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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This study examines Department of Defense policy on manpower planning for new weapon systems and evaluates the implementation of that policy by the military services. A review of formal policies, procedures and organizational relationships is complemented by seven case studies of manpower planning during major system acquisition programs. The conclusion is that a 17 August 1978 memorandum from the Assistant Secretary of Defense (Manpower, Reserve Affairs, and Logistics), "Manpower Analysis Requirements for System Acquisition,"		

20. ABSTRACT

corrects a major deficiency in defense policy, but there remain serious shortcomings in the presentation and implementation of that policy. It is recommended that the Assistant Secretary of Defense (Manpower, Reserve Affairs, and Logistics) take the following actions:

1. Institute formal, post-DSARC management reviews of integrated logistic support implementation to verify that actions are being taken to minimize manpower and other support resource requirements.
2. Urge the Army, Navy and Marine Corps to press on with efforts to develop improved methods for determining the maintenance manpower needed to support peak wartime operations under various scenarios and to measure the impact of maintenance manpower constraints on combat operations.
3. Throughout the acquisition process, require that estimates of new system manpower requirements be supported by analyses that (a) state explicitly the assumptions about operating scenario, support concept and system characteristics and (b) explore the sensitivity of the estimates to changes in those assumptions.
4. Encourage the Navy to engage manpower planners, trainers and personnel managers in the acquisition process earlier and more actively.
5. Task one of the military services to prepare, on a trial basis, a long-range projection of the characteristics of the population which will be entering the defense manpower force.

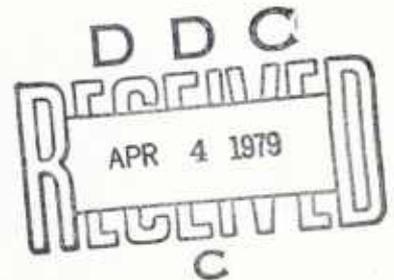
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MANPOWER PLANNING FOR NEW WEAPON SYSTEMS

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EXECUTIVE SUMMARY

DoD policy on manpower planning for new weapon systems is expressed in six directives, several memoranda, and a guide. This report reviews those documents, examines how manpower planning actually is done by the military services, and recommends actions by the Assistant Secretary of Defense (Manpower Reserve Affairs and Logistics) (ASD(MRA&L)) to improve both the presentation of DoD policy and the quality of manpower planning for new systems.

Our review of formal policies, procedures, and organizational relationships is complemented by seven case studies of manpower planning during major system acquisition programs. The programs are TACFIRE, an Army field artillery fire direction system; PATRIOT, an Army air defense missile system; FFG-7, a Navy guided missile frigate; VIKING (S-3A), a Navy antisubmarine warfare aircraft; CH-53E, a Marine Corps helicopter; and A-10 and F-16, both Air Force tactical aircraft. The case studies yielded the following findings:

1. Most estimates of manpower requirements made during acquisition programs are too low.
2. The reasons for the low estimates are varied.
3. Operating and support concepts are likely to vary throughout the acquisition process, causing fluctuations in the estimates of manpower requirements.
4. There is greater uncertainty associated with maintenance manning than with any other element of new weapon system manpower requirements.
5. Estimates of new system manpower requirements frequently reflect program goals rather than unbiased assessments of manpower needs.
6. Manpower goals or constraints established for new systems have addressed only the aggregate manning of the using unit, not total manpower or skill level requirements.
7. Controlling training requirements can be as important as constraining manning levels.

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8. Operational test and evaluation conducted prior to DSARC III does not normally test the intermediate level of maintenance support.
9. For most systems, manpower estimates made during the acquisition program assume wartime deployment.
10. The Navy's standard method of determining wartime maintenance manning requirements of aircraft squadrons is unsound.
11. The impact of battle damage on manpower requirements rarely is assessed.
12. Peacetime manning, the prime determinant of operating and support costs over the life of a weapon system, is a function of military service end strength and readiness priorities.
13. Actual manpower requirements of a new system are not determined until years after the final DSARC review of the program.
14. Manpower planning for a new system requires a broader perspective than that provided by a program manager alone.

Until recently, there was a decided lack of specific guidance from the Office of the Secretary of Defense on manpower planning for new systems. That deficiency was corrected by a 17 August 1978 ASD(MRA&L) memorandum, "Manpower Analysis Requirements for System Acquisition." Consequently, DoD policy on manpower planning for new systems now appears adequate, but still there are serious shortcomings in the presentation and implementation of that policy.

We recommend that the ASD(MRA&L) take the following actions:

1. Institute formal, post-DSARC management reviews of integrated logistic support implementation to verify that actions are being taken to minimize manpower and other support resource requirements.
2. Urge the Army, Navy and Marine Corps to press on with efforts (a) to develop improved methods for determining the maintenance manpower needed to support peak wartime operations under various scenarios and (b) to measure the impact of maintenance manpower constraints on combat operations.
3. Throughout the acquisition process, require that estimates of new system manpower requirements be supported by analyses that (a) state explicitly the assumptions about operating scenario, support concept and system characteristics and (b) explore the sensitivity of the estimates to changes in those assumptions.

4. Encourage the Navy to engage manpower planners, trainers and personnel managers in the acquisition process earlier and more actively.
5. Task one of the military services to prepare, on a trial basis, a long-range projection of the characteristics of the population which will be entering the defense manpower force.

CONTENTS

	<u>Page</u>
EXECUTIVE SUMMARY	ii
<u>CHAPTER</u>	
I. REVIEW OF POLICY STATEMENTS	1
A. Overview	1
B. Assessment	6
II. MANPOWER PLANNING BY THE MILITARY SERVICES	7
A. Introduction	7
B. Participation in the Acquisition Process	7
C. Estimation of New System Manpower Requirements	14
D. Evaluation of the Impact of New System Requirements on the Total Manpower Force	25
E. Validation of Wartime Manpower Requirements	27
F. Determination of Peacetime Manpower Authorizations	29
G. Development of Training Plans and Requirements	31
H. Operational Test and Evaluation	34
III. REVIEW OF CASE STUDIES	39
A. Introduction	39
B. Findings	39
IV. CONCLUSIONS AND RECOMMENDATIONS	51
A. Post-DSARC Management Review of Integrated Logistic Support	51
B. Methods of Estimating Wartime Maintenance Manpower Requirements	52
C. Explicit Assumptions and Sensitivity Analysis	53
D. Participation in the Acquisition Process	53
E. Long-Range Manpower Planning	55
<u>APPENDIX</u>	
A. Summaries of DoD Directives and Memoranda	
B. ASD(MRA&L) Memorandum, "Manpower Analysis Requirements for System Acquisition," 17 Aug. 1978	
C. Working Notes on Manpower Planning for New Weapon Systems	

I. REVIEW OF POLICY STATEMENTS

A. OVERVIEW

The term "policy statement" is used in this report to refer to directives, instructions, guidelines or other formal statements of principle or procedure published by the Office of the Secretary of Defense. There are ten such documents pertaining to manpower planning for new weapon systems, as identified in Table 1.

TABLE 1. POLICY STATEMENTS ON MANPOWER PLANNING FOR NEW WEAPONS SYSTEMS

Acquisition Policy

DoDD 5000.1, "Major System Acquisitions," January 18, 1977
DoDD 5000.2, "Major System Acquisition Process," January 18, 1977
DoDD 5000.3, "Test and Evaluation," January 19, 1973
DoDD 5000.4, "OSD Cost Analysis Improvement Group," June 13, 1973
DoDD 5000.28, "Design to Cost," May 23, 1975

Integrated Logistic Support

DoDD 4100.35, "Development of Integrated Logistic Support for Systems/Equipments," October 1, 1970
DoD Guide 4100.35G, "Integrated Logistics Support Planning Guide," October 15, 1968

Manpower and Logistics

ASD(I&L) Memorandum, "Logistics Annex to the Decision Coordinating Paper," 18 March 1977
ASD(MRA&L) Memorandum, "Manpower and Logistic Concerns for New Major Systems," 17 August 1978
ASD(MRA&L) Memorandum, "Manpower Analysis Requirements for System Acquisition," 17 August 1978

Each of these documents is summarized in Appendix A. Table 2 is a topical breakdown of the same information.

TABLE 2. SUMMARY OF DEPARTMENT OF DEFENSE POLICIES, INSTRUCTIONS,
AND GUIDANCE ON MANPOWER PLANNING FOR NEW SYSTEMS

DEFINITIONS

1. DoDD 5D00.1 defines logistic support as supply and maintenance of materiel essential to proper operation of a system in the force.
2. DoDD 410D.35 defines integrated logistic support as a composite of all the support considerations necessary to assure the effective and economical support of a system for its life cycle. The directive also identifies personnel and training as one of nine principal elements of integrated logistic support.

PROGRAM CONSTRAINTS, OBJECTIVES, GOALS OR TARGETS

1. DoDD 5000.1 directs that the number and skill levels of personnel be constraints in system design and that integration of the human element and system start with concept studies.
2. DoDD 50DD.28 directs that life cycle cost objectives be established. Also, recognizing the inadequacy of current operating and support cost data, the directive requires the identification of surrogate goals for D&S costs--number of people, reliability, maintainability, etc.--and directs that D&S goals be used to control initial outfitting cost, personnel, spares, rework, etc.
3. DoDD 4100.35 directs that the system design take into account the aspects of logistic support and consider them in view of available resources, under the conditions and in the environments in which the system will be used.
4. ASD(I&L) Memo, "Logistics Annex to the Decision Coordinating Paper," cites manpower as an example of a logistic resource for which a program threshold or goal might be defined.
5. ASD(MRA&L) Memo, "Manpower Analysis Requirements for System Acquisition," directs that for each new system, either there be a goal of constraining manpower requirements to stay within the current weapon or mission area levels or there be presented a design or support option that will satisfy such a goal. The memo states also that the DCP for Milestone II should specify manpower goals and thresholds, that documentation should provide the rationale for those goals and thresholds, and that the DCP for Milestone III should reaffirm the manpower goals and thresholds on the basis of test and evaluation results.

MISSION ELEMENT NEED STATEMENT (MENS) CONTENT

1. DoDD 5000.2 directs that the MENS state the known constraints to apply to any acceptable solution including operational and logistics considerations.
2. ASD(MRA&L) Draft Memo, "Manpower and Logistic Concerns for New Major Systems," lists as one of the questions to be addressed "Does the MENS include broad manpower constraints?"

DECISION COORDINATING PAPER (DCP) CONTENT

1. DoDD 5D00.2 directs that the DCP include a one-page logistics annex.
2. DoDD 4100.35 directs that the DCP specify that the project manager shall develop, at the beginning of full-scale development, an appropriate integrated logistic support plan with milestones.
3. ASD(I&L) Memo, "Logistics Annex to the Decision Coordinating Paper," provides interim guidance for the preparation of the logistics annex. Content requirements are keyed to decision milestones (DSARC I, II or III) and are presented in three categories: operational readiness and logistic goals; logistics, concepts, plans, and management; and potential logistic problems and risk areas. The memo
 - a. Cites manpower as an example of a logistic resource for which a program threshold or goal might be defined at DSARC II and requires test plans and schedules for verifying thresholds and goals.
 - b. Includes the availability of trained maintenance personnel as one element of maintenance capability and requires that scheduled dates for achieving an organic maintenance capability be provided at DSARC III.
 - c. Cites personnel as an example of a logistic element or requirement which may be (DSARC I), is (DSARC II), or has been (DSARC III) crucial to achieving operational readiness and cost objectives. It requires identification of the crucial element or requirement, assessment of the risks involved, and a statement of related plans or actions.
4. ASD(MRA&L) Memo, "Manpower Analysis Requirements for System Acquisition," directs that the DCP summarize in one paragraph the estimates of unit manning levels, the comparison of manpower requirements of the new system with those of baseline operational system, and the trade-offs to be conducted among manpower, design and logistic elements. The memo states also that for Milestone II the DCP should specify manpower goals and thresholds and that for Milestone III it should reaffirm those goals and thresholds on the basis of test and evaluation results.

ACTIVITIES SPECIFIED FOR EACH PHASE OF A PROGRAM

1. General

- a. DoDD 5D00.1 directs that logistic planning be consistent with key program decisions and phases of activity.

- b. DoDD 4100.35 directs that integrated logistic support be tailored to the system, that trade-offs addressing operational environment and logistics support requirements be made to maximize the effectiveness and efficiency of the support system, and that the effect of changes in integrated logistic resource requirements on system operational capability and effectiveness be assessed.

2. Conceptual Phase

- a. DoDD 4100.35 directs that integrated logistic support planning begin at the conceptual stage and that integrated logistic support requirements be outlined in requests for proposal or during conceptual phase and validation phase efforts. The directive states also, as guidance, that integrated logistic support activities during this phase involve making only broad, general plans and noting special problems.
- b. DoD Guide 4100.35G describes the principal personnel and training-related activities during the concept formulation (conceptual) phase: preparing personnel and training estimates, making preliminary estimates of skill requirements, establishing the personnel and training concept, and developing personnel and training plan requirements.

3. Validation and Demonstration Phase

- a. DoDD 5000.28 directs that a life cycle cost estimate be made at the beginning of the validation phase.
- b. DoDD 4100.35 states, as guidance, that special logistics problems be addressed during the validation phase.
- c. DoD Guide 4100.35G describes the principal personnel and training-related activities during the contract definition (validation) phase: establishing personnel and training evaluation criteria, evaluating proposed personnel and training requirements, and approving personnel and training plans.

4. Full-Scale Engineering Development Phase

- a. DoDD 5000.1 directs that detailed logistic planning be initiated with full-scale engineering development and that firm requirements be established early in that phase.
- b. DoDD 5000.28 directs that the life cycle cost estimate be updated prior to initiation of the full-scale development phase.
- c. DoDD 4100.35 directs that the integrated logistic support planning be formalized at the beginning of full-scale development and maintained in phase with the development program.
- d. DoD Guide 4100.35G describes the principal personnel and training-related activities during the development phase: determining personnel availability (a continuous activity), preparing the training package, beginning instructor training, beginning operator and maintenance personnel training, and updating personnel and training requirements.

5. Production and Deployment Phase

- a. DoDD 4100.35 states, as guidance, that during this phase system-oriented logistic support has been obtained and is functioning.
- b. DoD Guide 4100.35G describes the principal personnel and training-related activities during the production phase: verifying required skill levels, verifying the availability of trained personnel, updating the personnel and training plans, identifying personnel and training deficiencies, updating the training package, and conducting additional operations and maintenance training.

MILESTONE REVIEW REQUIREMENTS

1. General

- a. DoDD 5000.4 directs cost reviews to consider all elements of system cost, including procurement, operations and support.
- b. DoDD 5000.28 directs that programs be reviewed periodically on a life cycle cost basis.
- c. ASD(MRA&L) Memo, "Manpower and Logistics Concerns for New Major Systems," lists questions on the following topics to be answered during program reviews in the depth appropriate to the milestone and individual program:
 - Estimates of program and mission area resource needs and resource constraints; resources include manpower.
 - Assessments of program affordability considering resource needs of other approved programs.
 - Resource consumptions, by activity level, of contemporary and developmental systems.
 - Determinants of resource demands and opportunities for reducing resource requirements.
 - Adequacy of project management plans and resources for evaluating alternative support concepts, analyzing manpower and logistic needs, conducting trade-offs, and setting manpower and logistic goals.
 - Effectiveness of test and evaluation in demonstrating operational suitability.
 - Procedures and schedules for transferring support responsibility from acquisition to logistics communities.
 - Programming and budgeting of support resources.

- Assignment of responsibilities for follow-on evaluation and analyses, tracking of resource consumption, taking corrective actions, and planning, funding and implementing departures from existing support practices.
- d. ASD(MRA&L) Memo, "Manpower Analysis Requirements for System Acquisition," directs that manpower analysis information, tailored to the program and decision milestone, be presented in a Manpower Analysis Paper or other appropriate document and submitted with the MENS or DCP. The memo specifies also that for Milestones I, II and III the information should include the following:
- A reference to the operational scenario and a description of the methodology and assumptions used to estimate manpower requirements.
 - The program impact on mission area manpower requirements.
 - Identification of O&S functions to be performed by contractors and by OoD manpower. Address interim contractor support, contractor logistics support and depot maintenance workload.
 - Plans for derivation or use of job task identification and analysis data during the subsequent acquisition phase. Address trade-offs among requirements for technical data, on-line and off-line test equipment, training and manpower (quantity, skills and specialties).
 - Manpower requirements that are system-driven vis-a-vis those that are policy-driven.
 - Manpower requirements compared to projected manpower assets throughout system life.
 - A summary of manpower-relevant program actions completed and planned.

2. Milestone 0

- a. ASO(MRA&L) Memo, "Manpower Analysis Requirements for System Acquisition," states that the manpower analysis information submitted with the MENS should identify any manpower constraints and include plans to assess design, support or operational concept alternatives to reduce manpower requirements or increase productivity.

3. Milestone I

- a. DoD 5000.2 directs the acquisition review councils, at Milestone I, to address the adequacy of operational and logistical considerations.
- b. ASO(MRA&L) Memo, "Manpower Analysis Requirements for System Acquisition," states that the manpower analysis information submitted with the DCP at Milestone I should provide a rationale for the selected alternatives with respect to manpower requirements, discuss the demonstration planned for design and manpower-related support alternatives, and discuss alternate approaches which will be considered during the validation phase to reduce manpower requirements or increase productivity.

4. Milestone II

- a. DoDD 5000.2 directs the acquisition review councils, at Milestone II, to address the balance between cost, performance and schedule, including operational and logistical considerations.
- b. ASO(MRA&L) Memo, "Manpower Analysis Requirements for System Acquisition," states that the manpower analysis information submitted with the DCP at Milestone II should provide a rationale for goals and thresholds; identify unique skills or specialties required; estimate manpower requirements by work center and compare them with those of the baseline system; discuss test and evaluation plans for information transfer approaches; and describe the sensitivity of manpower requirements to system activity level and maintenance demand rates.

5. Milestone III

- a. DoD 5000.2 directs the acquisition review councils, at Milestone III, to address the adequacy of planning for deployment, including manpower and training, and the adequacy of support for initial operational units.
- b. ASD(I&L) Memo, "Logistics Annex to the Decision Coordinating Paper," requires that the scheduled dates for achieving an organic maintenance capability (including trained maintenance personnel) be provided at DSARC III.
- c. ASO(MRA&L) Memo, "Manpower Analysis Requirements for Systems Acquisition," states that the manpower analysis information submitted with the DCP at Milestone III should include a manning document; compare manning with a baseline system; estimate the peacetime manpower utilization; discuss plans for acquisition of personnel to meet wartime and peacetime requirements; identify asset problems and any skill or specialty categories not yet approved; discuss operational test plans and results, quantify sensitivity of manpower requirements to activity levels and maintenance demand rates, and present plans for follow-on evaluation of manpower requirements.

TEST AND EVALUATION REQUIREMENTS

1. DoD 5000.3 directs that operational test and evaluation be accomplished during full-scale development to assist in evaluating operational effectiveness and suitability and that it be continued as necessary during and after the production period. The directive states also that operational test and evaluation provides information on organization, personnel requirements, doctrine and tactics and may provide data to support or verify material in operating instructions, publications, and handbooks.
2. DoDD 5000.28 directs that program review include that portion of the test and evaluation phase developed to measure life cycle cost factors and determine life cycle cost performance.
3. DoDD 4100.35 directs that each program include a plan with milestones for verifying the logistic support at each key decision point using functional and environmental tests and analyses.

4. ASD(I&L) Memo, "Logistics Annex to the Decision Coordinating Paper," requires test and evaluation plans for verifying (logistics) thresholds and goals.
5. ASD(MRA&L) Memo, "Manpower and Logistics Concerns for New Major System," lists, as one of many topics to be addressed during program reviews, the effectiveness of test and evaluation in demonstrating systems supportability.
6. ASD(MRA&L) Memo, "Manpower Analysis and Requirements Information," states that the manpower analysis information submitted with the DCP at Milestone II should discuss plans for testing and evaluating information transfer approaches, that the DCP for Milestone III should reaffirm the manpower goals and thresholds on the basis of test and evaluation results, and that the manpower analysis information submitted with the DCP for Milestone III should discuss operational test plans and results.

ASSIGNMENT OF RESPONSIBILITY

1. DoDD 4100.35 directs that responsibility be assigned for planning, analyzing, designing and managing integrated logistic support and that logistic support managers be assigned to support acquisition programs.
2. ASD(MRA&L) Memo, "Manpower and Logistics Concerns for New Major Systems," lists among the topics to be addressed during program reviews the assignment of responsibilities for follow-on evaluation and analysis, tracking of resource consumption, taking corrective actions, and planning, funding and implementing departures from existing practices.

CONTRACTUAL REQUIREMENTS

1. DoDD 4100.35 directs that essential integrated logistic support requirements be outlined in requests for proposal or during conceptual phase and validation phase efforts and that execution of the logistic support approach be a major factor in the evaluation of contractor performance.

B. ASSESSMENT

Until the publication of ASD(MRA&L) memo, "Manpower Analysis Requirements for System Acquisition," 17 August 1978, there was no specific guidance on manpower planning for new weapon systems. The manpower aspects of an acquisition program were considered to be part of integrated logistic support. Consequently, references in DoD directives to integrated logistic support, or sometimes simply to logistics, could be extended implicitly to manpower. This guidance by implication did not represent a clear, comprehensive statement of policy on manpower planning, especially when the presentation of policy on integrated logistic support itself was somewhat fragmented and diffuse. Furthermore, conflicting definitions of logistic support contributed an air of confusion to DoD statements of policy: DoDD 4100.35 explicitly includes personnel and training as an element of integrated logistic support, whereas DoDD 5000.1 explicitly restricts logistic support to the supply and maintenance functions.

The 17 August memo on manpower analysis requirements fills a void in DoD guidance. It prescribes DoD policy on constraining manpower requirements and specifies how the requirements should be analyzed and presented for review at each decision milestone in the acquisition process. There remains the task of incorporating the provisions of recent memos into the DoD directives and revising the directives to present a complete, concise and coherent statement of policy on manpower planning as an integral part of integrated logistic support. The Office of the Secretary of Defense clearly intends manpower planning to be included in integrated logistic support and is in the process of revising both DoDD 5000.1 and DoDD 4100.35.

II. MANPOWER PLANNING BY THE MILITARY SERVICES

A. INTRODUCTION

Each of the military services has established an acquisition process that complies with DoD directives. Each has regulations or instructions that, at a minimum, reiterate those portions of DoD directives that pertain to manpower planning for new weapon systems. Each has followed the lead of the Office of the Secretary of Defense and included manpower planning in integrated logistic support.

Although the Services' manpower planning are similar in many ways, the organization and assignment of responsibilities do differ from Service to Service. So do procedures for evaluating the manpower implications of new systems and for accomplishing the various manpower planning tasks to develop and field a new system.

This chapter summarizes several key aspects of manpower planning in each military service. Its purpose is to point out the strengths and weaknesses in the ways each Service carries out manpower planning for new systems. More detailed descriptions are contained in the working notes listed in Appendix C.

B. PARTICIPATION IN THE ACQUISITION PROCESS

1. Army

More than the other Services, the Army, has tried to build into its acquisition process a balance between the roles of the materiel developer and those responsible for lifetime support of the system. The principal participants, in addition to the Army General Staff, are two major Army commands: the U.S. Army Materiel Development and Readiness Command (DARCOM) and the U.S. Army Training and Doctrine Command (TRADOC).

DARCOM is responsible for materiel development and logistic support. As materiel developer, DARCOM directs program management activities; as the Army's logistic command, it oversees the integrated logistic support aspects of an acquisition program.

TRADOC is responsible for training and tactical doctrine. Tactical doctrine is the concepts for organization, use, and support of tactical forces. TRADOC also represents the users' interests in the acquisition process; i.e., it tries to ensure that a new system meets the user's needs, is effectively integrated into the operational forces, and is provided with adequate personnel, training, and logistic support.

Both DARCOM and TRADOC participate actively in every phase of an acquisition program. During the conceptual phase, TRADOC takes the lead in defining the need for a new system and in evaluating the costs and operational effectiveness of alternative system concepts. DARCOM evaluates their technical feasibility and risks. When the preferred system concept has been selected, DARCOM and TRADOC jointly prepare and authenticate a letter of agreement outlining the general characteristics of the proposed system and the investigations needed to develop and validate the concept.

When a program manager is appointed within DARCOM, TRADOC appoints a counterpart, the TRADOC system manager. The TRADOC system manager is the focal point for all TRADOC participation in the acquisition program. He is assisted by a small staff, normally three officers plus administrative support. Each of the officers specializes in either training, personnel management, or logistics support.

In the acquisition program reviews associated with each major decision milestone, the TRADOC system manager defends the requirement for the new

system, while the program manager defends the technical approach and program management. The various elements of the Army General Staff participate according to their traditional, functional responsibilities. Manpower requirements planning is generally done by the Deputy Chief of Staff for Operations and Plans (DCSOPS). DCSOPS designs the force structure; establishes the schedules for activation, deactivation, or modification of units; approves unit authorization; and establishes priorities for development and introduction of new weapon systems into the force. The Deputy Chief of Staff for Personnel (DCSPER) is concerned primarily with management of personnel: recruiting, training, promoting, assigning, etc. He is responsible also for the Army's human factors engineering program and the manpower authorization criteria (MACRIT) program. DCSPER is just beginning to participate actively in the acquisition process.

Also new to the Army acquisition process are affordability analyses prepared by the Program Analysis and Evaluation Directorate. These analyses evaluate the resource implications (money, manpower, and time) of major Army decisions. The baseline for the evaluations is the extended planning annex to the program objectives memorandum.

2. Navy

The key figures in the Navy acquisition process are the Naval Material Command (NAVMAT) and the deputy chiefs of naval operations (DCNO) who have staff responsibility for the various segments of the Navy. For example, DCNO (Air Warfare) has staff responsibility for Navy air forces. Because of their titles, these DCNOs are commonly referred to as warfare sponsors. The warfare sponsor is the proponent for a new system. He identifies the mission need, writes the operational requirement, and defends the need for the new system. NAVMAT has dual responsibility for material development and logistic

support. It prepares the development proposals, directs the program management activities, and oversees the integrated logistic support aspects of the acquisition program.

The Navy has no counterpart to the Army's TRADOC. The warfare sponsor determines how a new system fits into the operating forces. Training is the staff responsibility of the Director, Naval Education and Training, but he does not participate actively in the acquisition process. NAVMAT develops the training system for a new weapon system and, late in the acquisition process, prepares a plan that identifies training resource requirements. The Director, Naval Education and Training then participates in the review, approval, funding, and implementation of the plan.

Until recently, the DCNO (Manpower) also did not participate directly in the acquisition process. NAVMAT and the warfare sponsor did the manpower planning that was done for a new system. NAVMAT concentrated on system manning requirements; the warfare sponsor on changes to the Five Year Defense Plan (FYDP). The DCNO (Manpower) simply reviewed draft manning documents and approved unit authorizations. As a result of a 1977 study, which showed the need for a more active DCNO (Manpower) role, that office is now developing a staff capability to evaluate the manpower implications of weapon system acquisition programs.

3. Marine Corps

As the smallest of the four Services, Marine Corps relies heavily on the others in the acquisition of major weapon systems. Normally, it monitors another Service's acquisition program until the production phase, then participates in procurement of the system. If the Marine Corps finds it necessary to influence system characteristics during development, it may participate in a joint acquisition program, but the lead service provides

project management. Only as a last resort will the Marine Corps acquire a system through a unilateral acquisition program. Even then, the appropriate material development agency in one of the other Services will perform the program management functions.

Marine Corps acquisition management supplements the program manager and plans the introduction of the new weapon system into the force. The main participants are the acquisition program sponsor and the acquisition coordinating group. The sponsor is the deputy chief of staff or director of major staff organization at Headquarters, Marine Corps who is responsible for the specific operational capability. The acquisition coordinating group is composed of four action officers representing: (1) the sponsor; (2) the Development Center, Marine Corps Development and Education Command (MCDEC); (3) the Deputy Chief of Staff, Installation and Logistics or the Deputy Chief of Staff, Aviation; and (4) the Deputy Chief of Staff, Research, Development and Studies.

The sponsor assumes the role of system proponent and is responsible for presenting the status of the system at Marine Corps System Acquisition Review Council reviews. MCDEC drafts required operational capabilities, monitors research and development efforts in the other Services and recommends the issuance of "declarations of interest" announcing Marine Corps intent to buy from another Service's acquisition program. The Deputy Chiefs of Staff, Installations and Logistics, and Aviation are responsible for integrated logistic support planning (including personnel and training requirements) for nonaviation and aviation systems, respectively. The Deputy Chief of Staff, Research, Development and Studies oversees the Marine Corps acquisition process and monitors all acquisition programs.

The program manager estimates manning requirements and training requirements. These recommendations may or may not be modified by the acquisition coordinating group, depending on guidance from the sponsor. The Deputy Chief of Staff, Manpower normally does not take part in the process. Approval of a program by the Commandant of the Marine Corps has generally been conditional on its not affecting the Corps' end strength (peacetime manning). Should this assumption prove to be erroneous, the sponsor must compensate by reducing other manpower requirements within his mission area.

4. Air Force

The major participants in the Air Force acquisition process, besides the Air Staff, are the operating command, which is both the user and system sponsor; the developer, which is the Air Force Systems Command; and the Air Force Test and Evaluation Command (AFTEC). Normally, the operating command originates the statement of operational need. The program manager receives his charter from the Air Force Systems Command and has exclusive responsibility for development and procurement of the system.

The deputy program manager for logistics is appointed by the Air Force Logistics Command, and, although he works for the program manager, he also reports to the Commanding General, Air Force Logistics Command. Normally, the operating command also has a representative assigned to the system project office to coordinate operational requirements (mission scenarios, deployment, basing, organizational structure, etc.) and to assist the functional organizations within the Air Force Systems Command to determine weapon system manpower requirements. But the program manager decides what will be presented at the DSARC reviews and in the decision coordinating paper (DCP).

The recently revised Air Force Regulation 57-1, "Acquisition Program Decision Process," reemphasizes the importance of manpower requirements and integrated logistic support planning during the early phases of an acquisition program. The revised regulation requires the operating command to provide a preliminary operational concept during the conceptual phase and to develop a detailed, final operational concept during the validation and demonstration phase. The document addresses system performance, tactics, operational availability and maintainability, operating scenarios (sortie rates, mission duration and mix), utilization rate (flying hours), force structure, deployment, basing and support requirements. The support portion of this document, which includes manpower, logistics, and training requirements, is intended to provide the basis for the integrated logistic support plan, which is finalized during the full-scale engineering development phase.

AFTEC directs a joint test force in conducting operational test and evaluation. The joint test force includes representatives from the contractors, the Air Force Systems Command, the Air Force Logistics Command, the operating command, and the Air Training Command. AFTEC's role is vital to the manpower planning process because its operational test and evaluation efforts include an assessment of the numbers and skills of personnel required to operate, maintain, and support the new system. The assessment is based on test findings and is made according to the same methodology used by the operating command to determine weapon system manpower requirements.

The Air Training Command's responsibility as part of the joint test force is to assess training requirements make recommendations on and the need for new Air Force skill codes. This command, not the program manager, develops the training plans for the new system.

Within the Air Staff, the Directorate of Manpower and Organization, under the Deputy Chief of Staff, Manpower and Personnel, has staff responsibility for approving manpower staffing standards and programming manpower resources. However, the Deputy Chief of Staff, Manpower and Personnel, is not a member of the Air Force Systems Acquisition Review Council.

C. ESTIMATION OF NEW SYSTEM MANPOWER REQUIREMENTS

1. Army

Equipment design dictates the number of operator positions and the workload associated directly with operating and maintaining the system. Standard Army manpower authorization criteria (MACRIT) provide rules for translating workloads into personnel requirements and staffing an organization with officers, supervisory enlisted personnel, and various administrative and support personnel whose positions are not a function of workload.

The MACRIT planning factors assume wartime deployment of a unit, with personnel available for duty 12 hours a day, 365 days a year. Positions requiring 24-hour manning are authorized two persons, one for each of two 12-hour shifts. The number of personnel required to accomplish a specified workload is derived by dividing the estimated annual workload by a standard planning factor for the annual productive man-hours per person.

For most equipments, maintenance workload is expressed in average annual maintenance man-hours (AMMH) for each item of equipment at each echelon of maintenance. For some equipments, AMMH are identified also by military occupational specialty. For aircraft, maintenance workload is expressed in maintenance man-hours per flying hour; AMMH must be calculated by multiplying by the estimated annual flying hours. Maintenance manpower requirements are obtained by summing the AMMH for all equipments by military occupational

specialty and level of maintenance, then dividing by the appropriate productive man-hours per person. The program manager estimates the AMMH for new equipments. This usually is accomplished by means of a logistic support analysis done by the contractor, and a physical teardown of the equipment done by Army personnel (frequently at the contractor's facility). For existing equipments, TRADOC extracts AMMH data from Army Regulation 570-2, "Organization and Equipment Authorization Tables - Personnel."

The Army believes the AMMH data are a major shortcoming of the MACRIT process. LMI agrees. Because neither the operating scenario nor the equipment reliability is explicit, it is impossible to identify separately the activity level (e.g., hours of operation per day), the failure frequency, or the duration of maintenance actions. Data sources are not identified. The AMMH might be based on contractor's estimates, project manager's estimates, field experience, or some other source. Because there are no routine procedures for updating AMMH from field experience, the data presented in Army Regulation 570-2 might reflect original contractor data or other obsolete information.

Two other shortcomings of the MACRIT are noteworthy. One is the assumption that two people can adequately man an operating position 24 hours per day, 365 days per year. Although two-shift operation may be satisfactory for a short period, prolonged operation in a combat environment might soon exhaust some operators. A second shortcoming is the establishment of a maximum ratio of .4 indirect to 1 direct productive man-hour for maintenance activities. This ratio assumes a support concept in which either most malfunctioning equipments are returned to a central location for repair or the maintenance personnel are collocated with the equipment. It is inadequate for a support concept in which maintenance personnel are dispatched from a central

location to the equipment site (i.e., travel time might exceed direct maintenance time).

2. Navy

a. Ships

A standard methodology for calculation of ship manning requirements is prescribed in OPNAV 10P-23, "Guide to the Preparation of Ship Manning Documents, Volume I - Policy Statement." This methodology derives ship manning from analyses of four categories of workload: (1) operational, (2) maintenance, (3) administrative and support, and (4) utility tasks and evolution. A fifth category, customer support, applies only to tenders and repair ships.

Operational workload is associated with the manning of watchstations. Normally, wartime cruising is considered the most demanding of operating manpower because it requires three shifts a day for a period of up to 60 days. However, the Navy is now realizing that the reduced availability of personnel while in port often precludes accomplishment of all workload.

Maintenance workload comprises preventive maintenance, corrective maintenance, and facility maintenance. Preventive maintenance requirements for most ship equipments have been established through the Navy material maintenance management system. For new equipments, the preventive maintenance requirements must be estimated by analogy to existing equipment or by engineering analysis. The average annual preventive maintenance workloads of all equipments are aggregated by occupational specialty and skill level and inflated by 30 percent to account for make ready, put away and data recording time. Normally, corrective maintenance is simply assumed to be equal to preventive maintenance for electronics and fire control systems and one-half of preventive maintenance for all other systems. Facility maintenance is the housekeeping needed to maintain cleanliness and preserve the ship against

corrosion and deterioration. (Facility maintenance requirements have been determined traditionally through work sampling. The Navy has recently developed a computer model which shows some promise for improving estimates of facility maintenance.)

Administrative support workload includes a variety of tasks: record-keeping, storekeeping, food preparation, disbursing, etc. Because of this diversity, there is no standard methodology for estimating administrative support workload, although planning factors are frequently used (e.g., one messman per 20 crew members).

Utility tasks include line handling, boat operations, cargo handling and similar miscellaneous chores. Evolutions are tasks required to provide a specific functional capability such as piloting, anchoring, replenishment at sea, and helicopter operations. Workloads for utility tasks and evolutions are determined on an item-by-item basis, then aggregated.

A productive allowance of 20 percent is added to all workloads except watchstanding, certain evolutions, and workloads for which the estimate already includes some productive allowance (e.g., those estimated by sampling). The productive allowance reflects the average additional time required to do tasks because of fatigue, environment, personnel needs, and unavoidable interruptions.

Once workloads have been calculated, they are translated into manning requirements in the following way. Watchstanding requirements are identified, and associated watchstanding workload noted. Next, a portion of the corrective maintenance workload is used to fill slack time of the watchstanders. (The total time a watchstander has available for productive work is specified as a Navy standard workweek.) The number of nonwatchstanders is

calculated by dividing the total remaining workload, in each occupational specialty and division, by the productive time available per man.

Although the Navy standard workweek differentiates between scheduled and unscheduled work (presumably corresponding to preventive maintenance and corrective maintenance), no distinction is made in calculating manning requirements. To account for cross-utilization of personnel, thus reducing manning requirements, workload can be shifted up one grade or skill level to fill slack time. Directed manning for such positions as master-at-arms and material maintenance management coordinator is added without regard to workload. A check is made to insure that sufficient personnel, with the needed skills, will be available to accomplish evolutions. Finally, the grade mix of the manning requirement is adjusted to insure adequate supervision and to achieve a suitable military command structure.

The major weakness in the OPNAV 10P-23 guidelines is the calculation of nonoperational manning as a function of average annual workload. Average annual workload does not reflect the variability of workloads or work accomplished during the various readiness conditions (battle, wartime cruising, peacetime cruising and in-port). A scenario-dependent methodology that estimated slack time and deferred workload in each ship division during each readiness condition would improve estimates of manning requirements and lead to better distribution of personnel and better estimates of off-ship support requirements.

b. Aircraft

Two standard procedures are used to estimate squadron manning requirements in the Navy. One has been used by the Navy Aviation Logistics Center (NALC) primarily during the full-scale engineering development and early production phases to provide the program manager with estimates of the

peacetime maintenance manning needs of the first operational squadrons. The other has been used routinely by the Navy Manpower and Material Analysis Centers (NAVMMAC) after squadron deployment to determine the wartime manpower requirements of operational squadrons. Because NALC has been encouraged to adopt some aspects of the NAVMMAC procedures, both methods will be described briefly.

NALC estimates only the maintenance manpower requirements. Direct maintenance man-hours per flying hour (DMMH/FH) are estimated for each rating in each work center by means of Navy data on similar aircraft, the contractor's estimates, test results (when available), and the analyst's judgment. Manpower quantity is computed from these DMMH/FH figures by the formula:

$$\# \text{ Men} = \frac{(\text{DMMH/FH}) \times (\# \text{a/c per squadron}) \times (\text{utilization}) \times (k)}{\text{monthly available productive hours per man}}$$

Utilization is the number of monthly flying hours per aircraft, and k is a factor to incorporate productive delay into direct productive man-hours. If Navy data are used to derive DMMH/FH, k takes the value 1.18. A larger k value, 1.82, is applied to contractor estimates. The monthly available hours per man is taken from the Navy standard workweek.

The above formula yields estimates of the required quantities of personnel justified by maintenance workload. Certain factors, such as two-shift manning, team-related functions, and fixed billets, can alter these manning requirements. The NALC analyst makes adjustments for each of these factors, using his knowledge of aircraft operations. Because of the large measure of subjectivity included in some NALC analyses, results may not be reproducible. Nonetheless, owing to the experience of the senior enlisted

personnel performing the analysis, most NALC reports are realistic estimates of peacetime maintenance manning.

The NAVMMAC method justifies all squadron manning requirements by flight operations, directed manning, or workload. Flight operations pertain solely to aircraft flight crews. The calculation is straightforward: the number of men in a crew multiplied by the number of aircraft per squadron and the number of crews per aircraft. Directed manning refers to all squadron personnel except flight crews and organizational maintenance personnel. Directed manning is governed by staffing standards or tables.

Workload is divided into five categories: corrective maintenance, preventive maintenance, administrative support, facilities maintenance, and utilities tasks. The latter three categories are calculated from linear functions of the first two. Thus, estimation of preventive and corrective maintenance determines squadron workload.

Preventive maintenance workload consists of all man-hours required to conduct scheduled inspections. Scheduled inspections are categorized as weekly, daily, per sortie, or per flying hour. Given the average number of sorties per week, the average flying hours per sortie and the man-hours required for each type of inspection, calculation of the average, weekly preventive maintenance workload is simple.

Corrective maintenance workload includes all man-hours required to isolate and repair failures. Estimates of the maintenance man-hours per flying hour (MMH/FH) are made by statistically regressing the monthly MMH/FH of operational squadrons against monthly flying hours. In the regression analysis, the relationship between MMH/FH and flying hours is assumed to be in the form of an inverse exponential, so that MMH/FH increase at a decreasing rate as flying hours per month increase. The lowest value of estimated MMH/FH

within the range of operational experience is selected as the estimated wartime MMH/FH. The wartime corrective maintenance workload is then estimated by multiplying the wartime MMH/FH by the wartime flying hours (i.e., corrective maintenance is a linear function of wartime flying hours).

The manpower requirements are derived from workload estimates by summing all workloads for each work center and dividing by the productive hours per man. The weekly productive hours per man are prescribed in the Navy standard workweek.

The NAVMMAC procedures are suitable for deriving peacetime staffing standards, but not for deriving the wartime manning requirements for which they are intended. Manning is based on a projected, average monthly flying program, rather than on combat flight operations. The practical constraints of aircraft carrier operations are not accounted for, and the corrective maintenance workload is assumed to be a linear function of wartime flying hours, an assumption the Navy knows to be unrealistic.

3. Marine Corps

a. Ground Equipment

The Marine Corps does not have a standard procedure for determining manpower requirements for ground equipment. For weapon systems developed by joint or unilateral acquisition programs, manpower requirements are estimated by the program manager, subject to Marine Corps guidance, using the procedures peculiar to the material developer concerned. These manning recommendations are reviewed by the acquisition coordinating group and the acquisition program sponsor and may be modified on a judgmental basis.

When procuring a system already developed by one of the other Services, the Marine Corps may either obtain manpower planning documents from the developing Service, or use existing tables of organization for the

replaced system. Many Marine Corps acquisitions are essentially one-to-one replacements of obsolete equipment with improved versions having a large degree of commonality with the phased-out equipment . Thus, initial planning for a new system may be based on the same table of organization that was used for the old one, until experience forces field commanders to request changes.

b. Aviation

The Naval Air Systems Command manages Marine Corps aircraft acquisition programs. Consequently, the same basic procedures are used to estimate manpower requirements for both new Navy aircraft and new Marine Corps aircraft. The NALC methodology is modified to reflect the operating and manning practices of the Marine Corps; the shortcomings of that methodology are retained.

NAVMMAC does not validate manpower requirements for Marine Corps squadrons, as it does for Navy squadrons. However, the Marine Corps is adapting the NAVMMAC methodology for developing squadron manpower requirements.

The Marine Corps has recently developed also a simulation model designed to assess the crew ratios required to accomplish various flying hour programs. Another simulation model, Marine Operational V/STOL Environment Simulation (MOVES), has been used to evaluate various aspects of maintenance organization and operations for the HARRIER aircraft. However, neither MOVES nor the crew ratio model are used routinely to estimate manpower requirements.

4. Air Force

Traditionally, most Air Force operating commands relied on contractors to recommend personnel requirements for a new system. These recommendations were then adjusted to reflect Air Force experience with comparable systems. For most new systems, the Air Force is now turning to a method that

has become standard for tactical aircraft. The program manager, the operating command, and the AFTEC each use the same methodology for estimating the wing manpower requirements of a new aircraft. The method is based on the Logistics Composite Model (LCOM), a detailed simulation model of Air Force maintenance operations.

LCOM is a sophisticated and flexible model which simulates the maintenance actions needed to support a specified operating scenario. Use of LCOM requires the development a data base containing maintenance task networks for all aircraft subsystems and equipments. Developing such a data base for a new system is a major undertaking for a team of expert analysts. During the acquisition process, the reliability and maintainability parameters for most of the new aircraft's subsystems are based on comparability analyses of subsystems already in the Air Force inventory. After establishment of an initial operating capability, the data base will be updated gradually to reflect the maintenance experience of the new subsystems.

The use of LCOM entails a series of iterative computer runs in which the wing resource constraints (manpower, test and equipment, and spares) are varied to attain the target sortie rate at minimum resource levels. A final set of runs is made to obtain at least five point estimates of the number of men by skill required for four different utilization rates (flying hours per month). In a postprocessor program, those point estimates are converted into regression equations for the LCOM-modeled work centers; staffing standards are applied for work centers not modeled by LCOM; and, for a specified utilization rate, the number of personnel required by skill and grade in each work center is derived from standard grade/skill distribution tables. Normally, a significant number of manpower spaces must be added to the LCOM-derived estimate because the functions involved were not modeled, either because the simulation

networks were not available or because manpower requirements for the function have no relationship to sortie rates (e.g., squadron and shop supervisors and survival equipment maintenance personnel).

Aircrew requirements are determined by another postprocessor, TAC FLIER, which also is a simulation model. The realized flying schedule output by LCOM is input to the TAC FLIER. Other input data include the aircraft attrition rate, aircrew recovery rate, replacement time for downed crews, rated squadron overhead personnel and flight crew duty regulations. The model simulates flight crew activities and determines the maximum number of crews required to execute the flight schedule for any day of the simulation period. The results of many TAC FLIER runs are regressed to determine a quadratic relationship between crew ratio and sortie rate.

Although LCOM provides the most sophisticated approach used by the Services to assess manning requirements in a wartime environment, several cautions about its application are in order. First, the achieved direct utilization rate is frequently far below the maximum allowable direct utilization rate used in Air Force manpower studies (usually 60 percent). This may result for several reasons. Fixed manning, such as requirements for minimum crew sizes and/or continuous manning, may require more manpower than justified solely by the workload. The number of separate operating locations to which a single wing is deployed will tend to lower the direct utilization because each location has its own requirement for fixed manning. Requirements to meet peak demands may also generate manpower requirements not justified by the average workload. (Incidentally, the Air Force is the only service to consider peak as well as average demands.) Thus, although workload may not totally justify the manpower requirement, any decrement will result in a degradation of operational capability.

Second, skill substitution is not used to reduce manpower requirements. LCOM has been altered to accommodate a revised organization which allows a certain amount of user specified skill substitution. However, the Tactical Air Command, the sponsor of the revised organization, intends to use it to increase readiness rather than reduce manpower (in the event that there is a potential for manpower savings).

Third, the procedure for constraining resources does not include explicit criteria for choosing between alternative distributions of manpower among work centers to attain the target sortie rate. The cost of each occupational specialty is assumed equal. The user's LCOM expertise and judgment can be an important factor, and different experts may arrive at different manning estimates. Although these estimates will not differ significantly in the total requirement, they may vary considerably by occupational specialty and hence affect training requirements.

Finally, TAC FLIER determines aircrew requirements sequentially, rather than simultaneously with maintenance requirements. An important assumption is that no mission will be cancelled due to lack of an aircrew. However, a certain level of mission cancellation due to a lack of spares or maintenance is permitted. Considering the high cost of aircrews, a more "optional" solution might be to supply more spares and maintenance and fewer aircrews to achieve the same sortie rate.

D. EVALUATION OF THE IMPACT OF NEW SYSTEM REQUIREMENTS ON THE TOTAL MANPOWER FORCE

Ostensibly, all the military services include new system manpower requirements in the force structure and manpower projections of the FYDP. In practice, the primary focus is on the program year, and not until the program year coincides with the year personnel must be trained for initial deployment

of the new system can much credibility can be given to the FYDP entries. Consequently, there is frequently a planning gap of several years, during which the manpower requirements of a new system are not projected completely or accurately in the FYDP.

The primary reason for the planning gap is the uncertainty associated with systems under development. Force planners are reluctant to include in their projections a system that may never be procured or be procured in different quantities and within different time frames than are anticipated during its development. Further, little confidence is placed in estimates of new system manpower requirements until late in the full-scale engineering development phase, at the earliest.

Even when new system manpower requirements are completely and accurately projected in the FYDP, they are stated in terms of total officer, enlisted, and civilian personnel requirements. They do not specify the grade and occupational skill requirements. Consequently, planning and programming data are insufficient for evaluating the impact of a new system on the training and personnel systems.

In fact, none of the military services has a means of evaluating the long-range impact of a new weapon system on future recruiting, training, promotions, and assignments. To make such evaluations, the detailed manpower requirements of the new systems, by grade and occupational specialty, must be projected and integrated with projections of manpower requirements for the total force.

1. Army

The Army has begun to develop a capability to make detailed projections of the manpower implications of new systems. The force accounting system has been modified to accept automated unit reference sheets, which are

essentially draft tables of organization and equipment for new systems. Work is also underway to develop an ability to post to the file of unit organizations projected changes in manning and equipment associated with the introduction of a new system into existing units. When the modifications have been completed, the Army's detailed, seven-year projections of manpower authorizations should include most new systems in the full-scale engineering development or production and deployment phases.

2. Navy

The Navy is proposing to develop, as part of its HARDMAN project, an automated management information system that will track acquisition programs and their manpower requirements. The system is still at the conceptual stage, and it will be years before the Navy can do more than check, on an exceptional basis, situations that appear to pose critical personnel or training problems.

3. Marine Corps and Air Force

Neither the Marine Corps nor the Air Force has, or is developing, a capability to make long-range projections of manpower requirements by grade and occupational specialty. Conceivably, the Air Force's Skill Projection Model, which now projects authorizations for the program year, could be modified to provide longer-range projections.

E. VALIDATION OF WARTIME MANPOWER REQUIREMENTS

1. Army

The basic wartime manpower document for standard types of Army tactical units is the table of organization and equipment (TOE). For a new system, the TOE is developed by TRADOC and tested, if necessary, early in the production and deployment phase through force development test and evaluation or user tests. During the testing period, there may be TOE changes as both TRADOC and the user gain familiarity with the new system. However, no unit is

actually manned on the basis of a TOE. Instead, units are organized according to modification TOE (MTOE), which are adaptations of the TOE to specific geographical or operational environments. MTOE are proposed by the major commands (e.g., U.S. Army Europe) and approved by Headquarters, Department of Army.

Once a system is fully deployed, TRADOC relies on informal feedback from using units to identify needed TOE changes. For example, if the MTOE proposed by various using units deviate consistently from the standard TOE, it will probably be revised accordingly.

2. Navy

One year after the commissioning of a new ship, or after establishment of initial operating capability for a new aircraft squadron, the Navy Manpower and Material Analysis Center validates the unit's manning requirements. These requirements are published in ship or squadron manning documents and are intended to represent the unconstrained, wartime manpower needs. The manpower requirements of each ship and aircraft squadron are revalidated periodically throughout the weapon system's operational life.

3. Marine Corps

The situation in the Marine Corps is similar to that in the Army. Wartime manpower requirements are documented by tables of organization, and there is no formal procedure for validating the requirements. Based on experience from deployments and exercises, field commanders may request changes to the tables of organization. Headquarters, Marine Corps retains approval authority.

4. Air Force

For the Strategic Air Command, the validation of wartime manpower requirements is unnecessary. Its peacetime alert mission imposes a greater

workload than its wartime mission; thus, its peacetime manpower requirements exceed wartime requirements.

For squadrons of the Tactical Air Command, wartime manpower requirements are validated with LCOM and TAC FLIER. The only difference between the procedures for making the initial manpower estimates for a new aircraft and those for making subsequent estimates is in the data base. The initial data are derived from comparability analyses. As operating experience is gained with the new aircraft, the data base is modified to better reflect the reliability and maintainability characteristics of the subsystems. Because the models provide justification for requesting manpower programming changes, update runs may be made from time to time throughout the weapon system's life.

F. DETERMINATION OF PEACETIME MANPOWER AUTHORIZATIONS

1. Army

The MTOE, proposed by the using command, identifies manning requirements for six authorized levels of organization (ALO). ALO 1 is the minimum manning required for sustained combat; i.e., full authorizations. ALO 2 is for 90 percent of full manning, and ALO 3 is for 80 percent. Type B identifies the minimum requirements for U.S. personnel; the complement can be non-U.S. (e.g., Type B manning might be used for an overseas transportation company). Cadre manning provides the nucleus for unit activation. Augmentation manning provides capabilities beyond the normal mission of the unit.

Headquarters, Department of Army (Deputy Chief of Staff for Operations) identifies the units in the force structure and allocates spaces to the major commands. The major commands then distribute the spaces to their units, propose changes to the MTOE, and identify the ALO for each unit. Thus, the MTOE, as constrained by the ALO, is the peacetime authorization document for the unit.

2. Navy

As in the Army, there are no formal criteria or methods for deriving peacetime authorizations from wartime requirements. The process is judgmental and is influenced primarily by priorities, manpower and funding constraints, and the preferences of the fleet commanders.

For a new system, initial authorizations are proposed by the warfare sponsor on the basis of information provided by the program manager. Once authorizations are approved by DCNO (Manpower), changes are proposed by the program manager until the weapon system is turned over to the using command. Thereafter, changes are proposed by the using command, subject to guidance formulated by the warfare sponsor and approved by DCNO (Manpower).

The manpower authorization document (OPNAV Form 1000/2) records both the current authorizations and the mobilization requirements. For ships and tactical aircraft squadrons, the mobilization requirements normally match the manpower requirements specified in the ship manning document or squadron manning document.

3. Marine Corps

The cognizant deputy chief of staff or director of major staff organization at Headquarters, Marine Corps, who is also the acquisition program sponsor, determines the peacetime manpower authorization (manning level) for a new weapon system. As in the other Services, this is a judgmental process influenced by the table of organization, available end strength, and priorities. If deemed necessary, the Marine Corps attempts to fully man the table of organization of a new system during the first few years. However, if the new weapon system is not expected to encounter any particular reliability or maintainability problems, it receives its fair, pro rata share of manning.

The authorized Marine Corps end strength is allocated to mission areas by the Chief of Staff's Committee, composed of all deputy chiefs of staff and directors of major staff organizations. The number of authorized billets by mission area has remained virtually constant since the Vietnam draw-down. This constant strength is accommodated through phase-out of obsolete weapons systems, annual adjustments in unit manning levels, and rearrangement of the force structure.

4. Air Force

Each major command submits annually to the Air Staff, Directorate of Manpower Organization, reports containing wartime manning requirements by weapon system, including new systems. These requirements are justified by approved manning standards, configuration changes, or base-specific deviations from the standards. Once approved, the manpower requirements become the basis for Air Force programming and manpower allocation decisions.

As in the other military services, total peacetime Air Force manpower authorizations are normally constrained below total manpower requirements by dollar and end strength ceilings. However, maintenance manpower requirements for combat aircraft are usually fully funded and manned. Unfunded manpower requirements are generally allocated among support functions, such as base operations support. Because of the need to maintain aircrew flying proficiency, the authorizations for aircrews are constrained by the funded, flying hour program.

G. DEVELOPMENT OF TRAINING PLANS AND REQUIREMENTS

1. Army

Throughout the acquisition process, development of training plans and requirements for a new weapon system is a joint TRADOC and DARCOM effort. TRADOC develops the training concepts, writes the training plans, and defines

requirements for training equipment, devices, aids, literature and support items. DARCOM develops and procures the materials to support the training program. DARCOM also procures initial training for instructor cadre personnel and provides training teams to train units when the new equipment is first deployed. TRADOC identifies all training resource requirements, student loads, and instructor requirements, determines course content, and conducts the training program. Training is a TRADOC responsibility, but DARCOM acquires the training materials and equipments and introduces the new system to field units.

2. Navy

NAVMAT, the material developer, is responsible for establishing all training capabilities required to support a new weapon system. This responsibility includes: developing and procuring course materials, equipment and devices; identifying student loads and instructor needs; providing, through contractors, initial training for cadre and test personnel; and estimating all training resource requirements.

The Director, Naval Education and Training becomes involved very late, sometimes subsequent to DSARC III, when the material developer submits the Navy training plan (NTP) to a NTP conference for review and approval. The NTP conference is one of the most beneficial manpower planning activities associated with a new weapon system. In many cases, it provides the first opportunity for the manpower planner, user, trainer and personnel manager to assess the manpower implications of the new system. Approved NTP, if funded, are implemented by the Naval Education and Training Command.

3. Marine Corps

The Marine Corps follows the same general procedures as the Navy. The material developer establishes the training system and develops the

training plan. Some variation in procedures occurs because portions of Marine Corps training are conducted by the other Services. For example, tank training is conducted by the Army, and most aviation training is conducted by the Navy. In these cases, the Marine Corps provides a pro rata share of instructors and training equipment in exchange for student billets.

Within Headquarters, Marine Corps, the training requirements recommended by the program manager are reviewed by the acquisition program sponsor and the acquisition coordinating group; entered into the integrated logistic support plan by the Deputy Chief of Staff, Installations and Logistics, or the Deputy Chief of Staff, Aviation; and approved by the Deputy Chief of Staff, Operations and Training. Invariably, the training requirements approved by the Marine Corps are different from those recommended by the program manager because the Marine Corps trains to authorized billets, not to tables of organization.

4. Air Force

In the Air Force, the division of responsibilities for development of training for a new weapon system is similar to that in the Army. The material developer, the Air Force System Command, develops and procures the training equipment, devices, materials, and contract training courses. The Air Training Command develops the training concept and training plans, identifies all training resource requirements, and implements the training program. Within the Air Training Command, a single manager is designated responsible for all Air Training Command participation in a particular acquisition program. The Air Training Command normally has its representatives assigned to both the system program office and the joint test force.

H. OPERATIONAL TEST AND EVALUATION

During the development process, prior to the decision to commence production, two types of test and evaluation are conducted to support program decisions. Development test and evaluation, conducted by the materiel developer, focuses on the technical characteristics of the system. The link to manpower requirements is indirect, and often uncertain and poorly defined. Operational test and evaluation, conducted by independent test and evaluation agencies, is aimed more directly at the suitability of the system for operation and support by military personnel. Normally, the prototype system is operated by military personnel in an environment similar to that in which deployed systems are expected to operate, and deficiencies in system design or performance are noted. Although operational test and evaluation may identify shortcomings that affect manpower, personnel or training requirements, there usually is no explicit attempt to validate these requirements. However, the military services, to various degrees, do attempt to assess through operational test and evaluation the adequacy of the numbers and skill levels of personnel designated by the program manager to operate and support the system.

1. Army

Current Army policy is to use operational test and evaluation to validate the total system support package prior to the Milestone III decision. This means selecting test personnel typical of those who will eventually operate and maintain the system, sending them through the same TRADOC training programs intended for equipment operators and maintainers, providing them with the same technical manuals planned for publication, and testing the system in the same operational environment with the same support concepts planned for fielded systems. This concept of operational testing and evaluation of total system support is new in the Army. Some program managers are expected to have

difficulty getting the support package ready early enough to permit such testing prior to Milestone III.

2. Navy

Operational test and evaluation of Navy weapon systems is planned and conducted by the Commander, Operational Test and Evaluation Force (COMOPTEVFOR). For testing aircraft and aircraft systems, COMOPTEVFOR has three test squadrons under his operational control. Testing of ship systems is accomplished by fleet personnel under the direction of COMOPTEVFOR. COMOPTEVFOR does not normally test and evaluate an entire ship, only selected systems, such as the combat system.

One of the express purposes of operational test and evaluation is to provide information on personnel requirements. COMOPTEVFOR does this by operating and, to the extent feasible, supporting a test system with military personnel, usually factory trained, in an operational environment, then observing the results. COMOPTEVFOR reviews the support plan, training plan, draft technical manuals, and project-manager-specified manning needs and collects data on system reliability and maintainability. From these observations, he makes a subjective judgment about the adequacy of planned, system manning.

3. Marine Corps

The Marine Corps Operational Test and Evaluation Activity (MCOTEA) is responsible for operational test and evaluation of all Marine Corps equipments. Testing is carried out by fleet marine force personnel under the direction of MCOTEA. Results are reported to COMOPTEVFOR and Chief of Staff, Marine Corps. Follow-on test and evaluation is conducted by fleet marine force units, if possible under simulated wartime conditions. Results of such

tests are reported both by MCOTEA and, independently, by the commander of the participating units.

The focus of Marine Corps operational test and evaluation is on tactical operation of the system in a tactical environment. Assessment of the proposed manning is judgmental.

4. Air Force

The Air Force Test and Evaluation Command (AFTEC) is the lead organization for initial operational test and evaluation, and it assists the operating command with follow-on operational test and evaluation. AFTEC appoints the director and staff of the joint test force for a weapon system acquisition program. Participating commands provide additional manpower for evaluation of logistics requirements (Air Force Logistics Command), maintenance requirements (operating command), training requirements (Air Training Command), computer software (joint Air Force Logistics Command and operating command) and operations (operating command).

AFTEC views its operational test and evaluation responsibility as encompassing a complete logistic assessment of the weapon system with particular focus on the following major elements of operational availability and supportability: manpower, spares, and support equipment (including cost trade-off potential); operating and support cost; and operational reliability. AFTEC used to investigate 26 elements of operating and support cost. It now limits itself to six test-sensitive cost elements: base maintenance manpower, base munitions manpower, aviation POL, replenishment spares, base maintenance materiel, and support equipment.

The three primary tools used by AFTEC for logistic assessment are LCOM, the Cost of Ownership (COO) model, and the Mission Completion Success Probability (MCSP) model. With these models, AFTEC assesses the impact of

deficiencies in terms of logistic supportability criteria (such as sortie rate, reliability/maintainability), operating and support cost (such as manpower, spares, and test equipment), and operational effectiveness criteria (such as performance, probability of kill, survivability, or vulnerability).

III. REVIEW OF CASE STUDIES

A. INTRODUCTION

To understand how manpower planning for new systems actually has been done, LMI examined the acquisition histories of seven major weapon system programs. Two systems apiece were selected from the Army, Navy and Air Force and one from the Marine Corps. Table 3 identifies the systems, their current program status, and the periods covered by the case studies.

To develop the case studies the manpower estimates and key manpower decisions made during the acquisition program were identified, and from them a chronology of system manpower requirements was constructed. The content of each study was dictated by the information available and the manpower issues peculiar to that acquisition program. Consequently, each tells a unique story.

We do not intend to recount all seven case studies here or to list all our observations about them. Many of the observations are peculiar to the individual weapon system or the military service responsible for the acquisition program. Each case study has been documented separately in the working notes listed in Appendix C. The statements in this chapter are generalizations based on all seven case studies, and they are presented as a context for the evaluation of overall DoD manpower planning policy for new systems.

B. FINDINGS

1. Most estimates of manpower requirements made during acquisition programs are too low.

Four of the case studies (the two Navy programs and the two Air Force programs) revealed significant growth in manpower requirements during the acquisition programs. One Army program, TACFIRE, is close to achieving

TABLE 3. CASE STUDIES OF MANPOWER PLANNING

	Type System	Program Status	Period Covered by the Case Study
<u>Army</u>			
TACFIRE	Field Artillery Fire Direction System	Limited Production	January 1966 - July 1978
PATRIOT	Air Defense Missile System	Full-Scale Engineering Development	April 1966 - March 1978
<u>Navy</u>			
FFG-7	Guided Missile Frigate	Leadship Commissioned Followships Under Construction	September 1970 - April 1978
S-3A	Carrier-based Anti-Submarine Warfare Aircraft	Production Completed October 1977	December 1965 - March 1978
<u>Marine Corps</u>			
CH-53E	Helicopter	Limited Production	October 1967 - July 1978
<u>Air Force</u>			
A-10	Attack Aircraft	Production	March 1967 - July 1978
F-16	Fighter Aircraft	Production	April 1972 - July 1978

its goal of having no net manpower impact on artillery organizations, but the manning requirements of direct support maintenance battalions must be increased to support the system. The other Army program, PATRIOT, has experienced moderate fluctuations in estimated manning requirements throughout the program. The PATRIOT project manager expects to stay within the DCP threshold, perhaps well below it if his "bare bones" manning concept is approved. However, PATRIOT manning estimates made by others have exceeded the threshold by as much as 25 percent.

2. The reasons for the low estimates are varied.

Sometimes optimism plays a role. Sometimes the increase in manpower requirements can be attributed to growth in the mission capability of the weapon system (i.e., added hardware). Frequently, however, changes in manpower requirements are related directly to changes in the operating scenario or support concept, neither of which can be controlled entirely by the project manager. For example, the major increase in A-10 manpower requirements resulted from a change in the deployment scenario. Nonetheless, the project manager is responsible for the reliability and maintainability characteristics of the new weapon system, and in at least two of the programs, TACFIRE and S-3A, failure to achieve established goals in those areas led to increased manpower requirements.

3. Operating and support concepts are likely to vary throughout the acquisition process, causing fluctuations in the estimates of manpower requirements.

Except for the FFG-7, all the programs studied exhibited changes in the operating concept, the support concept, or both during the acquisition process. Because manpower requirements are, to a large extent, determined by the operating and support concepts, every change in one of these concepts changes the estimate of manpower needs.

In the TACFIRE program, a change in maintenance concept increased maintenance manpower. In PATRIOT, there were several changes in battalion organization that caused changes in manpower requirements. The planned number of aircraft per squadron and the flying hour program in the S-3A program changed several times, each time affecting manpower requirements. The deployment concept was changed in the CH-53E program. Instead of augmenting each heavy helicopter squadron with four CH-53Es, it was decided to consolidate all CH-53Es into two squadrons, each capable of deploying two or more detachments. That change in deployment plans increased requirements for intermediate maintenance personnel. In the A-10 program, the deployment scenario was changed during full-scale engineering development, causing a significant increase in wing manpower needs. In the F-16 program, a decision not to include an auxiliary power unit and an engine health monitoring system affected the requirements (more support equipment and maintenance personnel).

The underlying reason for variation of operating and support concepts during the acquisition process is not clear. For systems like PATRIOT and CH-53E, evolving hardware characteristics may have caused changes in organization and deployment concepts. For other systems, such as A-10 and S-3A, too little attention may have been given in the early phases as to how the system was to be used or supported.

4. There is greater uncertainty associated with maintenance manning than with any other element of new weapon system manpower requirements.

Operator requirements are normally determined early in equipment design. Although force structuring decisions often change the number of systems to be deployed and, consequently, the operator requirements, estimation of operator requirements is basically deterministic.

Requirements for administrative personnel are generally determined by Servicewide staffing standards; thus there is little uncertainty associated with them. Occasionally, as for PATRIOT and FFG-7, the program manager proposes nonstandard manning for the new system, and then there will be uncertainty about his success in presenting and defending the proposal.

All the case studies revealed uncertainty in the estimation of maintenance manpower requirements, not only in numbers of maintenance personnel, but also in their distribution across occupational skills. In those programs where total manpower requirements increased during the acquisition process (FFG-7, S-3A, A-10 and F-16), the increase was precipitated by maintenance requirements. In TACFIRE also, the increase was in maintenance personnel.

5. Estimates of new system manpower requirements frequently reflect program goals rather than unbiased assessments of manpower needs.

A program manager's job is to meet the goals of the acquisition program without violating program constraints. When manpower-related goals such as system manning or maintainability are established, the program manager tailors the system design and support concept to achieve those goals. Until convinced otherwise, he assumes that the goals will be achieved, and he estimates manpower requirements accordingly. Thus, successful achievement of program goals becomes a key assumption in the manpower estimate. Furthermore, the validity of such assumptions is usually not tested until late in the acquisition program, sometimes well after the final DSARC review.

In the TACFIRE program, one of the design goals was for the operator to be able to correct 90 percent of the system failures. Throughout the development program, it was assumed this goal would be achieved. Two years after the final DSARC review, follow-on test and evaluation and user testing

of limited procurement systems indicated that the system operator could correct only about 70 percent of system failures. Consequently, the support concept was changed, and the requirement for maintenance personnel was increased.

The FFG-7 was designed to a manpower constraint. In 1971, during preliminary design, a manning goal of 176 was imposed. Although earlier ship manning estimates had ranged from 184 to 213, once the goal was set, estimates conformed to it and remained unchanged throughout the design phases and into the initial stages of leadship construction--a period of over four years that included the final DSARC review of the program. During that period, manning estimates were based on the explicit assumptions that the FFG-7 class would receive needed support from intermediate maintenance facilities, that sufficient spare components would be procured to support the remove-and-replace maintenance strategy, and that the ships would be manned with a full complement of fully trained personnel. In 1975, it became evident that these assumptions, especially the last one, might be unrealistic. As a result, and due partly to the addition of hardware, the latest draft preliminary ship manning document for followships identifies requirements for 206.

6. Manpower goals or constraints established for new systems have addressed only the aggregate manning of the using unit, not total manpower or skill level requirements.

Specific manning goals or constraints were included in three of the programs reviewed: TACFIRE, PATRIOT and FFG-7. For TACFIRE, the goal was for artillery unit manning. Only late in the program were direct support maintenance manpower requirements fully considered. For PATRIOT, the manning constraint is for a PATRIOT battalion. The "bare bones" manning concept is an attempt to minimize battalion manning by drawing administrative and logistical

support from other units.¹ For FFG-7, the goal applied to ship manning. The full impact on manning of intermediate maintenance facilities and depots is not yet known.

7. Controlling training requirements can be as important as constraining manning levels.

In the TACFIRE program, the program manager was successful in constraining the manning level; but optimistic in assessing the amount of training required for organizational maintenance. When testing indicated that organizational personnel could not adequately maintain the system, the support concept was changed, and a larger portion of system maintenance was allocated to intermediate maintenance personnel. In the FFG-7 program, the program manager met the ship manning constraint by, among other things, designing a ship organization that requires a full complement of trained personnel, many with long periods of training unique to the FFG-7 class. Because of these training requirements, Navy personnel managers do not yet know if the ship can be adequately supported.

8. Operational test and evaluation conducted prior to DSARC III does not normally test the intermediate level of maintenance support.

In none of the acquisition programs reviewed did operational test and evaluation prior to DSARC III attempt to test the planned intermediate maintenance support capability. Although military personnel were used to test the operation and organizational maintenance of the new system, intermediate maintenance was provided by contractor personnel. The ability of military personnel to provide adequate intermediate maintenance support was not tested until follow-on test and evaluation or user testing of limited production or initial production systems.

¹This does not imply that the program manager is being devious or that his ideas are unsound. His proposal might well be the best approach for minimizing total manpower requirements.

9. For most systems, manpower estimates made during the acquisition program assume wartime deployment.

For all the programs studied, except the S-3A and CH-53E, the estimates of weapon system manpower requirements were based on combat deployment of the system. Manning estimates for both TACFIRE and PATRIOT assumed 24-hour operation; duration was undefined. FFG-7 manning was for wartime cruising (Condition III). Manning requirements for the A-10 and F-16 were based on simulations of combat operations.

The S-3A and CH-53E acquisition programs were both managed by the Naval Air Systems Command (NAVAIR). The standard NAVAIR method for estimating squadron manning requirements calculates maintenance workload as a function of average, annual peacetime flying hours. Navy squadrons are surveyed periodically, commencing one year after establishment of the initial operating capability, to determine wartime manpower requirements. The Marine Corps has no standard, analytic procedure for deriving wartime requirements. For the CH-53E, the manning estimate was based on a wartime flying program but peacetime availability of personnel. (The Marine Corps is now reassessing the manpower requirements of the CH-53E.)

10. The Navy's standard method of determining warime maintenance manning requirements of aircraft squadrons is unsound.

Wartime corrective maintenance workload is estimated as a linear function of wartime flying hours. When the method was used for the S-3A, the resulting manpower requirements were unrealistically high. Consequently, ad hoc procedures were used to develop the S-3A squadron manning document.

11. The impact of battle damage on manpower requirements rarely is assessed.

The manning requirement for a weapon system is supposed to reflect the mature system in a sustained, wartime environment. Except for the A-10 program, the case studies showed that no effort had been made to assess the

impact of battle damage on system readiness, including the potential requirement for additional manpower.

In the case of the A-10, the Air Force conducted several studies of the vulnerability and survivability of the system, with the resulting parameters used in a series of LCOM runs designed to assess sortie generation capability under presumed battle damage conditions. These studies showed that spares would be the primary resource constraining readiness, but that manpower requirements would increase by about 10 percent. While the need for such assessments may be a function of the planned operational environment of the weapon system, it would appear that battle damage impact studies for developing weapon systems would provide valuable information to both the program manager (possibly affecting the system design) and the manpower planners responsible for mobilization requirements.

12. Peacetime manning, the prime determinant of operating and support costs over the life of a weapon system, is a function of military service end strength and readiness priorities.

In the Army, a system such as PATRIOT, which has an important peacetime mission, probably will receive peacetime authorizations equal to its wartime manning requirement. TACFIRE might or might not, depending on its geographical area of deployment. If the Navy follows traditional ship manning procedures, the FFG-7 authorizations will probably be less than wartime requirements, except during its first year of operation and during overseas deployments. Current authorizations for the S-3A are less than wartime requirements, as are authorizations for the CH-53. In the Air Force, the standard practice is to authorize full wartime manning of tactical units. Manpower shortages are allocated among headquarters and support organizations.

13. Actual manpower requirements of a new system are not determined until years after the final DSARC review of the program.

Final DSARC reviews have been conducted on six of the weapon system programs studied: TACFIRE, FFG-7, S-3A, A-10, CH-53E and F-16.

The last TACFIRE DSARC review was held in January 1975. Follow-on test and evaluation, user tests, and operational test and evaluation were conducted in the spring of 1978. Results led to a change in support concept and the addition of maintenance personnel.

The last FFG-7 DSARC review was held in November 1975. Manpower requirements for the leadship will be validated in August or September 1978.

The last S-3A DSARC review was held in October 1973. The manpower requirements for the first S-3A squadron were validated in May 1976.

The last A-10 DSARC review was held in January 1976. In September 1977, the A-10 wing manning requirements developed from follow-on test and evaluation showed changes in the manning of almost every work center. Totals, however, remained close to earlier estimates. Also, since September 1977, decisions have been made to add avionics subsystems and to develop new weapon delivery systems for the A-10. These decisions are likely to have manpower implications.

The last CH-53E DSARC was held in January 1978, but the Marine Corps was directed to return with a more detailed assessment of manning requirements for review and approval by OSD. This assessment is currently in progress, as are tests to verify that the system meets specified reliability and maintainability goals.

The last F-16 DSARC was held in October 1977. The user, the U.S. Air Force Tactical Air Command, has not yet conducted its independent manpower study using LCOM, but authorizations have increased since October 1977.

The point is, the final DSARC review of an acquisition program comes at the beginning of a weapon system's life. At that time, the manpower

requirements of a system can be estimated, but they are not determined until much later.

14. Manpower planning for a new system requires a broader perspective than that provided by a program manager alone.

The program manager can propose an operating scenario, but the user determines how the system is used. The program manager can design the system for a specific support concept, but he has no assurance that the user and logistics command will implement that concept. He can propose new or revised occupational specialties for personnel supporting his system, but the personnel manager makes the decision. The program manager can design and procure training equipment, training aids, curricula and factory training courses, but the training command carries out the training program. He can specify the personnel and training needs of his system, but he cannot judge how they will compete, conflict, or complement the personnel and training needs of other systems in the force.

In the TACFIRE program, decisions on the military occupational specialty and deployment of direct support maintenance personnel are being influenced by the maintenance requirements of other systems, some still under development. The decision will be made by the Military Personnel Center. In the PATRIOT program, the program manager is proposing a "bare bones" manning concept in which PATRIOT battalions would rely on other units for administrative and logistical support. The decision will probably be made by TRADOC and the major using command. In the FFG-7 program, the program manager proposed 30 new occupational specialties; 19 were approved. Also, he designed the ship for a manning concept that probably will not be fully supported by the training and personnel systems. In the A-10 program, the user, U.S. Tactical Air Command, changed the operating scenario, resulting in an 8 percent increase in wing manpower requirements.

The program manager must take the lead in estimating manpower requirements for a new system and in planning the manpower-related support. He knows the operating and maintenance characteristics of the equipment best, and he usually is responsible for establishing new training capabilities. But there are many aspects of manpower support that he cannot control. To insure effective manpower support, those responsible for using the new system and providing the personnel and training must be actively involved, with the program manager, in manpower planning for the system.

IV. CONCLUSIONS AND RECOMMENDATIONS

A. POST-DSARC MANAGEMENT REVIEW OF INTEGRATED LOGISTIC SUPPORT

ASD(MRA&L) reviews of the integrated logistic support aspects of an acquisition program, which include manpower planning, are usually associated directly with DSARC reviews of the program. The DoD acquisition process for major systems is structured to provide DSARC reviews only at key decision milestones, the last of which is normally approval of full-scale production of the system.

Whereas the full-scale production decision is the last major Secretary of Defense decision in the acquisition process, it marks only the beginning of ASD(MRA&L) responsibilities for weapon system support. During the several years after the final DSARC review, the true reliability and maintainability characteristics of the system begin to emerge, the training and personnel support plans become actions, and the using command begins to integrate the new system into operational forces. Manpower and other support requirements become needs, as opposed to plans, estimates and goals. It is also during this early part of a system's operational life that actions can be taken to adjust the personnel, training and other support to garner life-long improvements in operational capability or reductions in support resource needs.

To focus management attention on that critical, early phase of integrated logistic support implementation, ASD(MRA&L) should conduct post-DSARC management reviews of integrated logistic support for new, major systems. The reviews should be held about a year after initial deployment to provide the

military service an opportunity to evaluate weapon system support under operational conditions. During the management reviews, ASD(MRA&L) should verify that personnel and training support is adequate; that the manning and support concepts for which the system was designed are being implemented; that, when feasible, engineering changes are being made to reduce manpower requirements; and that personnel and training systems are being modified to improve system support.

Recommendation: Institute formal, post-DSARC management reviews of integrated logistic support implementation to verify that actions are being taken to minimize manpower and other support resource requirements.

B. METHODS OF ESTIMATING WARTIME MAINTENANCE MANPOWER REQUIREMENTS

Estimating the numbers and skills of maintenance personnel is the most difficult aspect of manpower planning for a new system. The Air Force is the only Service with a satisfactory method of determining the maintenance manpower needed to support peak, wartime operations under various operating scenarios or, alternatively, to measure the impact of manpower constraints on combat operations.

The Army, Navy and Marine Corps base wartime maintenance manpower requirements on estimates of average workloads. The Army recognizes that its manpower authorization criteria for maintenance operations are unsatisfactory. The Navy method of projecting aircraft maintenance requirements from peacetime experience has serious, analytic shortcomings. The methods used to determine ship manning are deficient in estimating corrective maintenance and in measuring deferred workloads. For aircraft, the Marine Corps follows the Navy procedures; for ground systems it accommodates the system within the Marine Corps end strength and relies on the judgment of field commanders to identify manning deficiencies.

The Army, Navy and Marine Corps each have underway studies or modeling efforts to improve maintenance manpower estimates. Those efforts should be closely monitored and strongly supported by ASD(MRA&L).

Recommendation: (1) Urge the Army, Navy and Marine Corps to press on with efforts to develop improved methods for determining the maintenance manpower needed to support peak wartime operations under various scenarios and (2) to measure the impact of maintenance manpower constraints on combat operations.

C. EXPLICIT ASSUMPTIONS AND SENSITIVITY ANALYSIS

During the acquisition process, statements of a new system's manpower requirements are estimates. True manpower requirements of a new system are not determined until the using command fully integrates the mature system into operating forces, years after the final DSARC review. The estimates are based on assumptions about the operating scenario, support concept, hardware characteristics, and structure and capabilities of the personnel and training systems. In fact, some are based so firmly on the assumption that the desired levels of system reliability and maintainability will be achieved that they should be considered manpower goals, not estimates.

Because manpower estimates are so dependent on assumptions, those assumptions must be made explicit, and the sensitivity of manpower requirements to changes in those assumptions must be fully evaluated. Specifically, there should be demonstrated in manpower analyses direct links between the operating scenario, support concept, system characteristics and manpower requirements. Furthermore, the analyses should explore the implications of realistic, alternative operating scenarios, support concepts, and hardware characteristics, especially reliability and maintainability.

Recommendation: Throughout the acquisition process, require that estimates of new system manpower requirements be supported by analyses that (1) state explicitly the assumptions about operating scenario, support concept and system characteristics and (2) explore the sensitivity of the estimates to changes in those assumptions.

D. PARTICIPATION IN THE ACQUISITION PROCESS

The key to effective manpower planning for a new weapon system is early and continuous participation in the acquisition process of those ultimately responsible for the operation and manpower, personnel, and training support of the system. Participation means an active contribution to the program, not merely a critique of the program manager's initiatives. There are several reasons why these individuals should participate in the acquisition program.

To the materiel developer, especially the program manager, the new weapon system is special. It is the object of devoted attention over a period of five to ten years spanning the acquisition process. However, once the system is deployed and becomes an integral part of the operating forces, it is no longer special. Unless it is a strategic system and enjoys an exceptionally high national security priority, the system probably will not command dedicated manpower, personnel or training support. It will be operated and supported as part of the operating forces and will have to compete with other systems for support resources.

The user, manpower planner, personnel manager, and trainer should be more aware than the materiel developer of the real operating and support constraints imposed by the operating environment and the manpower, personnel and training systems. Also, because they have responsibilities that span all operating forces, they should be more aware than the materiel developer of how the support provided the new system will affect or be affected by the support provided other systems. Thus, the user, manpower planner, personnel manager, and trainer can bring to the manpower planning process a degree of pragmatism not necessarily found in those more directly responsible for the development and procurement of a new system.

Equally important, if the new design of the weapon system requires modification of existing manpower, personnel or training systems, the program manager must receive assurances that such modifications will be made. Only if those responsible for the use and manpower, personnel and training support of the system are actively engaged in developing the operating and support concepts is it likely that the operating forces and support systems will be prepared to accommodate the new system.

The Army and Air Force have begun to bring into the acquisition process the organizations ultimately responsible for manpower support. In both Services, operational test and evaluation is beginning to play a major role in verifying the adequacy of planned weapon system support. The Navy, too, seems to recognize the desirability of such participation, but has some institutional traditions to overcome, namely the dominance of the acquisition process by the warfare sponsors and the material developer. The Navy could use a little prodding and support from ASD(MRA&L).

Recommendation: Encourage the Navy to engage manpower planners, trainers, and personnel managers in the acquisition process earlier and more actively.

E. LONG-RANGE MANPOWER PLANNING

The focus of manpower planning for new weapon systems is on identifying and satisfying requirements on a system by system basis. Only the Army, as part of its newly initiated affordability analyses, attempts during the acquisition process to assess formally the feasibility of accommodating the proposed system within future force constraints. None of the Services has the capability of making long-range projections of total manpower requirements by grade and occupational specialty. None makes long-range projections of the numbers, aptitudes and attitudes of personnel who will be available to operate and maintain new systems. As a result, materiel developers, through their

weapon system designs, are determining future manpower and training requirements without knowledge of the capabilities of the personnel and training systems to support each new system and without an understanding of how manpower support for a new system will affect or be affected by other systems competing for the same resources.

The ASD(MRA&L) has already taken the first steps to improving the situation. In his 17 August 1978 memorandum, "Manpower Analysis Requirements for System Acquisition," the ASD(MRA&L) directed each of the secretaries of the military departments to provide him with a proposed method to make 15-year projections of manpower needs. The same memorandum directs that for each new system, either there be a goal of constraining manpower requirements to stay within the current weapon or mission area levels or tradeoffs be identified for any proposed increases. The latter requirement essentially tells all Services to do the type of manpower evaluation that the Army includes in its affordability analyses.

One more step should be taken to complete the creation of a long-range manpower planning capability. That step is to complement the long-range projections of manpower requirements with long-range projections of manpower supply. Although demographic information is routinely used to project the size of the labor pool from which the DoD must recruit its personnel, there is little information available to the weapon system planner about the abilities and attitudes of the personnel who will be available to operate and support a new system when it becomes part of operational forces. What is needed is a glimpse into the future to see what types of jobs defense personnel will be able to do and what types of jobs they will be willing to do. By its very nature that type of "crystal ball" projection will be less definitive than will be the projections of manpower requirements. However, providing such

information to weapon system planners would be a start at bringing together the characteristics of defense manpower needs and the characteristics of the population from which those needs must be satisfied.

Recommendation: Task one of the military services to prepare, on a trial basis, a long-range projection of the characteristics of the population which will be entering the defense manpower force.

APPENDIX A

SUMMARIES OF DEPARTMENT OF DEFENSE DIRECTIVES AND MEMORANDA

TITLE/PURPOSE	GUIDANCE ON MANPOWER, PERSONNEL OR TRAINING
<p>DoDD 5000.1, "Major System Acquisitions," Jan. 18, 1977: Prescribes DoD policy.</p>	<ol style="list-style-type: none"> 1. Defines logistic support as the supply and maintenance of materiel essential to proper operation of a system in the force. 2. Directs that logistic planning be consistent with key program decisions and phases of activity, that detailed planning be initiated with full-scale engineering development, and that firm requirements be established early in that phase. 3. Directs that the number and skill levels of personnel be constraints in system design and that integration of the human element and system start with initial concept studies. 4. Refers in an enclosure to related documents, among which is DoDD 4100.35, "Logistic Support." (Correct title of DoDD 4100.35 is "Development of Integrated Logistic Support for Systems/Equipments.")
<p>DoDD 5000.2, "Major System Acquisition Process, Jan. 18, 1977: Defines the DoD acquisition process, including establishment of acquisition advisory councils, preparation and processing of the mission element need statement and the decision coordinating paper, preparation of mission areas analyses, and conduct of program reviews.</p>	<ol style="list-style-type: none"> 1. Directs that the DCP include a one-page logistics annex. 2. Directs the acquisition review councils to address the following issues: <ol style="list-style-type: none"> a. Milestone I: Adequacy of operational and logistical considerations. b. Milestone II: Balance between cost, performance and schedule, including operational and logistical considerations. c. Milestone III: Adequacy of planning for deployment, including manpower and training, and adequacy of support for initial operational units.
<p>DoDD 5000.3, "Test and Evaluation," Jan. 19, 1973: Prescribes DoD policy and assigns responsibilities for test and evaluation of defense systems. Defines and specifies the purposes of the various types of test and evaluation acceptance.</p>	<ol style="list-style-type: none"> 1. Defines OT&E as that test and evaluation conducted to estimate the prospective system's military utility, operational effectiveness, and operational suitability (including compatibility, interoperability, reliability, maintainability, and logistic and training requirements), and need for any modifications. States also that DT&E provides information on organization, personnel requirements, doctrine and tactics and may publications and handbooks. 2. Directs that OT&E be accomplished during full-scale development to assist in evaluating operational effectiveness and suitability and that it be continued as necessary during and after the production period.
<p>DoDD 5000.4, "DSD Cost Analysis Improvement Group," June 13, 1973: Defines the membership, responsibilities, and administrative procedures of the CAIG.</p>	<ol style="list-style-type: none"> 1. Directs cost reviews to consider all elements of system cost, including procurement, operations and support as appropriate.
<p>DoDD 5000.28, "Design to Cost," May 23, 1975: Prescribes DoD policy on establishment, evaluation, and use of acquisition program cost goals.</p>	<ol style="list-style-type: none"> 1. Directs that life cycle cost (LCC) objectives be established and separated into cost elements for development, production, operation and support; that the cost elements eventually be firmed into cost goals; and that operation and support (O&S) goals be used to control initial outfitting cost, personnel, spares, rework, etc. 2. Recognizes that because of insufficient D&S cost data, design-to-cost goals will be for average unit fly-away cost; but, nevertheless, requires surrogate goals for D&S costs--number of people, reliability, maintainability, etc. 3. Directs that a LCC estimate be made at the beginning of the validation phase and updated prior to the initiation of the full-scale development and production phases; that cost trade-off analyses be based on LCC; that programs be reviewed periodically on a LCC basis; and that program review include the portion of the test and evaluation plan developed to measure LCC factors and determine LCC performance.
<p>DoDD 4100.35, "Development of Integrated Logistic Support for Systems/Equipments," Oct. 1, 1970: Defines integrated logistic support (ILS) and prescribes various policies for planning and managing an ILS program.</p>	<ol style="list-style-type: none"> 1. Defines integrated logistic support as a composite of all the support considerations necessary to assure the effective and economical support of a system for its life cycle. Identifies nine principal elements of ILS: the maintenance plan, support and test equipment, supply support transportation and handling, technical data, facilities, personnel and training, logistic support resource funds, and logistic support management information. 2. Directs that: <ol style="list-style-type: none"> a. The system design take into account the aspects of logistic support and consider them in view of available resources, under the conditions and in the environments in which the system will be used. b. ILS be tailored to the system. c. Trade-offs addressing operational environment and logistics support requirements be made to maximize the effectiveness and efficiency of the support system.

TITLE/PURPOSE	GUIDANCE ON MANPOWER, PERSONNEL OR TRAINING
	<ul style="list-style-type: none"> d. The effect of changes in ILS resource requirements on system operational capability and effectiveness be assessed. e. Responsibility be assigned for planning, analyzing, designing and managing ILS. f. ILS planning begin at the conceptual stage, be formalized at the beginning of full-scale development, and be maintained in phase with the development program. g. The DCP specify that the Project Manager shall develop an appropriate ILS plan with milestones at the beginning of full-scale development. h. Each program include a plan with milestones for verifying the logistic support at each key decision point using functional and environmental tests and analyses. i. Essential ILS requirements be outlined in requests for proposal or during conceptual phase and validation phase efforts. j. Execution of the logistic support approach be a major factor in the evaluation of contractor performance. k. Logistic support managers be assigned to support acquisition programs/projects. <p>3. Provides brief, general guidance on ILS activities during each phase of a system's life cycle.</p> <ul style="list-style-type: none"> a. Conceptual Phase: make only broad, general ILS plans and note special problems. b. Validation Phase: address special logistics problems. c. Full-Scale Development: provide ILS plan early. d. Production: implement ILS plan. e. Deployment/Operations: system-oriented logistic support has been obtained and is functioning. <p>4. Refers to DoD Guide 4100.35G, "Integrated Logistic Support Planning Guide for DoD Systems and Equipments."</p>
<p>DoD Guide 4100.35G, "Integrated Logistics Support Planning Guide for DoD Systems and Equipments," Oct. 15, 1968: Provides general descriptions of the principal activities involved in developing an ILS plan and keys those activities to the major project management activities and events of a typical systems acquisition program.</p>	<p>1. Describes, by acquisition program phase, the principal management activities required to accomplish the personnel and training portion of an ILS program.</p> <ul style="list-style-type: none"> a. Conceptual Formulation: <ul style="list-style-type: none"> - Prepare personnel and training estimate - Make preliminary estimate of skill requirements - Establish personnel and training concept - Develop personnel and training plan requirements b. Contract Definition: <ul style="list-style-type: none"> - Establish personnel and training evaluation criteria - Evaluate proposed personnel and training requirements - Approve personnel and training plans c. Development: <ul style="list-style-type: none"> - Determine personnel availability (a continuous activity) - Prepare training package - Begin instructor training - Begin operator and maintenance personnel training - Update personnel and training requirements d. Production: <ul style="list-style-type: none"> - Verify required skill levels - Verify availability of trained personnel - Update personnel and training plan - Identify personnel and training deficiencies - Update training package - Conduct additional operations and maintenance training
<p>ASD(I&L) memo to ASA(I&L), ASN(I&L) and ASAF(I&L). Subject: "Logistics Annex to the Decision Coordinating Paper," 18 Mar. 1977: Provides interim guidance for the preparation of the logistic annex to the DCP. Content requirements of the annex are keyed to decision milestones (DSARC I, II or III) and are presented in three categories: Operational Readiness and Logistic Goals, Logistics Concepts, Plans and Management, and Potential Logistic Problems and Risk Areas.</p>	<p>1. Cites manpower as an example of a logistic resource for which a program threshold or goal might be defined at DSARC II; requires test plans and schedules for verifying thresholds and goals.</p> <p>2. Includes the availability of trained maintenance personnel as one element of maintenance capability; requires that scheduled dates for achieving an organic maintenance capability be provided at DSARC III.</p> <p>3. Cites personnel as an example of a logistic element or requirement which may be (DSARC I), is (DSARC II), or has been (DSARC III) crucial to achieving operational readiness and cost objectives.</p>
<p>ASD(MRA&L) memo to the secretaries of the military departments. Subject: "Manpower and Logistic Concerns for New Major Systems," 17 Aug. 1978: Identifies areas to be emphasized in review of the manpower and logistics issues of an acquisition program and directs that the results of such reviews be included in DSARC documentation.</p>	<p>1. Lists sets of questions on the following topics to be answered during program reviews:</p> <ul style="list-style-type: none"> a. Estimates of program and mission area resource needs and resource constraints; resources include manpower. b. Assessments of program affordability considering resource needs of other approved programs. c. Resource consumptions, by activity level, of contemporary and developmental systems. d. Determinants of resource demands and opportunities for reducing resource requirements.

TITLE/PURPOSE	GUIDANCE ON MANPOWER, PERSONNEL OR TRAINING
<p>ASD(MRA&L) memo to the secretaries of the military departments. Subject: "Manpower Analysis Requirements for System Acquisition," 17 Aug. 1978: Prescribes DoD policy on constraining manpower requirements for new systems and specifies requirements for analyzing new system manpower requirements and submitting the results of the analyses to OSD.</p>	<ul style="list-style-type: none"> e. Adequacy of project management plans and resources for evaluating alternative support concepts, analyzing manpower and logistic needs, conducting trade-offs, and setting manpower and logistic goals. f. Adequacy of efforts to insure minimum peacetime manpower and logistic consumption, yet effective wartime support. g. Effectiveness of test and evaluation in demonstrating operational suitability. h. Procedures and schedules for transferring support responsibility from acquisition to logistics communities. i. Programming and budgeting of support resources. j. Assignment of responsibilities for follow-on evaluation and analyses, tracking of resource consumption, taking corrective actions, and planning, funding, and implementing departures from existing support practices. <p>2. Refers to a separate memo which amplifies manpower-related requirements.</p> <ul style="list-style-type: none"> 1. Directs that for each new system, either there be a goal of constraining manpower requirements to stay within the current weapon or mission area levels or there be presented a design or support option that will satisfy such a goal. 2. Directs that each military department prepare a method for making detailed, 15-year projections of manpower needs. 3. Directs that each military department assign specific responsibilities for assessing, projecting and economizing on manpower requirements during system development. 4. Directs that the DCP summarize in one paragraph the estimates of unit manning levels, the comparison of manpower requirements of the new system with those of the baseline operational system, and the trade-offs to be conducted among manpower, design and logistic elements. 5. Directs that manpower analysis information, tailored to the program and decision milestone, be presented in a Manpower Analysis Paper or other appropriate document and submitted to OSD with the MEWS or DCP. 6. Provides detailed instructions, keyed to each decision milestone, on the information to be presented for each DSARC review. (The instructions are too specific and lengthy to summarize here; the memo is reproduced in Appendix B.)

APPENDIX B

ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, D. C. 20301

17 AUG 1978



MANPOWER,
RESERVE AFFAIRS
AND LOGISTICS

MEMORANDUM FOR Secretaries of the Military Departments

SUBJECT: Manpower Analysis Requirements for System Acquisition

I believe we should place greater emphasis on controlling and forecasting the effects of our weapon systems on manpower and personnel needs. Initially, I want to focus on manpower requirements for major systems in development. For these we must conduct earlier and more comprehensive tradeoffs among manpower, system characteristics and support concepts. Detailed manpower analysis requirements are in the enclosure, which you should follow for milestone reviews taking place after January 1, 1979.

For each new system, I would like you to adopt a broad goal of constraining manpower requirements for numbers and proficiency levels to stay within the current weapon or mission area levels or to identify tradeoffs for any proposed increases. This goal should be consistent with acceptable system performance and cost. Where your new programs do not meet this goal, I would like to see a design or support option that stays within current levels. The Defense Acquisition Executive fully supports me in this request.

To provide a better long term manpower outlook, within six months I would like you to provide me a proposed method to project your outyear manpower needs. This should allow numbers, proficiency levels, and major skill groupings to be summarized by year in a 15-year projection. The projection should distinguish between the manpower associated with approved programs and manpower associated with developmental systems.

I would like you to assign specific responsibilities for assessing, projecting and economizing on manpower requirements during system development. These responsibilities include development of improved methodology and overseeing the implementation of procedures to provide the analysis and data requested in this memorandum. Please provide me the name of your focal point and advise me within 90 days of your plans in this area.

A handwritten signature in black ink, appearing to read "John P. White", is written over a large, stylized, and somewhat illegible stamp or mark.

JOHN P. WHITE
Assistant Secretary of Defense
(Manpower, Reserve Affairs & Logistics)

Enclosure

Manpower Analysis and Requirements Information

I. Purpose

This manpower analysis and requirements information will support the Office of the Secretary of Defense (OSD) review of system acquisitions. Manpower contributes the major part of weapon system operating and support (O&S) cost, and since the lifetime O&S cost usually exceeds acquisition cost, considerations of the full impact of manpower must be an integral part of the Defense System Acquisition Review Council (DSARC) Process.

II. Application and Scope

Manpower analysis includes personnel assets, spaces, policies, planning, training and utilization (including support policies and equipment, capital/labor trade-offs, technical data, job classifications, and organizations). The requested manpower analysis information should be submitted to OSD for each DSARC program milestone review in a separate Manpower Analysis Paper or in existing documents if appropriate. It should be submitted with the Mission Element Needs Statement or each Decision Coordinating Paper (DCP). Detailed backup information should be referenced and available for timely OSD review. Appropriate supporting data should be compiled and maintained to permit comparison with data based on operational experience. These comparisons can be used to refine the treatment of manpower during the acquisition process. Non-DSARC programs should use these requirements as a guide.

III. Content

The required information ranges from commitments at Milestone 0 to consider manpower-sensitive alternatives, to manpower requirements analyses at Milestones I and II, to a preliminary manning document and accompanying analysis at Milestone III. Manpower requirement determinations should consider options among number of personnel, skill (job proficiency) levels, and military occupational specialties.

Each DCP should summarize in a paragraph (with reference to details):

- o The estimated manning levels per unit (e.g., squadron, battalion or ship) and for the total program, to meet wartime and peacetime requirements.
- o Comparisons of manpower requirements with those of a baseline operational system where one exists.

- o Specific trade-offs to be considered among manpower, design and logistic elements.

The form, detail, and content of the information should be tailored to individual programs and should be appropriate to the milestone. Information for Milestones II and III should include:

- o A reference to the operational scenarios and a description of (or reference to) the methodology and assumptions used to estimate wartime and peacetime manpower requirements.
- o The program impact on mission area manpower requirements.
- o Identification of O&S functions to be performed by contractors and by DoD manpower. Address interim contractor support, contractor logistics support, and depot maintenance workload.
- o Plans for derivation or use of job task identification and analysis data during the subsequent acquisition phase. Address trade-offs among requirements for technical data, test equipment, training, and manpower (quantity, skills and specialties).
- o Manpower requirements that are system-driven (e.g., due to system design or system complexity) vis-a-vis those that are policy-driven (e.g., due to watch-standing or support policies).
- o Manpower requirements compared to projected manpower assets (such as high-skill technicians in relevant occupations) throughout system life.
- o A summary of manpower-relevant program actions completed and planned.

IV. Milestone Reviews

In addition to the above requirements, the information submitted at the respective milestone reviews should emphasize the following topics:

A. Milestone 0 - Program Initiation

- o Identify any broad manpower constraints on the mission need to stay within current weapon, mission area, or force level.
- o Include commitment to assess alternatives to reduce manpower requirements or increase productivity.

B. Milestone I - Demonstration and Validation

- o Provide visibility of the manpower requirements associated with each of the alternatives considered, along with rationale for options selected. Identify and discuss subsystems and policies that drive manpower requirements or represent risk. Discuss plan for resolution of risks.
- o Discuss the demonstrations planned for design and manpower-related support alternatives. Reliability, availability/activity level, maintainability, operational-readiness monitoring systems, built-in-test, testability, and module cost should be addressed as part of the system-driven factors.
- o Discuss alternate approaches which will be considered during the validation phase to significantly reduce manpower requirements or increase productivity. For example, consider:
 - changes in maintenance concept including number of levels and functions to be performed
 - increased productivity of personnel through information transfer approaches such as improved job oriented information and training, adaptive instruction, system-embedded maintenance and training, and use of operator and maintainer training simulators or devices.

C. Milestone II - Full-Scale Engineering Development

The DCP should specify manpower estimates and thresholds. In addition, manpower documentation should:

- o Provide rationale for estimates and thresholds.
- o Identify unique skills or specialties required.
- o Estimate manpower requirements by work center for all levels of below-depot maintenance and all operational units. Discuss planned demonstration requirements. Compare with baseline system.
- o Discuss test and evaluation plans for information transfer approaches.
- o Describe sensitivity of manpower requirements to system activity level and maintenance demand rates.

D. Milestone III - Production and Deployment

The DCP should reaffirm the manpower estimates and thresholds on the basis of test and evaluation results. In addition, a preliminary manning document should be provided that presents total manning and work center manning by specialty and skill level. The basis of manning, such as direct work, peak demand, watch-standing, and doctrine should be described.

Accompanying manpower documentation should summarize efforts thus far, support the manning document, and should:

- o Compare work center manning with a baseline system.
- o Estimate the peacetime manpower utilization in terms of direct productive manhours to total duty hours of authorized maintenance personnel.
- o Discuss plans for acquisition of personnel, including use of Reserves, to meet wartime and peacetime manpower requirements. Identify asset problems, particularly for specialties with shortages. Identify any skill or specialty categories not yet approved and programmed by Service personnel and training systems.
- o Discuss operational test plans and any results in terms of the expected system activity levels and operational availability during initial deployment. Project to maturity and combat employment based on mature manning levels. Quantify manpower sensitivity to activity levels (including surge) and maintenance demand rates.
- o Present plans for follow-on evaluation of manpower requirements.

APPENDIX C

WORKING NOTES ON MANPOWER PLANNING FOR NEW SYSTEMS

A. CASE STUDIES

Kennelly, Della M. Manpower Planning for the Navy VIKING (S-3A) Aircraft, WN ML801-3. Logistics Management Institute, July 1978.

Kennelly, Della M. Manpower Planning for the Army Tactical Fire Direction System (TACFIRE), WN ML801-5. Logistics Management Institute, September 1978.

Kennelly, Della M. Manpower Planning for the Army PATRIOT Air Defense Missile System, WN ML801-7. Logistics Management Institute, October 1978.

Nauta, Frans. Manpower Planning for the Guided Missile Frigate (FFG-7), WN ML801-2. Logistics Management Institute, August 1978.

Nauta, Frans. Manpower Planning for the Marine Corps Super Stallion (CH-53E) Heavy Lift Helicopter, WN ML801-8. Logistics Management Institute, December 1978.

White, Thomas A. Manpower Planning for the A-10 WN ML801-4. Logistics Management Institute, September 1978.

White, Thomas A. Manpower Planning for the F-16, WN ML801-6. Logistics Management Institute, November 1978.

B. DESCRIPTIONS OF PROCEDURES IN THE MILITARY SERVICES

Betaque, Norman E, Kennelly, Della M., and Nauta, Frans. Navy Manpower Planning for the New Weapon Systems, WN ML801-1. Logistics Management Institute, August 1978.

Betaque, Norman E. and Kennelly, Della M. Army Manpower Planning for New Weapon Systems, WN ML801-9. Logistics Management Institute (to be published).