. However, regardless of the total number involved, the current mix of enlisted positions—in terms of skill and rank requirements—appears questionable due to the deficiencies discussed.

Potential for Reducing Manpower Requirements on Navy Ships

The potential for reducing ship-manpower requirements is suggested by the results of our test of those requirements for two sample ships. By using assumption set F, as described above, the Peterson showed a 6-percent reduction in enlisted manpower requirements, and the more manpower-intensive Hoel showed a 12-percent reduction. The reductions for each ship in the Navy would vary, depending on how each ship is equipped and configured.

Statistically accurate projections to the aggregate Navy fleet based on the test SMDs derived for these two sample ships cannot be made. However, since the SMDs for all Navy surface ships are determined through the same assumptions and equations, it is possible that similar reductions could occur throughout the fleet. The potential magnitude is significant.

Reductions in ship-manpower requirements would not necessarily equate to cutting the Navy's end strength since the Navy does not receive funding from the Congress for all its requirements. However, since the Navy's manpower requirements form the basis for its personnel budget request, which, in turn, forms the basis for the Congress's authorization of personnel end strength for the Navy, it is likely that a significant portion of any reduced manpower requirements would be either available for reallocation to areas of documented need to improve readiness or eliminated without harming readiness.

Agency Comments and Our Evaluation

DOD strongly disagreed with the findings of this chapter. While DOD agreed that certain refinements to the SMD model are appropriate, and that these have been or will be implemented to the maximum cost-effective extent possible, it did not agree that all of the assumptions we used would be valid adjustments to the present SMD model. DOD had a number of comments concerning the lack of rigor in the assumptions we used in our case study of the two ships. DOD also stated that reductions calculated for only two ships utilizing less rigorous procedures than our own report recommends cannot be projected to the Navy's fleet as a whole.

We agree that some of our assumptions could be questioned. We were not and are not advocating that the Navy adopt the assumptions we used in our example. For most of these assumptions, the lack of documentation in the Navy's program makes it impossible to validate either the set of assumptions we used or those presently incorporated in the SMD model.

Chapter 4
Examples of How Refinements in
Methodology, Assumptions, and
Programming in the SMD Program Could
Reduce Wartime Manpower Requirements

Our purpose in presenting the case study was to illustrate for DOD and congressional decision-makers the significant impact that changes to the SMD program could have on Navy manpower requirements. We continue to believe that the illustration of potential impact provides valuable insight even though the results cannot be accurately projected across the Navy.

DOD did not agree that the MRPA and the productivity allowances should be eliminated because, according to DOD, they were developed from extensive sampling and are being applied to raw productive-time estimates. However, neither DOD nor the Navy provided any evidence to substantiate how the sampling was actually done or how the time estimates were developed.

DOD also noted that we (1) offered no documentation in support of the 20-percent reduction of the at-sea maintenance work load that could be performed in port and (2) did not explain how such maintenance work can be accounted for when no in-port segment is included in the wartime at-sea SMD model. The Navy lacks sufficient data to allow us to calculate the exact amount of in-port tasks that have been included in the at-sea maintenance work load. Also, the SMD model fails to provide for an in-port period and to realistically reflect that in wartime some ship maintenance will be done in port where the Navy has alternatives such as the use of contractors, shore-based personnel, or reservists to get the work done.

DOD also disagreed that the standard workweek should be increased to 76 hours for both watchstanders and non-watchstanders by reducing Sunday free time from 11 hours to 1 hour. DOD stated that we provided no analysis to support the reduction to Sunday free time below that now utilized in the SMD model. We were not recommending that the workweek be increased to 76 hours by reducing Sunday free time to 1 hour. But we did question the amount of Sunday free time now being allowed for in the current workweek and recommended that the Navy study this issue and include in the SMD model only the amount of Sunday free time that would be allotted in wartime.

The SMD Process

To determine manpower requirements, the Navy uses a manpower modeling system whereby the most demanding scenario of wartime operations is translated into a conceptual model which, in turn, is simulated on computers. As input to the conceptual model, the Navy uses the ship work load (the operational and maintenance tasks which assigned ship enlisted positions would have to perform in wartime) and staffing standards (the amount of time and skills needed to perform these tasks). Resulting outputs are known as ship-manpower requirements and are recorded on an SMD.

The Wartime Scenario

The wartime scenario refers to the probable strategy and methods of operation to be employed by the U.S. Navy during a war to meet the expected threat. The scenario is not a single codified document but consists largely of plans, projections, and assumptions developed by the DCNOS. Many of the scenario's basic assumptions can be derived from such documents as Navy policy statements, instructions, regulations, standard operating procedures, and the ROC/POE statements developed for each ship.

ROC/POE Statements

The wartime scenario is largely reflected in the Required Operational Capability (ROC) and Projected Operational Environment (POE) statement developed for each ship class by the Deputy Chiefs of Naval Operations for Surface Warfare, Air Warfare, and Submarine Warfare. The ROC/POE statements describe the operational capabilities each ship is required to maintain under various conditions of readiness.

Conditions of Readiness

The five principal conditions of readiness, which are common to most ships, are as follows:

Condition I: Battle Readiness. All personnel are continuously alert. All possible operational systems are manned and operating. No maintenance is expected except that routinely associated with watchstanding and urgent repairs. Maximum expected crew endurance at condition I is 24 continuous hours.

Condition II: Battle Readiness—Limited Action. Accomplishment of urgent underway maintenance and support functions is expected. A minimum of 4 to 6 hours of rest is provided per man per day. Subject to these conditions, required operational systems are continuously manned

and operating. Maximum expected crew endurance at condition II is 10 continuous days.

Condition III: Wartime Cruising Readiness. Operational systems are manned and operating, as necessary, to conform with prescribed ROCs. Accomplishment of all normal underway maintenance, support, and administrative functions is expected. Opportunity for 8 hours of rest is provided per man per day. Maximum expected crew endurance at condition III is 60 continuous days.

Condition IV: Peacetime Cruising Readiness. Operational systems are normally manned only to the extent necessary for effective ship control, propulsion, and security. Accomplishment of all underway maintenance, support, and administrative functions is expected. Maximum advantage is taken of training opportunities. Expected crew endurance at condition IV is not manning constrained.

Condition V: In-port Readiness. Systems and watch stations are manned to the extent necessary for effective operation as dictated by the existing situation. Watch stations are assigned as required to provide adequate security. Personnel on board are at all times adequate to meet anticipated in-port emergencies and perform in-port functions as prescribed by unit ROCs. Accomplishment of all required maintenance, support, and administrative functions is expected. Maximum advantage is taken of training opportunities. Subject to the foregoing requirements, the crew will be provided maximum opportunity for rest, leave, and liberty.

SMD Conceptual Model

Using the wartime scenario, the SMD program staff has created a conceptual model of wartime ship operations by determining ship work load and staffing standards.

Five major types of work are performed aboard surface Navy ships: watch station (WS), own unit support (OUS), preventive maintenance (PM), corrective maintenance (CM), and facilities maintenance (FM). In addition, tenders and repair ships have work load classified as customer support, which entails providing repair and support services to the fleet. The manpower required to accomplish this work constitutes a ship's organizational manning, which is the number and type of positions needed to obtain full combat capability in condition I, to maintain condition III on a minimum three-section watch at sea, and to accomplish all of a ship's work in conditions III, IV, and V.

Watch stations are ship positions responsible for manning essential ship systems, subsystems, and equipment—such as engineering control, ship control, and combat systems. These positions must be manned on a continuing basis for the proper and effective defense and safe functioning of the ship. Examples of WS titles are Lookout, Teletype Operator, Helmsman, and Console Operator.

PM involves the planned or scheduled maintenance of ship equipment. PM requirements are determined through analysis of required maintenance actions generated by the Planned Maintenance System of the Navy Maintenance and Material Management (3-M) System. The 3-M System stipulates (1) the PM tasks to be performed, (2) the frequency with which these tasks are to be accomplished, and (3) the amount of time required to perform the work.

CM involves unscheduled maintenance that is necessary because of the malfunction, failure, or deterioration of equipment. Most CM requirements are determined through the application of ratios of PM to CM. For electronic equipment, the Navy allows 1 hour of CM for every hour of required PM. For all other equipment, it allows 1 hour of CM for every 2 hours of PM.

OUS involves administrative, resupply, food service, medical, and utility tasks; as well as special evolution tasks aboard ship that require a designated portion of ship personnel to work together to accomplish specific functional capabilities, such as refueling, reprovisioning, and anchoring. SMD procedures call for OUS requirements to be determined by analyzing the time and skills required to perform the various OUS tasks and how often the tasks are accomplished.

FM involves the cleaning and sanitizing of all habitable areas and for preserving the hull, decks, superstructure, and equipment against corrosion and deterioration. Analysts derive FM requirements by (1) measuring a ship's facilities—such as determining the gross area and material makeup of floors, walls, and ceilings, and (2) counting the number and type of compartments, equipment, and fixtures—such as the number of lights, mirrors, desks, sinks, and toilets. Analysts then apply basic industrial work standards developed by the General Services Administration to derive the time required to perform various tasks required to clean, paint, or otherwise maintain the ship and its facilities.

After the basic times for performing OUS, PM, CM, and FM work have been estimated, two time allowances are added. A 30-percent allowance, called make-ready and put-away (MRPA), is added to the basic time for PM tasks to account for extra time required to get tools and parts, shut down systems, return tools, and restart systems when the job is completed. An additional 20-percent productivity allowance, to allow for nonproductive time, is added to each of the basic times required for these tasks to account for personal needs or fatigue.

The computed work load for each of the above types of work is divided by the available work hours from the Navy's at-sea workweek to determine the number of enlisted positions required for each work center on the ship. The at-sea workweek is 74 hours for watchstander and 66 hours for non-watchstander positions. Included in these hours is a service diversion allowance and a training allowance to account for training and other activities which must be or are generally accomplished during normal working hours as required by regulations or by the nature of shipboard routine.

The makeup of a ship's work load differs, depending on the type of ship. Table I.1 shows, for Navy surface ships, the approximate percentage range of total ship work load that each of the above work-load elements and allowances comprises.

Table I.1: Percentage Range of Work-Load Elements and Allowances

Work-load element	Percentage range
WS	18 - 46
OUS	14 - 27
FM	5 - 9
PM	5 - 9
CM	2 - 4
Allowance	
Nonproductive time	5 - 9
Service diversion	3 - 5
Training	3 - 5
MRPA	^a

^aNot readily determinable—included as a part of PM work load.

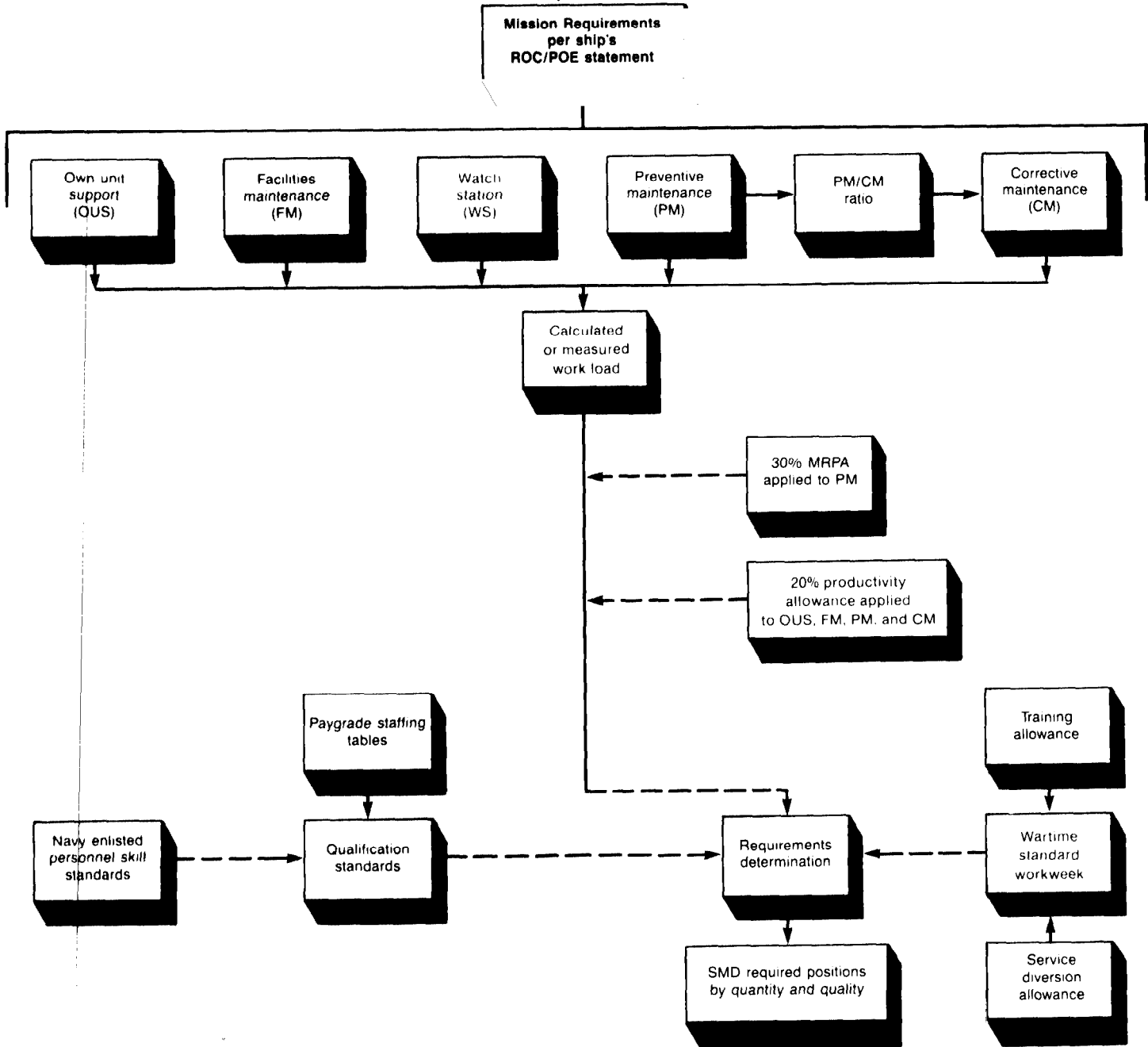
To determine the quality—paygrade and special skills—of each position, SMD analysts use two guides: (1) the Manual of Navy Enlisted Manpower and Personnel Classification and Occupational Standards,

developed by the Naval Occupational Development and Analysis Center, and (2) paygrade staffing tables developed by the SMD program. The manual describes the paygrade and special skills necessary to perform various operations or tasks aboard ship. The paygrade staffing tables determine the paygrade mix required for each work center to provide for necessary supervision and career-advancement opportunities.

Once enlisted work-load measures and standards are derived, they, along with the allowance and workweek data, are entered into the Navy Manpower Requirements System, a computerized system which provides automated data-processing support in the development of SMDs as well as in the shore and squadron manpower-requirements programs. This system is used to generate ship-manpower requirements in an established SMD format, usually on a ship-by-ship basis.

Figure I.1 illustrates how the work-load data, allowances, qualification standards, and standard workweek are used in the SMD process to derive manpower requirements.

Figure I.1: Schematic Display of the SMD Process



Objective, Scope, and Methodology

This review is a part of our larger examination of manpower programs across DOD to assess whether the services' policies and procedures for determining manpower requirements accurately identify, through sound and rigorous processes, the quantity and quality of manpower needed for national defense. While originally self-initiated, this series of jobs is now being done at the request of the Chairman, House Committee on Armed Services. In this review, we focus on the Navy's SMD program, the program by which the Navy determines its ship-manpower requirements.

We undertook this study to assess the extent to which the Navy based SMD requirements on sound and supportable industrial engineering principles. Specifically, our objectives were to assess the validity and reliability of the data used to compute ship-manpower requirements; to assess the extent to which and the manner in which the data is actually used; and to assess the extent to which the data is systematically reviewed, monitored, and updated.

We reviewed the SMD methodology for Navy surface ships. We excluded submarines principally because of the unique character of the submarine environment, such as highly constrained working areas and, in some cases, alternating crews. We visited the following primary locations during our review:

- Deputy Chief of Naval Operations (DCNO) for Manpower, Personnel, and Training, Washington, DC,
- DCNO for Surface Warfare, Washington, DC,
- Naval Sea Systems Command Headquarters, Washington, DC,
- Navy Manpower Engineering Center (NAVMEC)—formerly the Navy Manpower and Material Analysis Center, Atlantic—Norfolk, VA,
- Commander in Chief, Atlantic Fleet, Norfolk, VA,
- Commander, Naval Surface Force Atlantic Fleet, Norfolk, VA,
- Navy Manpower Engineering Center Detachment—formerly Navy Manpower and Material Analysis Center Pacific—San Diego, CA,
- Commander in Chief, Pacific Fleet, Pearl Harbor, HI,
- Commander, Naval Surface Force, Pacific Fleet, San Diego, CA, and
- Naval Sea Support Center, Pacific, San Diego, CA.

At each of these locations, we interviewed key officials responsible for developing, maintaining, and utilizing various data bases used in the SMD program to develop functional work-load standards and manpower requirements. We also reviewed applicable SMD program policies and

regulations and obtained available documentation supporting the (1) criteria, (2) various functional work-load standards, and (3) allowance factors used in SMD development.

In addition, we visited five Navy In-Service Engineering Agencies having responsibility for determining maintenance requirements for those shipboard-equipment items included in our sample. Further, we accompanied and observed analysts from NAVMEC and the detachment in San Diego during portions of on-board surveys of the USS Mount Whitney (LCC-20) and USS John A. Moore (FFG-19). We also visited the USS Peterson (DD-969), USS Bainbridge (CGN-25), and the USS Tuscaloosa (LST-1187) to discuss the development and adequacy of the SMDs developed for these ships.

Our analysis included reviewing the logic of the SMD model and the processes used within the NMRS system to accumulate the work-load requirements used in deriving shipboard manpower needs. We also reviewed previous GAO reports, Navy and DOD audit service reports, and studies conducted by the Naval Personnel Research and Development Center, NAVMEC, and private contractors.

We limited our study to the way in which the Navy uses the SMD program to determine its requirements for enlisted positions, which comprise the majority of a ship's workforce. We were unable to examine how the Navy determines its officer requirements because, in December 1983, the Navy established a new system to determine these requirements, and it was under review and revision at the time of this study.

Cost and time constraints made it impractical for us to review all the standards in the data base used by NAVMEC or even a statistical sample of them. This data base is very extensive. For example, NAVMEC's watch station base contains over 1,200 individual condition III ws standards for the 55 different surface ship classes (323 ships) that were part of the active fleet at the time of our review. Also, the Navy's 3-M planned maintenance system contains over 600,000 individual shipboard maintenance requirement cards which the SMD program uses to estimate PM work load.

To review the ws data base, then, we concentrated mainly on requirements for condition III, which account for the majority of positions required on Navy ships. Consequently, we reviewed the standards for all (55) condition III ws enlisted positions required for one sample ship. We reasoned that reviewing the whole operation of the sample ship, rather

than looking at only selected elements of ship operation aboard several ships, would allow us to better understand the need for each of the ws requirements.

As our sample ship, we selected the USS Peterson, DD-969, a Spruance-class destroyer. We selected this ship for the following reasons:

- At the time of our review, the Spruance class was not bunk-constrained; therefore, the full SMD-generated manpower requirement was authorized for most of these ships.
- As of April 1983, the Spruance class was the second largest ship class (31 ships) in the Navy. The largest class, which was the FF-1052 Knox class, is bunk-constrained.
- The Spruance class is one of the Navy's newer surface ships and experienced several manning problems when first introduced to the fleet.
- The USS Peterson was in port during the time of our review.
- The USS Peterson had undergone an SMD review at the time of our field work, and working papers supporting the SMD development were readily available. For most ships, these supporting working papers were not available because it is NAVMEC's policy to destroy them after the SMD is published.
- The USS Peterson is reasonably representative since many of the other active Navy ships required anywhere from 9 to 40 percent of the condition III watch stations found on the DD-963 class ship.

To review the PM data base, we selected 20 systems aboard the DD-963 Spruance class ship. We then performed a detailed review of how the PM work-load requirements for these systems were derived and used to develop manpower requirements.

For the OUS data base, we reviewed procedures used by the Navy to collect OUS work-load data from 42 statistically selected ships. The Navy is using this data to develop new OUS standards.

In addition to the Peterson, the USS Hoel (DDG-13), an Adams class destroyer, was selected as a second ship upon which to assess the effect of various changes in SMD methodology assumptions. We performed no detailed review of the procedures used in developing FM work-load standards. Nor did we review the procedure that the Navy Occupational Development and Analysis Center used to develop the Manual of Navy Enlisted Manpower and Personnel Classifications and Occupational Standards, which the SMD program uses to derive skill and rank requirements for positions aboard ship. The development of this manual will be

the subject of another GAO review focusing on the grade-determination procedures used by all the military services.

Comments From the Department of Defense

FORCE MANAGEMENT
AND PERSONNEL

ASSISTANT SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301-4000

13 DEC 1985

Mr. Frank C. Conahan
Director, National Security
and International Affairs Division
U.S. General Accounting Office
Washington, DC 20548

Dear Mr. Conahan:

This is the Department of Defense (DoD) response to the General Accounting Office draft report, "Navy Manpower: Improved Ship Manpower Document Program Could Reduce Requirements," dated 29 October 1985, (OSD Case 6868/GAO Assignment Code 967111).

The GAO report will be useful to the DoD in making refinements to the Navy manpower requirements program. The DoD, however, is concerned with the overall tone of the report and the impression it leaves that reductions in manpower requirements translate directly into budget savings. The report also gives the false impression that the Navy manpower requirements program is seriously flawed and has little or no analytical basis. On the contrary, the Navy's Ship Manpower Document Program uses the latest and best techniques available to develop manpower requirements.

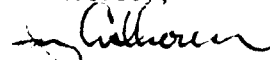
In addition, the resource implications of adopting the GAO recommendations that concern reductions in requirements and funded resources need to be clarified. The Department has never received full funding of its requirements, in either end strength or appropriations. Although adjustments in requirements may result from some of the draft report recommendations, the adjustments can not be translated into end strength or budget reductions. The adjustments would only reduce the difference between the actual requirements for the Department and the manpower end strength actually funded for the Department. The GAO report, unless clarified in the final version, will lead some readers to infer that budgetary savings are directly available.

Appendix III
Comments From the Department of Defense

Furthermore, the draft report is based on information involved in a review conducted over a two year period. The Navy, therefore, has already initiated corrective action for many of the cited deficiencies, and others have been overtaken by events. The Navy, for example, has consolidated management of its various manpower requirements determination programs under the Navy Manpower Engineering Program (NAVMEP) in the Office of its Deputy Chief of Naval Operations for Manpower, Personnel, and Training. This consolidation was accomplished to enhance management effectiveness and to improve guidance to the various elements of the Navy manpower requirements development program. The improved guidance includes policies such as those mentioned in the draft report. The Navy, therefore, has made substantial strides in its programs for manpower requirements determination. These programs are complex and dynamic, however, and minor problems will always be present. The Navy is continually reviewing and solving these problems that are often the result of valid differences of opinion among rational and reasonable program managers.

Detailed responses to the draft report findings and recommendations are enclosed.

Sincerely,



Jerry L. Calhoun
ACTG Assistant Secretary of Defense
(Force Management & Personnel)

Enclosures

Appendix III
Comments From the Department of Defense

GAO DRAFT REPORT DATED 29 OCTOBER 1985
(GAO CODE NO. 967111) OSD CASE NO. 6868

"NAVY MANPOWER: IMPROVED SHIP MANPOWER
DOCUMENT PROGRAM COULD REDUCE REQUIREMENTS"

FINDINGS AND RECOMMENDATIONS TO BE ADDRESSED
IN THE DOD RESPONSE TO THE GAO DRAFT REPORT

* * * * *

FINDINGS

o FINDING A: Importance of Accurate Manpower Requirements To Navy. The GAO observed that a cost effective work force is important to the Navy for three major reasons: i.e., (1) because the Navy personnel costs are significant, accounting for about 33 percent (over \$30 billion) of its total budget, (2) because the Navy's expansion from 535 ships in 1982 to 600 by 1990 will require an estimated 49,300 additional active personnel at a cost of at least \$1.1 billion annually (at fiscal year 1986 pay levels), and (3) because the number of personnel required to man Navy ships has grown so much, there are not enough bunks to accommodate them. Based on its analysis of berthing capacity on 344 deployable Navy surface ships active as of July 1984, GAO found that approximately 60 percent of these ships will have exceeded berthing capacity by fiscal year 1986. GAO concluded that since it is not the Navy's policy during peacetime to "hot bunk" (i.e., assign more personnel to a ship than that ship has available bunks), growth of requirements in excess of berthing capacity can have adverse effects on readiness. (pp. 2-3, GAO Draft Report)

DOD RESPONSE: CONCUR. DOD agrees that a cost effective work force is important in view of personnel costs, particularly the cost of personnel for additional manpower positions required for Navy's future 600 ship fleet; in context, the term "cost effective" means the least cost manpower mix which will provide assured combat capability. Navy's SMD process is structured to that end, to describe the minimum quantitative and qualitative position requirements necessary to provide required wartime capability. DOD also concurs that position requirements for many ships have grown as a result of the addition of greater weapons system capability and that position requirements for some ships exceed berthing capacity established under peacetime policy; however, full personnel readiness in wartime is ensured by mobilization plans to augment ship's personnel to full manning. Peacetime berthing standards will be relaxed in order to accommodate the additional personnel in wartime.

o FINDING B: Problems With Procedures Used To Determine Navy Watch Station (WS) Requirements. Because WS manning accounts for a large portion (18 to 46 percent) of a ship's total personnel needs, GAO observed it is especially important that rigorous procedures be used to determine WS standards, which serve as the basis of WS requirements. GAO found, however, that (1)

Now on p 11

documentation maintained in support of the WS standards was generally incomplete or lacking and (2) that WS standards were seldom based on rigorous on board analyses of ship operating procedures that include direct, systematic observations and method improvement studies. For example, GAO noted that WS analysts rarely observe WS work actually being done when the ship is at sea, or even simulations of the work when the ship is in port. Instead, GAO found that the analysts rely on interviews with ship supervisory personnel. Further, GAO found that WS analysts generally make no systematic observations of the total ship operations. According to GAO, such observations are necessary because changes in the ship occur fairly routinely during the life of the ship, and the changes could cause substantial quantitative and qualitative differences in WS manning. At the time of the review, GAO found that the Navy Manpower Engineering Center (NAVMEC) only had 10 individuals serving as WS analysts to cover the entire Navy surface ship force, consisting of about 70 classes of ships, and it is implied this is an impossible task for only 10 analysts. GAO also found that WS analysts do not routinely perform methods studies, which determine the most efficient ways of performing given tasks. GAO concluded that failure to determine the most efficient and economical way of performing ship operational functions will perpetuate any existing inefficiencies in the way ship operations are carried out. GAO concluded that poor documentation discredits the validity of WS standards and perpetuates weaknesses. GAO generally concluded that on board ship determinations of WS requirements currently lack an accepted degree of rigor (pp. 9-18, GAO Draft Report)

DOD RESPONSE: PARTIALLY CONCUR. DOD agrees that increased documentation can refine watch station standards that serve as the basis for WS position requirements, but disagrees that the determination of WS requirements now lacks an adequate degree of rigor. SMD manpower analysts are shipboard operationally experienced personnel who conduct extensive prior analysis of WS positions, taking into account ship equipment and configuration changes. The on board portion of the SMD process is then used to validate the WS "battlebill." The validated WS positions are displayed in a draft manpower requirements document, which is reviewed by all levels of the chain of command and staff manpower officials. This extensive development and review contains many of the essential elements of the method study process and is effective in validating tasking and improving efficiency. DOD agrees that the degree of rigor can be increased with additional SMD manpower analysts to conduct method studies and to perform some additional at sea observations, where Navy determines this to be cost effective. DOD does not concur, however, that methods studies in ships are required by DOD or Navy directives, as implied by the GAO. Action in these areas is continuing within present resources. (See DOD Response to Recommendations 1, 2, 3, 4 and 6)

o FINDING C: Problems With Procedures to Determine Manning For Own Unit Support (OUS) Requirements. According to GAO, manning for OUS accounts for the second largest portion of a ship's total personnel needs (14 to 27 percent), which makes it important that rigorous procedures also be used to determine the standards on which the requirements are based. GAO found, however, that Navy officials could provide no documentation to support the development of manning for OUS standards or the changes that have been made to them over time. In addition, GAO found that the Navy's progress updating and validating OUS standards has been slow. (GAO noted that the Navy's initial goal was to have validated 70 percent of the standards by the end of fiscal year 1984, but current Navy goals are to have 70 percent of the standards completed by the end of fiscal year 1985, with the remaining 30 percent to be completed in fiscal year 1986.) GAO also found that analysts relied mainly on interviews with ship workcenter supervisors and crew members to obtain OUS data. In addition, GAO found that the Navy did not perform any methods studies to identify inefficiencies in the way OUS work is accomplished. GAO also noted that analysts are instructed to record what has happened or is happening, rather than to record what should be happening. GAO concluded that measuring work in this manner perpetuates currently inefficient procedures by including them in the new OUS standards (pp. 18-25, GAO Draft Report)

DOD RESPONSE: CONCUR. DOD concurs that refined procedures should be used in the development of OUS standards. Starting in November 1983, the Navy Manpower Engineering Center (NAVMEC) effected procedures to retain all OUS standard documentation and to maintain an audit trail which includes data collected onboard ship, final standards approval, and changes to the approved standard. The NAVMEC also implemented, in August 1984, an improved management plan for collection of OUS data. This plan requires that data be substantiated via ship's records where possible. DOD also agrees that progress in updating and validating OUS standards has been slower than desired; this is because of resource constraints, which have also prevented the introduction of methods studies. Action in these areas is continuing within current resources. (See DOD Response to Recommendations 4, 5, and 6)

o FINDING D: Problems With Navy Procedures Used to Determine Preventive And Corrective Maintenance Work Load. GAO observed that preventive maintenance (PM) and corrective maintenance (CM) represent a significant portion of a ship's high-skilled work load. GAO found that at present, however, no PM data and only a small portion of CM activity is collected and reported through the Navy's Maintenance Data System (MDS). GAO reported that the Navy has recognized this deficiency and to overcome this problem,

has authorized a new system, the MDS II which will be used to collect complete PM and CM workload data after the system has been designed, implemented, and installed on all ships designated for the system, anticipated by late 1986. GAO noted that several Navy studies suggested that the data the SMD program now uses to determine necessary PM manhours may be inaccurate and, as a consequence, the resulting manpower requirement may be overstated. GAO also found that preventive maintenance manhour estimates were not documented or validated. (GAO noted, for example, that the Navy was unable to provide documentation to substantiate the methods used to develop the PM data, or to validate its currency or reliability for a sample of systems aboard Spruance class destroyers.) In addition, GAO found that the SMD program determines CM workload and manpower requirements by applying hourly ratios of PM to CM despite the fact that Navy studies have concluded that such ratios are invalid and generally underestimate ship CM, workload and personnel requirements. The GAO reported that the Navy could provide no documentation to explain and support the methods, data, and assumptions used in developing these ratios. The GAO concluded, therefore, that the Navy needs to abandon these ratios for estimating CM workload and substitute the kind of data expected to be produced by the MDS II system. The GAO further concluded that the present lack of data on actual PM and CM maintenance time contributes to a lack of credibility in the Navy's stated ship manpower needs. (PP. 25-34 and p. 43, GAO Draft Report)

DOD RESPONSE: PARTIALLY CONCUR. DOD concurs that the new Maintenance Data System (MDS II) will collect PM and CM data more completely. This can be used to improve the accuracy of total ship maintenance manhours. DOD does not agree that preventive maintenance manhour estimates cannot be documented or validated. PM estimates are developed by NAVSEA under Military Specification, MIL-P-24534A, to the level of documentation required by that DOD standard. DOD agrees, however, that the currently used ratio of PM to CM workload hours does not provide optimum accuracy, and probably leads to underestimating manpower requirements. Accordingly, Navy will replace the use of PM/CM ratios as soon as the MDS II system is fully operational; however, MDS II capability will not be fully developed until FY 1991. In the interim, Navy has tasked the Center For Naval Analyses (CNA) to study how present methods can be improved; this study is expected to be completed in June 1986. Navy will then apply any feasible, cost effective improved methods until the MDS II data is available. (See DOD Response to Recommendations 7 and 8).

o FINDING E: Navy's Accuracy and Use of Allowances Is Questionable. The GAO found that the Navy currently adds two allowance factors to its estimates of the time required to do maintenance and OUS work aboard ships: (1) a 30 percent

make-ready and put away (MRPA) allowance, which is applied to the estimated weekly PM workload and (2) a 20 percent allowance for nonproductive time to the estimated work hours for PM (after the 30 percent, MRPA allowance has been applied), CM, facilities maintenance, and OUS. GAO found, however, that SMD program officials could not provide documentation showing when and how these allowances were derived. GAO learned that several Navy studies conducted in the early 1970s challenged the accuracy of these allowances and observed that the use of allowances is an acceptable industrial technique only when used in conjunction with raw productive time, reliably measured by engineering techniques, such as time and motion studies or work activity sampling. GAO also found that the Navy is unable to show that its raw PM, CM, and OUS manhour estimates were developed by precise engineering methods and, therefore, include no nonproductive or MRPA time. GAO concluded that the effect is that nonproductive preparation and cleanup time is likely to be double-counted, which results in increased manpower requirements. GAO further concluded that as the Navy develops a data base of actual PM and CM time requirements, the need for adding allowances will disappear. GAO finally concluded that, because Navy descriptions of the program indicate that the requirements are established and validated through "rigorous application of accepted industrial engineering techniques," decision makers in DOD and the Congress could be misled into believing that the Navy's ship manpower requirements have been more reliably determined than they have been. (pp. 34-37, and p.44, GAO Draft Report)

DOD RESPONSE. PARTIALLY CONCUR. DOD does not concur that application of the existing 30% MRPA allowance is inappropriate. The 30% factor was developed in 1972, using industrial engineering techniques in at sea sampling of raw productive time on board USS HENRY B WILSON (DDG 7) and USS INGRAM (DD 938) over a six month period. Therefore, DOD believes the allowance is being applied to raw productive time and that this is a usefully accurate adjustment to the overall ship PM manhours required.

Concerning the 20% Productivity Allowance (PA) for nonproductive time, DOD concurs that the application of the productivity allowance to PM manhours, in addition to the MRPA allowance, could result in some double-counting. Therefore, Navy will suspend the application of PA allowance to PM manhours effective December 31, 1985. (See DOD Response to Recommendation 8).

o FINDING F: Navy SMD Paygrade Staffing Tables Need To Be Supported and Revalidated. The GAO reported that the SMD program claims it uses staffing tables to show the grade mix of enlisted personnel required for all work centers aboard all ships. GAO found, however, that the Navy could not provide documentation to

justify or support the development of the staffing tables, or the changes that have been made to them. GAO also found that the staffing tables assigned a higher paygrade requirement than that indicated by the Navy's occupational standards manual for 65 (20 percent) of 323 enlisted personnel on GAO's sample ship, the USS PETERSON. The GAO identified a number of examples where the Chief of Naval Operations made changes to SMD requirements by increasing enlisted paygrades in certain occupations in an effort to aid recruitment and retention. GAO concluded that such changes to the SMD requirements are inappropriate because they are likely to become embedded in the SMDs as minimum requirements, and not changed when such retention incentives are no longer required. GAO also concluded that the staffing tables may not reflect minimum wartime personnel requirements because of the perceived need for career pattern and advancement opportunities, which are designed to maximize retention. GAO further concluded that the Navy cannot assess the adequacy of the tables without performing a complete revalidation, which is necessary because 1972 (when the tables were developed) was toward the end of the Vietnam era, and the tables probably incorporate the higher grade mix that is typical during the latter stages of a conflict. (pp. 37-40, GAO Draft Report)

DOD RESPONSE. PARTIALLY CONCUR. DOD concurs that documentation on the development of present staffing tables is lacking, but for valid reasons: In 1972, the original staffing tables were developed using data from at sea observations of approximately 75 ships to build the data base. In the evolution of the current Navy Manpower Requirements System, original documentation and data were deleted, and thus, this supporting documentation cannot now be retrieved. Navy, therefore, established a staffing table revalidation process in 1982, to be completed by FY 1990. Revalidation of the SK, BM, ET and DS Rating Staffing Tables has been completed and documented. DOD does not concur that deviations from Occupational Standards noted in the staffing tables have been effected for reasons of recruitment, retention, career pattern, or advancement opportunity. These deviations are necessary in that the minimum occupational standard for skill levels to accomplish individual tasks cannot be simply aggregated to an organization to perform these tasks within a ship. The organizational element must be structured into a functional workcenter, considering such factors as span of control and watchstanding and supervisory requirements. Further, DOD does not concur that the staffing table paygrade specifications are likely to be inadvertently embedded in statements of minimum position requirements. The SMD process first builds the workcenter position structure from workload only and, then, applies the staffing tables. Therefore, visibility is maintained of changes which are effected in the process of building the proper workcenter paygrade structure. (See DOD Response to Recommendation 9).

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o FINDING G: Need For More And Better Navy Analysts. GAO reported that several Navy officials told GAO that the Navy has too few analysts. GAO also reported that although NAVMEC plans to double its work force in the WS area, some NAVMEC officials believe that even this increase will be too small to allow frequent on board validations. In addition, GAO reported that Navy officials claimed that manpower personnel lack adequate training as analysts. According to GAO, NAVMEC officials said they are reviewing the training needs of their analysts and plan to establish a new training program that is more relevant to the type of work SMD analysts do. GAO found that the Navy's manpower analysts are relatively inexperienced. For example, of 11 military OUS analysts interviewed, GAO reported that the average time they had each spent in their positions was 1.2 years. GAO concluded that the shortages of analysts and their lack of adequate training and experience are likely contributors to the inadequate methodology used to establish and validate requirements for watch stations and OUS. (pp. 40-42, and p. 43, GAO Draft Report)

DOD RESPONSE. CONCUR. DOD concurs that additional analysts and effective training are needed to effect appropriate SMD program refinements. Navy will determine by September 1986 how many more analysts will be needed. DOD also agrees that the individual analyst's experience as an SMD analyst is lower than optimum, but these same individuals are career Navy personnel whose prior operational experience in the Fleet is applied in the analyst position. (See DOD Response to Recommendation 1).

o FINDING H: Navy SMD System Does Not Meet Criteria For Sound Modeling. GAO identified four ways in which the SMD modeling system does not meet generally accepted criteria for sound modeling; (1) the SMD conceptual model does not reflect some of the wartime scenario's basic assumptions, (2) the SMD computer simulation does not reflect assumptions of the SMD conceptual model on FM, (3) documentation of the SMD system and changes to it is poorly maintained, and (4) some Navy decision-makers do not understand the assumptions of the SMD model. GAO found that as a result of the above, the SMD model inflates the at sea workload, thereby inflating ship manpower requirements. GAO concluded that NAVMEC needs to analyze all maintenance tasks thoroughly, examining specifically those that can be performed either in port or at sea, in order to eliminate in port tasks from the at sea workload. GAO also concluded that the Sunday free time could be changed to 1 hour to reduce ship manpower requirements considerably. In addition, GAO found that the SMD conceptual model assumes that some general housekeeping tasks (sweeping, cleaning, painting) will be shared or "floated," among the various ship divisions, but this assumption is not reflected in the computer simulation and, as a result, the SMD system is currently creating additional manpower requirements, even when

personnel from other divisions could do this work. GAO concluded that reprogramming the computer to float FM would greatly reduce manpower requirements. Overall, GAO concluded that the described modeling problems preclude the Navy from achieving the desired level of realism and that, as a result, ship manpower requirements may be higher than they need to be. GAO also concluded that the use of computer modeling to derive these questionable requirements could mislead Congress into believing that they are valid. (pp. 46-57, and p. 62, GAO Draft Report)

DOD RESPONSE. PARTIALLY CONCUR. DOD does not concur that the SMD model does not reflect the basic wartime scenario assumptions. The SMD model reflects the wartime readiness condition that requires 60 days steaming as described in OPNAVINST C3501.2G, and this provides the readiness standard under which specific levels of wartime capability are described in the statement of Required Operational Capabilities/Projected Operational Environment (ROC/POE). The SMD model, therefore, represents in full the basic scenario assumption providing for the capability to respond to myriad tactical situations which may actually develop in wartime.

DOD concurs that, at the time the GAO examined the SMD model, the computer SMD simulation did not reflect the latest Navy decision as to management of FM workload; however, this decision was being effected manually. The SMD model was updated in June 1983, to float FM workload across division organization lines. DOD does not concur that the use of the SMD model results in significantly higher than necessary or invalid requirements. As discussed in the DOD response to several findings, the SMD model correctly represents the proper wartime assumptions and, in the case of the Navy policy for FM workload, the policy was being correctly applied by manual methods at the time of the GAO examination.

Also, DOD does not concur with the GAO conclusion that a Sunday free time reduction to one hour should be made nor that the lack of such adjustment to the SMD model constitutes a deficiency. The SMD model will be adjusted by the NAVMEC by September 1986, to reflect three hours of Sunday free time for both nonwatchstander and watchstander positions. This action will standardize both position categories to a single free time criterion. Further reduction in free time to the GAO proposed one hour is not concurred in as no analysis is available to support such reductions.

DOD concurs that any maintenance workload associated with tasks which cannot be feasibly (or physically) accomplished at sea should be removed from the SMD model. Navy will identify and remove any such workload by January 1986. It should be noted, however, that this concurrence does not imply concurrence with the concept of the current computer modeling misleading the Congress, nor the concept of an "in port wartime workweek" proposed in Finding K and Recommendation 10.

Further, DOD does not concur that the SMD portion of the Navy Manpower Requirements System (NMRS) is poorly documented and maintained. NMRS predates the current Life Cycle Management (LCM) system, and documentation to the degree currently required by LCM procedures was not then required; however, similar documentation is available. A Systems Requirements Plan (SRP), dated 19 April 1974, addresses the basic objectives and specifications of NMRS and the system was developed from those specifications. Since that time, documentation has been maintained, including: Functional Description; Data Base Specifications; Program Maintenance Manual; System/Subsystem Specifications; and, Users' Manual. A milestone IV LCM review was conducted in March 1983, by the Commander Naval Military Personnel Command (NMPC 16), and NMRS was recertified in June 1983. Additionally, the NMRS Users' Manual contains complete information on how to use the system and how to recommend changes to it. Changes to the manual are published quarterly to document changes which have been effected in the previous quarter, and all system changes are documented on System Change Request (SCR) forms which serve as official historical records.

At the time of the GAO review, it was correctly noted that not all Navy decision makers fully understood the SMD process; however, OPNAVINSTs 5310.18 and 5310.19 were and are available to provide a detailed description of the SMD system to all concerned manpower managers. Both instructions now are in revision by the CNO to further refine the SMD system description. Also, key manpower officials from CNO and operational echelons will attend the new Ship Manpower Requirements Training Course for specific training in the SMD process. These actions will improve Navy wide understanding of the SMD process. (See DOD Response to Recommendations 10, 11 and 12).

FINDING I: Navy SMD System Lacks Some Necessary Management Controls. GAO reported the Required Operational Capability/Projected Operating Environment (ROC/POE) statements describe the tasks a ship is expected to accomplish under various conditions of readiness, and SMD analysts use the ROC/POE statements to determine which shipboard system must be manned, and to what extent, in order to perform wartime missions. GAO found that the Navy has no formal plan to ensure that the ROC/POE statements are periodically reviewed and updated for all classes of ships to eliminate unnecessary manning. In addition, GAO found that criteria is lacking by which to evaluate the ROC/POEs. The GAO also found that the communication among SMD program staff and operations officials is not always effective, as illustrated by many operational officials not understanding, in general, the SMD model and how it works. GAO concluded that the modeling problems (discussed in Finding H above) might not have arisen if operational officials had been aware of the assumptions incorporated in the SMD model, and were able to communicate effectively about them. (pp. 57-60, GAO Draft Report)

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DOD RESPONSE. PARTIALLY CONCUR. DOD concurs that, at the time of the GAO review, formal plans requiring specific, periodic ROC/POE review and update were not in effect, but such plans have since been effected. OPNAVINST C3501.2G of September 3, 1985: (1) provides guidelines for developing and criteria for reviewing ship ROC/POE statements; and, (2) requires such statements be maintained current. Additionally, SMD officials are required to review new or changed ROC/POE statements and to provide an analysis of manpower positions which would be added or deleted by such changes. ROC/POE update provisions will also be reiterated and further amplified in OPNAVINST 5310.18A (draft) and 5310.19A (draft) now in revision by the CNO for promulgation by October 1986. As previously stated in response to Finding H, Navy is also taking appropriate action to improve the knowledge of all appropriate manpower officials in the SMD model and process, but DOD does not concur that any significant problems have accrued to a lack of understanding of the SMD model by operational officials. (See DOD Response to Recommendations 12, 13 and 14).

o FINDING J: Examples Of Potential For Reducing Navy Manpower Requirements. After reviewing the enlisted manning requirements for the USS PETERSON and USS HOEL, GAO estimated that these requirements could be reduced by 19 and 48 billets, respectively. According to GAO, this reduction could be accomplished by (1) changing the way FM workload is allocated aboard ship, (2) eliminating the nonproductive and MRPA allowances, and (3) adjusting the standard workweek to reflect wartime conditions by reducing Sunday free time to one hour. The GAO arrived at these estimated reductions by running ship workload data through the SMD computerized model (except for FM workload, which had to be done manually). (The assumptions used by GAO are listed on page 64 of the GAO Draft Report. Page 65 shows the extent to which ship manpower requirements would be reduced aboard the two ships based on these assumptions.) GAO concluded that, regardless of the total number involved, the current mix of enlisted personnel in terms of skill and rank requirements appears questionable due to the deficiencies discussed in the previous findings. (pp. 63-65, GAO Draft Report)

DOD RESPONSE. PARTIALLY CONCUR. Although reductions in manpower position requirements may be calculated if the GAO's assumptions are used, DOD does not concur that all assumptions are valid adjustments to the present SMD model. GAO assumptions were not based on engineered data or documented analysis, nor did GAO utilize the procedures recommended to Navy in this report. GAO calculations were based on complete elimination of MRPA allowance and productivity allowance (PA), but GAO provides no basis in the report for their complete disallowal. As noted earlier in responding to Finding E, MRPA and PA allowances were developed from extensive sampling, are being applied to raw productive time and are, thus, usefully accurate adjustments. The GAO assumptions also adjusted the standard workweek used in

the SMD model, reducing Sunday free time to one hour for all crewmembers; additionally, GAO increased the wartime workweek manhours used in the calculations from 74 to 76 hours. GAO provides no analysis to support the reduction to Sunday free time below that now utilized in the SMD Model, and no justification, documentation, or analysis is provided to support the wartime workweek increase. The GAO assumptions also reduced the at sea maintenance workload by 20%, which GAO assumes to be actually performed in port in peacetime; however, GAO offered no documentation in support of this estimate. Moreover, GAO does not explain how current peacetime observations of in port maintenance were used as a basis for adjustment to the SMD model, when no in port segment is included in the wartime at sea SMD model. As discussed in responses to earlier Findings, DOD concurs that certain refinements to the SMD model are appropriate and these have been or will be implemented, to the maximum cost effective extent as discussed in the findings responses. (See DOD Responses to Findings D, E, H, J and K and Recommendations 2, 3, 4, 6, 7, 8, 9, 10, 11 and 14).

o FINDING K: Potential For Reducing Manpower Requirements On Navy Ships. GAO found that by using assumption F (as described on pp. 64-65 of the GAO draft report), the USS PETERSON showed a 6 percent billet reduction in enlisted manpower requirements, and the more manpower intensive USS HOEL showed a 12 percent reduction. GAO concluded that a potential for reducing ship manpower requirements is suggested by its test of the two sample ships. GAO noted that statistically accurate projections based on the manpower reductions of the two sample ships cannot be made, and the reductions for each ship in the Navy would vary, depending on how each ship is equipped and configured. Because the SMDs for other Navy surface ships are determined through the same assumptions and equations, GAO nonetheless concluded that it is possible that similar reductions may occur throughout the fleet, and the potential magnitude of such reductions is significant. For example, GAO noted that if the 6 percent reduction experienced on the USS PETERSON could be realized on all Navy surface ships, it would free up about 10,000 positions to either be allocated to areas of documented need or eliminated. (pp. 65-66, GAO Draft Report)

DOD RESPONSE. PARTIALLY CONCUR. As discussed in the DOD responses to previous findings, DOD concurs in a number of GAO recommended actions to refine the SMD model and process. DOD does not concur that the percentage of reduction in required manpower positions which may be achieved is as large as that proposed by GAO. Also, DOD does not concur in the GAO's assumption that reductions calculated for only two ships, utilizing less rigorous procedures than the report itself recommends, may then be extrapolated to Navy's fleet across the board. This is inappropriate because of the diverse nature of the Navy's fleet, in which scores of ship classes and diverse

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capabilities are represented. It is also important to note that any theoretical reduction in future position requirements would represent diminished future position requirements only. GAO statements in this finding could lead those not familiar with the Navy's Manpower Requirements Determination System to conclude that actual, present, personnel could be reduced or that these personnel are in excess of Navy needs. Such is not the case. Any actual reduction in future position requirements would mean simply that the present Navy personnel inventory would more nearly match projected position requirements.

RECOMMENDATIONS

o RECOMMENDATION 1. GAO recommended that the Secretary of the Navy commit the necessary analytical staff resources, both in number and experience, and provide adequate training to the analytical staff, to ensure that improved methods will be used to determine SMD personnel requirements. (p. 44, GAO Draft Report)

DOD POSITION: CONCUR. The Navy Manpower Engineering Center (NAVMEC) has internally reallocated six personnel to additional analyst billets in the Watch Station and Maintenance data bases. Also, four additional personnel have been assigned to the Own Unit Support and Facilities Maintenance Divisions. To provide increased continuity and minimize the impact of military analyst turnover, civilian Technical Director positions were established in February 1984 for each data base. Three of the four positions have been filled and the final position is expected to be filled by March 1986. Any additional personnel which may be required will be determined by a CNO/NAVMEC study to be completed by September 1986. A Ship Requirements Determination Training Course, tailored to the SMD process, will be conducted by NAVMEC starting in January 1986; potential SMD analysts will attend this in-depth training prior to assignment to analyst positions. Personal Qualification Standards (PQS) will be established by October 1986, by the NAVMEC for formal certification of program knowledge of SMD analysts. These adjustments to billet allocation and to the training program have been effected from within current NAVMEC resources. Overall expected completion is by end of FY 1988.

o RECOMMENDATION 2. GAO recommended that the Secretary of the Navy re-examine, on a systematic basis, the adequacy and accuracy of all WS standards used in the SMD process. (P. 45, GAO Draft Report)

DOD POSITION: CONCUR. Documentation for all watch station positions will be systematically re-examined and updated by the NAVMEC during FY 1986-1987. For watch stations common to a number of ships or ship classes (e.g. helmsman, lookout, CIC supervisor, Engineer Officer of the Watch), documented standards are planned to provide an efficient means of determining those WS position requirements. Unique watch stations will continue to be

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documented fully during each SMD evolution. A proper audit trail has been established as of August 3, 1984 by NAVMEC for all WS standards. These procedures will be formalized in OPNAVINST 5310.19A (draft) planned for promulgation by October 1986. Action will be continuing.

o RECOMMENDATION 3. GAO recommended that the Secretary of the Navy require a more rigorous and comprehensive on board ship validation including observation of the crew functioning in an operational environment or simulation and analysis of ship supporting records. This is especially important for new ship classes and for ships that have undergone extensive alteration in terms of new equipment and configuration change. (p. 45, GAO Draft Report)

DOD POSITION: CONCUR: Determination of the frequency and depth of feasible and cost effective observations or simulations will be recommended by NAVMEC, based on an ongoing NAVMEC study which includes experience gained in an FY 1986 at sea limited survey of an aircraft carrier. The study is scheduled for completion by September 1986, at which time a determination will be made as to the appropriate level of such observations to be conducted. Action will be continuing.

o RECOMMENDATION 4. GAO recommended that the Secretary of the Navy ensure that the justification and basis for WS and OUS standards are adequately documented and that a proper audit trail of changes to these standards is maintained. (p. 45, GAO Draft Report)

DOD POSITION: CONCUR. As discussed in the response to Recommendation 2, for watch station positions, comprehensive documentation and audit trail procedures have been established by the NAVMEC as of August 1984, and will be formalized in OPNAVINST 5310.19A (draft) planned for promulgation by October 1986. Full record documentation for new watch stations, or changes to existing watch station standards, is provided for. For OUS, starting in November 1983, the Navy Manpower Engineering Center (NAVMEC) effected procedures to retain all OUS standard documentation and to maintain an audit trail which includes data collected onboard ship, final standards approval, and changes to the approved standard. The NAVMEC also implemented, in August 1984, an improved management plan for collection of OUS data. This plan requires that data be substantiated via ship's records where possible. Follow up action will be undertaken and monitored to ensure compliance in annual CNO reviews of the SMD program commencing in FY 1986.

o RECOMMENDATION 5. GAO recommended that the Secretary of the Navy expedite the development of the new OUS standards. (p. 45, GAO Draft Report)

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DOD POSITION: CONCUR. Navy will expedite the development of new OUS standards to the maximum degree feasible within current resources. Of the total 70 OUS standards to be developed, 15 have been completed and approved. The remainder will be completed during FY 1986-1990.

o RECOMMENDATION 6. GAO recommended that the Secretary of the Navy identify areas of ship operations where method studies are practical and feasible and begin a program of conducting method improvement studies. (p. 45, GAO Draft Report)

DOD POSITION: CONCUR. NAVMEC is to complete a study by September 1986 to identify those appropriate areas of ship operations and administration in which method studies are expected to be practical and cost effective. CNO will determine at that time the appropriate schedule for commencing the recommended studies and what additional resources will be required. Action is continuing.

o RECOMMENDATION 7. GAO recommended that the Secretary of the Navy expedite the development of both a PM and CM data base for establishing SMD maintenance workload and work force requirements by ensuring that the MDS II is (a) developed properly to incorporate both PM and CM data collection components, (b) implemented in a timely manner, and (c) used by the fleet to accurately report actual PM and CM workload data. (p. 45, GAO Draft Report)

DOD POSITION: CONCUR. Navy already intended to establish an empirical data base for PM/CM. An improved Maintenance Data System (MDS II) is planned to provide this capability. The software required to capture both CM and PM data will be available in 1987, but all ships will not receive the required SNAP computers until 1989-1990. When this data base is available, data will be used in SMD calculations. In the interim, Navy will apply all cost effective refinements which are to be recommended by a CNA study to be completed in June 1986.

o RECOMMENDATION 8. GAO recommended that the Secretary of the Navy consider suspending the addition of the MRPA allowance to estimated PM workload and the nonproductive allowance to PM, CM, and OUS workload estimates until the Navy is able to measure these workloads using more precise methods, and if allowances are used in the future, develop documented support for the accuracy and justification for their use. (p. 45, GAO Draft Report)

DOD POSITION: CONCUR. A CNO/NAVMEC review of MRPA and PA allowances will commence in April 1986, to determine if further adjustment to any allowance is appropriate. In the interim, the application of the 20% allowance for nonproductive time applied

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to PM will be suspended effective December 31, 1985. Completion of the review of MRPA and PA allowances is estimated as September 1987; documentation of required allowances will be refined by the end of FY 1988.

o RECOMMENDATION 9. GAO recommended that the Secretary of the Navy validate the paygrade staffing tables to establish wartime grade (rank) requirements and develop documented support for their use. (p. 45, GAO Draft Report)

DOD POSITION: CONCUR: A staffing table revalidation process was established during 1982. Revalidation and documentation of staffing tables for several rating groups by the NAVMEC (i.e., SK, DS, ET and BM) has been completed to date. Action is continuing for completion of all staffing table revalidation during FY 1986-1990.

o RECOMMENDATION 10. GAO recommended that the Secretary of the Navy require that the SMD model be reviewed and adjusted so that it (a) reflects the amount of ship maintenance done in port (b) allots no more Sunday free time than would be allotted in wartime, (c) introduces a wartime in port workweek and workload standards, and (d) ensures that work accomplished during watch duty is not being double counted. (p. 61, GAO Draft Report)

DOD POSITION: PARTIALLY CONCUR: The SMD model will be adjusted by the NAVMEC by September 1986, to reflect three hours of Sunday free time for both nonwatchstander and watchstander positions. This action will standardize both position categories to a single free time criterion. Further reduction in free time to the GAO proposed one hour is not concurred in, as no analysis is available to support such reductions. A portion of the work which is accomplished on watch is presently being accounted for in the SMD for some ships. Additional work on watch accomplishment, which may properly be accounted for within wartime readiness requirements, will be identified through an ongoing evaluation by CNO and various Navy echelons, and incorporated when completed by late FY 1987. Wartime in port workweek and in port workload standards should not be incorporated in the SMD model because the entire SMD process is based on being at sea for 60 days during wartime, not in port.

o RECOMMENDATION 11. GAO recommended that the Secretary of the Navy ensure that the computer simulation of the SMD model is corrected to allow FM workload to float across occupation, division, and department lines. (p. 61, GAO Draft Report)

DOD POSITION: PARTIALLY CONCUR: FM workload has been "floated" across occupational and divisional lines (within their parent ship's department) since August 1980, using manual methods. The SMD model was updated June 1983, to incorporate this provision.

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DOD does not concur that it is practical to float FM workload across ship Department lines without constraint. Ship Department Heads are individually responsible for assigned space material condition and safety and, therefore, responsibility for FM workload must follow departmental lines; however, the SMD FM measurement plan is now being used manually to identify "common use areas", where FM can float across Department lines selectively without compromising department authority and responsibility. Final implementation in the SMD model of this provision (i.e., fully automated) will be accomplished by NAVMEC by September 1987.

o RECOMMENDATION 12: GAO recommended that the Secretary of the Navy require that management and users are provided with a properly documented description of the SMD modeling process. (p. 61, GAO Draft Report)

DOD POSITION: CONCUR. OPNAVINSTs 5310.18 and 5310.19 provide a thorough description of the SMD modeling process. Both of these directives have been revised and updated by CNO for promulgation by October 1986. Additionally, the Ship Manpower Requirements Training Course will commence in January 1986, and will provide in-depth information on the SMD process for Navy manpower management officials at the CNO and operational level.

o RECOMMENDATION 13: GAO recommended that the Secretary of the Navy require that ROC/POE statements be thoroughly and critically analyzed on a periodic basis, with the objective of eliminating unnecessary tasking requirements; and that criteria for making this analysis be provided. (p. 61, GAO Draft Report)

DOD POSITION: CONCUR. OPNAVINST C3501.2G dated September 3, 1985 directs that ROC/POE statements be maintained current by the responsible officials, and specifies the criteria for conducting manpower impact analysis by manpower officials prior to approval of ROC/POE changes. This procedure also ensures the deletion of unnecessary tasking. Further amplification of the periodic ROC/POE review process will be provided in OPNAVINST 5310.18A (draft) planned for promulgation by October 1986.

o RECOMMENDATION 14: GAO recommended that the Secretary of the Navy improve the management of the SMD program to reduce the likelihood of future problems by (a) establishing a monitoring system that will periodically review the SMD system, model assumptions, and documentation for currency, accuracy, and completeness, and which will include reviews of SMD assumptions by operational officials, and (b) improving communications, especially between Navy operating officials and SMD program staff, by providing the operating officials with a channel for notifying SMD staff of changes in scenario assumptions, and a basic understanding of the processes of the SMD system. (p. 62, GAO Draft Report).

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Appendix III
Comments From the Department of Defense

DOD RESPONSE: CONCUR: An initial in depth review of the SMD program by CNO and NAVMEC is ongoing. Standards for future annual CNO reviews of the SMD Program will be updated based on this examination planned to be completed by September 1986. Informal communications and organizational relationships have been clarified and formalized by OPNAVINST C3501.2G (ROC/POE guidance and review), and will be further amplified to all Navy fleet manpower officials by OPNAVINST 5310.18A (draft) and OPNAVINST 5310.19A (draft) planned for promulgation by October 1986.

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