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Report to Congressional Requesters

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DOD ACQUISITION

Strengthening Capabilities of Key Personnel in Systems Acquisition

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Comptroller General
of the United States

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The Honorable William V. Roth, Jr.
Chairman, Committee on Governmental Affairs
United States Senate

The Honorable William S. Cohen
Chairman, Subcommittee on Oversight of
Government Management,
Committee on Governmental Affairs
United States Senate

This report responds to your request that we examine the capability of the defense acquisition work force. The report addresses the capabilities of two key players--the program manager and contracting officer--in weapon system acquisition. The report discusses their roles and responsibilities, career preparation, tools to do the job, and operating environment.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of the report. At that time, we will send copies to interested parties and make copies available to others upon request.

Charles A. Bowsher
Comptroller General
of the United States

Executive Summary

Nearly 100 major weapon system programs are in various stages of development and production in the Department of Defense (DOD). The costs to acquire them may exceed $750 billion. Operating costs during their useful life will be considerably more. Most of these future costs are predetermined by basic design decisions made during early program phases.

This report discusses the capability of key individuals—program managers and contracting officers—involved in these early program phases. It addresses (1) their roles, (2) tools to carry out the roles, (3) external influences, and (4) career preparation.

The study was done at the request of the Chairmen of the Senate Committee on Governmental Affairs and its Subcommittee on Oversight of Government Management.

Background

In general each weapon system acquisition is managed by a program office, headed by a program manager. Various specialists, including a contracting officer, assist. Only contracting officers are legally authorized to commit the government to industry contracts.

The acquisition strategy laid out by the program office controls a new system's development and procurement process. Paramount is the creation of design alternatives and their exploration within an innovative and competitive industry environment. To guide strategy development, current DOD policy calls for sustained competitive design and development efforts with flexibility to formulate competitive strategies best suited to the particular program—that is, tailoring.

GAO's statement of desired conditions for satisfactory DOD acquisition capability came from current policy and multiple expert sources. These sources included expert advisors, agency management, and panels of top program managers and contracting officers. Seventeen case studies of new weapon system programs were the basis for analyzing current conditions. (See pp. 13 to 17.)

Results in Brief

The capability of program managers and contracting officers to contract with industry for new weapon systems is not what it should be because:

- Their roles in early program phases are not fully defined or well understood in practice.

- Acquisition strategy development lacks criteria to tailor the scope and extent of competition to individual programs.
- External factors affect many programs and create a poor climate for logical, planned program development.
- Career programs do not provide the intense and diverse experience, training, qualification criteria, and incentives needed to develop program managers and contracting officers.

Principal Findings

Roles and Responsibilities

The program manager's role is clear except in the military requirements area. Uncertain is whether the program manager has the latitude to ensure a flexibly stated requirement that encourages (1) a creative industry design process, (2) competition, and (3) reexamination of the requirement as costs and other information become available.

The program manager's role did not always conform to policy due to such reasons as late assignment to the program. Often, the program manager and the contracting officer did not operate as a team in planning competitive strategies for new weapon system programs.

The contracting officer is frequently not assigned early enough to be involved in acquisition strategy planning, nor is DOD policy clear on this role. In executing such plans, the contracting officer's role is clear in policy but diverges so widely in both practice and perception that it brings into question what the fundamental policy is or should be. (See pp. 19 to 23 and 26 to 35.)

Tools to Do the Job

In carrying out these roles, current DOD policy calls for tailoring competitive design and development to individual programs and suggests sustaining a minimum level of competition—up to the new system's full-scale development. Beginning in fiscal year 1987, competitive sources will be required in full-scale development and production, but can be waived by the Secretary of Defense. (See pp. 23 to 26.)

The optimum level of competition is a complex matter, varies from program to program, and is difficult to determine. Yet DOD has not identified

program characteristics sensitive to various levels of competition or criteria to apply them. Several prior studies have urged DOD to address this policy deficiency. (See pp. 38 to 40.)

About half of the 17 new programs reviewed fell short of the minimum level of competition suggested in current DOD policy. In the absence of guidelines on competition, it is difficult to say whether decisions to terminate competition were premature or, in other cases, whether competition should have been sustained beyond the minimum level. (See pp. 26 to 32.)

External Influences

Four types of influences external to the program office affected the programs reviewed. Insufficient up-front funding, which influenced about half of the programs, was a major limiting factor. The other three were preprogram decisions, mandates to use a particular design solution, and unstable program commitments. (See pp. 47 to 60.)

Career Preparation

A triservice panel of top program managers stressed the need for substantial program office and other diversified acquisition experience, as well as specialized training. Many program managers appointed in recent years lack these qualifications. (See pp. 68 to 74 and 76 to 79.)

Existing military service career programs have various limitations, and civilians are given few opportunities to be program managers. Military career paths for program managers do not identify the types of acquisition experience desired and in some cases, the officers' career paths do not permit enough time to obtain and utilize acquisition experience. (See pp. 81 to 102.)

Little emphasis is placed on providing contracting officers with specialized (program office or product) experience. And selection of contracting officers is not based on specific experience, educational, and/or training criteria. (See pp. 110 to 122.)

Recommendations

The report contains 21 recommendations, many addressed to the Secretary of Defense and others to the military services. These recommendations are aimed at (1) clarifying roles, responsibilities, and timing of assignments, (2) providing criteria and accountability for developing competitive strategies for new weapon system acquisitions, and (3)

strengthening career development and incentives for both military and civilian personnel.

The report also offers ways to minimize the effects of external influences on new programs.

Agency Comments

Comments on a draft of this report were received from DOD, the Office of Federal Procurement Policy, and the Office of Personnel Management. DOD concurred with many of the report's findings and recommendations and partially agreed with the others. The Office of Federal Procurement Policy generally agreed with the report and expressed an interest in applying some of the recommendations to civilian agencies. The Office of Personnel Management concurred with the basic thrust of the report but disagreed with one recommendation pertaining to professionalization of contracting officers.

Contents

Figures

Abbreviations

DOD	Department of Defense
DSMC	Defense Systems Management College
GAO	General Accounting Office
MAM	Materiel Acquisition Management
OMB	Office of Management and Budget
OPM	Office of Personnel Management
OSD	Office of the Secretary of Defense
PACE	Professional and Administrative Career Examination
WSAM	Weapon Systems Acquisition Management

Introduction

In recent years, an increasingly large amount of the defense budget has been devoted to major weapon systems. Nearly 100 such systems are in various stages of development and production. Their estimated cost exceeds $750 billion.

The Weapon System Concept

As military needs became more dependent on advanced technology, the military services instituted a process to create high-performance, integrated weapon systems. The process, which evolved over the past 30 years, is referred to as the weapon system concept or systems approach. Under this concept, a new weapon is conceived as a total system, and its subsystems are designed to the total system's requirements. To ensure that individual components are compatible and can perform well when they are combined into the total system, system level control over the entire design and development process became necessary.

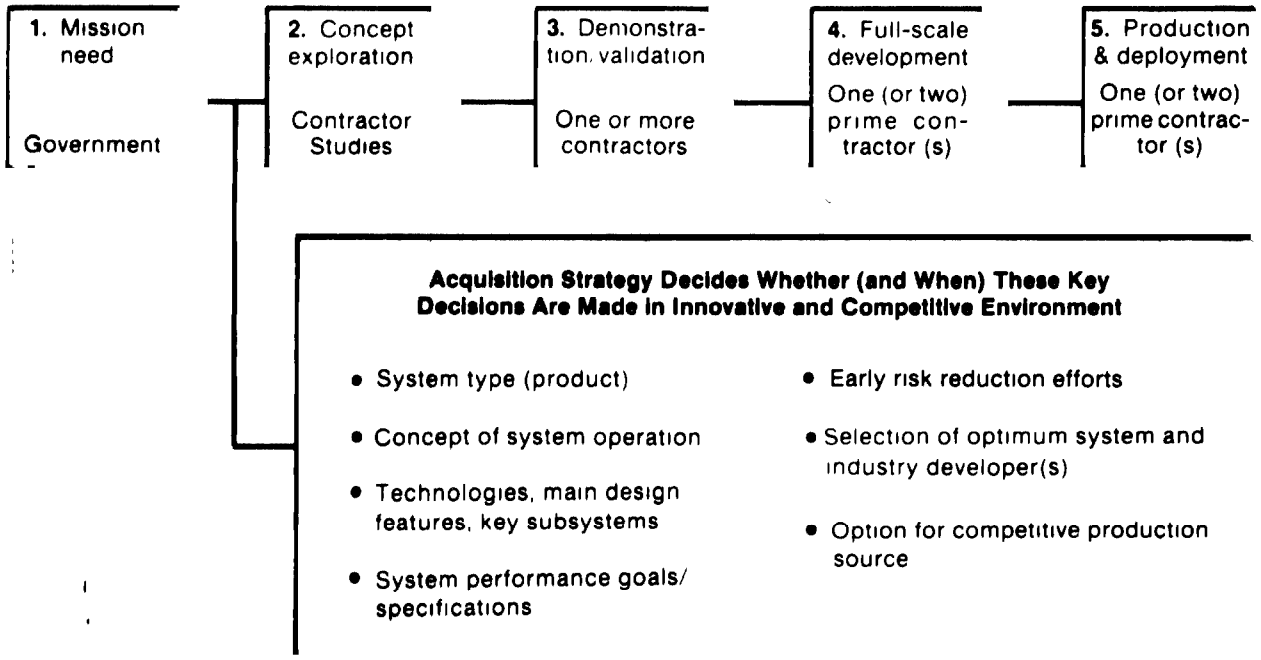
The need for system level control over the many diverse, complex design activities caused a fundamental change in the way weapons were developed and acquired. For each weapon, the military services began contracting with one firm (a prime contractor) for all system design and integration functions. With limited exceptions, the prime contractors direct subordinate contractors (subcontractors) which develop and produce particular subsystems and components.

Another major change accompanied the Department of Defense (DOD) move to the systems approach. Development and production, formerly managed by separate military entities, were joined into a single program office. This change was made to smooth transition from engineering to production and to consider such issues as operational support and maintenance during early design phases. Now military management of the entire acquisition process is vested in the program (or project) office, headed by a program (or project) manager. Each military service has organized its acquisition activities into system command organizations to support and oversee these program offices.

The program manager is assisted by specialists in such areas as engineering, contracting, logistics, and testing. Before a program office can do business with private industry, the contracting officer must become involved. Only contracting officers have the authority to formally commit the government and execute contracts with industrial firms. They have a special mandate to comply with government policy and ensure fairness in government business dealings.

Major system acquisition programs usually begin with the validation of a need. Once the need is accepted, management must examine alternative ways to satisfy it. Typical examples are (1) develop a totally new system, (2) upgrade an existing system, and (3) use an existing off-the-shelf system. If the decision is to design a new or modified system, a body of directives[1] is available to help guide the complicated weapon system acquisition process. The various program phases and the early key decisions are shown in figure 1.1.

Figure 1.1: Program Phases and Key Decisions



Source DOD Directive 5000 1

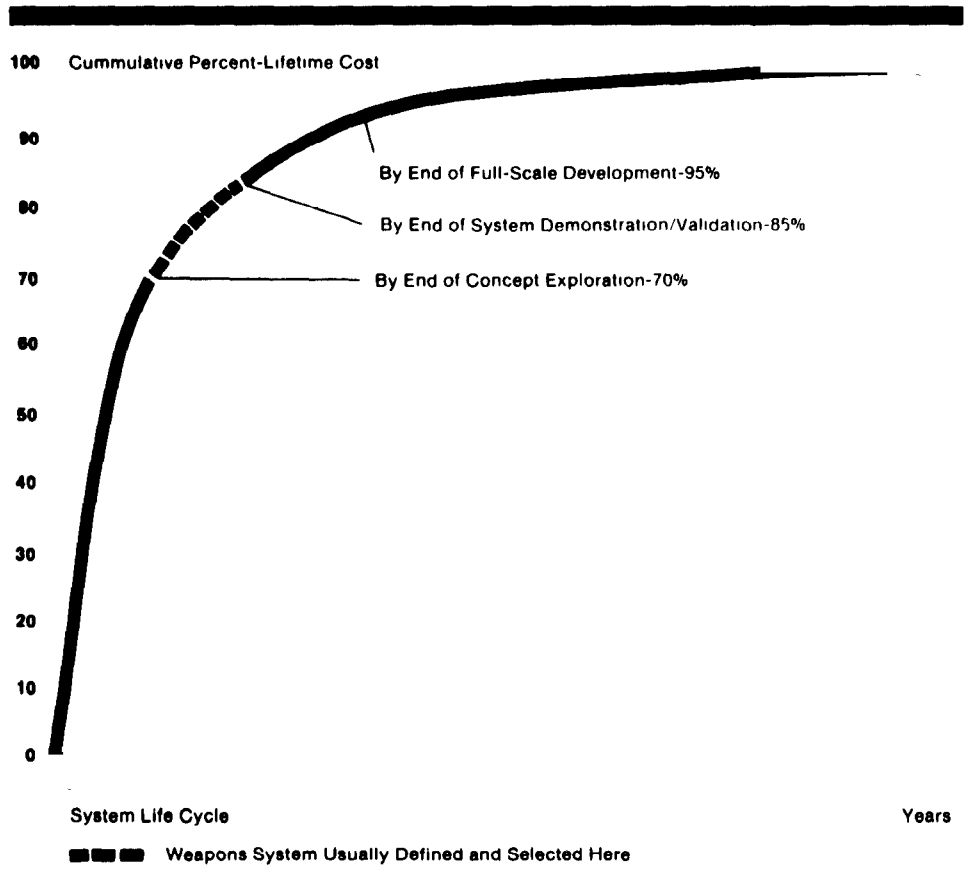
Outcome Predetermined by Early Key Decisions

With any new system, the program office usually begins with a small core group. Prior to system development, program office action is focused on formulating and executing an acquisition strategy. A major part of this strategy is the structuring of an extended industry competition during which various design concepts are created, explored, and evaluated.

[1]Most notably DOD Directive 5000 1 and Office of Management and Budget (OMB) Circular A-109.

Eventually, a new weapon system design concept and its developer/producer are selected. The basic design and the developer usually endure for the program's life span. At this point, long before full-scale development and long before costs can be accurately predicted, much of the system's lifetime cost and operational performance are essentially locked in, although only a very small fraction of program costs have yet been incurred. (See fig. 1.2.) In other words, the nature of the system itself—the type of product and its main design features, technologies, and key subsystems—is predominant in the system's ultimate cost.

Figure 1.2: Early Decisions Commit Most Future Program Costs



Source Proceedings from National Security Industrial Association Symposium on Navy Systems Acquisition, October 27-28, 1977

This study focuses, therefore, on the early acquisition phase and the people who influence the decisions and shape the competitive contracting strategies for choosing new system designs. In addition to the importance of these early system or product competitions, this early

stage uses all of the critical events in government contracting and presents a significant challenge to the capability of key DOD personnel.

Objective, Scope, and Methodology

Our review objective was to determine the capability of DOD program managers and contracting officers to plan and carry out competitive acquisition strategies for the early design phases of new weapon systems. We looked at performance in a particular area because capability depends on the opportunity to execute and cannot be assessed in isolation from the acquisition process. We evaluated (1) competitive contracting strategies established for 17 new programs, (2) the roles and responsibilities of program managers and contracting officers in these strategies, (3) external influences on achieving strategy objectives, and (4) career preparation (programs, selection, tenure, and incentives). We compared desired conditions for each of these four issues with existing ones. Where major gaps were found, we analyzed them and explored ways to bring conditions up to the desired level.

This work was undertaken at the request of the Chairmen of the Senate Governmental Affairs Committee and its Subcommittee on Oversight of Government Management. The Committees initially made a broad request for study of the procurement work force due to the rapidly increasing federal expenditures in that area. Agreement was reached to focus the study on weapon system acquisition because that environment involves the greatest expenditures and places the greatest demands on work force capability.

We made our review during 1984 and 1985 in accordance with generally accepted government auditing standards. The methods we used to gather information for determining desired and current conditions are shown in table 1.1 for each of the issues evaluated.

Table 1.1: Methods Used to Define Desired and Current Conditions

Methods	Strategy formulation/ execution	Roles and responsibilities	External influences	Career preparation
Desired conditions:				
Current policy	X	X	X	X
Expert panels		X	X	X
Management views		X	X	X
Industry views/ practices	X	X	X	X
Prior studies	X	X	X	X
Expert advisors	X	X	X	X
Current conditions:				
Case studies	X	X	X	X
Career program reviews				X
Prior studies	X	X	X	X
Industry views	X	X	X	X

How Desired Conditions Were Determined

For desired conditions, we used basic congressional and DOD policies where they were relevant to the issue being examined. If existing policies were incomplete or nonexistent, we developed the desired condition using multiple expert sources. If through the cross-validation process the experts' views eventually converged, this view became the desired condition. The sources and methods of inquiry used are described below.

Expert Panels

At each of seven system acquisition activities visited,[2] we worked with an expert panel composed of five program managers and five contracting officers selected by management as the most capable performers. Panel participants were given questionnaires and were interviewed on subjects ranging from roles and responsibilities to what career programs are needed to prepare them for these roles. The participants received a written summary of the responses obtained at their locations. Panel meetings, chaired by us, were then held to

- review the summaries;
- trade information in group discussions and permit changes to initial views;
- encourage the participants to air their views on the issues and possible solutions;

[2]Army Aviation and Missile System Commands, Army Armament Research and Development Center, Naval Air and Sea System Commands, and Air Force Aeronautical Systems and Space Division.

- discuss the major implications of panel conclusions;
- allow the participants to suggest areas that should be investigated further; and
- summarize the predominant view, if one emerged, and any significant alternatives.

After completing the seven panel meetings, we assembled a composite panel of representatives from each panel. Before convening, participants received a summary of the views expressed at all locations. Our purpose was to explore a possible triservice consensus on the issues. Equally important, we presented possible ways of dealing with the issues to test potential recommendations.

Management Views

Top management represented another expert source of desired conditions. To obtain the views of top management, we used questionnaires and follow-up interviews at each of the seven locations visited. In addition, we obtained the views of each service's system command headquarters and of policy level executives in the Office of the Secretary of Defense (OSD) and the service secretaries. We sought views on significant issues raised during our review and on proposed solutions.

Industry Views and Practices

For more information on desired conditions, we compared private sector acquisition practices and work force characteristics with their federal sector counterparts. We asked private firms for their views on government practices as well.

We surveyed officials of 28 aerospace, electronics, and shipbuilding firms. These officials were working on new major programs as industry negotiators, program managers, and subsystem contract managers. A total of 150 officials at 22 firms completed questionnaires. (See app. I for additional information on the approach used and the participating firms.)

Prior Acquisition Studies

The weapon system acquisition process has been the subject of many studies and DOD management initiatives over the past 20 years or so. These studies provided important background for our review and helped us develop desired conditions and recommendations for improvement. (App. II lists the major studies used.)

Expert Advisors

On a voluntary basis, a number of defense acquisition experts provided information and cross-validation on desired conditions and options for improvement. Their names, together with their relevant experience and qualifications, are in appendix III.

How Actual Conditions Were Determined

The prior studies and industry surveys referred to above helped shed light on current conditions and how they evolved. Our principal methods of determining actual conditions, however, were case studies of 17 new weapon system programs and reviews of service career programs.

Case Studies

We did case studies of 17 emerging weapon system acquisition programs at 7 acquisition activities in the 3 military departments. These activities represented, for the most part, the larger ones. The case studies were structured to elicit detailed information on the current roles of program managers and contracting officers in formulating and executing competitive program strategies. They also helped us identify the external influences on both roles and performance.

The programs were chosen, in consultation with the services, based on their (1) relative newness, (2) good likelihood of continuing through design, development, and production (not all did), and (3) anticipated production quantity. Our rationale for choosing new programs follows.

- We wanted to focus on roles and responsibilities in the early, very high leverage business decisions that lay an acquisition program's foundation.
- Major acquisitions occur over a 10- to 15-year period and involve many complex variables. This often obscures cause and effect relationships, because the long-term effects of picking one alternative over another are confounded by the effects of subsequent actions and choices.
- Each weapon system is in some sense unique, and the acquisition environment is dynamic. Relatively new programs are the only ones in which acquisition decisions will reflect the current characteristics of the acquisition climate and work force.
- Decisionmakers and the rationale for their decisions on new programs are generally available to us; in contrast, history may be dim or incomplete on older, established programs.

Separate documents were prepared as supplements to this report which outline the results of each of our case studies. The supplements are listed in appendix VIII and are available upon request. Instructions for

requesting copies of the supplements are on the inside back cover of this report.

Career Program Reviews

For each military service, we gathered information on current and planned career development programs for program managers and contracting officers. The features of these career programs were compared with both DOD policy and typical military career programs to assess their strengths and weaknesses. At the seven system activities visited, we collected data on the characteristics of program managers and contracting officers assigned to our case study programs. We also took a larger sample covering program managers and contracting officers appointed during 1982-84.

Roles and Performance of the Program Manager and Contracting Officer

The program manager's and contracting officer's responsibilities in new weapon system programs need to be clear to ensure that

- key events in these programs are not decided by default or carried out by whomever is available regardless of their experience, training, or motivation;
- people are properly developed, in the quantity and quality needed, to perform the key events; and
- people know what is expected of them and can be held reasonably accountable for results.

However, responsibilities are not fully defined or well understood in practice. In policy, some roles are unclear; in practice, they differ from desired ones and vary over a wide range.

To guide the two key players in carrying out their roles, DOD policy calls for tailoring the competitive phases of new systems to characteristics of the individual program. However, such characteristics have not been identified, and no analytical tool or aid exists to help tailor the program. Consequently, program managers and contracting officers lack the tools to do their job, and it is difficult to assess

- what level of design competition should be used for new weapon systems and
- what training is needed to carry out this function.

In about half of the programs we studied, the level of competition used fell short of a desired DOD minimum. In the absence of criteria, the optimum level of competition for these programs is unknown.

Without clear roles and basic tools to do the job, the extremely complex strategies for new programs are more vulnerable to outside influences than they ideally should be. Such influences adversely affected many of the programs reviewed. They are briefly identified in this chapter and discussed more fully in chapter 3.

Historical Concerns

As the major systems concept evolved over the past 30 years, DOD has been faced with a continuing controversy over the specific roles of the program manager and contracting officer and their relationship to each other and other DOD units. Some attempts have been made to clarify the program manager's role and authority, such as by charters defining responsibilities and reporting channels. The contracting officer's role

has been endlessly debated in research papers and studies, and alternate roles have been tried—without clear resolution.

The outcomes of competitive strategies have also drawn considerable attention in the past. For example, there has been concern over DOD's practice of inducing premature product performance expectations and pricing commitments from firms wanting to win new programs. Such competitions can result in limited industry rivalries for new programs followed by sole-source development and production contracts. Emphasis on extending these rivalries further into competitive demonstration has varied with DOD administrations. Concerns about the degree and quality of competition are evidenced by (1) a 1982 presidential executive order on procurement reform, (2) a 1984 Office of Federal Procurement Policy letter implementing a presidential memorandum on competition, (3) various congressional initiatives, such as the 1984 Competition in Contracting Act, and (4) the creation of agency competition advocates.

The most recent evidence of congressional concern was in late 1985, when a new section was added to the Armed Services Procurement Act. The act requires competitive sources for major defense acquisition programs in full-scale development and production while allowing the Secretary of Defense to waive this requirement for programs meeting specified criteria. Further, for each new program entering full-scale development, DOD must submit a report on its acquisition strategy to the armed services committees describing the extent of competition planned for the new system and major subsystems during both full-scale development and production. These committees are also to be notified of DOD revisions to the acquisition strategy 60 days beforehand. These provisions become effective in fiscal year 1987.

Desired Roles Are Not Fully Defined or Understood

DOD policy, as well as management and expert views, agree that the program manager heads both the planning and execution of a new weapon's acquisition strategy. DOD policy broadly defines the contracting officer's role in strategy planning and spells out a clear role in its execution. On the other hand, expert panels established during our study were not able to confirm this role or reach a consensus on what the contracting officer's role should be. During early program phases, both the program manager's and the contracting officer's roles in the military requirements area were unclear.

Strategy Formulation Roles

By regulation and policy, program managers have the key leadership role in acquisition strategy formulation. DOD regulations state that the contracting officer shall support the program manager by preparing and maintaining the acquisition plan.[1] In fact, one of their first steps is to design an acquisition strategy—the blueprint for the new program. The acquisition strategy covers a range of important issues over a program's life, such as objectives, resources, milestones to complete the program, system alternatives, test and evaluation, and operation and maintenance issues. A key part of the strategy is the planning of an industry design competition for the new system and a second production source, if one is appropriate. By DOD policy, the acquisition strategy must be submitted when the first program go-ahead decision is made.

Expert panels and military service management confirmed the program manager's leadership role in strategy formulation. Expert views on the contracting officer's role varied from an almost nonexistent one to actually putting together the competitive strategy for the program manager.

Strategy Execution Roles

Carrying out the strategy in the early program phases entails a process of allowing industry to explore alternative design concepts and narrowing these concepts down to the most promising one(s). Initially, the program office must oversee preparation of a request for proposal to start the industry design phase and development of an overall plan for selecting the system's source. The proposal request includes the statement of work, military need and specifications, business terms and conditions, and criteria for selecting the industrial team with the winning system design concept.

Basic DOD policy and regulation do not address the program manager's and contracting officer's roles in the military need or requirements area. This role has two aspects. The first is to review how the need or requirement is described. That is, is it expressed in functional or mission capability terms or in hardware solution terms? If in hardware terms, it can prematurely commit the design solution and limit industry's design freedom. The second aspect of the role is to interact on a continuing basis with the operational user to refine requirements and trade them off against cost and schedule. A recent study by the Defense Science

[1]Federal Acquisition Regulation 34 004, DOD FAR Supp 7 103(f) (DAC 84-10, 1/10/86) and DOD Directive 4105 62 on selecting sources for major defense systems

Board confirmed the need for this close interaction and stated that programs which lacked it invariably got into trouble.[2]

As to other acquisition strategy actions, various functional groups working under a matrix arrangement—engineering, logistics, contracting, and so forth—contribute to program office efforts by preparing specifications, work statements, requests for proposals, and other documents. These groups work with and support program offices but have considerable authority on their own. Charters issued by some services to program managers try to clarify relationships between the program offices and the functional groups. However, some early critical events can transpire before a single, accountable program manager is appointed and a charter issued.

The contracting officer's role in carrying out the contracting strategy is quite visible in regulations dealing with major systems. For example, contracting officers are specifically responsible for:

- Notifying industry of the proposed system acquisition.
- Holding an industry conference and sending firms an advance copy of the request for proposal for their comment.
- Including in the proposal request source selection criteria consistent with the acquisition strategy.
- Sending the final request for proposal to all prospective proposers. The request is to (1) describe the mission capability needed—not a specific system, (2) state that each offeror is free to propose its own technical approach, main design features, subsystems, and so forth, and (3) exclude references to and mandating of government specifications unless a particular subsystem or component is earmarked under approved procedures.

Regulations are also clear that only the contracting officer can negotiate a contract with industry and bind the government contractually. A September 1985 update of DOD Directive on Selection of Contractual Sources for Major Defense Systems (4105.62) reaffirms the roles discussed above.

Working Relationships Historically Vary

For the execution phase, various working relationships have been formed over the years between the program manager and the contracting officer.

[2]Practical Functional Performance Requirements, Defense Science Board, fall 1985 briefing slides

- The contracting officer works in the program manager's office but reports to a central contracting department.
- The contracting officer works in the contracting department but is dedicated part time or full time to the program manager.
- The contracting officer reports directly to the program manager.

Expert Panel Reached Agreement on Working Relationship but Not on Specific Contracting Roles

Various Army, Navy, and Air Force panels of top program managers and contracting officers had differing views about desired roles. Army and Navy program managers believed they should review the military need statement for background but did not stress screening it for unnecessary restrictions on industry design freedom. Program managers thought they should be primarily responsible for planning the design competition and exploring design alternatives.

As the Army and Navy panels discussed events further into the execution phase, the program manager's role remained primary; however, the contracting officer's role began to emerge but varied. In planning the design and production competition, for example, the contracting officer's role ranged from advisory to joint to primary. That role also varied during the request for proposal phase, although regulations are clear that the contracting officer should coordinate this action. Army and Navy contracting officers generally believed they should have a primary role in developing business terms and conditions and an advisory role in other areas. The general view was that the contracting officer should check and balance the program office until the program reaches the industry cost proposal evaluation and contract negotiation stages. At that point, Army and Navy panelists believed the contracting officer should take the primary role.

In contrast, the two Air Force panels thought the contracting officer should be the action person on all these events under the program manager's overall direction. This role included major assistance in formulating the competitive strategy. The Air Force panels stressed a team approach in which contracting officers attend the earliest program office planning sessions, learn about the program goals, and help achieve them. For contracting officers to properly challenge strategies or offer alternatives, an intimate program background was considered necessary. The basic idea was to steer actions right from the start rather than attempt to correct them (break up the "game plan") afterwards.

To preserve the check-and-balance role, separate Air Force reporting channels exist to maintain the contracting officer's independence. This

is accomplished through a matrix arrangement in which contracting officers are colocated in program offices but remain members of and are evaluated by the contracting organization.

The triservice panel agreed that the Air Force team working relationship was desirable. While the consensus was that the program manager should be in charge, panelists could not agree on whether the person directly responsible for getting the contracting events done should be the contracting officer, the program office business manager, or someone else. Some panelists said the contracting officer's role might vary depending on work load or might be shared with others.

As for top management's view, the Army, Navy, and Air Force system command headquarters held that the contracting officer should be assigned an important role in the early phase.

- Air Force: The contracting officer should be assigned as early as possible to (1) assist the program manager in developing business strategy[3] and (2) lead preparation of the request for proposal and source selection plan.
- Army: The contracting officer should be assigned early in the process and be organizationally separated from the program office to retain independence.
- Navy: The contracting officer should be the principal contracting advisor to the program office and should plan, develop, and establish the contractual strategy for the overall program.

Guidance on Performance of Roles Is Vague

In developing and executing acquisition strategies, program managers and contracting officers must follow certain guidelines. To ensure that new systems are cost effective and respond to mission needs, DOD policy requires that new defense systems be competed to the maximum extent practicable. This principle is reinforced by a governmentwide policy requiring that new major systems be defined in an innovative and competitive environment.[4] The purpose is to promote and force to the surface multiple design approaches and to progressively narrow them to the optimum system for the defense need.

[3]The terms "business, contractual, procurement, or acquisition strategy" are sometimes used interchangeably in DOD to mean how the government is going to posture itself with industry in such areas as a new weapon program's competition, type of contract, incentives, and warranties.

[4]The Armed Services Procurement Act, Executive Order 12352, and OMB Circular A-109 reinforce DOD Directives 5000.1 and 4245.9. In addition, the 1984 appropriation act added a "sense of the Congress" to expand and increase competition in national defense expenditures

Competition in the production phase must also be considered. In the case of major systems, the groundwork for a second source usually must be laid years ahead of time through technical transfers or codevelopment arrangements. The Congress, believing that DOD's early planning in this area was deficient, established new requirements in the 1984 appropriations act. The legislation bars the military services from committing funds for full-scale development until they either file a plan with the Congress to engage two or more production sources (system or subsystems) or certify that the anticipated system quantities are too small to justify two production lines.[5] Current DOD thinking is to establish a competitive option for the production phase before selecting the system design and its developer. Otherwise:

- Industry may invest in a new program in anticipation of the full production quantity only to find later that a second source will be introduced.
- DOD may lose the leverage to negotiate a transfer of technology and technical assistance to a second firm.
- The passage of time and events may make it difficult, if not impossible, for a second firm to catch up and effectively compete.

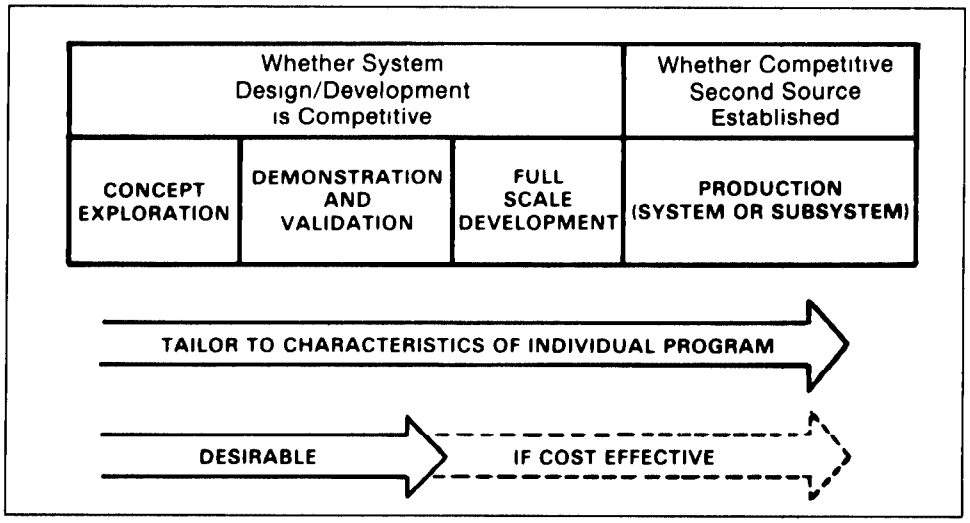
Policy Guidance Leaves Unanswered Questions

As to carrying out the program manager's and contracting officer's roles of planning the competitive design phase, DOD's current policy is to tailor competition to the characteristics of individual programs. DOD goes on to say in another part of its guidance that design competition should be sustained through the first two program phases or beyond, if it is determined to be a "cost-effective acquisition strategy."[6] Beyond that, the guidance does not identify any criteria or program characteristics that should be considered in tailoring programs. Figure 2.1 summarizes DOD's dual policy guidance for system design and development and production.

[5]Senate Appropriations Report No. 98-292, p. 12. The House Armed Services Special Procurement Panel also drew attention to this issue earlier in a 1982 report. This requirement was also in the 1985 and 1986 appropriations acts. Beginning in fiscal year 1987, competitive sources will be required in production as a result of 1985 amendments to the Armed Services Procurement Act.

[6]DOD Directive 5000.1, p. 5.

Figure 2.1: DOD's Dual Policy Guidance on Competition



In applying these policies, or evaluating whether required competition should be waived, program managers and contracting officers are confronted by the following questions:

1. How far should the industry competition be sustained into the design and development process?

2. How many companies should be involved at each stage?

3. When is it appropriate to have a competitive second source in the production phase?

Prior studies have suggested a need for additional guidance. The Defense Science Board recommended in 1978 that DOD develop a series of strategies and criteria for tailoring strategies to types of systems and program characteristics. In a 1979 report, the Rand Corporation said:

"A general prescription in favor of competition is not enough. What is needed is guidance that will help the services to decide when, under what circumstances, for what kinds of systems and contractors, and how far into development hardware competition appears desirable "[7]

In 1984 the Defense Systems Management College published a handbook to help program managers decide when and how to establish a second

[7] Acquisition Policy Effectiveness Department of Defense Experience in the 1970s, Rand Corporation, R-2516-DR&E (Santa Monica, Calif 1979)

source for system and subsystem production.[8] It describes the various techniques for second sourcing and provides a model to screen program characteristics for deciding if a second production source is desirable and, if so, which of several techniques may be most suitable to the particular program. The handbook does not deal with a system's design and development phases.

Actual Performance Diverges From Desired Roles and Policies

As shown in table 2.1, the program manager and contracting officer fulfilled the planning roles which the triservice panel and management defined as optimum in 7 instances, or about 40 percent of the 17 case studies. During execution of these strategies, they did so in only one case study. (See table 2.6.) In some instances, they performed their roles alone rather than as a team.

Table 2.1: Summary of Current Conditions

	Number of case studies
Desired strategy formulation role performed by	
Both key players as team	7
Program manager	5
Contracting officer	2
Neither performed role	3
Total	**17**
Competitive strategies accepted by top management	10
Competitive strategies which met DOD minimum criteria	8
Competitive strategies affected by external influences	15

Almost two-thirds of the recommended strategies were accepted by top management. Eight, or about half, of the programs met the minimum DOD criteria[9] of sustaining competitive design efforts up to full-scale development. Of these eight programs, four had competition planned into the third phase also, and two of these extended competition into the fourth, or production phase. However, these two programs have been terminated. We should also note that some of the programs that met minimum DOD criteria are too early in implementation to be sure how far competition will actually extend into system development. Additionally,

[8] Establishing Competitive Production Sources. A Handbook for Program Managers, Defense Systems Management College (Fort Belvoir, Va.· 1984)

[9] Policy currently in effect In fiscal year 1987, competition will be required in full-scale development and production

the Air Force Systems Command has a policy of maintaining system competition up to critical design review, an advanced stage in full-scale development. Only one of the seven Air Force programs met this criterion.

Further details on the case studies can be found in tables 2.2 to 2.5 and in our separate case study reports.

Table 2.2: Results of Design and Development Phase—Army

Case study program	Performed strategy formulation role		Initial strategy accepted by top management	Level of competition	Strategy satisfied minimum DOD criteria	System selected yet	Strategy affected by external influences	External influences/ issues
	PM	CO						
Aviation Systems Command:								
Light helicopter								
Airframe	Yes	No	No[a]	Critical design review	Yes	No	Yes	Program underfunded at front end Planned airframe competition may be cut back from initial production (flyoff) to critical design review Funding issue may also defer risk reduction efforts
Engine	U	No	No[a]	Preliminary flight rating	Yes	No	Too soon to say	
Missile Command:								
Tactical missile	No	Yes	Yes[a]	Completion of concept exploration	b	No	Yes	This joint program dissolved in favor of individual service (Army/ Air Force) programs During joint phase, legislation directed one of two airframes used in pre-program technology demonstration Draft military requirements directed a warhead weight adequate for only one of the two airframes Emphasis on pre-program technology demonstration reportedly kept two contractors from proposing their most cost effective concepts Congress lifted these restrictions and directed competitive development

Case study program	Performed strategy formulation role: PM	Performed strategy formulation role: CO	Initial strategy accepted by top management	Level of competition	Strategy satisfied minimum DOD criteria	System selected yet	Strategy affected by external influences	External influences/ issues
Armament Research and Development Center:								
Guided antiarmor projectile	No	Yes	N/A	Total program	Yes	Terminated	Yes	Strategy initially recommended was competitive through production phase, but due to requirements problems, the Army terminated the program.
Sense and destroy armor	No	No	No[a]	Total program	Yes	Terminated	Yes	Limited up-front funding led to a single contract award; unsolicited industry proposal instilled hardware competition into program. New policy and competition advocate improved strategy during execution phase. Due to funding and requirements problems, however, the Army terminated the program. Need for the system was not resolved until program had been underway for several years.

[a]Service management only; program had not yet been reviewed by OSD

[b]If DOD approves skipping of second program phase, this program will have satisfied criteria

Note: PM=program manager
CO=contracting officer
U=unclear role

Table 2.3: Results of Design and Development Phase—Navy

Case study program	Performed strategy formulation role		Initial strategy accepted by top management	Level of competition	Strategy satisfied minimum DOD criteria	System selected yet	Strategy affected by external influences	External influences/ issues
	PM	CO						
Naval Air Systems Command:								
CV inner zone helicopter	Yes	No	No	Completion of concept exploration	Yes[a]	Yes	Yes	Naval operational requirement called for one design solution, but OSD directed a competitive acquisition After completion was underway, Congress directed sole-source solution. While that design solution was ultimately selected, according to OSD, program costs were reduced $1 4 billion
Jet trainer	Yes	No	Yes	Completion of concept exploration	No	Yes	Yes	Low-priority funding cut back planned competition from hardware development to concept exploration
V-22 OSPREY (JVX)	No	No	Yes	None	No	Yes	Yes	OSD and Navy operational requirement favored a particular technology. When the only two technology leaders teamed, this negated any design competition strategy The production competition strategy was limited when Navy entered into contract without challenging industry teaming agreement to defer production competition until 5 years after first delivery The Navy now hopes to introduce competition earlier

Case study program	Performed strategy formulation role		Initial strategy accepted by top management	Level of competition	Strategy satisfied minimum DOD criteria	System selected yet	Strategy affected by external influences	External influences/ issues
	PM	CO						
Naval Sea Systems Command:								
Antisubmarine standoff weapon	Yes	Yes	Yes	Completion of concept exploration	No	Yes	Yes	Acquisition strategy received high marks from industry However, agency commitment to program was unstable and up-front funding was low System was defined and selected before validation of design concept
Destroyer DDG-51	Yes	Yes	No	Completion of contract design	Yes	Yes	No	Top management chose to place greater risk on industry by using fixed-price incentive contract for lead ship construction rather than cost-type contract
Minesweeper hunter	Yes	No	No	Completion of contract design	Yes	Yes	No	Top Navy management overturned acquisition strategy to open up the design process to the latest commercial technologies

[a]This level of competition is considered to have met DOD minimum criteria because an existing system is being modified

Table 2.4: Results of Design and Development Phase—Air Force

Case study program	Performed strategy formulation role		Initial strategy accepted by top management	Level of competition	Strategy satisfied minimum DOD criteria	System selected yet	Strategy affected by external influences	External influences/ issues
	PM	CO						
Aeronautical Systems Division:								
Advanced air-to-surface missile (SRAM II)	Yes	Yes	Yes[a]	Completion of concept exploration	No	No	Yes	Air Force acquisition community debated extensively on how far to carry this competition into development After deciding on a moderate level, the Air Force later removed the funding necessary for the competition in response to across-the-board funding cut
Advanced tactical fighter	No	No	Yes[a]	Subsystem validation	Yes	No	Yes	Funding has been an issue, but it is too soon to say the extent competitive strategy will be affected A competitive demonstration (flyoff) was not planned for funding reasons, although option remains open
Advanced fighter engine	Yes	No	Yes[a]	Critical design review	Yes	No	Yes	Same as above
Ballistic Missile Office:								
Small ICBM	Yes	Yes	No	Subsystem validation	No	No	Yes	Congress legislated design weight restrictions on missile, limiting industry design freedom to make trade-offs in other areas. Competition is still underway and could be affected by funding problems

Case study program	Performed strategy formulation role		Initial strategy accepted by top management	Level of competition	Strategy satisfied minimum DOD criteria	System selected yet	Strategy affected by external influences	External influences/ issues
	PM	CO						
Space Division:								
Advanced warning system	Yes	Yes	Yes	Completion of concept exploration	No	Terminated	Yes	Planned strategy was constrained by (1) failure to pursue technological option and (2) limited front-end funding Program was subsequently terminated
Military strategic tactical relay (MILSTAR)	Yes	Yes	Yes	Partial validation	No	Yes	Yes	The two technology leaders for a critical subsystem teamed, thereby forestalling competition for that part of system Air Force says teaming was unnecessary
Space-based space surveillance	Yes	Yes	Yes	Completion of concept exploration	No	Terminated	Yes	Critical technologies were not validated Low front-end funding would have curtailed competitive phase if program had not been terminated

[a]Service management only, program not yet reviewed by OSD

As can be seen in the tables, many of the strategies were affected by one or more external influences. For example, several strategies were tailored to the funding available or were modified due to across-the-board funding cuts. Other influences were (1) directions received by the program office on design solutions, (2) unstable agency commitments or requirements, and (3) teaming of the only two technology leaders. These external influences and their effect on the program manager's and contracting officer's authority and accountability are discussed in chapter 3.

Strategy Formulation Roles Vary

Contrary to DOD guidance, program managers sometimes did not take the lead role in formulating acquisition strategies. The other roles they performed ranged from a management team member to no participation. In addition, contracting officers often did not play a substantive role in formulating strategies. Sometimes the absence of a significant role was because either the program manager or the contracting officer or both were not on the scene when pivotal actions were initiated or because other actions had constrained their roles. The variations in strategy formulation roles and the reasons why are shown in table 2.5.

Table 2.5: Actual Strategy Formulation Roles

Case study program	Strategy formulation: Program manager	Strategy formulation: Contracting officer	Explanation of variations from desired role
Army:			
Light helicopter			
Airframe	L	N	Program manager not assigned when program got started, but was on board in time to be actively involved in strategy formulation Contracting officer was not involved in airframe or engine strategy
Engine	U	N	
Tactical missile	N	M	Initial strategy evolved from management committee, program manager not yet assigned
Guided antiarmor mortar projectile	N	M	Program manager designated after strategy formulation
Sense and destroy armor	N	N	Neither program manager nor contracting officer assigned when original course of program set, major changes made to strategy during program
Navy:			
CV inner zone helicopter	L	N	Contracting officer not assigned at strategy formulation time
Jet trainer	L	N	Contracting officer not assigned at strategy formulation time
V-22 OSPREY (JVX)	N	N	Latitude limited by teaming agreements (See table 2.3)
Antisubmarine standoff weapon	L	M	
Destroyer DDG-51	L	M	
Minesweeper hunter	L	N	Contracting officer not on board when strategy initially formulated

Case study program	Strategy formulation: Program manager	Strategy formulation: Contracting officer	Explanation of variations from desired role
Air Force:			
Advanced air-to-surface missile	L	M	
Advanced tactical fighter	M	N	No contracting officer assigned when the strategy was initially formulated. An acting program manager was involved as member of a management team.
Advanced fighter engine	L	N	Contracting officer did not have active role until after strategy was formulated.
Small ICBM	L	M	
Advanced warning system	L	M	
MILSTAR	L	M	
Space-based space surveillance	L	M	

L = Lead role (defined as working with staff and others creatively to develop one or more alternative strategies for presentation to top management)
M = Member of management team or advisor
N = No significant role
U = Unclear role

Strategy Execution Roles Depart From Policy/Expert Views

The actual execution roles fluctuated by program and varied from DOD policy and expert views, as shown in table 2.6. The greatest variation was in reviewing military statements of need or requirements to see if they allowed design freedom and trade-offs between performance and cost. Program managers usually did not perform the role but instead reviewed the statements for background only. Contracting officers perceived little or no role at all in this event.

In developing source selection plans, program managers took the lead role in about half of the cases. Contracting officers participated in most cases.

Although regulations give the contracting officers the lead coordinating role in the request for proposal, in most cases they participated to a lesser degree. The request for proposal has several key features—the work statement, specifications, source selection criteria, and business terms—but about half of the contracting officers were concerned only with the last one.

As noted earlier, the triservice panel held that the program manager should have the lead role for all events and that the contracting officer or comparable official should be an action-oriented full team member from program inception.

Table 2.6: Actual Strategy Execution Roles

	Reviewing if need flexibl / stated and permits innovat on		Developing source selection plan		Developing request for industry proposals	
Case study program	Program manager	Contracting officer	Program manager	Contracting officer	Program manager	Contracting officer
Army:						
Light helicopter						
Airframe	N	N	-	-	-	-
Engine	N	N	M	M	M	M
Tactica missile	M	N	L	M	L	M
Guided antiarmor mortar project ile	N	N	M	N	M	M
Sense and destroy armor	U	N	U	N	U	L
Navy:						
CV inner zone helicopter	N	N	M	M	M	L
V-22 OSPREY (JVX)	N	N	N	M	M	L
Jet trainer	N	N	M	M	N	M
Antisubmarine standoff weapon	L	M	L	M	L	M
Destroyer DDG-51	N	M	L	M	L	M
Minesweeper hunter	N	N	L	M	M	M
Air Force:						
Advanced air-to- surface missile	L	N	L	M	L	M
Advanced tactical fighter	M	N	-	-	-	-
Advanced fighter engine	L	N	L	M	L	M
Small ICBM	N[a]	N[a]	L	M	L	M
Advanced warning system	N[a]	N[a]	M	L	L	M
MILSTAR	N[a]	N[a]	L	M	L	M
Space-based space surveillance	N	U	L	M	L	M

L = Lead role (defined as taking responsibility for getting the job done)
M = Member of management team or advisor
N = No significant role
U = Unclear role
Blank = Not performed yet

[a]No formalized need statement issued on these programs

Use of Competitive Production Option Is Limited

According to the program offices, about half of the programs we studied had insufficient quantities to seriously consider the large initial cost of setting up two production sources for the new system or a key subsystem. Of the remaining seven programs, the competitive option was addressed in three programs, it was addressed too late in one program, and the situation on the other three was still unknown at the time of our fieldwork. (See table 2.7.)

By the conclusion of our review, five programs had reached the full-scale development stage, which is when the Congress had to be informed of the competitive production decision. Decisions on three of them were reported to the Congress, and in one case, the entry into full-scale development preceded the law. Use of the competitive production option is summarized in table 2.7 and detailed for the 17 programs in table 2.8.

Table 2.7: Summary of Competitive Production Option Use

	No. of programs
Insufficient quantities for two production sources	5
Competitive production option addressed in strategy and with industry[a]	3
Competitive production option addressed too late or not at all	1
Unknown at this time	4
Total	**13[b]**
Programs which had not yet reached stage to inform the Congress	9
Programs in which the Congress	
Has been informed	2
Has not been informed	1
Not applicable	1
Total	**13[b]**

[a]To properly address the option, the winning system developer should be contractually obligated to work with and help qualify a second source

[b]Four case study programs were terminated

Table 2.8: Use of Competitive Production Option in Individual Case Studies

Case study program	Competitive option arranged	If not, reason	The Congress informed
Army:			
Light helicopter			
Airframe	Anticipated		a
Engine	Yes		
Tactical missile	No	Insufficient quantity	a
Guided antiarmor mortar projectile	b		-
Sense and destroy armor	b		-
Navy:			
CV inner zone helicopter	No	Insufficient quantity	Yes
V-22 OSPREY (JVX)	Late	Teaming agreement deferred until late in production program	a
Jet trainer	No	Insufficient quantity	Yes
Antisubmarine standoff weapon	Yes		a
Destroyer DDG-51	Yes		a
Minesweeper hunter	Uncertain		No
Air Force:			
Advanced air-to-surface missile (SRAM II)	In planning stage		a
Advanced tactical fighter	"		a
Advanced fighter engine	"		a
Small ICBM	No	Insufficient quantity, option still open	a
Advanced warning system	b		-
MILSTAR	No	Insufficient quantity	N/A
Space-based space surveillance	b		-

[a]Because program has not reached full-scale development, the service is not yet required to inform the Congress.

[b]Program subsequently terminated

Criteria Are Needed to Tailor Competitive Design and Development

As noted earlier, two studies in the late 1970s recommended that DOD develop guidance for tailoring the competitive design and development phase. A 1981 follow-up to one of those studies concluded that "reliable guidelines for acquisition managers have not yet been developed."[10] We were unable to find an analytical aid, model, or other criterion for tailoring competitive strategies to individual programs.

The 1985 amendments to the Armed Services Procurement Act require that beginning in fiscal year 1987, DOD must establish competitive sources for new major systems and subsystems in full-scale development as well as in production. This legislation permits the Secretary of Defense to waive the requirement under certain conditions. Use of the waiver provision requires an assessment of the impact of establishing competitive sources on such conditions as technological risk, design improvement, program cost, program delays, and national security. Therefore, the new legislative requirement will reinforce the need for program managers and contracting officers to have an analytical tool and criteria to analyze the characteristics of their programs and make appropriate recommendations to higher level management.

DOD's current policy encourages design competition up to full-scale development. This minimum criterion can be misleading. For example, investing in competitive development up to full-scale development may be impracticable for some very large-scale systems and for one-of-a-kind systems but may not go nearly far enough for other systems or subsystems with large quantities and high development risks. Aside from lacking substantive criteria, a program manager cannot possibly prove in advance that a particular investment in competitive development will deliver better system quality, more timely fielding, or substantial cost savings. Further complicating the decision is the problem of limited research and development funds for early program phases. For example, the cost of carrying one system through a competitive development phase could jeopardize another system's survival in the absence of decisions to terminate lower priority programs.

A 1982 Logistics Management Institute report noted that the benefits of competition are highly dependent on individual program characteristics. However, the benefits in one program cannot be extrapolated to others.

[10] Factors Affecting the Use of Competition in Weapon System Acquisition, Rand Corporation, R-2706-DR&E (Santa Monica, Calif. 1981)

The report said that sustained parallel efforts through full-scale development had prevented selection of the wrong contractor and that a critical issue is—how far should competitive development efforts be funded?[11]

Criteria offered by Institute for Defense Analyses

A 1983 Institute for Defense Analyses study began to develop some guidelines for competition based on four case studies.[12] The Institute found in its case studies that when a system was carried far enough into competitive development to permit industry to reduce risk and prudently price production options, the following events occurred.

- Bold cost reduction innovations (initially resisted by the military customer) were pushed by firms and were eventually accepted after demonstrating that they actually worked.
- New and risky technology was introduced during development, which led to dramatic cost reduction.
- Up-to-date tooling was acquired (an investment which otherwise would not have been made), which led to exceptional cost reduction.
- Costly design features were avoided, and frequent cost/performance trade-offs were made.
- Much more favorable production terms were established with industry, including lower production prices and warranties against design defects.
- The ultimate system design winners were not those favored before the extended hardware competition. (The Rand study reached the same conclusion.)

The Institute's report indicated savings of more than a billion dollars in three of its four case studies as a result of competitive development programs. The report also identified program characteristics and criteria worthy of an extended competitive phase. The criteria centered on the opportunity to control cost and improve performance and included

- technical risks,
- rapid production buildup (to recover the cost of money),
- likely major follow-ons,
- program and requirements stability,

[11] Price Competition in the DOD, Logistics Management Institute (Washington, D.C Sept 1982), p 3-2

[12] Competition as an Acquisition Strategy Impact of Competitive Research and Development on Procurement Costs

- credible industry opponents, and
- potential savings (discounted for present value) of more than the cost of competition.

In addition to cost savings, the Institute noted other bonuses: (1) improved system performance, (2) lower schedule risks, (3) lower cost to operate and maintain the ultimate system, and (4) an important hedge against failures in only one system development.

Industry Views on Criteria

The program characteristics that, in industry's opinion, warrant extension of the competitive development phase are shown in table 2.9.

Table 2.9: Industry Views on Extending Competitive Development

Program characteristic	Concept exploration only	System or subsystem demonstration	Full-scale development
New concept, advanced technology, or unproven design	High support	Moderate support	Low support
Competition cost less than 5 percent of total program value	Moderate support	High support	Moderate support
Substantial production volume	Moderate support	High support	High support

As can be seen, industry gave strong support to competitive hardware development and demonstration if the competition cost was small compared with the total program cost and if the production volume was substantial. Continuing competition through the more costly full-scale development stage was recommended only if production volume was substantial. A tight or delayed program schedule did not change industry views much.

Appendix IV more fully discusses the need for further research into criteria for structuring the competitive design and development phase. It includes thoughts on designing a judgmental tailoring aid that would help decide the level of competition, depending on whether the goal was (1) an optimum system solution or (2) an additional goal of lower cost designs and lower cost production of those designs. In late 1985, the Air Force business center at Wright Field informed us that it had just initiated some research in this area.

Conclusions

Clear roles and responsibilities are basic to developing people, guiding their further training, measuring performance, and holding them

accountable for results. Program managers have, by policy, the lead role in formulating acquisition strategies, whereas the contracting officers' role needs further definition. Together, they operated as a team in the planning phase in less than half of our case studies. One reason was late assignment of one and sometimes both to the program.

In carrying out the strategies, the roles of both key players in the requirements area were unclear. Yet, program success may hinge on the extent to which requirements are flexibly stated and subject to feedback from the design and development phases. The program manager and contracting officer should have sufficient latitude over the military requirement to

- establish a creative design process in industry,
- ensure competition among design alternatives, and
- permit trade-offs in performance and cost as new information becomes available.

Due to late assignment or other reasons, program managers' actions in other events did not always conform to their desired lead role. In the case of contracting officers, they normally serve two masters—the program manager and the contracting department. The contracting officer may be a full program office team member or an outsider with limited program background. The role itself varies from an active one, working under the program manager's overall leadership, to one of reacting to plans and proposed actions formed much earlier by others. While the contracting officer's role is reasonably clear in policy, it often deviates from policy and is not well understood in practice.

A "full team member" and a "check and balance" role need not be mutually exclusive. If assigned at the program's conceptual stage when the initial program planning takes place, contracting officers are in the very best position to protect the government's financial interest. If they are not involved on an early, continuing basis, program plans will have settled in a certain direction. Contracting officers will then lack the background and opportunity to properly challenge strategies or offer meaningful alternatives. Since time is usually of the essence in defense programs, trying to restructure a program after the fact can hardly be expected to succeed.

The preference would seem to be to have an experienced contracting officer or other professional expert dedicated at the outset to work on a day-to-day basis with the program manager on acquisition strategy and

execution. This view was shared by top management in all three military services. What is not clear from the triservice panel is who that should be, the contracting officer or the program office business manager.

In carrying out their roles, program managers and contracting officers are supposed to tailor competitive design phases to the particular programs' characteristics. This policy has been unworkable because (1) program characteristics most sensitive to different levels of competition have not been identified and (2) no basic tools exist to help program managers and contracting officers do the tailoring analysis. In the absence of these tools and with diffused roles and responsibilities, external influences, such as insufficient up-front funding, tend to dominate decisionmaking. As the consensus for the program builds, more funding becomes available, but it is too late—the design competition has already been held, the program structured, the system defined, and the developer/producer selected. To help overcome this problem, approved strategies need to be linked with the budgetary process and responsibility for changes made clear.

The appropriate level of competition in new weapon programs is very difficult to determine because it depends on analysis of a multitude of factors which may vary from program to program and from time to time as new information is obtained. As a minimum, guidance is needed on program characteristics sensitive to different levels of competition and on methods to tailor such guidance. An analytical or judgmental aid should also identify some of the questions that program managers and contracting officers need to answer about their programs before they respond to new legislation and make recommendations to higher authorities.

Several prior studies have pointed to this void and the need for action. Without criteria to help tailor the appropriate level of competition and guide judgments, three problems arise.

- Program managers and contracting officers must somehow invent a basis for tailoring each and every program and, at the same time, develop a rationale to fend off external influences. (See ch. 3.)
- Program managers and contracting officers cannot be properly trained to carry out their functions.
- Agency decisionmakers and the Congress have no valid basis to assess how well programs are being or have been structured.

Recommendations

Clarify Ro es and Fully Establish Team Approach

We recommend that the Secretary of Defense establish policies to:

- Assign the first program manager at the program conception stage.
- Clarify the program manager's role with regard to ensuring a flexibly stated requirement that permits a creative design process and is subject to reexamination as the program proceeds.
- Clarify the contracting officer's role and relationship with the program manager in weapon system acquisition, including assignment of the first contracting officer at the program conception stage.
- Establish in each program office a clear focus and responsibility for contracting strategy formulation and execution. The contracting officer or other expert filling such a position should be a highly qualified system acquisition expert (see ch. 5) and a full team member from program inception.

Provide Criteria for Tailoring Competitive Design and Development

We also recommend that the Secretary of Defense:

- Have a research and experimentation program to develop criteria for determining the appropriate level of competition in the design and development phases of new programs.
- Require training to be provided to program managers and contracting officers on the newly developed guidance.
- Pending development of such criteria, require competition in the concept exploration and demonstration and validation phases unless specifically waived by the Secretary of Defense.

Strengthen Competitive Strategy Development and Maintenance

We further recommend that the Secretary of Defense have management approval of the acquisition strategy linked to the budget/funding process so that key front-end decisions will be protected and the optimum program strategy will set funding requirements, not the reverse.

Agency Comments and Our Response

In official oral comments, DOD concurred in a number of the chapter's findings and recommendations and partially agreed with others. Its comments are in two categories: (1) program manager and contracting officer roles and relationships and (2) tools to do the job.

Roles and Responsibilities

DOD concurred in the need to clarify roles in the requirements area. DOD said it finds that there is little, if any, emphasis on or accountability for the cost of military requirements. Nonessential requirements are often imposed without consideration of the impact on cost or schedule. DOD said program managers and contracting officers should be able to challenge noncost-effective requirements. DOD went on to say that decisions made in this area before the program manager and contracting officer are identified can limit their flexibility to develop an acquisition strategy.

DOD said it would clarify the timing of the program manager's initial assignment to a program, probably by revising an existing directive. On the other hand, it said that timing of the first contracting officer's assignment did not appear critical because other contracting expertise is available. While other contracting expertise is available, this approach does not address the issue of (1) who is responsible for the contractual aspects of early decisions that drive programs and (2) whether the particular people involved have the competence and authority to act for the agency in these matters. Further, during our study, management of the military system commands stressed the need for early assignments of contracting officers in order to assist the program manager in developing the acquisition strategy and to take the lead in coordinating implementing actions. (See p. 23.) We agree and believe that otherwise, the contracting officer's role is likely to be preempted by others, constrained by early program decisions, or limited by lack of program background.

As to clarifying the role of the contracting officer in weapon system acquisition, DOD did not comment on our findings about the many departures of that role from existing policy. It expressed the view that no action was needed to further clarify this role beyond what was in the regulations.

The contracting officer's role diverges from policy so much that a fundamental question arises about what the real policy is or should be. We believe contracting officers need management's assistance in this area. For example, during our study, one of the military services held a national conference of contracting officers in Washington, D.C., to resolve a number of issues, including the question of their roles. At the conference's conclusion, they were unable to reach agreement. We believe it is essential that DOD management resolve this issue.

Tools to Do the Job

DOD agreed that a comprehensive tool or model was not currently available for designing competitive acquisition strategies. While not convinced at this time that additional guidance could or should be developed, DOD agreed to explore the need. We believe the need has been established by a multitude of studies done independently of one another—the Defense Science Board, the Rand Corporation, the Institute for Defense Analyses, the Logistics Management Institute, and finally, this review which covered 17 new programs. We believe further that the feasibility of doing something useful has been established by (1) the work of the Institute for Defense Analyses (see p. 39) and (2) the experimental approaches discussed in appendix IV. Consequently, rather than beginning another study, we believe it is time for DOD to start a research and experimentation program, and we are encouraged by the fact that one of the services has recently started an initiative in this area. (See p. 40.)

Pending development of a tool, DOD agreed that the Secretary of Defense should require a minimum competition level for new weapon systems. It further noted that a training program would be established if additional guidance for designing competitive strategies could be developed. DOD also agreed that acquisition strategies should set funding requirements, not the reverse.

In its oral comments, DOD referred to proposals of the Assistant Secretary of Defense (Acquisition and Logistics) that would satisfy some of our recommendations by creating a Defense Acquisition Agency, a Defense Acquisition Corps, or a Professional Acquisition Service. Because these proposals have not been accepted by DOD, we believe that DOD should implement the recommendations in this report at an early date.

The Office of Federal Procurement Policy also furnished comments on the report. (See app. VI.) It generally supported the recommendations and included several suggestions to improve the report which we have incorporated where appropriate. The Office said it looked forward to expanding the recommendations to civilian agencies where applicable.

The Effect of External Influences and a Strategy for Change

If program managers and contracting officers are to develop and execute effective acquisition strategies—and be held accountable for the results—they must operate in a reasonably stable climate. That is, they must be allowed to exercise their authority in finding cost-effective design solutions. Due to uncertainty in future threats and requirements and in keeping with DOD policy, the options for competing technological solutions should be kept open as long as possible.

However, the current acquisition climate does not offer the necessary stability. The acquisition strategies and associated contracting plans for practically all of the 17 programs reviewed were influenced by factors outside the control of program offices.

These external influences are not related to policy matters or normal oversight of individual programs, but rather to matters which unduly limit program manager's and contracting officer's execution of their roles. They include such actions as the teaming of the only two technology leaders, which eliminated design alternatives before some programs began. Unstable agency commitment or unstable basic requirements also adversely affected roles, as did insufficient up-front funding. Further, external directions on design solutions limited both the program manager's and industry's flexibility in several programs.

This chapter also offers a basic strategy for contending with external influences in the early program phases as well as options, recommended by others, for moderating or eliminating them.

The Acquisition Climate Must Support Program Development

Several conditions need to exist before (1) weapon systems can be acquired efficiently, (2) accountability can be instilled in the acquisition process, and (3) an effective acquisition strategy can be developed.

First, a strong technology base is required to provide design alternatives which industry can competitively develop to meet the desired military capability. To find cost-effective solutions to the overall program design, the program manager should have the insight and capability to understand the current state of technologies.

Second, two or more contractors must be able and willing to compete. Contractor teaming can be beneficial when the combined expertise of both firms is brought to bear on defining the design solution, but teaming arrangements which are formed solely to discourage competition are not in the public interest.

Third, a strong, high-level commitment to achieving the desired military capability is necessary before starting a major weapon system acquisition. DOD's program planning and approval processes are intended to provide this commitment and sufficient priority to conduct the program efficiently. However, a program can lose this commitment if the chosen system's ability to achieve the desired military capability is questionable or if other programs have higher priority. Although criteria are not available to measure agency commitment, the funding level and the stability of the requirement are indicators of the level of commitment.

Fourth, once the commitment to achieve a certain military capability is made, maintaining design options and flexibility in the early stages of a new weapon system is necessary to accommodate a better definition of requirements. Such flexibility helps avoid premature system selection, strengthens competition, and increases the probability of achieving the desired military capability. For this reason, a major thrust of DOD Directive 5000.1, implementing OMB Circular A-109, is to ensure that military requirements are stated as desired capabilities without specifying the design to meet those capabilities.

Fifth, the program office needs sufficient freedom to choose/recommend the best design alternative and to be held accountable for program results. DOD Directive 5000.1 states that:

"When a line official above the program manager exercises decision authority on program matters, the decision shall be documented as official program direction to the program manager, and a copy shall be available to the DAE [Defense Acquisition Executive]. The line official shall be held accountable for the decision."

Finally, as DOD Directive 5000.1 states, the program manager should be given sufficient resources to acquire the system efficiently. However, determining what is sufficient can be difficult. As discussed in chapter 2, one way to do so is to first design an acquisition strategy; the next step should be to fully fund elements of that strategy.

Acquisition Strategies Are Limited by External Influences

In 15 of the 17 weapon systems studied, as shown in table 3.1, external influences limited, or could have limited the the program office's ability to formulate or implement design competition strategies. Because several of these programs are still in their early stages, the full extent of the external influences is not known.

Table 3.1: Programs Affected by External Influences

Program	Preprogram decisions	Unstable commitment or requirements	Insufficient up-front funding	External management direction
Army:				
Light helicopter			X	
Tactical missile	X	X		X
Guided antiarmor mortar projectile		X		
Sense and destroy armor		X		
Navy:				
CV inner zone helicopter				X
Jet trainer system		X	X	
Joint service vertical lift aircraft	X			
Antisubmarine standoff weapon		X	X	
DDG-51 destroyer				
Minesweeper hunter				
Air Force:				
Advanced air-to-surface missile (SRAM II)			X	
Advanced tactical fighter			[a]	
Advanced fighter engine			[a]	
Advanced warning system	X		X	
MILSTAR	X			
Small strategic missile				X
Space-based space surveillance			X	

[a]Too early to say, but indications are that funding has been and will be an issue

Preprogram Decisions Limit Latitude

As shown in table 3.2, preprogram decisions ultimately affected four programs. Those decisions limited program managers' latitude in formulating acquisition strategies and prevented them from obtaining the desired level of design competition.

Table 3.2: Preprogram Decisions

Program	Decision	Result
MILSTAR	The two leading firms, which developed a critical technology for the intelligence community, decided to team when the Air Force initiated program competition	Other contractors would not compete with this team for a critical subsystem The Air Force modified the contracting strategy to permit competition on other parts of the system
Joint service vertical lift aircraft	When an acquisition program was initiated, the two firms teamed.	Only one design proposal was received from industry Production competition deferred until at least the fifth year from limited production delivery
Advanced warning system	Technology base funding for developing an advanced technology was diverted to fund system survivability.	Alternative design solutions were not available to compete with the existing solution
Tactical missile	The two firms whose airframes were used in the technology demonstration project decided to team The third possible competitor notified the Army that it intended to drop out of the competition, but at the Army's urging subsequently reentered the competition	There were two proposals received for the program

The purpose of the technology base is to serve as a source of options for future system acquisitions and a hedge against technological surprises. If the only two technology leaders team, the program manager cannot be held accountable for competing alternative designs. Although we are told that on occasion the military services have broken up adverse teaming agreements, DOD has no guidelines on when program managers and contracting officers should object to these agreements.

The MILSTAR satellite program illustrates a teaming arrangement that does not appear to be in the government's best interests. This joint service program was designed to meet the minimum essential wartime communication needs of the President and Commander-in-Chief to command and control strategic and tactical forces through all levels of conflict.

The MILSTAR program office originally wanted to procure the total system (electronics payload, satellite bus, mission control) as an integrated package.[1] To do so, it envisioned competition among various major contractors to provide the desired capability. However, two contractors, which had developed the technology for a critical subsystem

[1] A satellite is comprised of a bus and an electronics package or payload The electronics payload is the equipment that satisfies the mission of the satellite. All support of equipment such as satellite housing, power supply, and propulsion system comprise the bus

before the program office was formed, decided to team. According to the Air Force, the two contractors did not need to team and could have competed with each other. A third contractor expressed concern that because these two contractors had done most of the earlier technological work, they had an insurmountable advantage over others wanting to compete for the system. As other contractors also expressed their intent not to compete, the MILSTAR acquisition strategy to compete the total system as an integrated package was jeopardized.

In reaction to these events, the program office designed an alternative contracting strategy based on an associate contractor approach; the competition for the critical subsystem would be split from the balance of the system. This strategy allowed the winner of the competition for the balance of the system to also do the integration work for the critical subsystem. The program office attempted to compete the critical subsystem validation phase, but the competition dissolved when other contractors dropped out. As a result of the program office's modified strategy, competition was achieved in part of the system, but no meaningful competition could be obtained for the critical subsystem.

Before MILSTAR's initiation, Hughes Aircraft Company, one of the programs pre-award bidders, had briefed defense officials on the general problem of underfunding industry design efforts during the early competitive phases of new programs. Hughes Aircraft laid out several options for industry if such a trend continued—one of which was teaming.

Unstable Commitments or Requirements Cause Uncertainty

Several programs experienced unstable commitments and/or requirements during the evolution or implementation of the program strategy. The causes of the instability and its effects on the programs are shown in table 3.3.

Table 3.3: Unstable Commitments or Requirements

Program	Instability	Result
Guided antiarmor mortar 4.2-inch projectile	Requirements for this size projectile left unresolved until the day of competitive contract award	Acquisition strategy not implemented
Sense and destroy armor	Size requirements were not resolved early in the program	Industry involved in program competition for several years while the requirement remained unresolved
Jet trainer system	Low-priority limited funding availability	Planned competition through full-scale development was terminated
Antisubmarine standoff weapon	Program support vacillated during which it suffered frequent funding cuts/delays	Terminated competition before concept was validated
Tactical missile	The Army and Air Force could not agree on operational requirements for common missile Within the Army, there was also lack of agreement on requirements.	Joint program was dissolved in favor of individual service programs, Army program was restructured as a result of revised requirements

Program managers' ability to design and implement contracting strategies can be severely limited if requirements are not well defined or well accepted at management levels and if they change after a specific design solution has been chosen. Two examples follow.

Anti-Submarine Standoff Weapon

The Navy is developing a new missile for use on submarines to defend against enemy submarines outside of effective torpedo range. The development program is part of a phase out of the existing submarine standoff weapon, whose effectiveness, according to the Navy, has diminished. This program was recently renamed the Sea Lance Anti-Submarine Standoff Weapon.

The level of commitment to this program has been unstable. Although the first program manager maintained that the Navy was strongly committed, several sources outside the program office stated that weak support in various organizations had resulted in funding cuts and program changes. The Navy's then head of research and development and industry sources attributed this weak support to concerns about (1) the value of this weapon versus others considering the limited submarine space, (2) the likelihood of obtaining approval to use a nuclear bomb in an underwater environment, (3) the problems being encountered with the alternate payload, the lightweight torpedo, (4) the capability of submarines to locate and accurately target enemy submarines at long distances, and (5) the weapon's relative cost.

The original acquisition strategy called for competition through the demonstration/validation phase. However, competition was stopped at the end of concept exploration. Again, there is a difference of opinion on the reason for this change. Although the Source Selection Authority, who was responsible for selecting the contractor, stated that insufficient funding was the chief reason for altering the acquisition strategy, the program manager maintained that the strategy was changed because one proposal was superior and contained lower risk. Other Navy and industry sources suggested that funding and the lack of high-level support were the reasons for the change. We were unable to resolve this discrepancy.

Because of the concerns noted and a Navy funding shortage, the program was almost eliminated. The Navy had two separate standoff weapons for surface and underwater vessels. In 1981, the head of Navy research and development proposed that funds for both standoff weapon programs be cut by 50 percent in fiscal years 1983 and 1984. He later proposed to eliminate funding entirely for the submarine standoff weapon. To save the program, it was revised to a common weapon for submarines and surface ships. This change in scope, coupled with another funding cut, resulted in further delay and an extension of the demonstration/validation phase. Realizing the underwater design solution was too expensive for surface ships, the Navy reverted, 5-months later, to the original submarine-only weapon.

While the actual level of commitment for this program could not be determined, the program did experience many funding fluctuations, changes in scope, and program delays. Due to this turbulence, the results of the competition could not be firmly negotiated and incorporated into a contract for 3 years.

Guided Anti-Armor Mortar Projectile

The Guided Anti-Armor Mortar Projectile program was intended to develop a mortar which would be more effective against enemy armor. The system was to be a 4.2-inch mortar system with an infrared seeker to enable it to home in and guide itself to enemy armored targets.

The planning and execution of the competitive acquisition strategy for this system had been underway over 2 years when the program was abruptly canceled on the day of the expected contract award. At that time, industry proposals had been extensively evaluated and contractors had been selected for full-scale development.

We were given several reasons for program cancellation. The diversity of these explanations suggests that the program lacked high-level commitment. The explanation from the highest Army level, was that the Army Chief of Staff had decided to replace the 4.2-inch mortar with a 120-mm mortar because it was considered more effective and had greater commonality with North Atlantic Treaty Organization (NATO) forces.

Insufficient Up-Front Funding Limits Program Office Authority and Accountability

In nearly half of the case studies, insufficient funding adversely affected the design or implementation of the competitive strategies. The funding problems and their impact on acquisition strategies are summarized in table 3.4.

Table 3.4: Insufficient Up-Front Line Item Funding[a]

Program	Condition	Result
Army:		
Light helicopter	Front-end underfunded from program inception.	Strategy is being modified to cut back competition from full hardware demonstration to a design review competition, and risk reduction efforts are being deferred
Navy:		
Jet trainer system	Navy underfunded front end due to unstable commitment and low priority	Planned competition was cut back and limited to concept exploration
Antisubmarine standoff weapon	Navy underfunded front end due to low priority	Competition limited to concept exploration, extensive program delays experienced
Air Force:		
Advanced air-to-surface missile (SRAM II)	Air Force removed competitive development funds in response to limited authority	The approved competitive strategy cannot be implemented unless decision is overturned at higher levels.
Advanced tactical fighter	Funds not programmed for competitive performance demonstration, although options exist to implement such strategy	It is too early to say, but indications are that funds will not be available to implement such a strategy
Advanced fighter engine	Funds not programmed for competitive performance demonstration although options exist to implement such a strategy	It is too early to say, but indications are that funds will be an issue
Advanced warning system	Preprogram technology programmed was insufficient, and Air Force cut the competitive system development unds.	Technology alternatives were precluded and planned competition was limited.
Space-based space surveillance	Funding was perceived by the program manager to be unavailable.	Strategy was limited to competition during concept exploration.

[a]Up-front funding was considered insufficient only if the lack of funds precluded the program manager from either designing or implementing a competitive acquisition strategy

DOD Directive 5000.1 states that program managers should be given the authority and resources needed to efficiently execute programs. But without sufficient resources, the program managers' authority to implement acquisition strategies, as well as their accountability, is limited. When external influences reduce the funding available to carry out approved contracting strategies, the impact of that reduction is beyond the program managers' control. The following discusses the funding problems in two programs.

Advanced Air-To-Surface Missile

The Advanced Air-to-Surface Missile being developed will replace short-range attack missiles as a key element in the penetrating bomber mission through the 1990s and beyond. The new missile will provide the B-1B and the Advanced Technology Bomber with a supersonic, low-radar cross section, air-to-ground nuclear missile that can attack fixed and relocatable targets and neutralize enemy terminal defenses, such as surface-to-air missile sites.

The program manager proposed, in the original acquisition strategy, to have competition through critical design review in full-scale development. This strategy was approved through the Air Force chain of command up to the Systems Command. However, in response to limited total obligation authority, DOD reduced the Air Force fiscal year 1985 request for the Advanced Air-to-Surface Missile by $26 million and the Congress reduced it by about another $3 million. In addition, the fiscal year 1986 request was reduced by about $39 million.

As a result, the total obligation authority was limited, and fiscal year 1986 funding appears to be inadequate to carry out the approved acquisition strategy. In setting priorities for its strategic offensive programs to comply with the fiscal year 1986 budget, the Aeronautical Systems Division selected a missile program funding option which rules out prime contractor competition through the critical design review stage. It carries competition up to award of the full-scale development contract. The funding option that corresponded to the approved contracting strategy was ranked very low and would have eliminated other higher priority programs.

The Air Force Systems Command Competition Advocate, who chaired the Command's Business Strategy Panel and approved the acquisition strategy, was not aware of the budget reduction. The Competition Advocate confirmed a lack of any effective link between the acquisition approval process and the funding process.

No final decision has been made on whether to fund the competition beyond system definition studies. Unless the current decision is overturned at higher Air Force levels, funds will not be available to carry competition as far as originally planned.

Advanced Warning System

The Advanced Warning System was an Air Force technology program to develop an advanced missile surveillance satellite using advanced technology to detect missile launches. Insufficient front-end funding affected

the program's acquisition strategy in two ways: technology base design alternatives were not adequately funded, and funding for planned competition was cut.

The program office originally wanted design competition for the advanced technology, but a change in national strategic policy emphasized the satellite's survivability over technology improvements. Because of insufficient funding for both survivability and the advanced technology effort, the advanced technology effort was not funded to the point of being able to demonstrate a small-scale version of the necessary technology. Another change in national priorities, specifically the Strategic Defense Initiative, created the need for both a survivable system and advanced technology. But because the earlier technological development effort was curtailed, an advanced technology design alternative was unavailable to compete with the existing technology.

Due to overall budgetary and other concerns, the Air Force did not issue a request for proposal for the advanced warning system. Program office officials believe that had they issued the request for proposal, they would not have received proposals for competing alternative designs.

The original acquisition strategy was to compete two contractors through the critical design review phase of full-scale development. However, Air Force budgetary constraints eliminated the funding for this option during the 1986 budget cycle. The Advanced Warning System was canceled in 1984.

External Management Direction Constrains Design Freedom

Several programs received external management "how to" directions to use specified design solutions. Such directions constrained (1) the program offices' ability to determine acquisition strategies and (2) industry's design freedom. Table 3.5 summarizes these cases.

Table 3.5: External Management: How to Directions[a]

Program	How to direction	Impact
Army:		
Tactical missile	The Congress, OSD, and draft requirements document provided design direction	Industry competition, design flexibility, and trade-offs were limited Restrictions were lifted during 1985
Navy:		
CV inner zone helicopter	The Navy originally planned to develop one helicopter derivative but was overruled by OSD After the competition was underway, the Congress cut funds and directed that funds be used only for one design alternative	Competition could have been limited, however, by opening up the procurement to competition and a cost-effectiveness analysis, program costs were reduced by about $1 4 billion
Air Force:		
Small strategic missile	The Congress limited the weight of the missile to less than 33,000 pounds	Industry innovation and latitude were constrained Weight reductions could have been achieved in other parts of the system

[a]Directions were considered to be "how to" only when they limited the program manager's ability to design or implement a desired acquisition strategy or industry's ability to propose alternatives for the requirement

When external management directs a specific design solution to meet a military capability, the program manager cannot be held accountable if that design solution does not work. Requiring the program manager to explore a particular design solution in the competitive process is appropriate, but directing the solution—even if it appears to be the only viable alternative at the time—seems unwise.

The following details the effects of external management directions on two programs.

Tactical Missile

The Tactical Missile System is part of a family of complementary weapons which the Army and the Air Force are developing to engage enemy forces deep behind the front battle lines. The Army's part of the system will be oriented toward enemy forces beyond the range of current cannon and rocket artillery systems. It will be used against such targets as second-echelon maneuver units, missile sites, and forward command posts. The Air Force development is focused primarily on targets beyond the reach of the Army system, such as enemy airfields and refueling sites.

The original acquisition strategy for the joint program was to have an unrestricted competition for the engineering concept development. However, concepts proposed may have been influenced by a draft Army requirements document which specified the warhead weight, number of missiles per launcher, system accuracy, and maximum range. The draft requirements document was referenced in the contract scopes of work although contractors were permitted to propose alternatives.

Moreover, a DOD technology program may also have influenced the concepts proposed. The technology demonstration effort used delivery vehicles neither of which were considered optimal by the Army and Air Force. However, the program manager believed that the DOD emphasis on the technology program kept contractors from proposing other concepts they thought were more cost effective.

Congressional action also threatened to affect implementation of the acquisition strategy. To expedite the system's fielding, the Congress, in the fiscal year 1984 Defense Authorization Act, restricted the use of Army funds to the previously evaluated T-16 (Patriot) or the T-22 (Lance) missile as the system's primary delivery vehicle.[2] According to the program manager, this restriction, combined with the warhead weight and maximum range requirements specified in the draft requirements documents, would have limited the delivery vehicle to the T-22 Lance missile.

If these mandates had been retained, they would have severely limited the options available to the program office as well as the design latitude and trade-offs permitted by competing companies. Further, neither of the two airframes would fully meet both the Air Force's and the Army's requirements. Thus, the mandates would have required the program office to develop a system which would limit competition and not fully meet the joint service requirements.

Subsequently, the Army and the Air Force signed a Memorandum of Agreement which stated that the program would be restructured to provide for complementary systems, rather than a common one. In addition, the fiscal year 1985 Defense Authorization Act did not continue the 1984 airframe requirements. The act did require the Army to establish design goals of a maximum range of 200 kilometers and a 1,000-pound payload at the maximum range. This change allows the program office

[2]According to Army program officials, these previously evaluated airframes were used in a technology demonstration for convenience only and neither one is compatible with both services' needs.

the flexibility to select other configurations to meet the desired military capability.

The 1985 Defense Authorization Act also required the Army to proceed with competitive development and to make maximum use of proven missile system technology so the Army could complete full-scale development by July 1, 1987.

It is too early to determine if the design goals will actually affect the acquisition strategy or industry's ability to propose the best design solution. Because "proven missile system technology" is not specifically defined and because the design goals are only goals, the impact of these directions will depend on how the Army and industry interpret the legislation. Concerning the requirement for competitive development, we were told by the Senate Armed Services Committee's staff member who drafted the language, that the purpose of the competitive development language was to have the Army carry two firms through full-scale development and test firings before selecting a system for production. The Army is currently interpreting the law in such a way that a competitive award of the full-scale development contract to a single contractor would meet the congressional goal of competitive development. A legal review of this act suggested that while the language in question was somewhat unclear, the Army's interpretation is not unreasonable.

Recently, the two companies whose airframes were favored by the 1984 act teamed up. According to a senior official of the remaining competing company, the decision to team caused the company to drop out of the competition. However, at the Army's urging, the company reentered the competition.

CV Inner Zone Helicopter

The CV Inner Zone Helicopter program was initiated to provide a weapon system to be used in antisubmarine warfare for carrier battle groups. The helicopter will provide a fast-reaction, highly mobile sonar and a homing torpedo delivery capability for detecting, localizing, and attacking enemy submarines which enter the high noise environment of the carrier battle group inner zone. The helicopter will also be used for search and rescue missions.

The original Navy acquisition strategy was a directed sole-source acquisition of a variant of one company's helicopter recently developed for the Navy's antisubmarine warfare mission. However, DOD challenged the use of a sole-source acquisition and directed the program office to

acquire the helicopter through an open competition because the cost of the program was too high. The cost effectiveness of the sole-source acquisition was also challenged by DOD. However, the Congress stipulated in the Defense Authorization Act of 1985 that the aircraft acquired be a derivative of the helicopter designated in the original sole-source contracting strategy.

According to an OSD official, because the competition was nearly complete, DOD allowed the competition to continue. In response to the Navy's request for proposal, four proposals had been received, but only two were for the entire system. When these two proposals were evaluated, only one was found to be in the competitive range. A full-scale development contract was awarded to the contractor whose helicopter was originally desired. However, according to OSD, the industry competition reduced total program costs by about $1.4 billion.

Industry and DOD Officials Believe the Acquisition Environment Will Get Worse

Industry and DOD officials involved with major weapon system acquisitions expressed several concerns about the current and future problems in the acquisition process and the environment in which it operates. Generally, they believe that the conditions addressed in this chapter will get worse.

Industry Viewpoint

Program managers and contract negotiators from major defense contractors highlighted the following priority concerns in terms of external influences on weapon programs.

- Inadequate funding of design and development.
- Inadequate program manager authority.
- Inadequate contracting office authority and flexibility.

Industry representatives expressed the need to ensure sufficient up-front funding for major weapon system development. Many of them indicated that insufficient funding had negatively affected the development of over one-half of the systems with which they had been involved over the last 3 years. They said further that funding deficiencies in the early program phases were a major reason for the recent industry trend toward teaming.

Industry representatives generally indicated that the program manager's and contracting officer's authority was not sufficient and that this compounded problems with the acquisition process. The lack of adequate authority, they said, manifests itself in the inordinate time needed to make key decisions.

A group of top industry spokesmen with whom we met at the conclusion of the study urged two basic changes in the current environment. These changes were to (1) encourage greater risk in the government and (2) make "program success" an important part of the contracting officer's performance criteria.

DOD Viewpoint

Top DOD program managers and contracting officers believe that past adverse trends will continue and intensify in the future acquisition environment. They see more legislation, regulations, and policy requirements limiting program flexibility. They also see an increase in centralized control and a decrease in local authority with more layers of monitoring, supervision, and oversight. In addition, funding is perceived as continuing to be unstable and manipulated at all levels. To compound the problems the future environment is expected to bring an increased push for competition but fewer people to manage the competition. At the same time, they predict that fewer firms will be dedicated to military work and that remaining firms will become increasingly specialized, thus further limiting the possibility of getting competition.

Strategy and Options for Change

A basic strategy is needed to (1) put in place the proper climate for program management and (2) remove barriers to implementing effective acquisition strategies. The strategy offered here is fourfold.

- Agency commitment to a program, evidenced by setting aside in the DOD 5-year program, appropriate up-front funding linked to the acquisition strategy. (See ch. 2.) This implies that DOD must make the necessary trade-offs to ensure that only those programs that can be fully funded are started.
- Assignment, at the very beginning of the program, of a program manager with the experience and confidence to cope with program development and external influence issues.
- Commitment by the program manager to stay with the program through the achievement of some concrete result (such as a hardware baseline solution or user test and evaluation).

- Agency management validation that the appropriate conditions are, in fact, present to start the program and that any adverse conditions, such as insufficient funding or how to direction on design solutions, are corrected.

If early program phases are well conducted and expected results are not defined prematurely (i.e., deferred until a baseline solution is developed), the likelihood of major disappointments later in the program will be reduced. Such disappointments are cited to justify a multitude of efforts to "micromanage" DOD and its program offices. As one advisor on this report said:

"Attempting to prevent all failure by continuous micromanagement generally increases the incidence of failure. This increase leads to increased micromanagement, and we end up where we are now: micromanaging our way to continuous trouble."

Experts and past studies have offered options aimed at reducing the impact of external influences on the major acquisition process. These options are directed at (1) ensuring that decisions made before the start of the program do not constrain program results, (2) achieving a stable commitment to program objectives, (3) obtaining sufficient up-front program funding, and (4) ensuring the technical solution to achieve the mission need is not misdirected. Table 3.6 summarizes the options suggested and the external influences those options are intended to mitigate.

Table 3.6: Options for Moderating and Eliminating External Influences

Sources[a]	Option	Preprogram decisions	Unstable commitments or requirements	Insufficient up-front funding	External how to directions
12	Increased user involvement in requirements development phases, joint military requirements planning		Provides user command backing and user service agreement on requirements	Provides commitment to program, which ensures sufficient priority to receive funding	
1,3,5,6, 7,8,9,11	Long-range mission budgeting/affordability		Allows long-term agreement on needs that are affordable	Provides long-term commitment to needs considering long-term funding availability	Permits need to be expressed in capability required versus hardware requirement
6	Development of long-range capital investment plan		Determines the need's priority	Ensures program has sufficient priority to receive funding	
1,2	Generic, rather than item-by-item, line-by-line budget process		Allows agency to trade-off different solutions to basic need	Allows agency to use funds for best solution	Does not dictate a premature hardware selection to receive funds
6	Biennial budget reviews		Ensures a longer commitment to the program	Makes funding less subject to yearly changes	Provides fewer opportunities for external management direction
5,10,11	Multiyear research and development authorization		Ensures long-term agreement on priorities	Makes funding less subject to yearly changes	Provides fewer opportunities for external management direction
13	Experienced, confident program leadership		Provides ability to maintain program commitment and avoid disruptive changes	Provides ability to convince management of the adverse consequences of insufficient up-front funding	Provides ability to ward off external management direction harmful to the program
6,12,13	Reduction in number of people in the chain of command		Increases authority to obtain and maintain commitments	Reduces opportunities to destabilize funding	Reduces number of people who can provide external management direction
None	DOD policy on undesired teaming arrangements	Enhances ability to challenge teaming agreements not in public/ national interest			

[a]See app V for a list of sources

Some Teaming Agreements May Need to Be Discouraged

The teaming of industry technology leaders can be in the best interests of the government, such as when contractors combine their expertise to achieve a program objective. However, when teaming agreements discourage other industry firms from competing in the early system design phase, their benefit is questionable. At a recent competition conference,

one experts panel took the position that when teaming agreements would eliminate competition, the agency should immediately react to them. The panel said this had been done in some cases. However, DOD does not have a policy defining the circumstances under which the agreements should be discouraged. Without such a policy, program offices would have difficulty developing the rationale to question the agreements.

Past studies have not, to our knowledge, addressed industry teaming arrangements.

Strong Commitments Are Needed

Most of the suggested options in past studies attempt to reduce program turbulence resulting from changes in priorities and requirements. Some of the options seek also to ensure that programs have sufficient commitment so they will not be subject to numerous funding cuts and/or changes in need. Many authorities have noted the adverse impact of a lack of high-level, stable commitment to achieving program objectives. A Defense Science Board study found that those programs having strong institutional support and stable funding had a higher probability of successful development.[3] The study also found that to achieve this strong institutional support, users, the research and development community, and industry should be closely associated.

The Defense Science Board's study found further that the military requirement itself should be prudently flexible and reassessed throughout the development program. The study recommended that the development of an operational requirement be an iterative process during which potential solutions are evaluated and traded off with respect to affordability, performance, and risk.

Other ways to ensure a strong commitment, as suggested by other studies, range from having experienced, confident program managers to increased involvement of the user and high-level prioritization of mission needs.

[3]Practical Functional Performance Requirements, fall 1985 briefing slides

Early Performance and Cost Trade-Offs May Help Ensure Sufficient Up-Front Funding

If sufficient resources are not provided in the early stages of major weapon system development, additional resources will be required later, in the more expensive stages, to correct problems not sufficiently addressed in the early phases. Many of the options for ensuring sufficient up-front funding focus on developing realistic program estimates which are fully funded. These options, which try to eliminate the premature selection of a specific design solution in order to receive funding, are geared to allowing early trade-offs between performance and cost. As the Defense Science Board study noted, programs which do not allow for such early trade-offs usually have overstated performance requirements and underestimated costs.

Externally Directed Design Solutions Suppress Flexibility

No matter how well intended, externally directed design solutions imposed upon the program office can preclude that office and industry from exploring alternative designs, making trade-off analyses, and developing innovative approaches. Further, if the directed design solution does not meet the mission need, it is difficult to place accountability for that failure.

The suggested options are aimed at ensuring that the design solution is not directed as the result of a particular industry or agency bias. Some of the options, such as budgeting early phases by mission capability versus specific hardware, would involve changing the budget format. Other options would increase the program manager's authority to cope with external influences by reducing review layers between the manager and the military decisionmakers who control resources.

Conclusions

External influences can undermine logical, planned program management and can create uncertainty for program management both in government and in industry. The options suggested by experts and past studies may have potential for moderating this turbulence in early program development.

We recognize that some of these external influences will always be present in varying degrees. To limit their adverse impact on individual programs, proven program managers and contracting officers must have the foresight to visualize future implications and the confidence and know-how to contend with those that might undermine the program. In addition, strengthened program management, together with more effective competition in defining new weapon systems, should improve results and the environment for future programs.

The environment in which new weapon systems are designed and developed demands the very best in program managers and contracting officers who have acquired all the skills of their profession; this is the subject of the next two chapters.

Agency Comments

In official oral comments on a draft of this report, DOD said that it concurred with our basic findings about external influences on acquisition strategies. It stated that DOD has recognized that the current organizational structure makes it difficult to maintain accountability. As a solution, DOD favored eliminating unnecessary layers above the program office. DOD stated that proposals of the Assistant Secretary of Defense (Acquisition and Logistics), which involve creation of a Defense Acquisition Corps, a Professional Acquisition Service, or a Defense Acquisition Agency, would (1) reduce the number of layers through which program managers report, (2) increase program manager responsibility and accountability, and (3) provide program managers access to senior acquisition executives who have requisite decision authority and control of resources. Further, DOD commented that these initiatives would greatly expand the options for change proposed by us.

Career Preparation of Program Managers

Program management is a position of substantial complexity and responsibility, involving decisions on weapon systems sometimes costing billions of dollars, which will ultimately determine capability on the battlefield. As such, development of qualified program managers requires appropriate experience, training, and education, as well as the ability to attract promising candidates into the field. DOD policy has, since 1974, recognized this need. Nevertheless, while some recently appointed program managers possess substantial experience and training, many do not. Changes are needed in current service programs to ensure a highly qualified cadre of program managers.

Concern over career development of program managers stems from reports challenging their qualifications. For example, in 1985, the Center for Strategic and International Studies reported that

"the military personnel system does not provide adequate incentives for officers to seek assignments in acquisition management. . . . The result is that the overall experience levels and training of uniformed personnel in acquisition is inadequate."[1]

And former Deputy Secretary of Defense David Packard testified in 1983 that

"major weapon systems are complex, they are large, they require advanced technology. We unfortunately have a system where we do not train and put the best management people in charge of these programs."[2]

Defining Effective Career Programs

In 1974 DOD established policy for the selection, training, and career development of program managers charged with managing major systems acquisition programs. Desired conditions—as defined by panels, experts, service management, industry surveys, and prior studies—were generally consistent with this policy, although in some areas they were more specific, as shown in table 4.1.

[1]Toward a More Effective Defense—The Final Report of CSIS Defense Organization Project, The Center for Strategic and International Studies (Washington, D.C · Georgetown University, 1985).

[2]Hearings, Senate Armed Services Committee, Nov 16, 1983.

Table 4.1: Desired Characteristics of Program Manager Career Programs

	DOD Directive 5000.23	Desired Condition
Entry		Early commitment
Development	Career progression plan, including identification of desirable experiences Prior program office experience Defense Systems Management College (DSMC) 20-week Program Management Course or 3-week Executive Refresher Course	Same intensity as operational fields Clear career path, including experience in —operational command, —multiple program office assignments, and —headquarters, logistics, systems engineering, laboratory, and test DSMC Program Management Course as minimum Intermediate and senior service college
Selection criteria	Based on demonstrated performance, skills, and experience	Based on performance in acquisition career field
Tenure	4 years or major milestone	Tangible result, 4 years, or major milestone
Promotion incentives	Equivalent to operational positions	Equivalent to operational positions
Use of civilians	Selection based on skills and experience—civilian or military	Selection of best qualified—civilian or military

Framework Provided by DOD Policy

DOD Directive 5000.23, System Acquisition Management Careers (Nov. 26, 1974), provides the basic framework for career programs for program managers. The directive states that successful management of major systems is dependent upon experienced and competent personnel; it requires that career opportunities be established to attract, develop, retain, and reward outstanding military officers and civilian employees required as program managers or as their principal deputies and assistants.

The directive sets minimum standards for experience and training of program managers. Colonels/captains or civilian equivalents assigned as program managers should have previous program management or system acquisition experience, including one or more assignments to a program office. The directive also provides that general or flag rank officers and civilian equivalents should normally be considered only if they have had "substantial" prior experience in program management or system acquisition, including experience at the lieutenant colonel or colonel (or equivalent) level.

Participation in the DSMC's Program Management Course or Executive Refresher Course is also encouraged. (The Program Management Course is a 20-week course for mid-level managers; the Executive Refresher Course is a 3-week course for executive-level (colonel or above) managers. In addition, the college has recently begun offering the Program Managers Workshop, a 4-week executive-level course for major system program manager designees and their deputies.)

Other requirements set forth in the directive cover career progression, advancement, and tenure. Development of a career progression plan—including identification of the types of experience considered beneficial for assuming higher level positions, training and professional education requirements, and provisions for advancement—is required. The directive also provides that opportunities for advancement be equivalent with those of officers in operational, line, and command positions. Concerning tenure, the directive states that changes of program managers, if necessary, should normally occur near major program milestones. A memorandum accompanying issuance of the directive stated that, notwithstanding this requirement, a program manager's tour should not be less than 4 years. (This tenure policy was enacted into law in 1984; the provision sets tenure for the military program manager of a major program at not less than 4 years or until completion of a major milestone.)

The directive provides for development and selection of both military officers and civilian employees, stating that "Personnel should be selected on the basis of skills and experience . . . regardless of military or civilian status." However, the memorandum accompanying issuance of the directive stated that the directive's thrust is to develop a cadre of military program managers and that assignment of a civilian as a major program manager would occur only "in a case of extreme circumstance."

More Specific Standards Called for by Experts

The desired conditions which evolved from panels, experts, and other sources were more specific (and stringent) in several areas. In particular, emphasis was placed on developing program management candidates with substantial prior program office experience and familiarity with the various functional/technical areas involved in the acquisition process.

Entry Into the Acquisition Field

Many experts and service managers believed that entry into the acquisition field should occur sufficiently early in a person's career to allow

adequate time to obtain and utilize desired experience. For military officers, experts believed that commitment to acquisition management as a career should occur reasonably early, after obtaining operational experience, that is, experience with a combat or combat support command.

Rather than defining a particular educational background for entry, the triservice panel concluded that the field should be open to those with appropriate technical, business, and other skills. In contrast, some service management believed that a technical educational background (engineering or physical science) was desirable A technical background was seen as allowing the program manager to converse knowledgeably with functional managers and contractors. Air Force management expressed the view that the optimal educational background was an undergraduate degree in engineering or a physical science and a graduate degree (usually obtained after entering military service) in management.

Experience and Training

Panels, experts, and other data sources emphasized that substantial acquisition experience and training—developing technical, management, and leadership skills—were necessary to produce a highly qualified program manager. Qualification for program manager of a major system acquisition was viewed as requiring the same intensity of experience as qualification for wing, brigade, or major sea command.

This principle has also been articulated in official service guidance. For example, the Navy's Career Planning Guidebook (OPNAV 13-P-1) states that

> "We would not expect a senior commander or captain whose last sea tour was 10 years earlier as a lieutenant to be prepared to command at sea. The same applies ashore. The senior commander or captain without experience with the Planning, Programming and Budgeting System (PPBS) would be hard pressed to perform well in certain key billets in the rapid-paced environment of OPNAV [Office of the Chief of Naval Operations] "

The triservice panel and other experts believed that the typical career pattern used to prepare officers for command in operational fields provided a useful model for developing program manager career programs. The typical operational career field includes a minimum of 8 to 11 years of experience, as well as specialized training, professional military education in intermediate and senior service colleges, and a clear career path for progression to command at the colonel/captain rank. For

example, as illustrated in table 4.2, the career path to command of an infantry brigade includes a minimum of 8 years, but more likely 11 years, of experience with the troops and 11 months specialized training. Experts believed that given the complexity of the acquisition business, such figures conservatively estimated the amount of experience and training necessary to develop program managers.

The triservice panel consensus was that since management of a major program was equivalent to major command of an operational unit, it required a similar level of preparation and a more clearly defined career path. Key developmental experiences identified by the panel included

- operational experience, that is, experience with a combat or support command or with the fleet;
- multiple program office assignments; and
- experience, through program office and other acquisition assignments, in systems engineering, testing, laboratory, and logistics and at headquarters (service level or above).

The recommended career pattern defined a need for a program manager with an understanding of the various functional fields involved in the acquisition process.

Operational experience was seen as providing the program manager with a user perspective, that is, an understanding of the concerns of the combat or support command which will employ the system. As stated by the Air Force in response to our management survey:

"Military acquisition decisions are basically tradeoffs between increasing effectiveness of weapons systems and the cost of those capabilities. They require sound military judgment about warfighting capability, as well as a firm grounding in sound business practice and public policy."

Program office experience was the most highly valued for preparing the program manager. The program manager is charged with managing and coordinating wide-ranging and critical processes—from evaluating

Table 4.2: Career Development in Operational Fields

Army: Progression to Command of Infantry Brigade

Grade	Target position	Years with troops (at each grade)	Specialized training	Professional military education
Lt.	Platoon leader	2 to 3	Basic (5 mos)	
Captain	Company commander	2 to 3	Advanced (6 mos)	Combined Arms and Services School (2 mos)
Major	Battalion executive officer	2 to 3		Command and General Staff College (10 mos)
Lt. Col.	Battalion command	2		Senior service college (10 mos)

Navy: Progression to Major Sea Command For Surface Warfare Officer

Grade	Target position	Years with fleet	Specialized training	Professional military education
Ensign/lt.	Division officer	2 1/2 to 4	Basic (6 mos)	
Lt.	Department head	3	Department head course (6 mos)	
Lt. Commander	Executive or commanding officer	3		Jr service college (6-10 mos)
Commander	Ship commanding officer	2 to 3		Senior service college (10 mos)

Air Force: Progression to Wing Commander

Grade	Target position	Years in operational duties	Specialized training	Professional military education
Lt.	Copilot/pilot	3	Undergraduate flying training (12 mos)	
Captain	Aircraft commander/ instructor pilot/flight examiner	6 1/2	Initial crew training (6 mos)	Squadron Officers School (2 mos)
Major	Flight commander/ operations officer	4		Intermediate service college (6-10 mos)
Lt. Co.	Squadron commander/ wing staff	4		Senior service college (10 mos)

alternative technical approaches, weighing performance and cost concerns, and assessing system performance to defining a contracting strategy and monitoring contractor performance. Prior program office experience enhances the program manager's ability to ensure that such tasks are effectively carried out.

Within the program office, experience in managing a nonmajor system or subsystem was identified as highly desirable. Such assignments provide the program manager with hands-on experience in the varied tasks involved in program management.

Given the multidisciplinary nature of program management, panels also believed the program manager should have experience with the major functional fields or organizations involved in acquisition. Headquarters

experience was valued because much of a program manager's time is spent explaining and advocating the program to higher organizational levels. It also gave the program manager an appreciation for the political dimension of the acquisition process. Systems engineering—the technical integration of all aspects of the system—was emphasized because it underlies the technical work the program office directs and coordinates. Logistics was valued because of the emphasis placed on considering, during system development, the costs and ease of maintaining the system once it is fielded. Laboratory and test experience provides familiarity with two major technical functions involved in the acquisition of any system: (1) research and development and (2) test and evaluation.

Other experiences frequently cited as desirable included business/financial management and industry experience. The latter can be obtained through programs which place personnel with industry for a year.

Panels, experts, and management believed that given the complexity and diversity of a program manager's responsibilities, specialized training was needed. DSMC's 5-month Program Management Course was viewed as the most comprehensive curriculum, which optimally would be supplemented with other specialized courses, such as the Program Managers Workshop. Service management also believed that attendance at intermediate and senior service colleges was desirable as it prepared officers for higher level command and staff duties.

Industry program managers surveyed were often critical of the capability of DOD program managers, supporting the need for increased experience and training. Sixty-one percent of the 46 respondents agreed with the statement that federal program managers have less or much less ability to perform their charter than counterparts in private industry. (Several respondents blamed the limited capability on bureaucratic regulations or constraints.) Thirty-nine percent indicated that federal and private industry program managers are about equal in ability. None indicated that federal program managers have more or much more ability compared with industry counterparts.

Selection

Service management and panels believed that selection of program managers should be based on performance in the acquisition career field. Selecting program managers from outside the acquisition field undermines the credibility of acquisition career programs and the ability to attract promising personnel into the field.

Tenure

Differing opinions were encountered on the optimal basis for defining the program manager's tenure. Some service management favored tying tenure to tangible results, such as a first working prototype: Since the program office's primary focus during early phases is research and development leading up to hardware development, the program manager's tenure could be linked to such a key event. Such an approach could also strengthen program manager accountability. In contrast, some preferred a fixed term (4-year) tenure policy as a means of assuring longer tenure than in the past. Others found the 4-year tenure policy disruptive to the program and favored program milestones as a means of minimizing disruptions and increasing accountability. However, the Defense Science Board, in a 1983 report, stated that management continuity during the start-up of production was critical and suggested that the milestone provision be modified.[3]

In our industry survey, we asked industry program managers to identify the most disruptive time for changes in federal program managers. "During full-scale development" was identified most frequently, "during demonstration and validation" ranked second, and "just after demonstration and validation" ranked third.

Incentives

Panels and service management believed that adequate promotion opportunities were needed to attract and retain promising personnel to acquisition. Further, they believed that promotion opportunities should be equivalent to those in operational fields.

Use of Civilians

While a wide range of views were expressed, the prevailing view was that the best qualified candidates—whether civilian or military—should be selected to fill program manager positions. Some expressed a preference for military program managers, stating that the military program manager brought a user perspective to bear, along with greater credibility with counterparts in the user commands. It was generally agreed that a military officer was preferred on certain mainline weapon programs, such as aircraft, ships, and tanks but that civilians could be used for combat support systems, such as communications, electronics, radar, or avionics. Some believed that civilian program managers provided greater program stability since they were not subject to rotational

[3]Report of the Defense Science Board Task Force on Transition of Weapons Systems From Development to Production, Office of the Under Secretary of Defense (Research and Engineering) (Washington, D C · 1983)

assignments and suggested that they be matched with military deputy program managers or advisers to obtain a user perspective. Others commented that senior acquisition jobs need to be available to attract and retain highly capable civilians in supporting positions.

The industry survey also provided support for a mix of civilian and military—about 74 percent supported some sort of mix—although a preference for military program managers was exhibited, as shown in table 4.3.

Table 4.3: Military/Civilian Composition of Program Manager Work Force: Responses of Industry Program Managers

	Percent
All or almost all should be military	21 7
The majority should be military	26 1
Roughly an equal mixture of military and civilians	23 9
The majority should be civilians	23.9
All or almost all should be civilians	4 3
	(n=46)

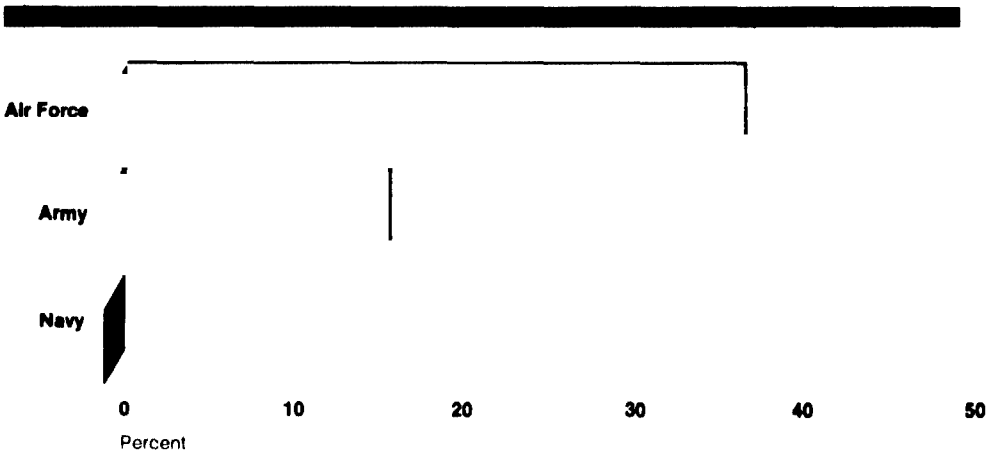
Most frequently cited as the reason for favoring military program managers was their user perspective. Longer tenure was the reason for favoring civilians.

Few Program Managers Have the Desired Mix of Experience and Training

Our examination of the background[4] of 34 recently appointed program managers showed that some possessed substantial acquisition experience, but few possessed the desired mix of experience and training. The proportion of program managers with substantial program office experience, 8 years total acquisition experience, and the DSMC Program Management Course was low; none of the Navy program managers, only 15.4 percent of the Army program managers, and 36.4 percent of the Air Force program managers met these criteria, as shown in figure 4.1.

[4]Experience and training before first appointment as program manager of a major program Major, as used here, refers to programs requiring Secretary of Defense or service secretary approval.

Figure 4.1: Combined Experience and Training[a]



[a]Percent with 4 years program office experience, 8 years total acquisition experience, and DSMC Program Management Course (Air Force n=11, Army n=13, Navy n=10)

Further, as shown in table 4.4:

- The highest proportion of program managers—54.5 percent—with substantial program office experience was in the Air Force; less than a third of Army and Navy program managers had the desired program office experience.
- The Air Force had the highest proportion of program managers—63.6 percent—with 8 years or more acquisition experience; about half of Army and Navy program managers met the desired condition.
- Nearly two-thirds of Army program managers attended the DSMC Program Management Course, compared with less than half of the Air Force and Navy program managers.

Acquisition experience was defined as involvement in the development of the system from requirements determination through production and deployment.

Table 4.4: Experience and Training Prior to Appointment as Program Manager of a Major Program[a]

	Air Force	Army	Navy
Program Office Experience:			
Percent with 4 years program office experience[b]	54 5	30 8	30 0
Median years of program office experience	5 1	2.4	1 2
Total Acquisition Experience:			
Percent with 8 years experience in desired career path[c]	63.6	38 5	40 0
Percent with 8 years total acquisition experience	63 6	46 1	50.0
Median years of total acquisition experience	13.0	7 2	8 4
Diversity of Acquisition Experience:			
Percent with experience in all five desired fields[d,e]	20 0	0.0	0 0
Percent with experience in four desired fields[d,e]	20.0	12.5	33 3
Percent with experience in three desired fields[d,e]	30.0	75 0	55 6
DSMC Training:			
Percent with DSMC Program Management Course	45 5	61.5	30 0
Percent with other DSMC only[f]	18.2	23 1	30 0

[a]Program managers appointed January 1982-August 1984 to programs in concept development or demonstration/validation phases Air Force n=11, Army n=13, Navy n=10 except as otherwise noted

[b]Desired condition was defined as multiple program office assignments Four years chosen as proxy since Air Force Systems Command operates on 4-year tours, Army on 3-year tours, and Navy on 2- to 3-year tours

[c]Headquarters, logistics, test, lab, systems engineering, and program office

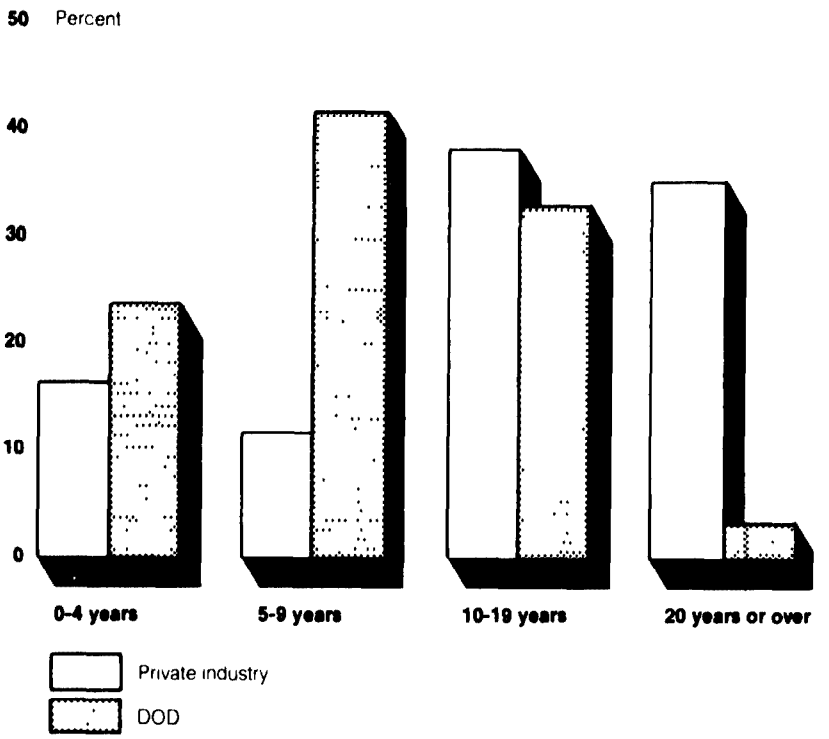
[d]Desired fields are headquarters, logistics, test, lab, and systems engineering

[e]Air Force n=10, Army=8, Navy=9 Complete data not available on some program managers

[f]Includes 4-week Program Managers Workshop and 3-week Executive Refresher Course

DOD program managers tended to have less acquisition experience than their counterparts in private industry, as shown in figure 4.2. However, it should be kept in mind that the responsibilities of industry program managers vary and often include production responsibilities. Furthermore, military program managers usually bring operational experience to bear on the acquisition process.

Figure 4.2: Comparison of DOD Program Managers With Private Industry Program Managers (Years of Experience[a])



[a]Industry respondents were asked to identify years of experience with major item programs for PMs appointed to new major items since January 1, 1982 DOD PM experience was defined as years of acquisition experience (Industry n=219, DOD n=34)

All but 2 of the 34 program managers in our sample had a technical educational background, the majority possessing a degree in engineering. A smaller proportion had both a technical and management background—18.2 percent of Air Force program managers, 38.5 percent of Army program managers, and 40.0 percent of Navy program managers sampled.

Tenure Policies and Practices Differ Among the Services

Programs experienced considerable turnover in program managers during their earliest phases, particularly in the Army and the Air Force. In our 17 case study programs, the tenure of program managers who had been replaced averaged 9 months for 3 Army programs, 15 months for 5 Air Force programs, and 39 months for 5 Navy programs.[5] As the

[5]In the remaining Army, Navy and two Air Force programs, the first program manager had not been replaced

programs progress, tenure tends to increase. Those currently serving as program managers have been in their positions (as of August 1985) for an average of 25 months for Army programs, 31 months for Air Force programs, and 26 months for Navy programs.

Tenure of program managers replaced from January 1982 to August 1984—for all programs and phases—was longest in the Navy. The average tenure of Navy program managers was 3.9 years, compared with 3.1 years for Army program managers and only 1.9 years for Air Force program managers. The relatively short tenure of Air Force program managers is consistent with the view expressed in testimony by the Commander, Air Force Systems Command. The commander disagreed with the need for fixed tours, saying it was desirable to maintain the flexibility to change program managers based on the needs of the program and the performance of the individual.

None of the services tied tenure to tangible results.

Promotion Rates for Acquisition Managers Exceed Service Averages

Recent promotion statistics suggest a healthy picture. Promotion rates for officers in acquisition management programs exceeded service averages. For example, for promotion to colonel/captain, the average (first time considered) rate of promotion for those in the Army's acquisition management program was 64.4 percent for 1983 to 1985, compared with the Army average of 48.6 percent. For the Navy, the (in zone) promotion rate for officers in the weapon system acquisition management program was 69.1 percent over the past 3 years, compared with a Navy average of 59.7 percent. Similarly, the average Air Force (first time considered) rate for those in acquisition/program management career fields was 51.6 percent in 1982 to 1984, compared with the Air Force average of 43.5 percent.

Available statistics also suggest a healthy picture for promotion to general officer/flag rank. The average promotion rate for Air Force officers in the program management career field for 1983 to 1985 was 1.7 percent, compared with the Air Force average of 1.5 percent. For the Navy, the average for officers in the weapon systems acquisition management program was 5.3 percent over the past 3 years, compared with the Navy average of 4.4 percent. Comparable statistics were not available for the Army, but it is noteworthy that the number of officers promoted to general officer, who were or had previously served as program managers, increased sharply from three in 1983 and three in 1984 to eight in 1985.

Other Data Suggest Less Favorable Situation

Other data suggests a different picture. For officers in the Army's acquisition management program considered for promotion to colonel in 1985, the selection rate was higher among those with less acquisition experience. In the Navy, of the eight program managers from operational communities (unrestricted line) promoted to flag rank in fiscal years 1983-85, all but one had major sea command as captains—confirming, according to Navy officials, that promotion has been based on success in officers' operational specialty. Moreover, at the system commands visited, program managers generally perceived that promotion opportunities in acquisition were not as great as in operational fields. And they often perceived that command-equivalent program manager positions were not valued the same as command of operational units.

The picture is thus confused. It is perceived that promotion opportunities are not equivalent for those in acquisition. Yet, some statistics suggest a different picture. Perceptions guide whether officers view the field as attractive, and thus whether high-quality officers will be attracted to the field. As a result, some favor reserving flag rank/general officer positions for those in acquisition management, as was done by the Navy in 1985. Reserving general officer positions could overcome perceptions that advancement potential is limited, as well as guard against changes in service management leading to changes in how acquisition careers are valued.

Current Programs to Develop Military Program Managers Fall Short of Those Desired

All three services have programs aimed at developing military program managers, with the Army and Navy having made significant changes in their programs over the past 3 years. While the Air Force's program most closely approximates the desired condition, further changes are needed in the programs of all three services to develop program managers with the desired career pattern and sufficient acquisition experience. Features of the services' programs are summarized in table 4.5.

Table 4.5: Service Programs for Developing Military Program Managers

	Summary of programs	Key issues
Air Force:	Except for pilots and navigators, officers may enter directly into the acquisition field or transfer into it after an initial assignment in an operational command. Officers receive repeated assignments in acquisition management, normally including assignments in a program office and at headquarters. Rated officers (pilots and navigators) typically receive one 3-year acquisition assignment before their 15th year of service and repeated acquisition assignments starting about their 15th to 16th year.	Limited time available for development of rated officers. Desired kinds of acquisition experience defined but not clearly identified in official career guidance.
Army:	Officers normally enter the Materiel Acquisition Management program between their 6th to 8th year of service. By their 16th year of service, officers should complete the Materiel Acquisition Management course, the DSMC Program Management Course and two (3-year) acquisition management assignments.	Program receives low priority in assignments process. Limited time available for some officers pursuing two specialties. Desired kinds of acquisition experience not identified.
Navy:	Officers normally enter the Weapon Systems Acquisition Management Program as lieutenant commanders. Officers from the unrestricted line (aviation, surface, and submarine warfare) and the Supply Corps alternate between sea and acquisition (shore) assignments. Officers from the restricted line receive assignments in acquisition and logistics. The Materiel Professional Program, which includes officers from the commander/captain grades and above, ensures that officers in the program are assigned exclusively to material management positions.	Limited shore time available to develop officers from the unrestricted line (warfighting communities). Desired kinds of acquisition experience not identified.

Air Force Program Approaches Desired Conditions for Some Officers

The Air Force is unique among the services in having a specialization in program management. Typical career paths leading to a position as a major program manager are shown in figures 4.3 and 4.4. The career path for rated officers (pilots and navigators) is significantly different from that followed by nonrated officers.

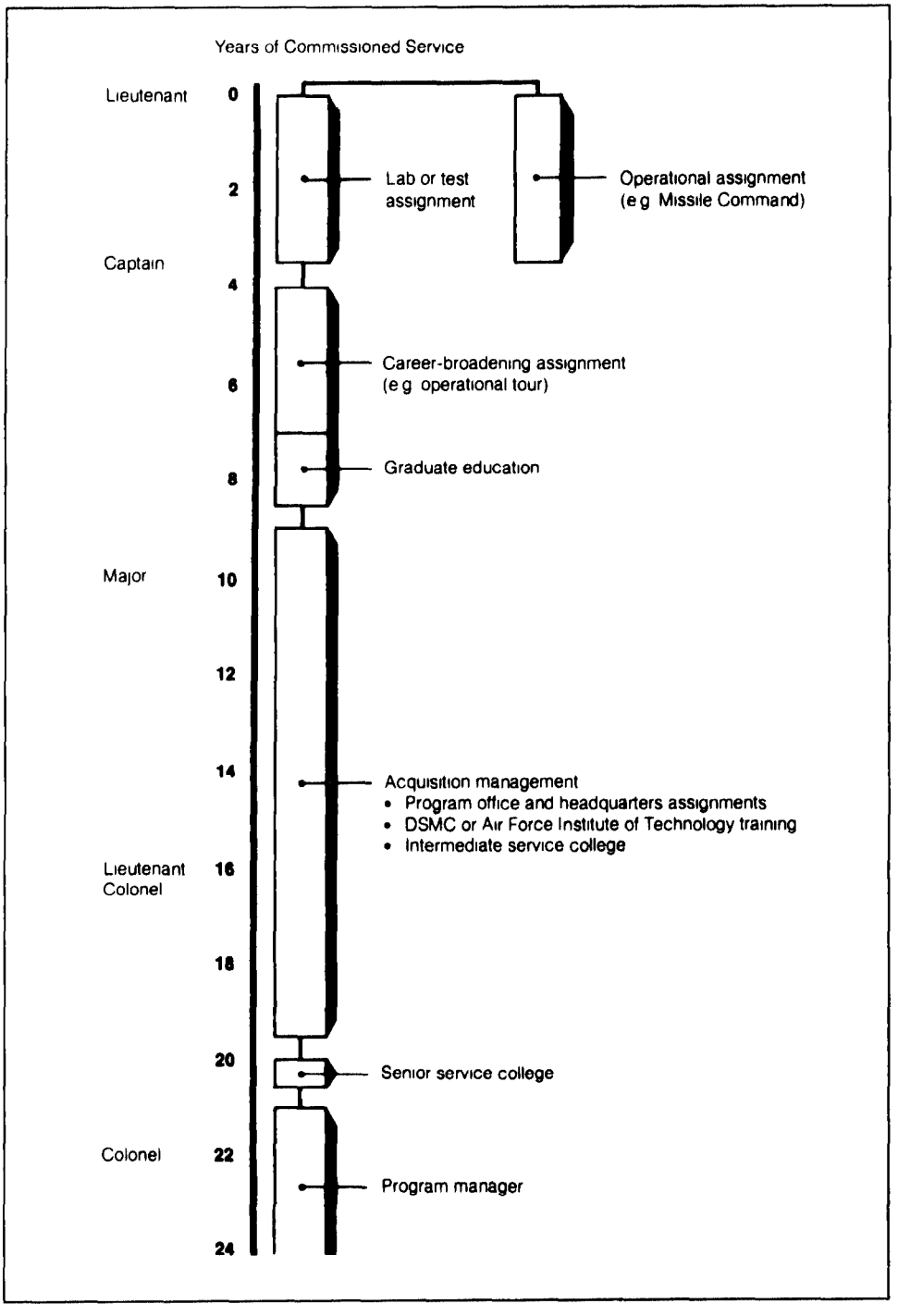
Over their careers, nonrated officers progress from one career field to another, generally starting with a technical field and moving into fields that emphasize managerial and leadership skills. They may begin their careers in the Air Force Systems Command, or they may enter through

an operational command, such as the Missile Command. Officers beginning in the Systems Command are likely to enter acquisition management via the development engineering or scientific fields and receive an initial assignment in a lab or test center. At about their 4th to 6th year, officers are advised to take a career-broadening tour. Obtaining operational experience is encouraged, although Air Force officials report difficulties in releasing engineers to operational assignments when shortages of engineers exist. Alternatively, officers may take career-broadening assignments outside their initial career fields. Officers who began their career in an operational command may transfer into the Air Force Systems Command at this point and take an assignment in a lab, test center, or program office. During this period, officers are also encouraged to attend Squadron Officers School and apply for graduate education.

Between their 7th and 11th year of service, nonrated officers pursuing program management as a career transfer out of their technical field into the acquisition program management career field. Officers entering this field must have an undergraduate degree in engineering, a physical science, math, or business management. Over the next 12 years, officers typically have two program office assignments and a headquarters assignment.

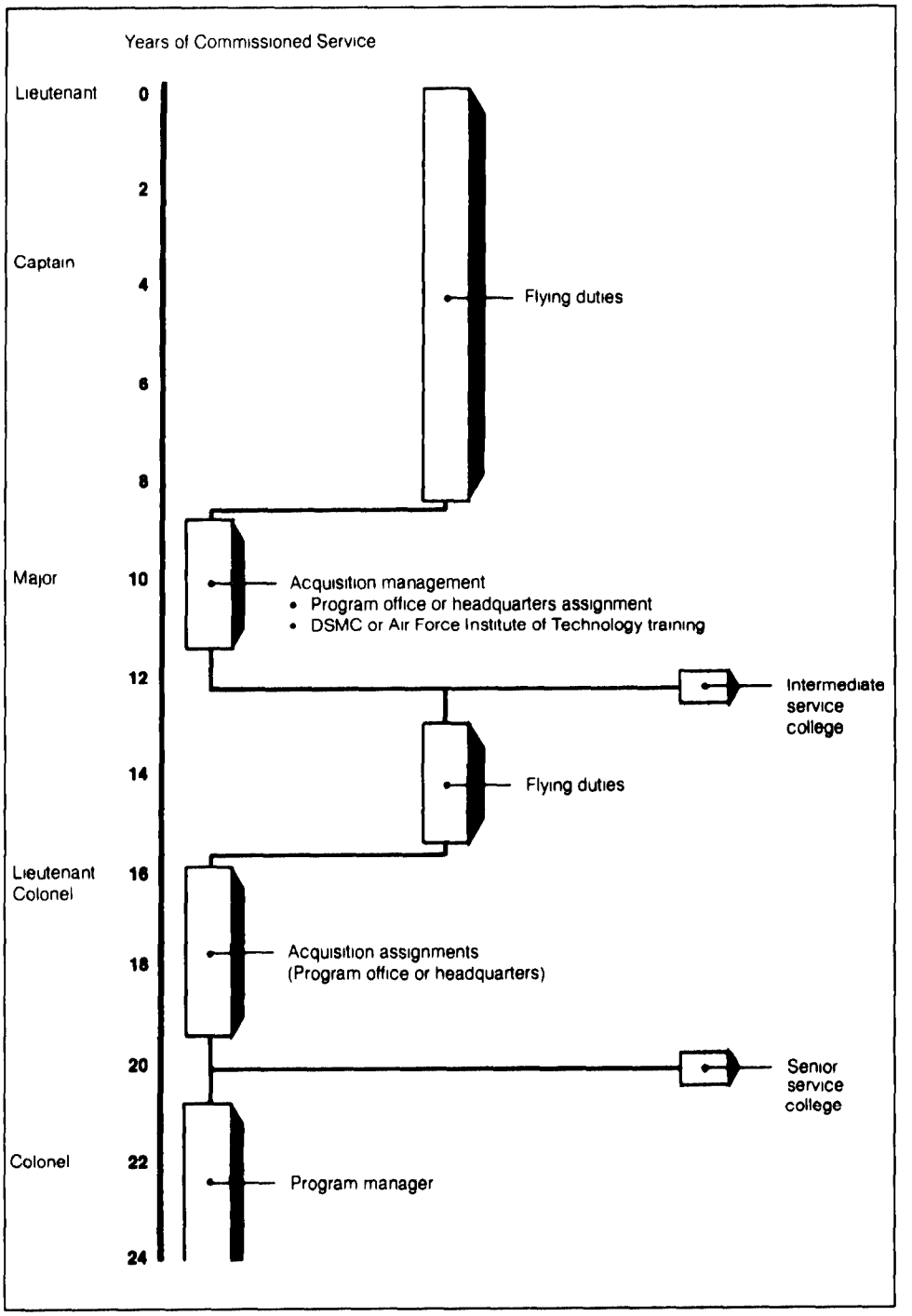
Program office assignments are intended to provide experience in two or three functional areas, such as (1) engineering, (2) configuration management (a component of systems engineering), (3) program control (financial management), (4) logistics support, and (5) test and evaluation. Headquarters assignments may be at the Systems Command headquarters or at the Air Staff or DOD level, although two headquarters assignments (one at Systems Command and one at Air Staff or higher level) are not uncommon. Officers may also receive a second operational assignment and/or participate in the Education with Industry program.

Figure 4.3: Typical Air Force Career Path for Nonrated Officer



Note Individual career paths will vary

Figure 4.4: Typical Air Force Career Path for Rated Officer



Note Individual career paths will vary

During this period, officers attend either the DSMC Program Management Course or specialized courses at the Air Force Institute of Technology. Officers may be selected to attend an intermediate service college (Armed Forces Staff College or Air Command and Staff College) and later, a senior service college (National War College, Air War College, or Industrial College of the Armed Forces).

Limited Time for Development of Rated Officers

The career path for rated officers differs from that followed by nonrated officers. For the Air Force to receive an appropriate return on training, and for officers to qualify for aviation incentive pay, rated officers generally spend at least 9 to 11 years in flying duties. Typically, officers spend their first 9 years in flying duties. They then rotate into the Systems Command for a 3-year acquisition assignment, often followed by attendance of intermediate service college, returning at completion to flying duties for an additional 3 years. At about their 15th to 16th year, officers are likely to return to the Systems Command and spend the remainder of their career in acquisition management. Thus, by the time rated officers are considered for assignment as program managers, they are likely to have about 7 years of acquisition experience. Air Force officials report that rated officers comprise about a third of those in acquisition management, although they account for about half the major program manager positions.

Selection of Program Managers

At about their 21st to 22nd year of service, officers are likely to be considered for program manager positions on major programs. Those selected are transferred into the program management career field. Eligibility requirements for this field, as defined in Air Force regulations, include (1) an undergraduate degree in engineering, a physical science, or math, (2) completion of the DSMC resident course, and (3) full qualification in a research and development career field, usually meaning 18 months to 4 years experience in either the acquisition program management, engineering development, or scientific career fields. Regulations also identify as desirable an advanced degree in management and completion of the Education with Industry program. Air Force officials report that these requirements are sometimes waived.

Selections of major program managers are made by the Commander, Air Force Systems Command, based on recommendations from the product divisions. Product division commanders select program managers for nonmajor programs, although colonels must also be approved by the vice commander of the Systems Command.

Air Force Career Path Not Always Followed

In several respects, the Air Force program resembles the desired conditions previously discussed; nonrated officers enter the acquisition field early in their career, usually gaining some early operational experience. Most of those entering the field have a degree in a technical field and are encouraged to earn an advanced degree in management. Completion of specialized training and service college is also encouraged. A career path has been established and desirable experiences, including experience across functional areas, have been identified. A program manager developed under the program would likely have at least one 4-year tour in a program office, headquarters experience, and at least 12 years total acquisition experience.

However, while the desired career path for nonrated officers was outlined by Air Force officials in response to our management survey and has been articulated in testimony by the commander of the Air Force Systems Command, we could not identify any written description of the career path for rated officers. Moreover, neither career path is clearly defined in official career guidance (Air Force Regulation 36-23). For example, the guidance does not define the importance or desirability of headquarters experience.

Further, the career pattern of several recently appointed program managers in our sample deviated significantly from the desired career pattern. Four of the 11 program managers in our sample lacked operational experience. Three lacked experience in a program office. Four had no headquarters experience. One officer's experience was almost exclusively in headquarters. Another's was exclusively in test. One officer entered the acquisition field as a colonel. And less than half attended the DSMC Program Management Course.

Rated officers had less acquisition experience; only one of the five rated officers in our sample had 8 years acquisition experience. The career path for rated officers provides for about 7 years of acquisition experience by their 21st year of service. Intensive management of rated officers' assignments could provide for more acquisition experience: certain acquisition-related positions such as test pilot also satisfy flying obligations. Alternatively, we believe Air Force management needs to consider the extent to which rated officers should be a source of program managers.

Changes Needed in Army Program

The Army's program for developing acquisition managers, including program managers, is the Materiel Acquisition Management (MAM) program. Initiated in 1983, the program focuses on ensuring that officers with the appropriate background and interest are assigned to acquisition positions and obtain specialized training. It is a more structured program involving more intensive management than the program it replaced.

MAM operates within the framework of the Army's Officer Personnel Management System, a system based on the concept of dual specialty development.[6] Under the current system, officers entering the Army are assigned to a combat arms branch (e.g., infantry, aviation), combat support branch (e.g., Signal Corps), or combat services support branch (e.g., ordnance, Transportation Corps). Officers also select an initial specialty generally associated with their branch, such as infantry or missile material management. By completion of their 8th year, the officers must also designate an additional specialty or functional area. Additional specialities include most of the 26 initial specialties and 12 other specialties not available to officers on initial entry into the Army. The latter includes such acquisition-related specialties as research and development and procurement. Starting about the 6th to 8th year, and for the remainder of their careers, officers generally alternate between assignments in their initial (branch) specialty and those in their additional specialty.

Acquisition management is neither an initial nor an additional specialty. Rather, officers in acquisition-related specialties (see table 4.6) can participate in MAM, which seeks to ensure that they are assigned to acquisition-related positions within their acquisition specialty.[7]

[6]Changes in the system were approved in 1984 and are being implemented incrementally from 1985 to 1989. Key changes are discussed below

[7]A MAM specialty can be an officer's initial or additional specialty (or both) but is most commonly the additional specialty

Table 4.6: MAM-Related Specialties

Specialty	Number of positions (FY 1985)	Percent of 1,909 MAM officers with specialty[a]
Research and development	1,247	43 9
Procurement and production	306	16 3
Operations research/systems analysis	142	8 3
Automated data systems management	90	4 5
Communications-electronics engineering	72	6 9
Missile material management	45	7 0
Communications-electronics material	40	2 4
Maintenance management	30	16 3
Material/services management	30	14.3
Aviation logistics	28	7 5
Comptroller	13	1 3
Chemical	11	2 8
Nuclear weapons	10	2 1
Munitions material management	3	6.4
Total	**2,067**	

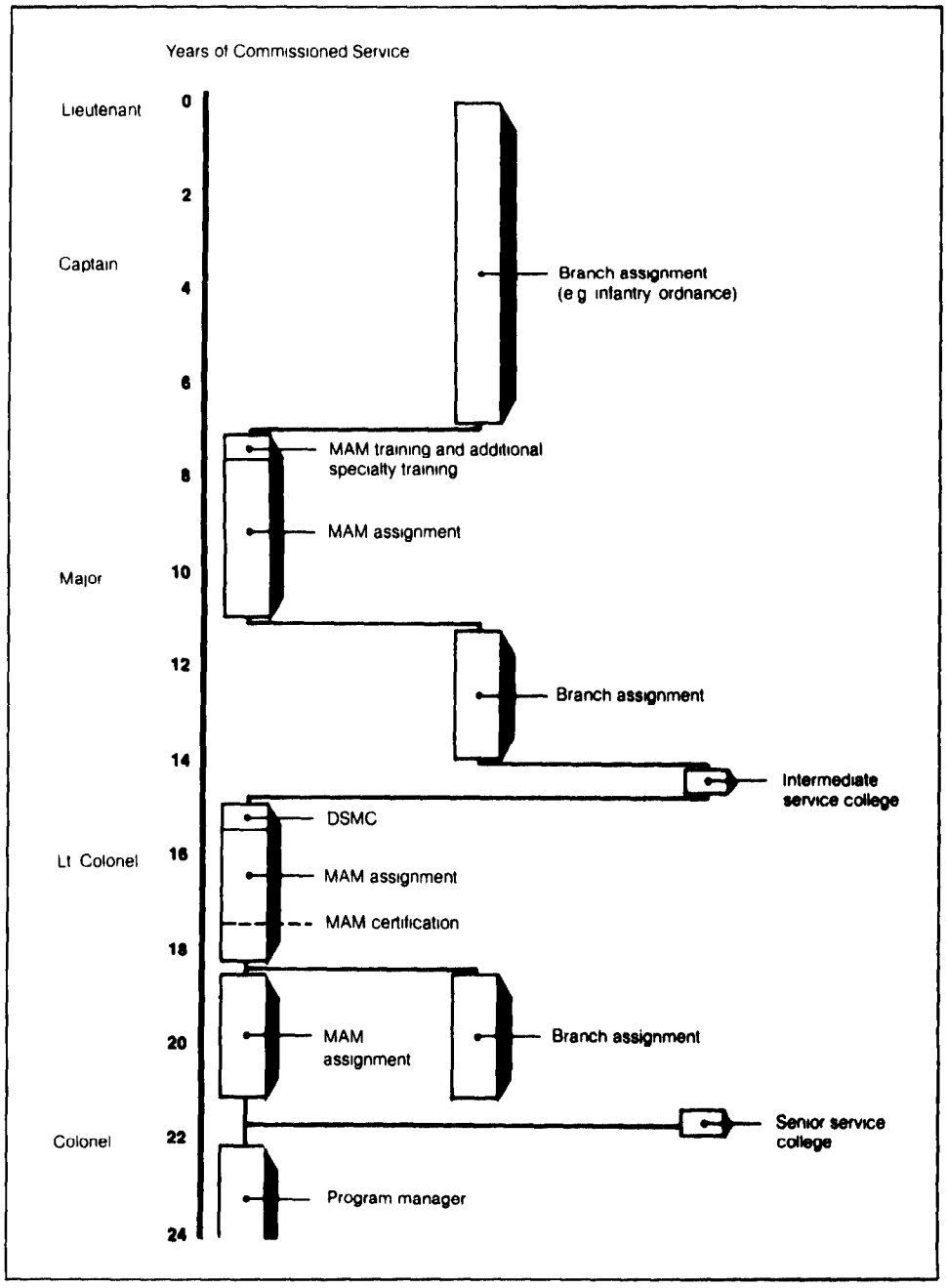
[a]Adds to more than 100 percent since some officers' initial and additional specialties are both MAM specialties (As of August 1985)

Officers are encouraged to apply for MAM after 5-1/2 years of service, although entry is allowed considerably later. Entry is competitive with selections made by a central selection board. Entry requirements include (1) designation of a MAM-related specialty, (2) a degree in engineering, science, or business/management (officers without degrees in these fields may qualify on the basis of acquisition training or experience), and (3) 6 years of commissioned service remaining.

MAM consists of three phases. The first, called the user/support development phase, is the officers' first 6 to 8 years of service, spent in the initial branch, as shown in figure 4.5. This phase provides experience with the type of systems and equipment that officers may eventually develop and acquire.

The second phase, known as the MAM development phase, begins after formal entry into MAM and runs from about the officers' 6th to 8th year of service to the 16th year. During this phase, MAM officers attend the 9-week MAM training course at the Army Logistics Management Center and complete their first acquisition assignment. Following an assignment in their branch, officers also attend the DSMC Program Management Course and complete a second MAM assignment. MAM development assignments

Figure 4.5: Typical Army Career Path for MAM Officer



Note Individual career paths will vary

include, for example, positions in a program office or a research and development lab, at headquarters, or with industry under the Training with Industry program.

The third phase, known as the certified manager phase, commences at approximately the 16th year of service. After selection for promotion to lieutenant colonel, officers are evaluated for certification as Materiel Acquisition Managers by a central board. Certification requirements for the mature MAM program include completing two acquisition assignments and the MAM and DSMC training courses. As certified acquisition managers, the officers could be considered for appointment as program managers of major programs, as well as other acquisition positions of significant responsibility.

MAM certification is not a prerequisite for appointment as a program manager. Selection criteria depend on the specific position but generally include command, program office and headquarters experience, DSMC training, and senior service college. Selections are made by a central board.

MAM is in Transitional Stage

It is envisioned that under a mature MAM program, officers will enter MAM at about their 6th year of service and complete two MAM assignments and training courses before being certified at the lieutenant colonel level. Army officials recognize, however, that it will take several years to achieve this goal. Officers are entering MAM at the rank of major and lieutenant colonel and can be certified without meeting all of the established criteria for the mature program. For example, 46 percent of the 334 officers admitted to MAM by the 1984-85 selection boards[8] were captains, 41 percent were majors, and 13 percent were lieutenant colonels. Officers are admitted to MAM later than envisioned partly because of the program's newness and partly because of a shortage of MAM officers relative to the number of MAM positions. Further, certification requirements have also been relaxed. Officers can be certified if they completed the DSMC Program Management Course and one MAM assignment or, if they did not attend DSMC, if they completed two or more MAM assignments.

[8]September 1984, January 1985, and April 1985 selection boards

Changes in Personnel System Will Provide Opportunity for Increased Acquisition Experience

Changes in the Army's officer personnel management system were approved in 1984. Under the modified system, some officers will continue to dual track, that is, alternate between assignments in their branch and their additional specialty, called "functional area" under the revised system. However, some will be allowed to "sequentially" track, that is, transfer from their branch to a functional area in about their 8th year (or to another branch in their 3rd or 8th year), receiving repetitive assignments in that functional area or branch. Such officers will not receive further assignments in their initial, accession branch. (The modified system will also permit some officers to "single track," that is, receive assignments only in their initial branch, but Army officials stated that this option will not normally apply to officers in acquisition fields.) As before, MAM will not be a specialty or functional area, but a skill encompassing officers across functional areas.

Army officials were unsure of the effect of these changes on MAM; the number of officers who will dual track or sequentially track has not yet been determined. However, combat arms officers (i.e., those in infantry, armor, artillery and aviation specialties) who want to remain in these specialties will be required to dual track. By the time they are promoted to colonel, these officers will likely receive only about 6 years of experience if they return to their branch as lieutenant colonels, for example, for assignment as battalion commander. Officers who remain in acquisition assignments after MAM certification will likely receive 8 to 9 years of acquisition experience. Officers who sequentially track will receive significantly more years of acquisition experience in an acquisition specialty. To the extent that MAM officers will sequentially track, we believe the program will be strengthened since sequential tracking will allow them to obtain substantial qualifying acquisition experience and leave time in their careers to utilize it.

MAM Officers Retain Functional Specialty Identity

MAM is designed to ensure that MAM officers are placed in acquisition positions within their specialty or functional area. Limited emphasis is placed on providing officers experience in different functional fields, the desired development pattern defined earlier.

Officers' positions are coded with two numbers. The first number (for MAM positions) denotes the acquisition specialty or functional area required and the second denotes the "hardware/ alignment" specialty desired, that is, the initial combat arms or support/services branch which gives officers their user orientation. MAM positions are also identified by a third number (6T) called an additional skill identifier.

Officers are assigned to positions in their functional area, generally dealing with acquisition of hardware and equipment associated with their branch. As a result, a research and development officer would receive only MAM assignments requiring this specialty. Exposure to other functional areas would be limited to assignments, such as those in a program office, requiring coordination or integration of functional areas. For example, a research and development coordinator in a program office could work with the logistics manager to ensure that logistics issues are addressed in system design, thus gaining some familiarity with logistics.

Some specialties, such as research and development—a specialty held by 44 percent of MAM officers—are relatively broad. The research and development specialty can include assignments in a program office, laboratory, test center or at headquarters. However, the research and development officer may choose to develop an area of concentration or subspecialty, limiting the diversity of assignments. For example, one research and development officer in our sample had experience almost exclusively in logistics management before becoming program manager of a major program. Another's experience was oriented primarily to the early requirements determination process.

Other MAM specialties are considerably narrower. For example, the procurement and production specialty involves assignments in contract formulation and administration and/or in production management and analyses. Officers in the operations research/systems analysis specialty are assigned to positions requiring the application of quantitative analysis skills to strategy, operational, and managerial defense issues; few such opportunities currently exist in program offices. Such specialties are not designed to develop acquisition managers with diversified acquisition experience.

Functional Specialty in Acquisition Management Is Desirable

Development of a career program that meets the desired conditions, that is, provides sufficient and diversified acquisition experience, suggests the need to create a functional specialty in material acquisition management. A functional specialty has several advantages.

First, it would permit greater direction and control over officers' career paths. Currently, MAM does not define the types of experiences—such as program office, logistics, test, or headquarters—desired for officers with particular career goals, such as program management. The number of specialties included in MAM makes it difficult to do so since many of

the specialties are relatively narrow or include few MAM-designated positions.

Second, a functional specialty would give MAM higher priority in the assignment process. Currently, first priority is given to matching an officer's specialty to the first specialty designated on a position request, second priority to the second specialty listed, and third priority to the MAM (additional skill) identifier. About 40 percent of MAM-designated positions are filled by MAM officers. If it were a specialty, MAM would be given first priority in the assignment process.

Third, as a functional specialty, there would be a floor (minimum) on the number of MAM promotions. A floor is set for each specialty based on the number of eligible officers in the specialty. Army officials are concerned that MAM will increasingly take officers away from the troops, affecting their competitiveness for battalion command and, thus, promotion. Battalion command is closely related to promotion: 94.4 percent of those with command credit were promoted to colonel (first time considered) in 1985, compared with an average promotion rate of 53.4 percent.

Changes Needed in Navy Program

The Navy has two programs for developing program managers. The Weapon Systems Acquisition Management (WSAM) Program, instituted in 1975, covers development of officers in the lieutenant through captain grades. The Materiel Professional Program, instituted in 1985, covers officers in the commander/captain grades and above.

WSAM Program

WSAM was created to identify, track, and improve utilization of personnel with experience and education related to the acquisition field. Like the Army's MAM program, it is not a specialty but is composed of officers from several specialties. It is less structured than MAM and requires less experience to be designated as a fully qualified manager.

WSAM officers are designated as either proven managers or manager selectees. To qualify as a proven manager (designated WW1) the officer should have (1) 4 years or two tours in acquisition positions, (2) graduate education in a technical or business field or completion of the Nuclear Power School, the Test Pilot School, the Industrial College of the Armed Forces, or DSMC, and (3) demonstrated superior performance. An officer designated as a proven manager by two successive selection boards is given the designation WW2. DSMC training is not required for an officer to be designated a proven manager.

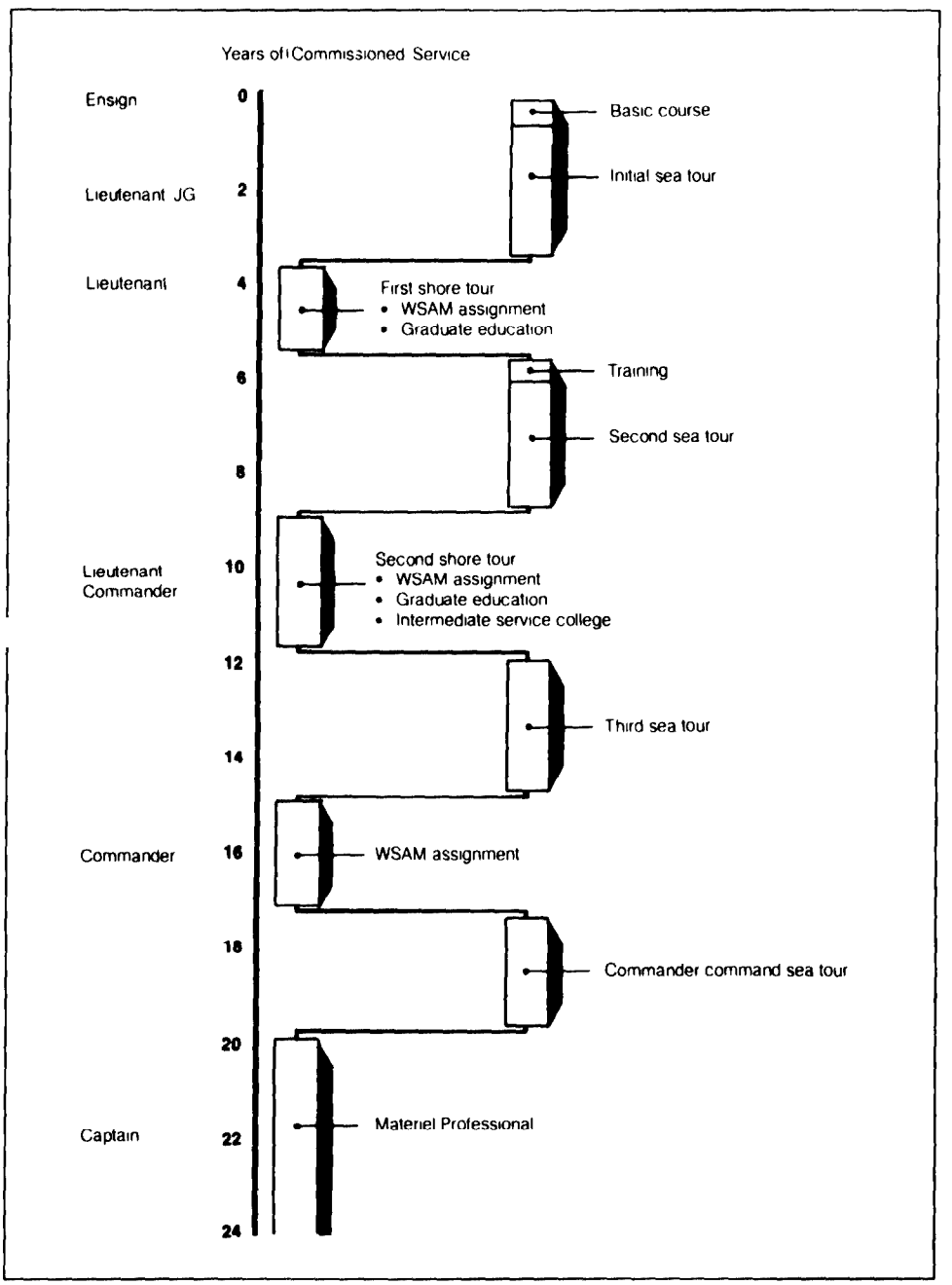
To be designated a manager selectee, officers at the lieutenant commander grade or above must have a technical or business educational background (as defined above) and one 2-year tour in an acquisition position. Officers generally enter the program at the grade of lieutenant commander or commander.

WSAM positions are classified in three categories: (1) WW1 positions requiring a proven manager, (2) WPI positions for which a proven manager is preferred, and (3) WT1 positions, which are training positions for manager selectees or officers interested in qualifying for WSAM. Assignment of a WSAM officer to a non-WSAM position (and vice versus) requires approval by a flag officer.

A WSAM selection board meets annually to screen new applicants and evaluate officers' qualifications for designation as a proven manager. The board also evaluates whether officers should be dropped from the WSAM pool, based on the absence of a recent acquisition assignment.

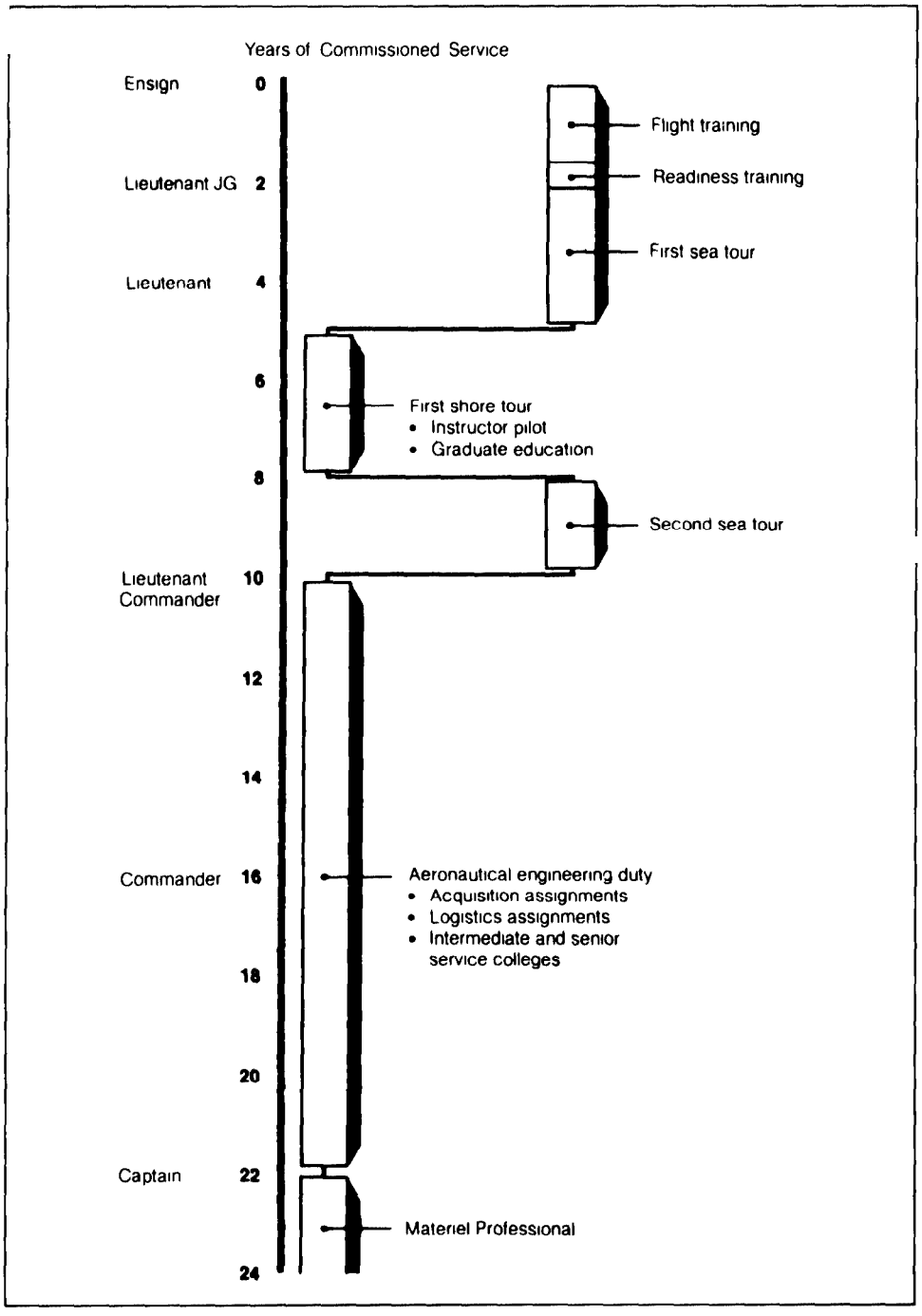
The WSAM population includes unrestricted line officers (those in such warfighting specialties as surface warfare, aviation warfare, and submarine warfare); restricted line officers (e.g., those in engineering duty and aeronautical engineering duty specialties); and staff corps (e.g., those in the Supply Corps). As of October 1985, 45 percent of the 2,834 WSAM officers were drawn from the unrestricted line, 38 percent from the restricted line, and 16 percent from the staff corps. The career paths for unrestricted and restricted line officers are illustrated in figures 4.6 and 4.7.

Figure 4.6: Typical Navy Career Path for Unrestricted Line (*Surface Warfare*) **Officer**



Note Individual career paths will vary

Figure 4.7: Typical Navy Career Path for Restricted Line (Aeronautical Engineering Duty) **Officer**



Note Individual career paths will vary

Unrestricted line officers spend a considerable portion of their first 20 years at sea or in specialized training, usually about 12 to 14 years. This leaves limited time available for development of a WSAM subspecialty. As shown in figure 4.6, unrestricted line officers typically serve in their first acquisition assignment at the grade of lieutenant or lieutenant commander, often devoting one of their shore assignments to graduate education. As commanders, they are likely to have a second acquisition assignment, and possibly a third assignment as a senior commander. Thus, by the time unrestricted line officers reach the grade of captain, they are likely to have approximately 4 to 7 years of acquisition experience, less than that desired.

The career pattern for restricted line officers more closely resembles the desired career pattern. Officers spend the first part of their career in the unrestricted line. Officers typically transfer into the engineering duty community after completing their first or second sea tour. Aviation officers typically transfer into the aeronautical engineering duty community at the rank of lieutenant commander, usually after 9 to 12 years of service. These officers spend the remainder of their careers in engineering positions and thus have the opportunity to gain a substantial number of years of acquisition experience.

Supply Corps officers alternate between sea and shore assignments, typically spending about 6 to 8 years at sea during their first 20 years of service. They are primarily concerned with the financial management and contracting aspects of acquisition and have little opportunity to gain experience in technical positions. Supply Corps officers are thus only considered for program manager positions for programs in the production phase.

Differences between the experience of unrestricted line officers and that of restricted line/staff corps officers are confirmed by Navy statistics on WSAM proven managers. Unrestricted line proven managers (as of November 1984) had an average of 4.3 years of acquisition experience. In contrast, restricted line officers had an average of 7.2 years of experience and staff corps proven managers, an average of 7.4 years.[9]

Materiel Professional Program

The Materiel Professional Program was created to attract and develop high-quality officers for managing systems acquisition, logistics, and

[9]These figures are subject to error but are the best available, they should thus be viewed as indicative of trends rather than as precise measures of acquisition experience

support. The program seeks to achieve this objective by providing a clear path to flag rank for officers in material management; about 40 percent of the Navy's 253 flag rank positions are reserved for officers in the program. However, the program does not significantly alter the career pattern of officers in the acquisition field, thus having little effect on the time available for unrestricted line officers to obtain acquisition (or other material management) experience.

Materiel Professional officers are drawn from the unrestricted line, the restricted line, and the staff corps. Once selected for the program, officers are assigned to Materiel Professional designated positions for the remainder of their careers. Assignment of a Materiel Professional officer to a nonprogram position or a nonprogram officer to a Materiel Professional position requires a waiver recommended by the Chief of Naval Operations and approved by the Secretary of the Navy.

Procedures for selecting officers for the program differ for the unrestricted line and the restricted line/staff corps. Unrestricted line officers are evaluated by a screening board after they have been screened for command assignments at the commander grade. The screening board considers those officers in the surface warfare, submarine warfare, or aviation specialties (1) who have the subspecialties shown in table 4.7 or are WSAM proven managers (WW1/WW2) or (2) who volunteer for the program. Officers are evaluated using "best qualified" standards based on education, experience, and potential. There are no minimum educational or experience requirements. A list of candidates is submitted to the Materiel Professional Standing Board. The standing board selects candidates and forwards its list to the Secretary of the Navy for approval. Those selected are invited to become Materiel Professionals; entry is voluntary.

The number of Materiel Professionals selected from the unrestricted line is controlled by a quota system. The approximate annual quota is 13 aviation, 12 surface warfare, and 7 submarine warfare officers.

Officers in the covered restricted line and staff corps specialties (shown in table 4.7) are evaluated by the standing board after promotion to captain. Those selected and approved by the Secretary of the Navy are invited to become Materiel Professionals. It is anticipated that nearly all the captain positions in the covered restricted line and staff corps communities will be included in the Materiel Professional Program.

Table 4.7: Specialties Included in Materiel Professional Program

Unrestricted line	Specialties
	Surface warfare Aviation warfare Submarine warfare
	Subspecialties
	Financial management Material logistics support management Acquisition management Applied math Operational analysis Antisubmarine warfare Command and control Electronic warfare Geophysics Oceanography Naval systems engineering Weapon systems engineering Aeronautical systems engineering Communications Computer technology Masters of Business Administration
	Additional qualification designator
	Weapon systems acquisition management (WW1/WW2)
Restricted line	Engineering duty Aeronautical engineering duty Aviation maintenance duty
Staff corps	Supply Corps Civil Engineering Corps

Materiel Professional officers will compete for promotion within their respective line and staff corps communities. Equitable consideration will be ensured by precepts (instructions) to the promotion boards. These precepts will identify Materiel Professional skill needs and any personnel shortages. Approximately 38 flag rank positions are reserved for Materiel Professionals in the unrestricted line, 28 in the restricted line, and 35 in the staff corps.

Career Pattern for Materiel Professionals

The career pattern for officers selected for the Materiel Professional Program will not be significantly different from that previously followed by officers in acquisition management. As before, restricted line and staff corps officers will have repeated assignments in their specialty, except that they will likely be designated Materiel Professionals after promotion to captain. Unrestricted line officers will, as before,

spend most of their first 20 years in operational assignments. These officers will be evaluated for the Materiel Professional Program as commanders. Selected officers are expected to complete their commander command assignments, thus becoming available for their first Materiel Professional assignments at about their 20th to 21st year of service, or about the time of promotion to captain. As captains, they would be considered for assignment to positions of significant responsibility, such as major program manager. Previously, unrestricted line officers were screened for major program manager, major sea command, and major shore command at the grade of captain. (Major program managers have also been selected from officers completing major sea or shore commands.)

The primary impact of the Materiel Professional Program is expected to be on the kind of officer attracted to material management. By providing a clear path to flag rank, Navy officials expect to attract high-quality officers who otherwise would seek major sea or shore command. Previously, officers without major sea or shore command were unlikely to be promoted to flag rank. Of the eight unrestricted line officers promoted to flag rank in fiscal years 1983-85 who had served as major program managers, all but one had had a major sea command. Moreover, Navy officials anticipate that officers seeking to be competitive for the program will place greater priority on obtaining desired education and material management experience.

Some Program Managers Selected Have Limited Acquisition Experience

Major program managers will be selected from among Materiel Professional officers. A screening board (the Materiel Professional Major Command Screening Board) will identify candidates for program manager positions. Selections will be made by the commander of the appropriate systems command or the Chief of Naval Research and forwarded to the Materiel Professional Standing Board for approval.

As of September 1985, 44 percent of major program managers were restricted line officers and 41 percent were unrestricted line; none were from the Supply Corps. (The remaining program manager positions were filled by civilians, Marine Corps and Medical Corps officers.)

Recent selections include officers with limited or no acquisition experience. One of the 10 officers in our sample had no prior acquisition experience, and 3 other officers had less than 4 years. Half had no prior program office experience.

Reconsideration of Unrestricted Line Officer's Career Path Needed

Development of a career program that meets desired conditions requires reconsideration of the unrestricted line officer's career path. Because of the demands of sea duty, limited time is available to gain acquisition experience. The restricted line career path, beginning in an operational community and followed by repeated engineering/aeronautical engineering duty assignments, allows adequate time to develop and utilize acquisition experience. For the Supply Corps officer, adequate time is available to gain acquisition experience, but there is limited opportunity to develop technical skills.

However, the career path for officers in the engineering and aeronautical engineering duty communities needs to be better defined. Both communities include assignments in acquisition and logistics (readiness), and a balance between the two is viewed as desirable. Further, the kinds of acquisition experience the officers should obtain—such as program office or test experience—are not well defined. Thus, to ensure that officers obtain the desired pattern and amount of acquisition experience, we believe the career path for officers specializing in acquisition should be clearly identified.

Current Efforts to Develop Civilian Program Managers

Although DOD Directive 5000.23, issued in 1974, requires development of civilians in program management, the services have been largely unsuccessful in establishing effective civilian programs The Army's and Air Force's recently revised programs offer some promise, although advancement potential has not yet been defined and in the case of the Air Force, program coverage is limited. The Navy is currently developing civilian programs.

Few civilians are actually used as program managers. There are no civilian program managers on major Army programs; civilian program managers are found on four major Navy programs and one Air Force program.[10] Civilians are more commonly used as program managers on less than major programs—35 percent of Air Force, 25 percent of Navy, and 21 percent of Army program managers for less than major programs are civilians.[11] Civilians are frequently used as deputy program managers.

[10]As of September 1985

[11]As of October 1985 for Air Force, July 1984 for Navy, and September 1985 for Army

Experts we consulted[12] identified several reasons for the difficulties encountered in establishing viable civilian programs. They perceived that

- the civil service system is considerably less flexible than the military system, making it difficult to control or influence the career path of civilians;
- civilians are narrowly developed in a functional specialty because of the difficulty involved in assigning them to positions outside their functional specialty;
- it is considerably more difficult to remove a civilian from a program due to performance problems than a military officer, and it is also difficult to geographically relocate civilians; and
- the services prefer military program managers.

While agreeing that military officers were preferred for some combat systems, experts believed that many other programs could be led by civilian program managers. Further, they perceived a need to expand the pool of highly qualified personnel from which program managers could be selected and to better utilize civilian resources. To achieve these objectives and overcome problems which have hampered previous efforts, the experts identified several desired characteristics of civilian programs.

- An appropriate, professional career series should be established in program management to provide more flexibility in developing diversified (cross-functional) experience.
- Civilians should begin in a functional field and enter the program management field at about the GS-11/12 level. (The triservice panel recommended the GS-13 level.)
- A source of career information on program management needs to be established; currently, functional managers (who represent one career alternative) are the primary source of career information.

Experts also believed that contracting officers represented a source of civilian program managers. The Office of Federal Procurement Policy, in commenting on a draft of this report, also stated that contracting officers should be recruited for program manager positions.

[12]We held a panel in May 1985 on civilian career programs Panel members included former and current service officials

Army's Logistics and Acquisition Management Program

The Army initiated the Logistics and Acquisition Management Program in 1984 to develop civilian managers for multifunctional management positions combining logistics and acquisition. Targeted positions include that of deputy program manager.

The program has three parts. The first, which covers the GS-5 to GS-12 grades, gives participants in acquisition and logistics specialties broader experience within their initial specialty (logistics/acquisition). This part emphasizes formal training courses and, in some cases, rotational assignments. During the second part, which begins at the GS-13 level, participants obtain experience in the alternate specialty (e.g., acquisition for participants with a logistics specialty). The goal is for participants to become knowledgeable of the other specialty, rather than to qualify as experts in it. This knowledge is gained through formal training which includes a core curriculum. Participants also receive a minimum of one 120-day rotational assignment in the alternative specialty and a second rotational assignment in their primary specialty but at a different organizational level. Completion of the DSMC Program Management Course is an option, depending on participants' background and career goals.

The third phase, which has not yet been implemented, occurs after graduation from the program. Positions at the GS-14, 15, and Senior Executive Service levels will be designated for which program participants will be automatically considered. These designated positions will also be open to candidates from outside the program, but if a program graduate is not chosen, the selecting official must explain his/her choice in writing.

Program success will ultimately depend on implementing this third phase. Senior positions will need to be available and program graduates successful in competing for them.

Air Force Program Limited in Coverage

The Air Force's primary program for developing civilian program managers is the Systems Acquisition Career Management Program for Civilians. The program operates under the direction of and within the Air Force Systems Command. A redesigned program is currently being put in place.

The first phase of the redesigned program may begin at the entry (GS-5/7) level. (Product divisions can decide whether to include this early phase.) This phase consists primarily of additional training and, potentially, a rotational assignment outside the participant's functional field.

The core of the program begins at the GS-12 level with participants graduating at the GS-13 level. During this phase, participants are given a series of 3- to 9-month rotational assignments. Such assignments can include, for example, program office, logistics, and business/financial management. The program also includes attendance at DSMC's Program Management Course.

While the program includes several desirable features, there are several concerns. First, the career path after program graduation is unclear. Each product division designates positions for competition among program graduates. Thus far, few higher level program office positions have been designated. Thus, advancement potential may be limited, making the program unattractive compared with competing functional (e.g., logistics) career development programs.

Further, the program is limited in coverage; product divisions decide whether or not to participate and what elements to include. During fiscal year 1985, only one of the four product divisions—the Aeronautical Systems Division—admitted new entrants to the program. Its program concentrates on GS-12 employees. The Armament Division is expected to initiate an entry level program during fiscal year 1986.

Navy Is Developing New Civilian Programs

The Navy is currently developing acquisition management programs for civilians. Although a WSAM Program for civilians was initiated, it was never fully implemented. In 1984, an instruction was issued placing responsibility for civilian acquisition career programs on individual systems commands. The Naval Air Systems Command is currently developing a program for entry-level, mid-level, and executive level personnel. The Naval Sea Systems Command plans to expand its Commanders' Development Program to include additional acquisition positions and to add acquisition courses to the curriculum offered by the Naval Sea Systems Command Institute. The Space and Warfare Systems Command, which was recently reorganized, has not yet developed a program. In addition to systems command programs, a civilian Materiel Professional Program is being developed for Senior Executive Service personnel.

Recent Congressional and Executive Initiatives to Establish Program Manager Qualifications

The DOD Authorization Act of 1986 requires that regulations be issued establishing experience and training requirements for those assigned as program managers of major programs. The regulations must require that, as a minimum, program managers (1) have attended the DSMC Program Management Course (or a comparable course) and (2) have at least 8 years of experience in the acquisition, support, and maintenance of weapon systems, including 2 years at a procurement command. (Time spent at DSMC or pursuing graduate education in a technical or management field may be counted against the 8-year requirement.) Flag and general officers assigned to systems commands must also be required to meet these education and experience requirements.

The act is valuable in introducing minimum qualifications for program managers. However, the requirements established are considerably less stringent than those defined as desirable by panels and other sources, particularly since the 8-year requirement can be satisfied by a wide range of experiences not directly related to acquisition or by experience narrowly confined to one aspect of acquisition. To meet the objective of a highly qualified cadre of program managers, we believe the services should establish qualifications for program managers more demanding than those set by the act.

DOD has undertaken a new initiative in this area. In August 1985, the Deputy Secretary of Defense directed that experience prerequisites and training requirements for procurement and program management officials be established. The process is expected to be completed by spring, 1986.

Conclusions

Appropriate career development of program managers requires career fields which provide an adequate intensity and diversity of experience. All three services provide the option for officers to spend the major part of their career in acquisition. At the same time, service programs also allow officers to pursue careers in both acquisition and operational specialties. With the requirements in operational specialties clearly defined, development of acquisition skills is fitted into the remaining time. This becomes problematic when the remaining time is limited. The services need to address the issue of how much operational experience is necessary for the development of program managers.

Improvements are needed in other areas as well. Desired qualifying experiences need to be more clearly defined. And opportunities need to be made available for civilians in program management.

Recommendations

We recommend that the Secretary of the Air Force:

- Modify the acquisition career field to identify desired acquisition experience within this career field.
- Identify types of program manager positions for which civilians should be considered.
- Select program managers based on demonstrated performance in the acquisition career field.
- Expand the coverage of the civilian acquisition career program.

We recommend that the Secretary of the Army:

- Establish a functional specialty in acquisition management and define desired acquisition experience within this career field.
- Identify types of program manager positions for which civilians should be considered.
- Select program managers based on demonstrated performance in the acquisition career field.

We recommend that the Secretary of the Navy:

- Establish a career field in acquisition that provides adequate acquisition experience and defines desired acquisition experiences.
- Identify types of program manager positions for which civilians should be considered.
- Select program managers based on demonstrated performance in the acquisition career field.

Agency Comments and Our Response

In official oral comments, DOD generally agreed with the chapter's findings and recommendations. It concurred that changes were needed in service programs, but noted that the model presented in the chapter might be too restrictive, given the limited time available in the career path for officers who serve in operational and acquisition tours. DOD suggested that alternatives proposed by the Assistant Secretary of Defense (Acquisition and Logistics) represent another approach to these problems. These proposals include establishment of a Defense Acquisition Corps, a Professional Acquisition Service, or a Defense Acquisition Agency.

The model presented in this chapter was developed with the assistance of top DOD program managers selected by the military services. The

model they helped to design could be considered restrictive only if operational rather than acquisition experience dominated assignments. Nevertheless, we do not advocate that the model be adopted in total. We believe it provides a useful framework for developing career paths appropriate to the needs of individual services.

DOD agreed with our recommendations on modifying the acquisition career fields and stated the DOD initiative discussed in the draft report (p. 106), involving establishment of experience and training requirements, would be the basis for these modifications. This initiative would also be the basis for modifying the Air Force's civilian career program. DOD also concurred with our recommendations on selecting program managers based on demonstrated performance in the career field. Further, DOD stated that it will investigate identifying program manager positions for which civilians should be considered as an interim step, while the Assistant Secretary of Defense's proposals were considered for implementation.

The Office of Federal Procurement Policy commented that development programs for program managers should emphasize industrial management skills, including proficiency in design engineering, production/factory management, business/financial management, and contracting/legal disciplines. We believe that DOD should consider these suggestions in responding to our recommendations to define desired qualifying experiences.

Career Programs for Civilian Contracting Officers

Contracting officers are the official government agents authorized to enter into contracts and obligate funds. Other members of the procurement work force, of which civilian employees comprise about 89 percent, include contract and procurement specialists, contract negotiators and administrators, and procurement analysts. This work force is responsible for purchasing various commodities and services, including complex major weapon systems, for the government.

To develop a qualified, professional work force, all three services have updated or established new career programs for civilian contracting personnel. These programs cover all contracting personnel, including major weapon system contracting officers. To be effective, the programs need to be based on clearly defined roles and responsibilities. But as discussed in chapter 2, the roles and responsibilities of major weapon system contracting officers are vague in the planning phase and vary considerably in practice. Other problems which could hamper career development are:

- While DOD does offer contracting training and experience, it is standard across the board and not tailored to the different skill levels needed for particular commodities. Generally, senior-level major weapon systems contracting personnel are required to take the same training as senior-level personnel who purchase commercial items.
- Personnel are not required to meet specific or uniform educational or experience requirements before selection as a major weapon systems contracting officer.
- Clear career paths and incentives leading to increasing responsibility are lacking.

Historical Concerns

Over the years, concern over the effectiveness of the procurement work force—and, in particular, the contracting officer—has increased. The Federal Acquisition Institute was created to assist in improving career development and training of government procurement personnel. In 1980 the Institute published Guidelines for Developing Procurement Career Programs to help agencies improve the quality and productivity of their present and future work force.

On March 17, 1982, Executive Order 12352 tasked each executive agency and department to:

"Establish career management programs, covering the full range of personnel management functions, that will result in a highly qualified, well managed professional procurement work force, . . ."

Subsequently, interagency task groups under the Office of Management and Budget/Office of Federal Procurement Policy leadership were established to design guidance for implementing the order. The career management program task group (Task Group 6) has since published Guidance on Establishing Procurement Career Management Programs in Support of Executive Order 12352. This guidance covers intern programs, contracting officer qualification programs, and performance incentives.

In 1983, the National Academy of Public Administration did a study[1] on the effectiveness of the procurement work force. The study concluded that the civilian work force was "overloaded, untrained, and inexperienced" and made a number of recommendations to professionalize the work force through improved personnel management. In addition, during a number of hearings on the issue, the Congress has voiced concern about the training and professionalism of contracting officers and their ability to deal effectively with contractors.

In response to these concerns, government agencies have initiated several efforts. As discussed below, the military services have recently designed new career programs or improved the existing ones. These programs basically cover all civilian fields related to acquisition.

Civilian Career Programs Focus on Developing a Qualified Work Force

The Air Force Acquisition Civilian Career Enhancement Program is intended to attract, develop, and retain a qualified, well-trained, professional work force. The program uses career boards composed of major command management, as well as functional and personnel specialists. The program elements include training and development, career-broadening programs, career planning assistance, recruitment, and management information systems.

In addition to its contracting career management program, the Army has instituted a new program called the Logistics and Acquisition Management Program. This program's goal is to improve the logistics and acquisition civilian work force by developing career civilians the same way as officers, such as (1) planning their development from the intern level to

[1]Revitalizing Federal Management Managers and Their Overburdened Systems, Interim Report

the Senior Executive Service, (2) providing a managerial training curriculum, (3) developing managers with a multidisciplinary understanding, and (4) providing a blend of assignments and schooling.

The Navy's career program for civilian contracting personnel also is aimed at developing a qualified, professional work force. Rotational assignments are provided through an intern program. In addition, through its education program, the Navy, as well as the other services, pays the tuition for job-related courses and awards fellowships for graduate study in contracting.

Entry Level Positions Are Filled Through a Variety of Methods

Procurement entry level positions can be filled through four basic methods: (1) examinations and/or direct recruiting from college campuses, (2) cooperative education programs, in which college students alternate periods of school with work, (3) upward mobility programs, which offer career opportunities to lower level employees in positions or job series that restrict their ability to realize full work potential, and (4) merit promotion systems or the job announcement process.

According to the contracting officers and program managers surveyed, generally all entry methods should be retained, including recruitment from college campuses. Task Group 6 agrees and has proposed that at least 20 percent of each government agency's intern program hires come from both internal and external sources, including college campuses.

Until 1982, the Professional and Administrative Career Examination (PACE) was the principal device used for external hiring of entry level procurement employees. PACE was abolished, pursuant to a consent decree resulting from a lawsuit which alleged that PACE had an adverse impact on the hiring of blacks and hispanics. As a result, the Office of Personnel Management (OPM) established an interim method of external hiring—Schedule B appointing authority. As shown in table 5.1, 43 percent of the military headquarters commands' procurement interns were hired through Schedule B authority or cooperative education conversions between January 1982 and August 1985.

Table 5.1: Entry-Level Hiring Methods

	Number of Procurement Interns				
Entry method	Air Force Systems Command	Army Materiel Command[a]	Navy Materiel Command[c]	Total	Percent
Schedule B	31	240	83	**354**	41 4
Merit promotion	62	209	53	**324**	37 9
Upward mobility	13			**13**	1 5
Co-op conversions	5		9	**14**	1 6
PACE	13	90	12	**115**	13 4
Other[b]	23		13	**36**	4 2
Total	**147**	**539**	**170**	**856**	**100**

[a]Figures given are for Oct 1981 to Aug 1985 (by fiscal years)

[b]Includes reinstated applicants, mid-level examination applicants, and priority placement personnel

[c]Navy Materiel Command was disbanded in 1985

Schedule B authority allows agencies to recruit directly from college campuses and make noncompetitive appointments. Such employees cannot be noncompetitively promoted beyond the GS-7 level. They may be converted to competitive status and promoted to the GS-9 level only after successfully competing with other applicants.

Because of the lack of conversion authority and the inability to promote Schedule B hires beyond the GS-7 level, Schedule B authority is viewed as a short-term solution only. According to the services, this limited appointing authority could result in Schedule B hires having trouble competing against workers already in the federal service, especially veterans who receive additional preference points. This lack of job security, coupled with more attractive offers by private industry, may lead to problems in recruiting and/or retaining qualified college graduates, according to many of our sources.

In response to these concerns, OPM has developed a competitive examination for the 1102 contracting job series which covers these interns. The new exam has been tailored to reflect the skills, knowledge, and abilities required by the procurement profession. The new register is scheduled to be in place by May 1986. All Schedule B hires appointed at least 6 months prior to establishment of the register (November 1, 1985), will be converted to regular civil service status at the hiring agency's discretion. Any persons hired in the interim will have to compete at the GS-9 level.

Experience and Training Provided Do Not Meet Desired Conditions

Policy Guidance Establis ıes Minimum Ski Levels

A key ingredient in establishing a professional procurement work force is the development of capabilities through on-the-job training and formal course work. The Government Employees Training Act (5 U.S.C. 4101) authorizes the heads of executive agencies to establish training programs for their personnel. OPM is authorized under 5 U.S.C. 4117 to coordinate agency training programs.

Pursuant to this law, DOD reissued DOD manual 1430.10-M-1, DOD Civilian Career Program for Contracting and Acquisition Personnel, in December 1982. It outlines a specific training program designed to improve the career development, advancement opportunities, and capabilities of civilian procurement and acquisition personnel. It also identifies the minimum level of skills to be attained through training courses, equivalency tests, or experience. In addition, each military service has a procurement intern program for developing entry level workers through a series of rotational on-the-job assignments and training courses.

DOD manual 1430.10-M-1 and the intern programs provide for general contracting experience and training (contract negotiations, price and cost analysis, etc.). However, in reviewing the training records of 1,551 intermediate and senior-level contracting personnel, the DOD Inspector General's Office found that 67 percent of these personnel had not taken all of the mandatory training prescribed by the manual.[2] Contradictory training policies, a shortage of training resources, and high turnover of experienced personnel were cited as causes of the problem. The Inspector General's review looked at civilian contracting personnel in general and was not specifically aimed at major system contracting officers.

While the triservice panel agreed that major weapon system contracting personnel should have this general contracting experience, the panel also believed specialized training was needed. This additional training

[2]Audit Report 84-047, February 14, 1984

should be a rotational tour in the program management office or developmental experience in the program or product line. Advisors on this subject agreed that contracting officers should have an understanding of the program management office. They believed this understanding could be gained through several ways, including a program office tour or colocation with the program manager. The specialized experience and understanding of the program office were believed necessary for contracting officers to make significant contributions in early acquisition planning and decisionmaking. (See ch. 2.)

While Air Force and Army officials generally agreed with the panel and advisors, Navy officials did not believe a program office tour would improve the quality of contracting officers' performance.

Task Group 6 believed that each agency should establish a career development program that identified training requirements. The group pointed out that the first step in determining training requirements was defining roles and responsibilities, which—as noted in chapter 2—are vague for major system contracting officers in the planning phase.

Little Program Office or Product Experience Obtained

As shown in table 5.2, at the seven locations visited, the majority of the major weapon system contracting officers appointed between January 1982 and April 1984 had general contracting experience. Few had previously toured in a program office or had product experience before becoming contracting officers. Our expert advisors believed that the Air Force practice of colocating contracting officers with the program managers was a way of gaining such experience, but this occurs after appointment as a system contracting officer.

Table 5.2: Contracting Officers' Experience

	Number of Contracting Officers With Experience					
	Total[a]	Contract specialist	Contract administration[b]	Pricing[b]	Program office[c]	Other[d]
Air Force:						
Aeronautical Systems Division	50	50	3	9	1	9
Space Division	15	15	7	7	•	•
Army:						
Armament Research and Development Center	11	11	6	3	1	5
Aviation Command	15	15	4	3	•	3
Missile Command	13	13	•	1	•	9
Navy:						
Naval Air Systems Command	22	22	5	5	•	12
Naval Sea Systems Command	15	10	•	•	•	12

[a]Some contracting officers have experience in more than one category

[b]Personnel classified as contract administrators and pricing analysts or who had at least 6 months experience in these areas

[c]Tour in program office before appointment as system contracting officer working as contracting specialist or performing other contracting duties

[d]Includes procurement analyst, production management buyer, contract negotiator, procurement agent and officer, contract and procurement assistant, military officer duty, intern programs, and private industry

Two-thirds of industry prime contract negotiators surveyed rated federal contracting officers capabilities as adequate or very adequate. The other third rated federal contracting officers' capabilities as marginally adequate. Suggestions for improving these capabilities included more experience and better training.

Selection Criteria Are Needed

Education and Experience Qualifications Not Fully Defined

Specific selection criteria for contracting officer appointments do not exist, although Federal Acquisition Regulation 1.603-2 provides broad general guidelines. It states:

"In selecting contracting officers, the appointing official shall consider the complexity and dollar value of the acquisition to be assigned and the candidate's experience, training, education, business acumen, judgment, character, and reputation."

The regulation also provides examples of selection criteria that can be used:

- experience in government contracting and administration, commercial purchasing, or related fields;
- education or special training in business administration, law, accounting, engineering, or related fields;
- knowledge of acquisition policies and procedures, including this and other applicable regulations;
- specialized knowledge in the particular assigned field of contracting; and
- satisfactory completion of acquisition training courses.

However, the regulation does not specify what training courses should be completed, what specialized knowledge is needed for various kinds of procurement, what particular educational backgrounds should be required, and so forth.

Although federal regulations do not require contracting officers to have a college degree or a particular educational background, the triservice panel consensus was that a major weapon system contracting officer should have a 4-year college degree with a minimum of 24 hours in business-related courses. This view was endorsed by Navy and Air Force headquarters management. According to Air Force managers, this minimum educational level is needed because contracting officers are required to ensure compliance with laws and regulations and to understand the effect of competition, the marketplace, analytical models, computer technology, and business strategies. They also believe that because cost accounting standards and other legislative and regulatory requirements have increased the complexity of contracting tasks, a strong background in accounting and business is needed.

While the Army believed that the need for more specialized education and training in the procurement field had increased, it did not recommend a minimum educational level for major system contracting officers.

Federal regulations also do not specify a particular experience level or background for contracting officer appointments. The triservice panel agreed that specific experience qualifications should be met but did not specify what the criteria should be. The panel felt that DOD should establish these criteria.

Task Group 6 agreed that contracting officer appointment and selection systems were needed and recommended that each agency establish selection criteria based on the skills and knowledge needed to perform required duties.

Current Conditions

Although major weapon system contracting officers are not required to have a specific educational background, 86 percent of those at the commands visited had a bachelor's degree or higher. (See table 5.3.)

Table 5.3: Contracting Officers' Educational Level

	Number of Contracting Officers[a]				
	High school or less	Some college	Bachelor's degree	Master's degree	Total
Air Force:					
Aeronautical Systems Division	3	2	28	17	**50**
Space Division		2	6	5	**13**[b]
Army:					
Armament Research and Development Center	2	1	6	2	**11**
Aviation Command		5	8	2	**15**
Missile Command	1	2[c]	5	5	**13**
Navy:					
Naval Air Systems Command	1		10	11	**22**
Naval Sea Systems Command		1	5	9	**15**
Total	**7**	**13**	**68**	**51**	**139**
Percent	**5.0**	**9.4**	**48.9**	**36.7**	**100**

[a]Officers appointed between January 1982 and March 1984

[b]Fifteen contracting officers were appointed, but adequate data are available for only 13

[c]Includes technical school

Our survey of industry prime contract and subcontract negotiators revealed that, similarly, over 80 percent had a bachelor's degree or higher. (See table 5.4.)

Table 5.4: Industry Negotiators' Educational Level

Highest level completed	Prime contract negotiators	Subcontract negotiators	Total	Percent
High school or less	5	16	**21**	5.2
Some college[a]	29	28	**57**	14.0
Bachelor's degree	83	127	**210**	51 8
Some graduate school	12	7	**19**	4 7
Master's degree	41	41	**82**	20 2
Higher	12	5	**17**	4 1
Total	**182**	**224**	**406**	**100.0**

[a]Includes trade school

The educational area of study varied, although 56 percent of the government system contracting officers, 44 percent of industry prime contract negotiators, and 43 percent of industry subcontract negotiators concentrated on business administration or related fields.[3] In addition, 20 percent of the prime contract negotiators and 27 percent of the subcontract negotiators majored in engineering; no government contracting officers majored in this field. Some of our experts believed an engineering background would enhance the contracting officer's ability to participate in the program planning phase.

Few Appointments Based on Education or Experience Requirements

Since DOD has not established uniform requirements for appointing major weapon system contracting officers, the selection criteria vary by service and command. The Air Force Systems Command regulations require an interview by a contracting review board. Air Force Systems Command product divisions and centers often include a question and answer session on contracting matters as part of the interview process. The way in which such sessions are conducted and the thoroughness of the reviews, however, vary.

The Army and the Navy do not have any formal, uniform contracting officer selection criteria or procedures. Basically, appointments to major weapon systems are based on promotions.

The Deputy Secretary of Defense has recently issued a new initiative directing the services and the Defense Management, Education, and Training Board to establish experience prerequisites and training requirements for civilian procurement personnel.

[3]Includes management, systems acquisition and management, finance, and economics

Career Incentives Should Be Provided

Contracting Officer Job Classified as Administrative

OPM classifies job series as professional, administrative, technical, clerical, or other To qualify for the professional series, an occupation must have qualification standards requiring the completion of certain college level work.

The contracting officer job position is classified under OPM's 1102 personnel series. Because no specific educational level is required to obtain the job, the series is categorized as administrative. The 1102 series covers a broad spectrum from contracting personnel who purchase spare parts, commercial items, and services to those who are involved in major weapon system acquisition.

Many agencies and other experts believe the entire 1102 series should be reclassified as professional. They argue that the procurement profession is a complex one involving a major part of the federal budget and that it requires various knowledge areas and skills, including (1) cost and price analysis, (2) knowledge of contract law and procurement legislation, (3) mathematical abilities, (4) forecasting abilities, and (5) knowledge of the economic climate. They believe that many of these basic knowledge areas and skills should be gained through college education.

On the other hand, OPM and other experts in the field believe specific educational requirements are not needed to enter or be promoted within the procurement field; therefore, the 1102 series should remain administrative. After reviewing the series in 1982, OPM reaffirmed this opinion. This review covered the entire 1102 series and did not focus exclusively on major system contracting personnel, who are only a small part of the series.

Many of our expert advisors concluded that the 1102 series covered such a broad spectrum that different skill levels were needed depending on the commodity or service being purchased. Since major weapon systems are very complex and require a high level of skills, these experts believe that a separate professional series for system contracting officers needs to be considered. Further, since most major system contracting officers already have college degrees, they should be given this deserved recognition. They believe this professional status would signal

to outsiders the importance and high degree of skills needed to become a system contracting officer and would increase its desirability as a career.

Legal Impediments to Establishing Educational Requirement

OPM classifies positions as clerical, administrative, or professional for the purpose of satisfying the provisions of 5 U.S.C. 3308 (1982). That section imposes restrictions on the imposition of minimum educational requirements; it prohibits minimum educational requirements for an examination for the competitive service except where OPM decides

> "that the duties of a scientific, technical or professional position cannot be performed by an individual who does not have a prescribed minimum education "

Thus, OPM defines a professional position as one in which successful performance requires a base of knowledge that may not be acquired through on the job training, but may only be acquired through a course of study in a recognized discipline.

Because of this statutory requirement, many professions normally considered "professional" in the generic sense, are not classified as professional by OPM. For example, budget examiners, program analysts, and management analysts—which would be considered "professional" in the generic sense—are classified as administrative by OPM.

Opportunity to Enter Other Acquisition Fields Offered by the Army

In addition to assigning professional status to the job, many experts believe more career incentives are needed in terms of advancement. Major weapon system contracting officers, in their opinion, should be broadly developed (as in the Army program) and have the opportunity to enter other acquisition fields, such as program management.

One of the objectives of the Army's Logistics and Acquisition Management Program, is to provide broad-based development of civilians in the logistics and acquisition fields. This development is to enable individuals to be placed in multifunctional positions, such as chief executive assistant, deputy project manager, or director of procurement. Because the program is relatively new, no data are yet available on its performance.

The Navy and Air Force programs also offer career opportunities for civilian contracting personnel, but these programs are geared more toward advancement within the contracting area.

Other Issues

One of the critical elements in developing a successful career management program is ensuring that sufficient resources are available, according to Task Group 6. The military services agree and have expressed concern on this issue. According to Air Force management, "The future [procurement] environment holds no promise of improvement without increases in personnel authorizations and training . . . . "

Some experts in the field believe that an effective career program must also address (1) the tenure of a system contracting officer on a program, (2) agency management leadership or degree of involvement in developing a career program, and (3) the development of the military officer as a contracting officer. Because our study addressed these issues in a very limited fashion, we could not come to any conclusions.

Conclusions

Experts believe that career programs for major weapon system contracting officers would be enhanced by

- maintaining a variety of entry methods, including a permanent method of recruiting college graduates;
- requiring more specialized training and experience;
- establishing specific selection criteria; and
- providing more career incentives in terms of professional classification and advancement opportunities.

We believe, however, that DOD career programs for major contracting personnel will have only limited success or effectiveness until the system contracting officer's role in the planning and execution phases is clarified. All aspects of the programs—recruitment, training and experience, qualifications for appointment, and career incentives—depend on clearly defined roles and responsibilities.

A part of recruiting is defining for prospective employees a career path entailing an increasing level of responsibility. If the contracting officer role is not defined, problems can occur in attracting and retaining employees once they reach that level. Further, if the role is unclear, it is difficult to determine the type and—more importantly—level of skills, background, or knowledge needed for the position. Similarly, it is difficult to determine the training and experience needed to do the job and the resources needed to provide such training and experience.

Recommendations

We recommend that, after clarifying the roles and responsibilities of the contracting officer and fully establishing the team approach (see ch. 2), the Secretary of Defense:

- Broaden the experience and training requirements for major system contracting personnel to include specialized experience and ensure necessary resources are provided to implement such a program
- Develop, based on such roles and responsibilities, specific education, experience, or other selection criteria for system contracting officers.
- Provide career incentives for system contracting personnel by allowing them to enter other acquisition fields through development and opportunity.
- Request that OPM evaluate reclassifying system contracting personnel from administrative to professional if the roles, as clarified, and needed qualifications justify such action.

Agency Comments and Our Response

In official oral comments, DOD generally agreed with our recommendations to strengthen the career program for major weapon system contracting officers and said it was taking steps in this direction. The Deputy Secretary of Defense has directed DOD to establish, in the spring of 1986, minimum experience levels and mandatory training requirements for contracting officers. In addition, the Deputy Secretary has requested OPM's assistance in professionalizing the procurement work force. These efforts encompass most if not all of DOD's contracting personnel, and DOD believes our recommendations should cover the entire contracting work force. Since our study focused on major weapon system contracting officers, we are not in a position to make recommendations for the entire contracting community.

OPM agreed with much of this chapter's coverage of career programs for contracting officers but disagreed with the emphasis placed on educational credentials and our recommendation that the Secretary of Defense request that OPM evaluate reclassifying system contracting personnel as professionals. OPM stated that the emphasis should be on job performance and expressed concern that educational requirements would restrict both DOD hiring practices and entry of people into the major systems contracting field.

While our report does discuss education as a possible selection criterion, it is only one of the factors that DOD might want to consider. Further, this is only one step in a three-step process. Our recommendations to DOD involve: first, clarifying the roles or job expectations; second, designing

a relevant career path; and last, establishing specific selection criteria for major systems contracting officers. This criteria could be education, experience, or other (such as an exam) or combination of any of these. With clarification of both the roles and the qualifications to achieve them, performance should clearly be the primary consideration. If DOD finds that education in a particular field, such as 24 hours in business related courses, is necessary to achieve desired performance, then we believe DOD should request that OPM establish a positive educational requirement. (See app. VII.)

Industry Surveys

The purposes of including private industry firms in our review were to (1) gather information and compare industry acquisition policies, practices, and work force with government and (2) obtain industry views on improving the defense acquisition process.

After pretesting survey questionnaires at 3 locations, we conducted structured mail surveys of prime contract negotiators, program managers, and system or subsystem contract managers attached to new, major item efforts at 28 private industry firms. In addition, we asked industrial personnel offices to complete questionnaires on the professional qualifications of people assigned to new, major item programs since January 1, 1982.

The 28 selected firms specialized in aerospace, electronics, and shipbuilding. They were judgmentally selected on the basis of their involvement in projects similar in scale and complexity to major defense system acquisition programs. These firms fall into the following categories: (1) firms that focus primarily on defense industry work, (2) firms primarily in nondefense industry work, and (3) firms with major activities in both areas.

All responses to these industry surveys are confidential. Although the names of surveyed firms are listed below, the names of individual respondents have not been disclosed. When we discuss an individual response in the report, we provide no information that could link it with a particular individual or firm. The firms which responded are:

The Boeing Company:
Boeing Aerospace Company, Seattle, Wash.
Boeing Commercial Airplane Company, Seattle, Wash.
Boeing Commercial Airplane Company—Renton Division, Seattle, Wash.

United Technologies:
Sikorsky Aircraft Division, Stratford, Conn.
Pratt & Whitney Aircraft, West Palm Beach, Fla.

General Electric:
Aerospace Business Group, Philadelphia, Pa.

International Business Machines Corporation:
Bethesda, Md.

Ford Aerospace Communications Corporation:
Newport Beach, Calif.

Douglas Corporation:
McDonnell Douglas Astronautics Company, Huntington Beach, Calif.

Texas Instruments, Inc.:
Dallas, Tex.

Bath Iron Works Corporation:
Bath, Maine

Hughes Aircraft Company:
Radar Systems Group, Los Angeles, Calif.
Missile Systems Group, Canoga Park, Calif.
Space and Communication Group, El Segundo, Calif.

Delta Airlines, Inc.:
Atlanta, Ga.

Raytheon Company:
Electromagnetic Systems Division, Goleta, Calif.

General Dynamics:
Electronics Division, San Diego, Calif.

Rockwell International:
Defense Electronics Operations Group, Anaheim, Calif.

Lockheed Missiles Space Company, Inc.:
Sunnyvale, Calif.

Hewlett Packard Company:
Palo Alto, Calif.

Martin Marietta Aerospace:
Denver, Colo.

Exxon Corporation Research and Engineering Company:
Florham Park, N.J.

Defense System Acquisition Studies Consulted

Report by	Prompted by	Issued
Blue Ribbon Panel	President	1970
Commission on Government Procurement	Congress	1972
Military services and Secretary of Defense	DOD	1974-75
Defense Science Board	DOD	1978
DOD Resource Management Study	President	1979
Special Panel on Defense Procurement Procedures	House Armed Services Committee	1982
The Grace Commission	President	1983
The Georgetown Center for Strategic and International Studies	Self-initiated Defense Organization Project	1985
Senate Armed Services Committee Study of DOD Organization and Decisionmaking	Committee Chairman	1985

Report Advisors

As part of the review methodology, we selected two or more expert advisors on each major topic in this report. In addition, we selected people with broad backgrounds in the field as overall advisors. The advisors have a wide diversity of technical and management experience in government, industry, and academia. They gave us feedback on our plans and report drafts and counseled us on some of the more important issues.

It must be emphasized that the advice and counsel was voluntary. Advisors acted in their capacity as informed private citizens, not as representatives of current or past employers. The conclusions and recommendations of this report, however, do not necessarily represent their views and should not be attributed to them.

Overall Advisors

Norman Augustine

Mr. Augustine has served in various top-level industry and government positions, including Under Secretary of the Army and Chairman of the Defense Science Board. He is now the President and Chief Operating Officer of Martin Marietta Corporation.

J. Ronald Fox

Mr. Fox has served in system acquisition policy positions in both the Air Force and the Army and has written extensively on the subject. He is professor of management at the Harvard Business School and is a member of the Procurement Roundtable.

Robert A. Frosch

Mr. Frosch headed the Navy's research and development activity for many years and then became Administrator of the National Aeronautics and Space Administration. He is now the vice president of research for General Motors Corporation.

General Robert T. Marsh, U.S. Air Force (retired)

General Marsh served in a variety of acquisition management positions at Air Force Headquarters and product divisions. He was named Commander of the Air Force Systems Command in 1981 and retired in 1984.

Thomas D. Morris

Mr. Morris has held a series of high posts in government and industry in which he has been exposed to numerous procurement and career development issues. The federal agencies include OMB, DOD, the Department of Health and Human Services, and GAO. He currently consults with some of these agencies periodically and is a member of the Procurement Roundtable.

David Packard

Mr. Packard is co-founder of the Hewlett-Packard Company and is board chairman. He has served as Deputy Secretary of Defense and more recently, as chairman of the President's Blue Ribbon Commission on Defense Management.

Individual Topic Advisors

Chapter 2: Roles and Acquisition Strategies

Dr. James P. Bell

Dr. Bell, an economist, has worked in private industry and is now a senior researcher at the Institute for Defense Analyses. He authored the institute's 1983 study, Competition as an Acquisition Strategy: Impact of Competitive Research and Development on Procurement Costs.

Robert R. Judson

Mr. Judson started his contract management career in the Navy and later held positions in industry. During the 1970's, he was Deputy Director of Staff Studies of the Commission on Government Procurement and Executive Director of Acquisition Research at the Naval Post Graduate School. He is now a manager of contracts with G.M. Hughes Electronics.

Commander Benjamin R. Sellers, U.S. Navy

Commander Sellers, a graduate of the Naval Post Graduate School, wrote his thesis on second sourcing of weapon system production.

During our fieldwork, he headed the Business Department of the Defense Systems Management College. He is now the business manager on the Navy F-14 program.

Chapter 3: External Influences and the Environment

Willis M. Hawkins

Mr. Hawkins began his career in the aerospace industry before World War II. He has held various industry positions, including manager of space systems, vice president for science and engineering, and president of a major aerospace firm. From 1963 to 1966, he served as Assistant Secretary of the Army for Research and Development, and from 1978 to 1983, he was a member of the Advisory Council of the National Aeronautics and Space Administration. He is the recipient of distinguished service awards from the Army, the Navy, and the National Aeronautics and Space Administration. Mr. Hawkins currently is senior advisor to the Lockheed Corporation.

Vice Admiral Levering Smith U.S. Navy (retired)

Admiral Smith served in a variety of research, development, and test positions before becoming Director, Navy Special Projects Office. This Office was responsible for developing and fielding the Polaris, Poseidon, and Trident strategic weapon systems. Since retiring in 1977, Admiral Smith has consulted with government and industry.

Chapter 4: Program Manager Career Development

Colonel Ivar W. Rundgren, U.S. Army (retired)

Colonel Rundgren is both an aerospace engineer and a former Army helicopter engineering, test, and combat pilot. He completed his Army service as a program manager. He is a consultant to industry and government.

Vice Admiral Ernest R. Seymour, U.S. Navy (retired)

After operational experience, Admiral Seymour served as a program manager in the Navy and remained in the acquisition field thereafter. He progressed to Vice Chief of the Naval Material Command before becoming head of the Naval Air Systems Command. He currently consults with both industry and government.

Perry C. Stewart

Mr. Stewart occupies the Army chair at the Defense Systems Management College. He has had an extended career in acquisition management, including development of career programs and selection of candidates for further development.

Chapter 5: Contracting Officer Career Development

Lieutenant Colonel Alan W. Beck, U.S. Air Force (retired)

Mr. Beck served as a contracting officer and contracting division chief He is a graduate of the Air Force Education with Industry Program and the Defense Systems Management College. An active National Contract Management Association member and author, Mr. Beck is currently a professor of acquisition management at the Defense Systems Management College.

Robert R. Judson

(See p. 130.)

Michael Miller

Mr. Miller has worked with the Office of Personnel Management and more recently with the Federal Acquisition Institute on federal procurement personnel classification and career programs.

Major General Robert Trimble, U.S Air Force (retired)

General Trimble has held a variety of responsible positions in procurement operations and policy with the Air Force, the Office of the Secretary of Defense, and the Office of Federal Procurement Policy. He is vice president of Martin Marietta Aerospace.

James E. Williams, Jr.

Mr. Williams has held a progression of positions involving contracting policies and major acquisition programs in the Air Force. He is the Deputy Assistant Secretary (Acquisition Management) in the Office of the Assistant Secretary of the Air Force. In addition, he serves as the Chairman of the National Contract Management Association's Committee on Professionalism.

Experimenting With a Design Aid for Tailoring the Competitive Phases of New Weapon Systems

Basic DOD policy in acquiring weapon systems is to tailor competitive phases to the unique characteristics of individual programs. Nevertheless, current DOD policy encourages competition through the first two program phases—concept exploration and demonstration/validation—and beyond, if cost effective. Programs do not always follow the latter guidance, and at present, the services have no criteria or analytical aids for tailoring the early competitive phases. Compounding the problem is the fact that the program characteristics most sensitive to different levels of competition have not been identified.

As discussed in chapter 2, determining the appropriate level of competition in new weapon programs is very difficult. Most programs are competed during an early "paper" design phase in concept exploration. Competition may be terminated at this early point and a single design concept and industry firm chosen. Sole-source development and production of the new weapon follow. In exceptional cases, a competitive source is established during the production phase.

Any substantial level of competition is difficult to sustain because new programs usually have low front-end funding, and even these low amounts are vulnerable to periodic across-the-board funding cuts by DOD and the Congress. As one top Air Force official said,

"determining the level of appropriate competition, obtaining funding, and defining the expected benefits continue to be one of our most challenging tasks "

The central question is, How useful would an analytical or judgmental aid be in optimizing the competitive phases of new systems?

Such an aid could be used to promote rational, consistent, and defensible allocations of resources to the competitive phases of new weapon programs. It would help ask the right questions about program characteristics and the industrial environment; the answers would help optimize competition for a particular program. The aid would also help program managers obtain approval of, and hold on to, an appropriate level of research and development funding. If used at such institutions as the Defense Systems Management College, it could be an effective training device for program and contracting personnel.

Some Characteristics of Weapons Competition and the Defense Industry

Most new weapon systems offer real opportunities for (1) cost and performance trade-offs in requirements, (2) design innovations, and (3) avoidance of costly design features.

- Paper designs are speculative, whereas hardware competition stimulates creativity and innovation in the defense industry. Paper designs exert little competitive pressure on the end products, but they exert other pressures—promises that cannot be fulfilled but are difficult to reject early in the process because of little good information.
- A weapon's competition can be just an intense rivalry inviting (1) overly optimistic and premature contractual commitments and (2) industry buy-ins.
- Keeping the contractor's top talent on the program in the early phases is important.
- Competition needs to be structured so that contractors are motivated during early design to reduce risks and control production costs inherent in the system's design.
- Delaying system design choices until there is reliable data from hardware experimentation puts both the government and industry in a much sounder position to make program and contractual commitments.
- If competition is carried through to the point of pricing production options, contractors—in their own interest—will control costs during the critical transition to production and will more likely make capital investments to improve production methods.
- Exposing new systems to competitive hardware demonstration permits more emphasis in system selection on such values as superior reliability and lower operating and support costs.
- Much more favorable terms can be negotiated after risks are reduced in hardware competition regarding (1) production prices, (2) type of contract (fixed price), and (3) correction of design deficiencies.
- Parallel competitive efforts are an important hedge against inefficient weapon designs and design failures.
- Avoiding any enormous miscalculation of expenditures in high risk major weapon system development can, in itself, pay for a number of competitive programs.
- Historically, funds are found later in a program to fix weapon system performance and absorb cost increases. Therefore, if the program need is real and management is willing to make the hard decision, funds can be made available up front—the point of maximum leverage and benefit.

Experimenting and Building on Prior Studies

Because each new weapon system program is unique, the complex considerations to be weighed in tailoring the extent of competition are not subject to formula or quantification. One approach, recommended by the Defense Science Board in 1978, is to develop a series of acquisition strategies and criteria for tailoring them to the type of system and program characteristics. A second approach is to tailor competition to particular goals or desired benefits based on analysis of program characteristics. One or both of these approaches could be tested on selected programs or used in combination until validated criteria emerge. Seasoned professional judgment would be required in applying such criteria.

Prior experience with different kinds of weapon systems is a beginning point. Some work has already been done. For example, a 1979 Rand Corporation report to the Under Secretary of Defense for Research and Engineering indicated that cost growth was one-third lower for those systems which had undergone competitive development in the 1970s. Rand also urged the development of guidance beyond a general prescription for competition.

As to how much to invest in competitive development, some limited information can be found in prior Rand studies and in a more recent Institute for Defense Analyses study. Rand found, for example, that the extra cost of a second firm prototyping a new system is about 2 percent of total program cost. The Institute for Defense Analyses found that if competition is extended far enough into development to prudently price production options, substantial procurement cost savings and other bonuses would be likely. In the most conservative program study (the one with the highest investment in parallel development), the Institute found that the procurement cost savings (discounted for present value of money) still far exceeded the additional investment and amounted to about 10 percent of the program's procurement cost.

Some Considerations in Tailoring Competitive Phases

Beyond the conceptual phase, competition initially can be limited to a small part of the system and start off with small design teams and minimum documentation requirements.

1. Competition can extend from a system's concept and preliminary design to hardware demonstration and full-scale development. The latter can include pilot production quantities as well. Hardware demonstrations can be confined to high risk pacing subsystems or components or to complete systems. Such demonstrations can include modifications of equipment already fielded.

2. The Defense Science Board's 1977 study noted that competitive prototyping at less than the system level—using breadboard, brassboard, and simulation techniques—could reduce the development schedule by up to 2 years and could cost only 20 to 25 percent of a full system prototype competition.[1]

3 In early development, information on all aspects of a system may not be necessary if the technology is well in hand. One possible strategy, for example, is to have each company with the most promising concepts and preliminary designs identify its most critical or elemental items for demonstration. Industry contractual commitments would then be limited to such items. Work on other parts of the competing systems, as well as development documentation and paperwork, would be deferred until the critical concept results were in.

4. If industry is allowed to build up fast in the early design phases, companies may not know what to do with their people and suppliers while the government goes through the extensive test and evaluation phase. The costs of such rapid industry buildups tend to drive the government into premature system commitment. But if programs start off with few people and suppliers, both the competing firms and the government have more resiliency to manage technical uncertainties. This austere approach enables the front-end funding of multiple competitive sources and alternatives. It also allows for identifying technical uncertainties and reducing risks before choosing the final weapon Furthermore, industry will not build up the work force until it has confidence in the emerging system and will not need to put so many people and suppliers on hold while the government evaluates hardware and selects a source.

Several factors need to be considered in choosing systems and subsystems for competitive development. For example, some systems are not amenable to extensive competitive development. Systems that might be ruled out are those of massive size and cost or few of a kind.

At the subsystems level, extensive design and development competition could be considered for subsystems that (1) are critical to the full attainment of system performance requirements, (2) involve moderate or greater cost, schedule, or design risk, and (3) are expensive to develop and produce. Also, if the integration of several subsystems involves

[1]A breadboard technique, for example, is to assemble an electronic circuit in the most convenient manner, without regard to final locations of components, to prove the feasibility of the circuit and to facilitate changes when necessary.

moderate or greater risk (no matter what their individual design risk), competitive development of the total system needs to be considered.

It may not be possible to predict the impact of competitive development on innovation, new technologies, and better design solutions. But as a general proposition, increasing and extending competition will likely benefit system design and quality. The value of this improved performance probably cannot be quantified for any particular system. Benefits are likely to be proportional to the technical risk involved and the ability to continue the competition far enough to justify serious industry commitments. As the Institute for Defense Analyses case studies showed, the presence of a rival developer motivates design innovations and dramatic cost reductions.

Furthermore, choosing between paper design proposals can be hazardous. At this stage, the military cannot tell whether a proposed design will even work or have a reasonable production cost. Both Rand and the Institute for Defense Analyses found, in the majority of their case studies, that the competition winners might well have been losers had selection been based on paper designs alone.

If substantial quantities are anticipated, competitive development has potential for (1) reducing production and operating costs, (2) arresting cost growth, and (3) securing a second production source later to compete with the winning designer.

1. To the extent that competition enhances a system's development to meet required capabilities, it forestalls many of the risks and performance and reliability problems that otherwise require high-cost "fixes" during production or operations.

2. The Institute for Defense Analyses study revealed that unusually favorable terms for initial production (including warranty against design defects) were established when competitive development was carried far enough.

3. If a new weapon's competitive development can be carried to the point of field demonstration, an overly complicated and lengthy source selection process can be bypassed and greater reliance placed on getting a working system with known costs.

Three Approaches to a Design Aid

The experimental aid shown in table IV.1 illustrates one approach. It describes a range of investment levels in competitive development, depending on goals and program characteristics. The second column indicates one level of investment if the goal is an optimum system incorporating the most appropriate technology with minimal modifications and retrofits later on. The third column indicates another level of investment if the further goals are to achieve lower cost designs and lower cost production of those designs—and the resulting benefits of lower system operating and maintenance costs. Within each goal and investment level would be competitive options, the selection of which would depend on the program's particular characteristics. For example, if the major risk element and cost were limited to one subsystem, competition for that subsystem might be promoted and sustained through a mature design and development phase. If the subsystem's quantities were also substantial, such competition might be extended even further into either initial or full production.

Another attractive approach is the Defense Science Board's idea of developing a series of strategies and criteria for applying them to individual programs. A third possibility is using a combination of these two techniques to first select a strategy that matches the program generally and then to refine it further depending on goals sought by the competition.

Table IV.1: Experimental Aid for Tailoring System Competition

Program characteristic	Through conceptual design and demonstration if[a]	Through commitments to production pricing if[b]
Agency/congressional commitment[c]	Moderate to strong	Very strong
Technical, schedule, and cost risks[d]	Moderate to high	Any degree of risk
Industry opponents	Moderately credible	Very credible
Production quantity	Not critical	Large
Industry responsible for design defects	Not applicable	Important
Competitively priced production options	Not applicable	Important
Affordable investment	Up to 2% of program cost[e]	Up to 10% of procurement cost[e]

[a]Ranges from key subsystems to fully integrated systems and from laboratory demonstrations to flyoffs/shootoffs.

[b]If production quantities are large enough and tooling cost is low enough, a second source should also be considered (See Defense Systems Management College Handbook on this subject.)

[c]If a new program is fighting for its life, sufficient funds will not ordinarily be available for competitive development.

[d]High risk, urgent programs may dictate extensive competitive development of critical elements regardless of cost.

[e]Additional investment may be justified if (1) fielding is extremely urgent, (2) the contractor has assumed complete responsibility for design defects, or (3) a special need to expand the industrial base exists.

Sources Recommending Options to Alleviate External Influences

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4. Dehoner, Major Trederich T., USAF, The Program Manager Authority Scenario. Program Manager-The Journal of the Defense Systems Management College: July/August 1984.

5. GAO panel of top program managers and contracting officers (AMCCOM), New Jersey: June 27, 1984.

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7. Komer, Robert W., The Neglect of Strategy, Air Force Magazine, Arlington, Va.: March 1984.

8. Major Weapon System New Starts. The President's Private Sector Survey on Cost Control, OSD-21. Washington, D.C.: Fall 1983.

9. Anonth, Dr. K.P., Navy Report on New Starts. Washington, D.C.: January 1983.

10. Hamre, John J., Potential New Patterns of Congressional Review of Defense Budget Requests. Cambridge, Mass.: Ballinger Press, October 1985.

11. Research Development Management and the Budget Process. The President's Private Sector Survey on Cost Control, R and D 2-2. Washington, D.C.: Winter 1983.

12. Practical Functional Performance Requirements. Defense Science Board. Washington, D.C.: Fall 1985.

13. Packard, David (Chairman, Hewlitt-Packard Co.), Statement before the Senate Committee on Armed Services: November 16, 1983.

Letter From the Acting Administrator of the Office of Federal Procurement Policy

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D C 20503

OFFICE OF FEDERAL PROCUREMENT POLICY

DEC 26 1985

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

Dear Mr. Conahan:

We appreciate the opportunity to comment on your draft report Capabilities of Key Personnel in the Early Stages of Defense Systems Acquisition. This subject is critical to the acquisition community. Much of the success of major system acquisitions can be attributed to the skills and abilities of the professionals who develop and execute the acquisition strategies to meet a new mission need. Unfortunately, the same can be said for the problems in major system acquisitions. Many of these can be attributed to the lack of experience and poor coordination between the various functional disciplines involved in a program. This report succinctly focuses on the needs of this area and makes several recommendations, which we generally support, to strengthen the knowledge and skills of personnel assigned to the major system acquisition field. For this you are to be commended.

One other extremely important aspect of major system acquisition is front end program planning activities. The report recognizes the influence of external factors on these activities and the compromises that must be made to develop a success oriented acquisition plan which accomodates these influences. The collective effect of personnel, strategy, and the real world environment on performance, schedule and cost of a major system is substantial and must be dealt with as suggested in your report.

We hope the discussions we had with your staff on November 27, 1985 were useful in clarifying and improving the draft report. The three main points of that discussion are repeated here for emphasis:

a) We concur with the recommendation in chapter two which states, in part, "Link acquisition strategy approval with the budget/funding process..." We could add caution however to applying that policy in every circumstance. We recognize the positive influence a stable budget has on program plans including acquisition strategies. But one must also recognize that program managers and contracting officers must adjust their plans to meet the realities of the everchanging budgeting environment.

b) In chapter 4, Career Programs for Program Managers, the report deals only lightly with the necessary skills for effective program managers while focusing more extensively on the career development process. We

offered two suggestions for enhancing your discussion on skills: (1) experienced contracting officers should be actively recruited into program management positions; and (2) development programs and qualification criteria for program managers should emphasize industrial management skills. The hypothetical program manager should be equally proficient in design engineering, production/factory management, business/financial management, and contracting/legal disciplines. Of course that never is achieved, but none of the skill areas should predominate over the others in a typical cross section of professional acquisition managers. An equal balance is desireable.

c) The responsibilities of the Federal Acquisition Institute have been defined in their charter. Their role extends into the development and monitoring of career programs for contracting personnel. Chapter 5 should recognize this role and direct the recommendations therein to the FAI as well as OSD.

We trust these written comments and the oral comments we made in our earlier meeting will be considered in your final drafting. We look forward to the report with a view toward broadening the recommendations, where appropriate, to the acquisition strategy process and the decision making personnel in major system acquisitions at the civilian agencies.

William E. Mathis

WILLLIAM E. MATHIS
Acting Administrator

Letter From the Director of the Office of Personnel Management

UNITED STATES
OFFICE OF PERSONNEL MANAGEMENT
WASHINGTON, D C 20415

DEC 23 1985

Honorable Charles A. Bowsher
Comptroller General of the United States
General Accounting Office
Washington, D.C. 20548

Dear Mr. Bowsher·

We appreciate the opportunity to comment on the U.S. General Accounting Office draft of a proposed report titled, "Capabilities of Key Personnel in the Early Stages of Defense System Acquisition." Our comments are confined to the personnel management aspects of the draft report.

The U.S. Office of Personnel Management agrees with much of the content of chapter 5 of this draft report concerning career programs for weapons systems contracting officers. As the draft report indicates, sound personnel management should include carefully defining the roles of contracting officers, developing rational career paths, providing employee development opportunities, and carefully selecting personnel at entry levels and through successive stages of advancement. Such programs can best be developed with the full knowledge and participation of Department of Defense (DoD) personnel officials.

We strongly disagree with the emphasis in the draft report placed on educational credentials instead of performance management for weapons systems contracting personnel. Performance evaluation was a cornerstone of the Civil Service Reform Act and continues to be a key element of this Administration's Federal personnel policy. Yet the draft report does not indicate that the GAO evaluators seriously considered performance evaluation as an important element in improving the capabilities of weapons system contracting personnel.

Chapter 5 of the draft report places major emphasis on educational credentials and on the question of changing OPM's designation of these positions from "administrative" to "professional." Both of these matters were raised by representatives of the contracting community and some Federal agencies during OPM's recent comprehensive study of the contracting occupation. After a careful review OPM concluded that neither idea merited adoption.

Federal Personnel Manual Supplement 271-1 and accepted personnel management practices mandate that employment requirements should be based on job analysis and have a demonstrated rational relationship to the job to be filled. Qualification requirements must be practical and realistic, and fairly measure the relative knowledge, skills, and abilities of individual candidates acquired through both experience and education against the work to be performed.

Stressing academic credentials per se, rather than the quality and content of an individual's work on the job is contrary to the concept of pay for performance and the longstanding requirement limiting credentials to the minimum needed to provide the knowledge, skills, and abilities necessary to do the job. By considering the broadest range of candidates, management has the fullest opportunity to choose the employee who can best get the job done. The imposition of a degree as an absolute requirement on employees who have been performing satisfactorily, with or without a degree, is clearly inappropriate. Limiting competition by imposing unnecessary restrictions on hiring and promotion will not improve the capabilities of present or future employees.

Reliance on a performance evaluation system is far more effective than reliance on educational credentials in assessing the capabilities of current and future high level staff and managerial employees. An employee's track record of accomplishments on the job is a better predictor of success than the employee's record of courses taken and degrees earned, sometimes years or decades in the past. Education and training are effective tools for developing managerial competence, but relatively ineffective for predicting successful performance of managers.

Now on page 123

Therefore, we recommend modification of the following proposed GAO recommendation (page 149) in the draft report:

> "After clarifying the roles and responsibilities of the contracting officer and fully establishing the team approach (see chapter 2), we [GAO] recommend that the Secretary of Defense . . . [d]evelop, based on such roles and responsibilities, specific education, experience, or other criteria for appointment as system contracting officers."

We urge deletion of the reference to "education" in this recommendation. Agency management always should clearly define roles and responsibilities of key personnel and

set selection criteria related to job content and consistent with Federal personnel law. The authority to set minimum educational requirements is limited significantly by law (5 U.S.C. 3308):

> "The Office of Personnel Management or other examining agency may not prescribe a minimum educational requirement for an examination for the competitive service except when the Office [of Personnel Management] decides that the duties of a scientific, technical, or professional position cannot be performed by an individual who does not have a prescribed minimum education. The Office [of Personnel Management] shall make the reasons for its decision under this section a part of its public records." [Emphasis added.]

Now on page 120

The GAO draft report (page 147) correctly states that OPM has concluded that a minimum education requirement is not needed for entry into the Contracting Series, GS-1102. OPM's conclusion that a minimum education requirement is not needed included consideration of major weapons systems contracting positions as well as all other positions classified in the Contracting Series, GS-1102.

Now on page 123

For the same reasons we also urge deletion of the following recommendation from pages 149-150:

> ". . . that the Secretary of Defense . . . [r]equest that the Office of Personnel Management evaluate reclassifying system contracting personnel from administrative to professional after the roles have been clarified and qualification criteria established."

The matter of changing OPM's designation of the Contracting Series also was raised during our comprehensive study of the contracting occupation. OPM decided in 1983 that the Contracting Series, GS-1102, is appropriately designated as "administrative" and that the designation "professional" is not appropriate for this series.

For Federal position classification purposes, we define "professional" as follows:

> "Professional occupations or series are those that require knowledge in a field of science or learning customarily and characteristically acquired through education and training that meets the requirements for a bachelor's or higher degree with major study

-4-

in or pertinent to the specialized field, as distinguished from general education . . . ."

OPM's study indicated that the criteria in this definition were not met in the case of the Contracting Series, GS-1102. Of course, our Contracting Series qualification standard clearly recognizes that a four-year course of undergraduate study is fully qualifying for GS-5 positions and is counted toward meeting the qualification requirements of higher grade positions. The criteria in this standard, as published, were agreed to by top level executives of agencies employing the vast majority of contracting personnel--including top executives of DoD. In fact, in opposing a suggestion that a Liberal Arts degree should not be qualifying, one military department said: "As entry level criteria either a BA or a BS is acceptable, regardless of the undergraduate major. This is an accepted practice in other technical occupations. As the qualification standards are now written, promising recruits with a BA in the Liberal Arts would be effectively barred . . . this is not at all in consonance with our requirements."

Now on page 120

Now on page 120

The reasons given in the GAO draft report (page 147) for designating a part of the Contracting Series as professional are not persuasive. The reasons given in the GAO draft report (page 147) are:

- ". . . major weapons systems are very complex and require a high level of skill . . . ."
- ". . . since most major system contracting officers already have college degrees they should be given this deserved recognition."
- "This professional status would signal to outsiders the importance and high degree of skills needed . . . ."
- ". . . increases its desirability as a career."

OPM does not dispute the complexity of major weapons systems, the high level of skills needed by contracting personnel, or the claim that most major weapons systems contracting officers have degrees. But these conditions and the desire of occupational interest groups to enhance their status are not the criteria OPM uses to designate an occupational series as professional in a position classification standard, as noted. Our conclusion was

not a negative comment on the "professionalism" of employees in the series, as the word "professional" is used in a more generic sense. It just means that the specific criteria for professional designation are not met in the context of the Federal position classification system.

The purpose of the proposed recommendation concerning "reclassifying" major weapons system contracting officer positions as professional is unclear unless interpreted in the context of the remarks of GAO's "expert" advisors on page 147. GAO's advisors stated that a separate professional series covering weapons system contracting positions needs to be considered. The draft report appears to accept this assertion uncritically.

Now on page 120

After an extensive occupational study, OPM concluded in 1983 that the Contracting Series should not be fragmented. The qualification requirements based on the job content of weapons system contracting positions are not substantially different than those of other kinds of contracting officer and specialist positions. Creating a separate professional series for this category of positions would establish unnecessary barriers to the development, advancement, and career mobility of other types of contracting officers and specialists. Career development would be limited for contracting specialists at trainee and development levels who are the contracting officers of the future. Restricting competition in hiring and promotion without sound, practical reasons will not improve the capabilities of weapons system contracting personnel.

Chapter 2 of the GAO draft report which discusses the role of contracting officers does not include proposals for changes in job content or job qualification requirements that justify imposition of minimum educational requirements or designation of these positions as professional. While clarification of managerial responsibilities is a desirable goal, there is no sound basis for linking that issue to the matters of minimum educational requirements or designation of these positions as professional.

The Office of Personnel Management has been active for some time in working with various elements of the procurement community to take sound steps toward improvement of the procurement work force. We have developed and issued the new Contracting Series classification and qualification standards, are preparing a new nationwide competitive

examination for entry-level contract specialist, and are assisting in a series of interagency meetings for headquarters procurement and personnel officials to foster agency career management programs.

The examination, in particular, offers a most timely opportunity in light of your suggestion that agencies strive to recruit college seniors and graduates in large numbers to help bring about long-term changes in the procurement work force. However, we believe that the recommendations for an absolute undergraduate education requirement and for designation of certain contracting positions as professional would not improve the capability of contracting personnel, would negatively impact on the exercise of sound agency management, and would be inconsistent with the spirit and letter of the controlling statutes codified in title 5, U.S.C.

Thank you for the opportunity to comment on this draft report.

Sincerely,

Constance Horner
Director

Report Supplements

DOD Acquisition: Case Study of the Army Light Helicopter Program (GAO/NSIAD-86-45S-1)

DOD Acquisition: Case Study of the Army Tactical Missile System (GAO/NSIAD-86-45S-2)

DOD Acquisition: Case Study of the Army Guided Anti-Armor Mortar Projectile Program (GAO/NSIAD-86-45S-3)

DOD Acquisition: Case Study of the Army Sense and Destroy Armor Projectile Program (GAO/NSIAD-86-45S-4)

DOD Acquisition: Case Study of the Navy CV Inner Zone Anti-Submarine Warfare Program (GAO/NSIAD-86-45S-5)

DOD Acquisition: Case Study of the Navy Undergraduate Jet Flight Training System (GAO/NSIAD-86-45S-6)

DOD Acquisition: Case Study of the Navy V-22 OSPREY Joint Services Advanced Vertical Lift Aircraft Program (GAO/NSIAD-86-45S-7)

DOD Acquisition: Case Study of the Navy Anti-Submarine Standoff Weapon Program (GAO/NSIAD-86-45S-8)

DOD Acquisition: Case Study of the Navy DDG-51 Guided Missile Destroyer Program (GAO/NSIAD-86-45S-9)

DOD Acquisition: Case Study of the Navy Minesweeper Hunter Program (GAO/NSIAD-86-45S-10)

DOD Acquisition: Case Study of the Air Force Advanced Air-to-Surface Missile Program (GAO/NSIAD-86-45S-11)

DOD Acquisition: Case Study of the Air Force Advanced Tactical Fighter Program (GAO/NSIAD-86-45S-12)

DOD Acquisition: Case Study of the Air Force Advanced Fighter Engine Program (GAO/NSIAD-86-45S-13)

DOD Acquisition: Case Study of the Air Force Advanced Warning System (GAO/NSIAD-86-45S-14)

DOD Acquisition: Case Study of the Air Force Military Strategic and Tactical Relay Satellite Communications System (GAO/NSIAD-86-45S-15)

DOD Acquisition: Case Study of the Air Force Small Intercontinental Ballistic Missile Program (GAO/NSIAD-86-45S-16)

DOD Acquisition: Case Study of the Air Force Space-Based Space Surveillance System (GAO/NSIAD-86-45S-17)

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