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REPORT TO THE CONGRESS

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Acquisition Of Major Weapon Systems

B-163058

Department of Defense

BY THE COMPTROLLER GENERAL
OF THE UNITED STATES

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COMPTROLLER GENERAL OF THE UNITED STATES
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C1 To the President of the Senate and the
Speaker of the House of Representatives

This is our report on the acquisition of major weapon systems by the Department of Defense.

Our review was made pursuant to the Budget and Accounting Act, 1921 (31 U.S.C. 53), and the Accounting and Auditing Act of 1950 (31 U.S.C. 67).

You will receive a classified supplement containing summaries of our evaluations of the individual weapon systems covered by our study. More detailed weapon system staff studies, some of which are classified, have been prepared and distributed.

Copies of this report are being sent to the Director, Office of Management and Budget; the Secretary of Defense; and the Secretaries of the Army, Navy, and Air Force.

Elmer B. Staats

Comptroller General
of the United States

Contents

ABBREVIATIONS

ARSV	armored reconnaissance vehicle
AWACS	Airborne Warning and Control System
CGN	nuclear-powered guided missile cruiser
CNM	Chief of Naval Material
CVAN	nuclear aircraft carrier
DCA	Defense Communication Agency
DLGN	nuclear-powered guided missile frigate
DOD	Department of Defense
DODI	Department of Defense Instruction
GAO	General Accounting Office
IOC	initial operational capability
MICV	mechanized infantry combat vehicle
OSD	Office of the Secretary of Defense
PPBS	Planning, Programing, and Budgeting System
SAR	selected acquisition report

D I G E S T

WHY THE REVIEW WAS MADE

The investment to acquire major Department of Defense (DOD) weapons continues to make a heavy impact on the Nation's resources. Because of this and the belief that there is need for further improvement in the acquisition process, the General Accounting Office (GAO) has again appraised those factors most closely related to effective performance in procuring weapon systems.

GAO plans to continue monitoring the acquisition of major systems by DOD and other executive agencies.

FINDINGS AND CONCLUSIONS

1. GAO has given recognition to, and is aware of, programs that have been instituted by the Office of the Secretary of Defense and the military services to improve management of the acquisition process. GAO's overall assessment is that, since last year's report, meaningful, measurable progress has been made in improving the acquisition process. However, certain troublesome areas remain that are noteworthy.

2. Considerable change is evident in weapon system development programs. GAO feels this is traceable to the early requirements planning and to the instability of program direction caused by internal as well as external influences.

   There is a question as to whether, in the conceptual stage, sufficient consideration is given to establishing the impact of one weapon system proposal on other programs, on the total force structure of a service or DOD, or on the possible ceiling on dollar resources. Some weapon systems appear to have been conceived and justified as independent systems.

   Once initiated programs change because of the increasing cost of the item itself or because of the need to make funds available for another program for which resources are more urgently needed. (See ch. 2.)

3. Weapon system acquisition problems are often aggravated by the cumbersome organizational structure.

   Decisions related to systems selected for program management appear to be based primarily on total expected cost rather than on a degree of technical risk, a need for aggressive management for that system, or the

desirability of grouping equipments into systems classed as major acquisitions because of system interfaces and integration.

There were important differences in the way project managers were organized and operated. The most significant, but less apparent, difference was the extent of their actual authority and operating decisionmaking powers.

There is evidence of progress in improving the project managers' status and training--further progress can now be achieved in their operating environments. Although it is impractical to create a model project manager structure that will fit automatically every major acquisition, GAO believes the management structure for each acquisition should be tailored to that particular program. (See ch. 3.)

4. A considerable amount of the cost growth in the acquisition of weapon systems is directly attributed to unrealistic early cost estimates. (See p. 28.)

5. Testing and evaluation procedures and associated terminology vary greatly among the services. The various test programs contained many approved deviations, substitutions, waivers, and examples of special circumstances. GAO has concluded that there is a need for better understanding of the basic principles and for better application of testing in DOD. (See p. 34.)

6. The estimated cost of 77 weapon systems has increased by about $28.7 billion (31 percent). This increase represents the difference between the original estimates and the current estimates of total program cost. This is down from last year's 40-percent increase reported on 61 systems and can be attributed primarily to the addition of a number of new systems to our review, which reduces the program-planning base on which the percentage computation is made. The other reason, which is of much more concern to GAO, is the significant number of quantity decreases on many of the 77 systems. (See p. 36.)

For the 46 systems for which complete cost data was available at June 30, 1971, GAO found that cost changes amounted to about $30.8 billion. Almost $12.2 billion is directly related to changes in the quantity of units to be purchased, and nearly all of that, or $11.7 billion, resulted from decreased units to be bought. (See p. 37.)

The effect of that kind of change is obvious--program costs go down and individual unit costs go up. Not so obvious, but perhaps far more significant, is the impact of these quantity reductions on interrelated weapon programs, all of which are part of an overall plan. (See p. 61.)

RECOMMENDATIONS OR SUGGESTIONS

The Secretary of Defense should:

1. Emphasize (a) a continuing rigorous analysis of the need for new weapon systems, (b) a careful analysis of the impact of proposed needs on the manpower and dollar resources of the total defense force as well as the implication to the plans for the usefulness of the equipment already in inventory, and (c) the inclusion throughout of a properly structured process which makes tradeoffs between various ways of fulfilling a function. (See p. 55.)

2. Reexamine the weapon systems which have been selected for project management and which have been retained under project management and spell out specifically, on a case-by-case basis, the functions that a project manager will, and will not, perform. (See p. 57.)

3. Develop and implement DOD-wide guidance for consistent and effective cost-estimating procedures and practices, particularly (a) an adequate data base of readily retrievable cost data, (b) a uniform treatment of inflation, (c) an effective independent review of cost estimates, (d) more complete documentation of cost estimates, and (e) dependable program definitions. (See p. 58.)

4. Develop and implement DOD-wide guidance to provide that (a) appropriate testing and evaluation be completed prior to making key decisions and (b) adequate controls be set over the granting of any waivers from required testing and evaluation. (See p. 59.)

5. Reassess the criteria for designating weapon systems for selected acquisition reporting in an effort to expand the system. (See p. 62.)

AGENCY ACTIONS AND UNRESOLVED ISSUES

DOD has stated that it is in general agreement with GAO's findings, conclusions, and recommendations and that it has taken corrective actions. (See app. III.)

MATTERS FOR CONSIDERATION BY THE CONGRESS

This report provides the Congress with an independent appraisal of the complex problems associated with weapon systems development and procurement by DOD--a matter of serious concern in the Congress.

CHAPTER 1

INTRODUCTION

The investment to acquire major Department of Defense (DOD) weapons makes a heavy impact on both short- and long-term allocations of the Nation's resources. Because of this impact and because of evidence that the weapon systems acquisition process has not, in many cases, been conducted efficiently, considerable congressional and public attention has been focused on improving the process.

This interest and attention continued during the past year. The authorizing and appropriations committees, as well as other committees of the Congress, continued to direct attention to major acquisitions and gave particular emphasis to major problem areas, including specific weapon systems.

The Congress has called upon the General Accounting Office (GAO) to report periodically on the progress of various acquisition programs and to provide its committees and members with more reliable information on which to base judgments concerning issues involving its oversights and its legislative functions.

To effectively respond to the needs of the Congress, GAO established a long-term program to provide up-to-date and comprehensive data on major weapon systems. This report is designed to provide an evaluation of the effectiveness of the acquisition process and substantive factual data on cost, schedule, and performance of the individual systems being developed. It is presented in a format consistent with that established in our March 1971 report and, in general, deals with management actions taken since June 30, 1970. The data presented on cost and changes covers the period from June 30, 1970, to June 30, 1971; however, the most recent information available has been used as much as possible in the other reporting areas.

DEVELOPMENT PROCESS FOR A MAJOR WEAPON SYSTEM

The development process for a major weapon system is highly structured and complex, involves interaction between

users and developers, and requires a substantial part of DOD's personnel and monetary resources and a large segment of the Nation's industrial capacity. It is estimated that it will cost more than $162 billion to acquire the 141 weapon systems currently under development. Some $93 billion of that amount is yet to be appropriated by the Congress. An oversimplified representation of the manner in which weapon systems evolve from an idea to production is shown in figure I on the following page.

Conceptual phase--This is the initial phase in the acquisition of a weapon system. In this phase, the need for new military capability is established, a concept which will provide this capability is developed, and the technical feasibility of the concept is explored and determined. The objective of this phase is to identify and define conceptual systems on the basis of a combination of analyses, experiments, and test results. Advancement to the next phase, validation, is dependent upon satisfying criteria designed to measure achievement of the conceptual phase's objective. The Secretary of Defense's approval is required to authorize the program to move into the validation phase.

Validation phase--In this phase, the preliminary designs and engineering for the weapon system are verified or accomplished, management plans are made, proposals for engineering development are solicited and evaluated, and the development contractor is selected. The objective of this phase is to verify that the technical and economic bases for initiating full-scale development of the weapon system are valid. Advancement to the next phase, full-scale development, depends upon establishment of achievable performance specifications for the weapon system that are supported by an acceptable proposal from the development contractor selected. The Secretary of Defense's approval is required for the program to move into the development phase.

Full-scale development--In this phase, the design and engineering of the weapon system is accomplished. The development contract is negotiated and awarded; the prototype of the weapon system is developed, produced, and tested; and the detailed specifications for manufacturing the weapon system are prepared. The objective of this phase is to develop a weapon system acceptable for production. Advancement to the

FIGURE I

Figure I

production phase must be authorized by the Secretary of Defense.

The development phase overlaps the production phase since development is not considered complete until adequacy of the production model of the weapon system has been validated by a series of production acceptance tests.

Production--In this phase, the weapon system is produced in quantity for deployment. It begins when the production contract is negotiated and awarded. Production acceptance tests are conducted to validate the adequacy of the production model of the weapon system. Quantity production is initiated, and the first operational unit is equipped with the weapon system and is trained in its use. Advancement to the operational phase occurs when the first operational unit equipped with the weapon system is deployed. However, production continues until all required quantities of the weapon system are produced. The production phase includes tests of production, service, and user acceptance.

Many potential weapon systems never progress beyond the early stages of consideration, e.g., the conceptual phase. There are many reasons for this: unavailability of necessary technology; realization that a potential system may become too costly for its intended purpose; anticipated obsolescence in terms of threat that the system is intended to counter; or subsequently, more effective competition by another system concept. As a system passes through validation, the Government's commitment to it becomes firmer. By the time the system reaches full-scale development, the Government's commitment has become so great, and the structure of the program so definite, that major adjustments to the program are difficult because they almost always delay critical delivery dates and are costly. Few really acceptable options are available to the Government once the design has been approved and a decision has been made to begin production.

The pattern of deeper involvement and decreasing options is shown in the following chart. (See fig. II.) The greatest opportunity for broad decisions occurs during the early stages of acquisition.

CONCEPTS OF THIS STUDY

It was clear to GAO that the underlying management difficulties and the problems of taking sound day-to-day actions at all levels were deep seated and could best be evaluated by a systematic review of the entire process by using specific systems and phases as a basis for case studies.

At the outset critical major weapon acquisition management actions and decisions, which would occur in every acquisition, were outlined. In determining these critical actions, DOD's own criteria and objectives were used. The critical management activities examined pertained to

--requirements for systems,

--assessment of technical progress, and

--organization and procedures.

Several factors influenced our selection of specific weapon systems. First, we selected some of the systems for which the Congress or DOD would have future options regarding further courses of action. Second, we selected a number of weapon systems which recently proceeded into the early phase of the acquisition process. This factor is most important because problems occurring in the earlier phases may plague the system for years and may adversely affect the cost, schedule, and performance of the system at a point when adjustments are difficult to make. As was noted earlier, it is also the point in time when the greatest number of options are available to both DOD and the Congress. Although little is to be gained by dwelling on problems which have occurred in weapon systems where options are low, we have included a few such systems in our study since they provide the best means of assessing the full import of sound and unsound past actions.

To fulfill our task we reviewed 38 systems (11 Air Force, 11 Navy, and 16 Army). We reviewed also cost and schedule data from a number of other systems. Still other systems were reviewed at the request of congressional committees. In all, the data in this report are distilled from studies of some aspect of 78 weapon systems. We appraised these systems

FIGURE II

in terms of what happened to them in the last year and attempted to evaluate the overall acquisition process in relation to the baseline established in our first report. We also examined some of the more critical problem areas in greater depth.

In chapter 2 the instability of acquisition programs is discussed. Chapter 3 contains details of our observations on project management organizations, staffing, and procedures. In chapter 4 several of the management actions critical to weapon system acquisition are described in some detail. Chapters 5 and 6 are concerned with system acquisition status and the selected acquisition reporting system. Chapter 7 contains our specific recommendations.

Scope

To review current policies and practices, we examined weapon systems in various phases of acquisition--conception, validation, full-scale development, or production.

Information on these programs was obtained by reviewing plans, reports, correspondence, and other records and by interviewing officials at the system program office, intermediate and higher commands throughout the military departments, and the Office of the Secretary of Defense (OSD). We evaluated management policies and the procedures and controls related to the decisionmaking process, but we did not make any detailed analyses or audits of the basic data supporting program documents. We made no attempts to (1) assess the military threat or the technology, (2) develop technological approaches, or (3) involve ourselves in decisions while they were being made.

CHAPTER 2

PROGRAM STABILITY

In our March 1971 report to the Congress, we pointed out that to effectively pursue program objectives required stable priorities and consistent program direction. We expressed the belief that the development of a comprehensive DOD-wide priority system was a first step toward incorporating stability into programs. Accordingly, we recommended that the Secretary of Defense make every effort to develop and perfect the DOD-wide method--then in its early stages of development. The method was designed to be followed by all military services for determining two things: first, what weapon systems were needed in relation to the DOD missions and second, what the priority of each should be in relation to other systems and their missions.

In the fall of 1971, DOD announced its new system for a revised Defense Planning, Programming, and Budgeting System (PPBS). This new system furnishes fiscal and logistical guidance for a 5-year period and provides for attaining required support levels by the end of that period.

The revised PPBS centers around five major changes.

--The system is designed to accept National Security Council input at key points.

--Economic realism is introduced at the earliest feasible stage through the fiscal guidance. Everyone in the process is forced to think about priorities throughout the cycle, instead of just a few people at the end of the cycle.

--The Joint Chiefs of Staff are involved for a longer period of time, and their views on forces, priorities, and risks, as expressed in the Joint Force Memorandum, have a key role in the development of the 5-year defense program.

--The responsibility for analytical input has been shifted to the services.

--The cycle is extended by about 4 months and provides an opportunity for a more active dialogue among the services, the Joint Chiefs of Staff, and OSD to get the full benefit of the best thinking in DOD. There is time for differences of opinion, but there is more time to reach agreement.

Although it may be too early for the influences of this revised system to be felt, the frequency and extent of changes in development programs suggest that the system is not yet accomplishing its stated objectives.

We reviewed changes in 61 programs on which we had complete data. Many of these changes related to hardware and were not consistent with original statements of need or with earlier indications of the important relationship between one subsystem and another.

Between June 30, 1970, and June 30, 1971, there was a net decrease of $4.2 billion (from $117 billion to $112.8 billion) in total estimated program costs for these 61 major systems. In all, quantity, engineering, economic, schedule, and other changes increased or decreased programs by $29.2 billion. By any measure cost fluctuations amounting to nearly 25 percent of the total estimated program costs indicate a major problem.

All programs are reviewed periodically, and a degree of modification is to be expected. As a rough generality, performance requirements for strategic programs undergo less frequent modification than do tactical programs. One of the principal reasons for the fluctuations in tactical weapon systems programs seems to be the changes in mission concepts during the development phase and their relationship to other programs, either in inventory or under development. Instances of substantial changes in the performance requirements for individual systems being acquired are commonplace. Some examples are the F-14, LANCE, LAMPS, F-111, SAM-D, HAWK, and AEGIS.

Examination of a number of programs provides clear illustrations of the penalties attendant to planning and programing where such management methods as those we recommended last year are lacking. To assist the Secretary in

accelerating the implementation of an improved management method, we reviewed the histories of several programs which, in our opinion, were not examined, planned, or managed, with full consideration of related programs and weapon systems. There is a question whether, in the conceptual stage, an attempt was made to establish the impact of a weapon proposal on other programs, on the total force structure of a service, or on the possible ceiling of dollar resources.

The change took place in and among these major systems during the last year and is illustrated in the following discussions.

CUTBACK OF THE DLGN PROGRAM

The requirement for nuclear-powered guided missile frigates (DLGNs) is closely related to the Navy's program for acquisition of nuclear aircraft carriers (CVANs). The Navy's stated program is to provide four DLGNs for each nuclear carrier, although according to Navy officials, a nuclear-powered guided missile cruiser (CGN) may be substituted for a DLGN. At June 30, 1970, the Navy had one nuclear carrier in operation and two additional carriers under construction. At that date the Navy program anticipated obtaining three additional nuclear carriers.

At the same date the Navy had two DLGNs and one CGN in operation. Two additional DLGNs were under construction. To provide for a six-carrier program, the Navy needed 19 additional DLGNs. This quantity was increased by an additional four ships required for reserve and other purposes, making a total of 23 necessary.

Early in 1971 the DLGN project office was instructed to reduce the number of DLGNs from 23 to six, the Navy position being that this quantity would satisfy the escort requirements for the three nuclear carriers then in use or under construction. A few months later the requirement was further reduced from six to three.

This same information follows in tabular form.

CVAN program		DLGNs needed for the CVAN program
In operation	1	4
Under construction	2	8
Anticipated	3	12
Reserve	-	4
	6	28

	DLGN program		
	6-30-70	March 1971	6-30-71
In operation	3	3	3
Under construction	2	2	2
Planned	23	6	3
	28	11	8

The rationale for these changes was explained in two letters from the Deputy Secretary of Defense to the Chairman, Joint Committee on Atomic Energy, as follows: (1) the substantial overall cost of the DLGNs (about $250 million for each ship), (2) other high-priority needs of DOD, (3) limitations on funds available for defense, and (4) the desire to incorporate new weapon systems on the DLGN, such as the AEGIS missile system currently under development.

There are several interesting aspects of the reduction in quantity of DLGN-38s. The decision to reduce the number of ships to be procured was based, in part, on the desire to incorporate new systems, such as the AEGIS. However, the Navy's ship acquisition plan stated that the AEGIS would not be ready in time to install it on early ships of the DLGN-38 class. Navy officials stated that AEGIS could be installed on DLGN-38s after they were completed, but OSD said that this would require a major overhaul, would be costly, and would tie up the ship for about a year.

The reduction in quantities of the DLGN-38 from 23 to three illustrates the problem we see in the present Defense planning. The rationale given by the Deputy Secretary is the kind of rationale that could be applied to almost any program. All weapon systems are expensive, and costs are increasing rapidly. There are always other high-priority needs; even in the best years funds have been limited, and new weapon systems must always be incorporated.

Obviously the 23 DLGN-38s were at one time a high-priority need. What occurred to reduce this need so substantially in terms of overall Defense needs is certainly not clear. We think that the real question is how this substantial reduction equates with what the Navy thought its high-priority needs were 4-1/2 years ago, what they think they are now, and what really has changed in the way DOD planned to accomplish its mission.

PLANNED USE OF THE AEGIS MISSILE SYSTEM

AEGIS, an expensive, advanced surface missile system, will not go on the DLGN-38, the ship for which it was originally intended. Unless a new class and/or classes of ships are authorized for construction, the alternatives for designation of a ship for AEGIS will involve modifications to the AEGIS system; design changes to ships under construction; or retrofitting ships that are, or will be, in the fleet.

A modified version of AEGIS suitable for installation in the DD-963 class destroyers would require changes in the ships' design. However, the contract for construction of the DD-963s was structured to minimize configuration changes to the ship and to maximize the contractors' responsibility for the characteristics of the ship. This alternative becomes even less attractive in view of the DD-963's shipbuilding schedule which currently indicates that most of the destroyers will have been completed by the time AEGIS is scheduled to be available.

There are many alternatives, such as retrofitting either the DD-963s which will be completed before AEGIS is available or the guided missile frigates in the fleet. The Navy has determined that it is feasible to retrofit AEGIS, but retrofit costs have not yet been determined. Generally, the Navy considers retrofitting as an unfavorable alternative because of its high cost.

Other possible alternatives include retrofitting carriers and the TARTAR-equipped frigates being constructed or using AEGIS on patrol frigates. The patrol frigates are still in the planning stage, and a much smaller version of AEGIS would have to be developed for use in these planned ships.

The designation of a need and ships for the AEGIS has alternately changed from the initially intended DLGN-38 (10,000 tons) to a possibility of DD-963s or DLGs (7,600 tons and 5,900 to 8,400 tons, respectively) and now to a new class of missile escort ships (probably on the order of 5,000 to 6,000 tons).

Because the ultimate platform for AEGIS is getting smaller and smaller, AEGIS must be scaled down accordingly. The Navy recently stated that the performance objectives of a scaled-down system were the same as those of the larger system except for reduced target-handling capacity.

ARSV, MICV, AND BUSHMASTER

The Army considers the capabilities of the armored reconnaissance vehicle (ARSV) and the mechanized infantry combat vehicle (MICV) to be closely related; they are considered to be companion weapon systems. The BUSHMASTER weapon system is designated as the primary armament for these vehicles. All three systems are urgently required to meet a threat that could not be met with existing equipment, yet the histories of these systems do not reflect the stated urgency of the requirement.

The project managers have considered these systems to be ready for the next phase of the acquisition process for quite some time, but progress of these programs has been delayed substantially. BUSHMASTER, MICV, and ARSV do not represent any great advancement in technology, but they have spent 10, 7, and 5 years, respectively, in the concept formulation phase. The deployment dates have slipped 13, 3, and 7 years, respectively. Of the funds that have been appropriated for BUSHMASTER and MICV, a large proportion has been reprogramed for use on other programs by either the Army or OSD. The Army, early in 1971, made the decision to enter the development phase of all three systems at the earliest feasible date.

Since 1967 the planned procurement of BUSHMASTER has dropped 94 percent. The procurement objectives for ARSV and MICV have been reduced substantially also. Current procurement plans include only enough BUSHMASTERS to equip the immediate needs of MICV. The gun system that has been designated to serve as an interim weapon for ARSV does not have the capability required by the Army at extended ranges. In addition, that gun is currently being retrofitted onto another vehicle and will have to be removed before it is put on ARSV. The Army still believes BUSHMASTER is the best weapon for ARSV, as well as for MICV. Under present funding constraints the Army is now planning to retrofit M139 guns

for ARSV because this approach would provide a marginally satisfactory interim capability. However, the Army still hopes to acquire funds in the future to equip both vehicles with BUSHMASTER. In addition to providing these vehicles with the most desirable gun system capability, the increased procurement would produce an added benefit of lowering the unit cost.

These three programs were initiated in about the same time frame and ostensibly were part of the Army's overall plan for satisfaction of combat vehicle requirements. They have been studied, reviewed, evaluated, redirected, and sustained throughout by nominal levels of funding.

Delays in MICV have been attributed to its relatively low priority, funding constraints, changes in management processes, and management reviews. Throughout the course of the ARSV program, many slippages occurred due to such factors as procurement method changes; delays in the concurrent acquisition of the BUSHMASTER gun; and the time needed to (1) reaffirm the ARSV program as the means of satisfying the requirements, (2) conform the program to changes in the acquisition process, and (3) prepare, revise, and coordinate the development concept paper, the management document used as a basis for the decision to advance to another phase. Also causing schedule slippage was evaluating the program to consider alternative versions and proposals in response to funding constraints resulting from the low priority of ARSV in relation to other Army programs. The long delay in the BUSHMASTER program has been caused primarily by the delays in the MICV and ARSV programs noted above, deletion of U.S. Marine Corps and main battle tank requirements, and increased fiscal constraints.

CHAPTER 3

ORGANIZATION, STAFFING, AND PROCEDURES

Last year we reported on some of the problems in organizing for weapon system management, including the differing practices followed in each of the services. We contrasted project manager organizations that are essentially self-supporting (a method used mainly by the Air Force and other services for such super programs as POSEIDON and SAFEGUARD) with those providing relatively little direct support to the project manager but relying heavily on functional organizations for support (employed mainly by the Army and Navy). The report also discussed the problems of layering in each of the services.

During the past year we have made further studies of the organization for project management in DOD, including the differing organizations in each service, a more detailed analysis of the layering problem, and the effects of functional organizations. We were seeking answers to the following three questions.

1. How much control does the project manager really have over weapon system design, design changes, and system interfaces?

2. How much control does the project manager really have over program resources--funds, people, and facilities?

3. How much control does the project manager really have over the contractor(s)?

The answers to these three questions varied widely among and within the services. A greater degree of control appeared to be present in some Air Force programs, and the least control was evident in Navy programs; the Army programs were generally somewhere in between.

We used program work breakdown structures which contain all the tasks requring accomplishment to meet the program objectives. These structures are supposed to facilitate a

more effective management and technical base for planning and assigning management and technical responsibilities by operations within those governmental offices responsible for acquisition of defense items and those contractors furnishing the items.

The Airborne Warning and Control System (AWACS), headed by a general officer, is a fairly typical Air Force project. The project manager has a staff of 106 people. Under Air Force policy he was permitted to select technical personnel who were well grounded in the various kinds of subsystems involved in his project, to give himself some fairly substantial competence in making independent technical appraisals and cost, schedule, and performance changes both in the initial design and in the day-to-day management of his project.

An examination of the work breakdown structure shows that all the hardware development is the direct responsibility of the project manager. He is responsible for all hardware items, such as navigation and air vehicle subsystems and communication, radar, beacon, and data processing equipment. The only technical task in his project over which he does not have direct control is early component testing. Several testing organizations are involved, with which the project manager must agree on schedules and programs. Most of these agreements are written and are fairly specific as to aircraft required, when they are required, and the responsibilities of the parties involved.

The XM-803 (formerly MBT-70) and the M-60, both tank programs, are reasonably typical Army projects. The XM-803 is managed by a senior civilian who reports directly to the Commanding General, Army Material Command, and the M-60 is managed by a military officer of lesser rank who reports to the Commanding General, Weapons Command, a layer lower in the organization.

In both cases the project managers rely more on other Army organizations for technical expertise than does the AWACS project manager. As many as seven major Army commands (each with its own missions, such as weapons, missiles, munitions, etc.) may be involved in the development and production of a tank.

Reliance by the project manager on organizations whose basic mission is different from his own for knowledge as to what is available for him to use, with no real way to appraise the alternatives, places him in a difficult position. Even when the project manager has knowledge of what appear to be acceptable alternatives to those offered by the functional experts, the sluggishness of decisions through the various organizations slows the whole acquisition process.

Probably the most complicated structure of all involves Navy ships. There are two reasons for this: (1) the Navy believes strongly in austere project management organizations and in heavy reliance on functional organizations and (2) a ship is essentially only a platform containing a very large amount of equipment developed by others. Much of the componentry is of such magnitude as to be individually managed and has complications in its own right.

The SSN-688 nuclear attack submarine program is typical of the complications in a ship program. It is directed and controlled by two project officers. One--staffed by seven people--reports to the Chief of Naval Material (CNM) and is responsible for broad planning and direction, and a second--staffed by 55 people--is responsible for the acquisition of the ship and reports to the Ship Systems Command, a suborganization of CNM. The program involves 37 submarines estimated to cost $6.8 billion over a 5-year period.

In all, the project manager interfaces with 23 organizations responsible for the 211 pieces of equipment making up the 15 subsystems on the submarine. In these organizations the project manager works through secondary managers who do not work directly for him but with whom he has generalized written agreements. Seven of these secondary managers are project managers who have their own functional interface problems.

There is not enough evidence to date to make a strong case for one particular type of program management organization's being clearly superior to another. There have been program successes and failures both with the centralized, self-sufficient, relatively large program offices and with the smaller program offices that utilize the service functional areas for major support. GAO will continue to evaluate program management to determine, from a lessons-learned

standpoint, the preferred concepts for various types of programs.

AUTHORITY OF PROJECT MANAGERS

With some exceptions the military services have not placed the project manager high in the organizational structure because of such practical considerations as the large number of project managers and the need for them to work directly at lower levels of the organization. The effect has been to create levels of review authority contributing little to the process of formulating decisions.

A project manager is normally a colonel or Navy captain, and his place in the organization is four or five levels below the service secretary and military chief. He is frequently outranked in the functional and staff organizations with which he must deal.

In addition to the chain-of-command layering, many of the functions, such as the budget and contracting function, are themselves layered so that approval for action in these functional areas must also clear through these organizational layers.

Project managers operate under charters that tend to be written very generally, and most charters could be applied to almost any project. A project manager's charter in the Army, for instance, could be applied to most Navy projects with only minor changes in wording. (There are some exceptions; for example, the F-15 tends to be more specific about what the project manager can and cannot do.) Most charters state that the project manager has broad authority and responsibility.

In actual practice the charters provide the project manager little authority because of a very large body of rules that project managers are required to follow. These rules involve many diverse activities, such as fund and configuration management; cost, schedule, and control; safety; logistics; development of work breakdown structure and management information systems; reliability; maintainability; cost reduction; value engineering, etc. Since the rules are written for everybody, they fit almost nobody.

When the project manager relies on support from other technical managers, he usually operates by means of written agreements. The use of letter agreements between project managers and the functional organization adds little in the way of real control to the project managers' operation, except in those cases where the agreements are specific. The agreements are generally very vague and say little more than "we will help each other." The agreements usually do not specify such things as who makes the final decisions, what kind of control the project manager exercises over the development, or the mechanisms available to him to know that what is being developed is best for his project.

EFFECTS OF FUNCTIONAL ORGANIZATIONS AND LAYERING ON PROJECT MANAGEMENT

Discussed below are several illustrative examples of the kinds of problems the system creates for project managers. Literally thousands of such examples could be given because they are typical of the way things are done and decisions are made. Most of the examples are oversimplified, since in tracing a transaction through the system, it is almost impossible to identify all the people or even the organizations involved.

1. The project office for the MARK 48 torpedo initiated a procurement request and associated documents for modification kits for the submarine fire control system estimated to cost $5 million. Without the kits the effectiveness of the torpedo is impaired. The request was therefore considered urgent, and to expedite matters a letter contract was to be awarded.

After preparation, the request was sent through the MARK 48 project office for approval and a copy went to the Naval Ordnance Systems Command for processing. The command processed it through the Contract Office Planner, Logistics Support, for a priority rating; through administration for a security classification; through Plans, Programs, and Financial Management for a check on fund availability; and through the Systems and Acquisition Directorate for review and approval of proposed data requirements. The request was then sent out of the command for contractual and funding reviews by the Antisubmarine Warfare System Project Office; was received back; and was reviewed by command lawyers and specialists in small business, labor surplus areas, security, patents, and various layers of contract administration. Each layer of budgeting activity through the Chief of Naval Operations was notified and signed off on required reprograming of funds. The contract planner also prepared an advance procurement plan, a request for authority to negotiate, and a determination and findings, which were subjected to a similar approval process by various levels and commands and which culminated with the approval of the Assistant Secretary of the Navy (Installations and Logistics) to negotiate with the only known source capable of fast delivery.

Three months after the request was initiated, a package of prenegotiation data, approvals, routing sheets, recommendations, funding data sheets, and other assorted data was given to a negotiator. He drafted a proposed contract and sent it to legal, patent attorneys, inspection acceptance, data requirements, security, and fiscal groups for review and approval or recommendations. After considering further recommendations, making necessary changes, getting approval from legal, obtaining a business clearance letter from Naval Material Command, and certifying a contractor's compliance with provisions of the Equal Opportunity Act, the Naval Ordnance Systems Command negotiator was finally able to send copies of the contract to the contractor for signature. After the contract was signed by the contractor, it was signed by the Navy's contracting officer and was sent to the distribution center for reproduction.

It took 4 months on an expedited "rush" basis to get from a procurement request to a letter contract, during which time it was subjected to at least 174 control, review, and approval points within 74 organizational elements at eight different management levels. Allowing an average of 21 work days a month, the decisionmaking process was able to react about twice a day. In addition, most of the precontract review and approval will be repeated as the letter contract is definitized into a negotiated fixed-price-type contract.

2. In August 1970 the project manager for the CHAPARRAL/VULCAN missile system requested that the Missile Command prepare a product improvement program for an improved guidance system on CHAPARRAL. Also in August 1970 the Deputy Secretary of Defense requested that the Army, Navy, and Air Force work together in exploring the possibility of obtaining a common missile, possibly by adapting the Navy SIDEWINDER to Army and Air Force use. The common missile, if developed, would be used by the Army in lieu of CHAPARRAL.

In January 1971 the Commanding General, Army Materiel Command, determined that it was not feasible to replace CHAPARRAL with a common missile. He therefore recommended that the Missile Command guidance improvement proposal, designated MOD-1A, be incorporated in the CHAPARRAL.

A Missile Command report, CHAPARRAL Improvement Program, which included MOD-1A and an active optical fuze program, was submitted to the Army on February 11, 1971. The package was returned on March 2, 1971, for detailed cost data and more justification than had been submitted. The Army also requested that each proposal be submitted separately and that a comparison study of the MOD-1A and REDEYE II SEEKER be provided. The Army Missile Command had previously reported (on January 13, 1971) to the Army that several infrared seekers, including REDEYE, had been investigated but had been eliminated for consideration.

The revised MOD-1A product improvement program was forwarded to the Army in May, and the new MOD-1A/REDEYE study was forwarded in June 1971.

During an Air Defense review in August 1971, an Army representative of the Chief, Research and Development, again raised the question concerning use of the REDEYE SEEKER. The Chief of Research and Development withheld concurrence of MOD-1A until a group went to the Missile Command in September 1971 for a briefing on the REDEYE and MOD-1A.

The project was finally approved by the Army on December 3, 1971. As of February 9, 1972, some 17 months after it had been initiated, the project was awaiting approval in OSD.

In summary, we found some important differences in the way project offices were organized and operated. On some programs the project manager is placed in an environment where he really does not have control over his project. Technical features of his program are under the direct control of others. The objectives of supporting organizations are not necessarily the same as his. Essentially, all the procedures under which his project will be managed are prescribed. Almost everything he does is done under a set of rules that gives him flexibility only to the extent that he is willing to ignore them. He has little control over his contractor because he lacks authority to make contracts and because, in any event, the procedures the contractor will follow are prescribed by a similar set of rules.

CHAPTER 4

ASSESSMENT OF CRITICAL MANAGEMENT ACTIONS

We have included four specific aspects of the acquisition process in this chapter. These areas were selected for special attention because they related to several of the critical management actions discussed in last year's report and again in this report. Also, they have been particularly troublesome in weapon systems acquisitions.

COST ESTIMATING FOR MAJOR ACQUISITIONS

Cost growth in acquiring weapon systems continues to be a significant problem in DOD. Much of this cost growth is attributable to unrealistic cost estimates. We found that the two overriding factors influencing the quality of cost estimates are (1) the lack of completeness of a plan stating what should be done and (2) inadequate documentation on what was done and how and why it was done.

There is a lack of uniform guidance on cost-estimating practices and procedures which would provide the basis for formulating valid, consistent, and comparable estimates throughout the services. Each service has its own set of guidance for the estimating function that ranges from a detailed estimating manual to a few general statements.

In virtually every system we reviewed, documentation of what had been done, and why, was clearly lacking. Cost estimates are frequently a succession of revisions over the previous cost estimate. To effectively accomplish cost estimates, we believe that the documentation must provide a complete disclosure of data sources, assumptions made, methods used, and all decisions basic to formulating the estimate.

There is a general lack of readily retrievable cost data which could serve as a basis for computing cost estimates for new weapon systems. Officials within OSD have stated that there is little organized effort to gather actual cost information on a systematic basis, to achieve comparability between the data collected on various weapon

systems, or to make any effort to see if the cost data being reported by the contractors is accurate and consistent.

We suggested that the Secretary of Defense consider further development of DOD-wide guidance for consistent and effective cost-estimating procedures and practices. Elements of particular importance are:

1. An adequate data base of readily retrievable cost data.

2. Uniform treatment of inflation.

3. An effective independent review of cost estimates.

4. More complete documentation of cost estimates.

5. Dependable program definitions.

We believe OSD agrees with our basic conclusions. To improve procedures and practices OSD plans to take steps to provide the necessary guidance to DOD components. This would include criteria to guide those charged with making estimates and would establish procedures to have cost estimates available for use by the services and the Secretary of Defense. In addition, it would provide guidance for the creation and maintenance of cost data systems to serve as a basis for computing cost estimates for new weapon systems. For example, in December 1971 the Secretary of Defense asked the services to make available to DSARC at each key decision point an "independent parametric cost analysis" in addition to other appropriate cost estimates.

We were advised that the services also were taking some action to improve their cost-estimating capabilities. For example, the Navy has established a resource analysis group. The Army is assigning a project officer who will be responsible for the development of an independent parametric estimate for each system which either is covered by a selected acquisition report (SAR) or is subject to a defense systems acquisition review council review. The Air Force Systems Command is about to reissue its Cost-Estimating Manual.

COST-EFFECTIVENESS STUDIES

Cost-effectiveness studies are one of the techniques used in reaching decisions as to which among several competing weapon systems is more likely to achieve a predetermined mission goal at the lowest cost. The overall goal of such studies is to assist a decisionmaker by arraying significant factors to help identify a preferred system from among the alternatives.

A cost-effectiveness study considers the need a system is supposed to fill, the alternative technical solutions available to meet that need, technical performance characteristics of each alternative, cost associated with each possible solution, and criteria for choosing among alternatives. The overall study should emphasize significant issues to clarify merits of alternative systems. Also, the analysis should be updated when changes in basic assumptions occur. Updating ensures continuing cost effectiveness of the system selected by allowing for changes in threat, technological advancement, or desired level of defense.

The basic elements of a cost-effectiveness study in a weapon acquisition program are:

--Statements of the mission(s) to be performed.

--Inclusion of alternative weapon systems.

--Disclosure of comparable estimated costs for each alternative.

--Logical presentation of relationships, including costs, predicted effectiveness, and assumptions.

We are convinced of the definite usefulness of cost-effectiveness studies. We believe the greatest advantage of the cost-effectiveness technique is that it forces advocates of a weapon system to examine and record the real need, alternatives, related costs, and assumptions considered. This serves to provide the decisionmaker with a body of information which is helpful in making a decision at an early phase in the acquisition process. Continual updating at major decision points would help confirm the development of the most cost-effective weapons.

In the cases reviewed we found that some weapon system cost-effectiveness studies were comprehensive and provided the type of information on aspects needed for decisionmaking. However, we found also other studies which lacked objectivity and which appeared to be designed to support the position of the advocating service in that

--known alternatives were excluded from the study,

--stated assumptions were too restrictive or were not completely valid, and

--available data on alternatives were not considered, and as a result, incomplete studies amounting to misleading information were furnished for decisionmaking.

We found further that studies were not updated to consider such program changes as

--availability of actual performance data at variance with predicted performance data,

--major cost or quantity changes, and

--major changes in initial study assumptions.

We suggested that the Secretary of Defense emphasize the need for cost-effectiveness studies and clarify their roles as formal documents supporting development concept papers at each stage of decisionmaking in the selection of specific weapon systems. When two or more services are competing for a weapon system, OSD should arrange for independent cost-effectiveness studies impartial to the service proposals.

PERFORMANCE MEASUREMENT FOR SELECTED ACQUISITIONS

Department of Defense Instruction (DODI) 7000.2, Performance Measurement for Selected Acquisitions, was promulgated by the Assistant Secretary of Defense (Comptroller) on December 22, 1967. It is intended to provide the criteria for contractor reporting of valid and up-to-date data for measuring progress against cost, schedule, and technical plans. From the time it was issued, DODI 7000.2 has been implemented within the services with varying degrees of enthusiasm. The Air Force has made substantial progress in implementation, and the Army and Navy are beginning to make progress.

Questions concerning interpretation of basic criteria provided in the instruction were major contributing factors to the services' failure to make better progress. Other problems involve the implementation and validation process on a plantwide basis, validation of major subcontractors, joint validation by all procuring agencies, defining measurable effort, and evaluating technical performance progress.

Adequacy of criteria established for program performance measurement

The criteria of DODI 7000.2 provide the basis of determining whether contractor management control systems are acceptable. With one exception, the lack of criteria related to technical performance measurement, we believe the criteria provided in DODI are adequate for this purpose.

The DODI criteria have been designed around cost and schedule management and have generally excluded technical performance measurement because acceptable criteria have not yet been developed. Military standard-499, dated July 17, 1968, contains technical performance measurement criteria which were approved by DOD for application on a test basis. These tests are continuing but have not been approved for use on all systems. We believe that DODI is a significant improvement over past practices of controlling on the basis of funds expended, without the ability to measure related work units accomplished.

Status of implementation efforts

During the period April 1969, when the first contractor activity was validated by the Air Force, to February 1972, the services approved cost/schedule control systems criteria implementations of 25 contractors at 36 of their locations where work on major weapons was being performed. Of the 78 weapon systems discussed in chapter 5, 16 were validated as meeting the requirements of DODI 7000.2.

In total, 19 of the systems approved to date were on Air Force contracts. The Navy validated three contractors and has efforts underway at six locations. Systems in use at three Army contractor locations have been validated, and systems at 14 other locations are currently recommended for validation. In addition, the Army has nine more validation efforts in process.

Other problem areas

Baseline maintenance

One of the basic features of the DODI criteria has been the employment of a firm baseline that enables the contractor and the Government to measure cost and performance progress. By maintaining a firm baseline, program status can be presented in terms of contractual costs and contract value can provide the baselines from which accomplishment is measured.

We noted that, on three programs where performance measurement systems had been validated (F-14, S-3A, and B-1), firm baselines were not maintained. In the case of the Navy F-14 and S-3A programs, cost variances being reported are not related to the contractor's original budget and have the effect of minimizing the extent of reported cost variances. Contractor program planning and control personnel indicate that they consider the flexible budget baseline presently in use to be a more realistic measurement of performance.

On the Air Force B-1 program, performance is measured against a short-range budget and the contractor does not use, or attempt to use, the time-phased total contract plan for performance measurement. The rationale given to us by contractor officials for this is that they believe it is

difficult to make realistic time-phased estimates for general work tasks that are not defined in enough detail to warrant assignment of budget and schedule during the early stages of a development contract for a sophisticated weapon system.

Use of approved performance management systems alone will not prevent overruns or ensure achievement of schedule or technical goals. Through proper surveillance by the Government, such systems should provide early identification of problems related to cost and progress and should enable alternative or corrective action in the early phases of a program.

Technical performance measurement has been recognized as a troublesome area. Until some way is found to more closely relate technical performance achievements to cost and schedule, emphasis should be placed on ensuring that sufficient critical technical milestones are included in contracts and achievement ensured through a comprehensive test and evaluation program.

TESTING AND EVALUATION IN ACQUISITION MANAGEMENT

The Deputy Secretary of Defense has enunciated, since July 1969, a series of policy statements setting forth the framework for an improved acquisition process, including such goals as reducing the extent of concurrent development and production. However, we observed a number of instances where decisions were made to advance weapon systems to some stage of production before completion of adequate testing.

Each of the three services has longstanding policies that require the completion of engineering testing before production begins, but these policies have been frequently waived. For instance, the Army has such a policy, but it also provides for waiving the policy to begin limited production because certain exceptional circumstances exist (i.e., urgency of need and low risk). Most, if not all, of the major weapon systems procured by the Army in recent years have been procured under this waiver. Similarly, the MARK 48 torpedo, the F-111 aircraft, and a number of other

weapon systems in the Navy and Air Force have entered production under waivers to the overall policy.

We also found that:

--The practices used in establishing test objectives were generally adequate; however, most weapon systems did not have adequate test plans.

--The test plans generally were unduly optimistic and success oriented and allowed no provision for alternative positions or time for repair, if needed.

--Test and evaluation was not accomplished quickly and effectively.

--Test and evaluation procedures and associated terminology varied greatly among the services.

--Complete and valid test data was not always available for consideration by decisionmakers at the key decision points.

We suggest that DOD policies and practices regarding testing consider:

--Adequate controls over granting any waivers from required testing and evaluation.

--Completion of appropriate testing and evaluation prior to key decision points in the acquisition cycle.

CHAPTER 5

SYSTEM ACQUISITION STATUS

In our review this year we analyzed the status of 78 major acquisition systems. One of the systems we reviewed (ULMS) has not yet been approved by the Secretary of Defense, and no program cost estimates have been provided to us. The estimated cost of the remaining 77 systems has increased about $28.7 billion from the cost anticipated in the planning estimate to current estimate through completion. It has increased about $13.4 billion from the cost anticipated by the development estimate to current estimate through program completion.

As reported in the SAR system, these cost changes are not cost growth in the sense of measuring cost increases for identical programs from initial baseline to current estimates. Rather, they are the net of a great number of changes, including inflation, cost estimating, quantities, weapon systems capabilities, and schedules. In effect, the SAR reporting system does not readily identify pure cost growth, i.e., increased costs in constant dollars for programs. Highlighting such increases would emphasize the need for improved cost estimating.

A summary of program cost estimates for these 77 systems is shown in the table below. The detail for each system is shown in appendix I.

Summary of Program
Cost Estimates as of June 30, 1971

	Number of systems	Planning estimate (note a)	Development estimate (note a)	Cost changes (note b)	Other	Current estimate through program completion	Total cost (note c)
		(millions)					
Army	21	$17,[illegible]53.7	$ 18,[illegible]14.5	-$2,775.2	$ 5,[illegible]65.6	$ 20,[illegible]04.9	$ 21,[illegible]55.3
Navy	28	3[illegible],[illegible]50.5	45,[illegible]0.1	-8[illegible]1.6	6,71[illegible].8	50,[illegible]9.1	53,[illegible]1.6
Air Force	17	3[illegible],[illegible]07.5	45,[illegible]4.9	-4,791.3	9,72[illegible].8	50,[illegible]0.4	55,[illegible]40.4
Defense Communications Agency (DCA)	1	2[illegible]1.8	2[illegible]1.8	-	7.8	229.6	261.5
Total	77	$93,[illegible]6.5	$109,[illegible]11.3	-$8,408.1	$21,[illegible]11.0	$122,[illegible]14.2	$130,[illegible]18.8

[a] For those programs with only a development or a planning estimate, we have made both estimates the same to prevent distortion between the totals of these columns.

[b] The cost changes represent the difference between the development estimates and the reported costs through program completion.

[c] Includes advance procurement costs.

SYSTEM COST EXPERIENCE

In past reviews we found that there had been considerable changes in the estimated cost to complete a program as it moved through the acquisition process. Present SAR instructions provide for classifying cost changes into nine categories of cost variance. An analysis of the changes occurring during fiscal year 1971 alone, as shown by the SARs, clearly illustrates the great amount of change that does exist. For the 46 systems on which information was available at June 30, 1971, we found that cost changes totaled $30.8 billion in fiscal year 1971. These changes are analyzed below by type of change and by military department and are discussed in detail in subsequent sections of this chapter.

Analysis of Cost Changes in Fiscal Year 1971

Type of change	Army	Navy	Air Force	Change during fiscal year 1971
	(millions)			
Total quantity decrease--net	$ 512.6	$10,460.5	$ 239.4	$11,212.5
Other changes:				
Engineering	$ 167.5	$ 702.2	$ 744.1	$ 1,613.8
Support	167.7	445.5	516.8	1,130.0
Schedule	156.6	924.2	364.7	1,445.5
Economic	1,326.9	1,251.3	1,598.3	4,176.5
Estimating	295.8	2,887.0	2,287.1	5,469.9
Sundry	66.5	561.0	1,926.2	2,553.7
Unidentified	-	2,296.4	-	2,296.4
Total other changes	$2,181.0	$ 9,067.6	$7,437.2	$18,685.8
Number of systems	11	24	11	46

Notes:

1. The above data represents total changes (increases and decreases), other than quantity, which occurred in fiscal year 1971 on 46 systems for which we have comparable data.

2. The above types of changes were originally adopted by GAO on advice of DOD as proper classifications of the causes or reasons for changes. After several reviews on this basis, we have concluded that, in the future, more specific analysis of changes will result in improved classifications of the basic causes.

Our analysis of cost changes of weapon systems on SAR at June 30, 1970, and June 30, 1971, is graphically shown on the following page.

CHRONOLOGICAL REVIEW OF COST CHANGES

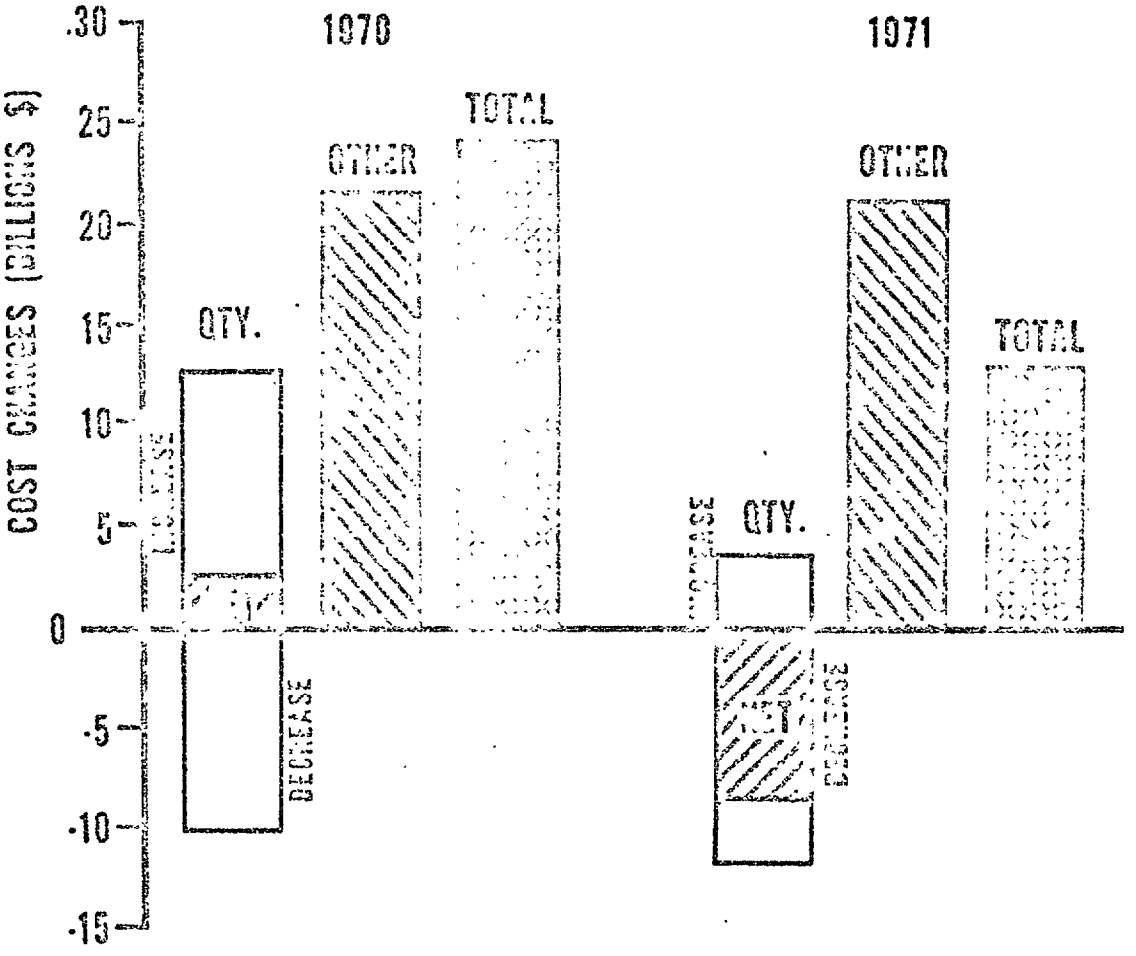

FIGURE III

Quantity changes--$11,212.5 million

Continued cost growth and the need to stay within the established budgetary limitations resulted in a significant reduction in the number of units to be acquired for many major systems. The effect of these quantity reductions is to obscure program cost growth and sometimes performance capability and to increase the unit costs of the remaining units to be acquired.

Quantity changes on Army systems amounted to $512.6 million which was related mainly to the SAFEGUARD program and which was attributed to deleting area defense from the program.

Quantity changes on Air Force systems amounted to $239.4 million which was related to the B-1, F-111, and MINUTEMAN III systems. The changes were attributed to a reduction of B-1 flight test aircraft from five to three, deletion of MINUTEMAN III research and development and production missiles, and termination of aircraft on the F-111 program.

The greatest quantity change, $10,460.5 million, occurred on Navy systems. During fiscal year 1971 the Navy reduced the DLGN-38, LHA, DD-963, F-14, and PHOENIX programs by nearly $9 billion through quantity reductions. In addition, our analysis indicates that the SSN-688 had a quantity decrease of $1.5 billion from last year. However, this indicated quantity reduction is the result of a change in baseline, and actually the SSN-688 program had a quantity increase of about $900 million in fiscal year 1971. The only other Navy program to show an increase in fiscal year 1971 was the A-7E aircraft which had a quantity increase of about $315 million.

Engineering changes--$1,613.8 million

An alteration in the established physical or functional characteristics of a system is called an engineering change. Incomplete descriptions of initial performance specifications and changes required to bring system performance up to expected standards have resulted in substantial engineering

changes. The three military services reported engineering changes of $1,613.8 million for 46 major acquisition systems in fiscal year 1971.

The Army reported engineering changes of $167.5 million primarily attributable to expected savings based on MBT-70 vehicle design austerity and increased cost for the CHEYENNE due to changes in the night vision system, system modifications, and related TOW development effort. The Navy and Air Force reported engineering changes of $702.2 million and $744.1 million, respectively. The Navy changes are primarily related to sonars, electronics communication, and test equipment for the DE-1052 and to a need to deliver DLG modernization ships which meet the latest specifications for operability. The Air Force reported engineering changes which are attributable to increases for design evolution on the B-1 aircraft and to decreases on the MINUTEMAN II and III due to deletion of equipment and cost refinements for force modernization and reduced systems engineering and technical direction.

Support changes--$1,130 million

Support changes involve such items as spare parts, ancilliary equipment, warranty provisions, and Government-furnished property and/or equipment. During fiscal year 1971 support changes reported by the three military services totaled $1,130 million.

The Army had support changes of $167.7 million primarily related to the SAFEGUARD due to revised spares requirement, added equipment, and MBT-70 systems for product ensurance, maintenance engineering, testing, and parts. The Navy had changes of $445.5 million primarily related to the S-3A for costs associated with VAST programming, crew position trainers, and miscellaneous support; to the P-3C for cost due to a revised investment spares requirement; and to the VAST-247 for special support equipment for onsite maintenance and basic spares program. The Air Force had changes of $516.8 million related to decreases for MINUTEMAN III due to reduced support at the western test range and to reductions in support items, such as ground support equipment data and modifications, and increases for the F-111 due to a reassessment of the program cost of support items.

Schedule changes--$1,445.5 million

Schedule changes reflect adjustments in the delivery schedule, completion date, or some intermediate milestone of development or production. The three military services reported schedule costs changes of $1,445.5 million for 46 major acquisition systems in fiscal year 1971.

The Army's schedule changes of $156.6 million are primarily attributable to the SAFEGUARD as a result of stretchout costs resulting from a longer deployment period. In addition, the Army had some minor schedule changes in the LANCE, DRAGON, and TACFIRE systems. Air Force schedule changes of $364.7 million resulted from a stretchout of the B-1 production rate and funding constraints and a production rate slowdown of the C-5A from three to two aircraft a month. The Navy had the biggest schedule change of $924.2 million. This change is attributed to a redirection of the F-14 program, to a revised fiscal year production buy of the PHOENIX missile, and to the A-7E system because of program stretchout and an invalid cost quantity curve.

For reporting purposes identifying such schedule adjustments is important. Our findings indicate that such adjustments are indicative only of other fundamental problems. Schedule changes, as such, are not a primary cause of cost growth but are rather the result of a management weakness or mistake.

Economic changes--$4,176.5 million

Economic changes reflect the influence of one or more factors in the economy. Included are specific contract changes deriving from economic escalation and changes in quantity--changing program estimates to reflect a revised economic forecast or changing actual contract quantities. The reported economic changes for 46 systems in fiscal year 1971 was $4,176.5 million.

Such systems as the SAFEGUARD, SAM-D, and MBT-70 account for most of the Army's economic change of $1,326.9 million in fiscal year 1971. The Navy's DD-963, S-3A, DLG modernization, DLGN-38, and SSN-637 account for most of its $1,251.3 million economic change.

The Air Force had the largest economic change, $1,598.3 million, related primarily to the B-1 due to revising the program estimate from fiscal year 1970 dollars to then-year dollars and to the F-111 to provide for escalation to complete the current program.

Estimating changes--$5,469.9 million

Estimating changes in a program or project cost are due to corrections and refinements in earlier estimates. In fiscal year 1971 the total reported estimating change for the 46 systems was $5,469.9 million.

Army changes, amounting to $295.8 million, related to SAFEGUARD for program increases and refinement and revision of previous estimates and to the MBT-70 program for advanced production engineering and increased testing support.

The Air Force had estimating changes of $2,287.1 million related to a revised program estimate of the C-5A, to the F-111 because of contractor price increases, to the SRAM as a result of the definitization of the production contract, to the MINUTEMAN III because of a deletion of missiles and program adjustments, and to the B-1 program as a result of revised past estimating methodology.

The Navy had an estimating change of $2,887 million attributable primarily to the MARK-48 program due to program reductions and revised program estimates based on the award of the production contract.

Sundry changes--$2,553.7 million

Sundry changes provide for all other miscellaneous changes which occur during the acquisition process. These changes would include (1) unpredictable changes, such as acts of God, work stoppage, and changes to Federal and State laws, (2) contract performance incentives changes resulting from contractor performances' being different from those predicted, and (3) changes due to contractors' actual contract costs' being over or under anticipated contract costs, but not attributable to any other category of cost growth. In fiscal year 1971 the three military services reported cost changes of $2,553.7 million on 46 major acquisition systems.

The Army had changes of $66.5 million as a result of converting the CHEYENNE contract to a cost-reimbursable type and adjusting a contractual cost for the SAM-D missile.

The Air Force had sundry changes of $1,926.2 million primarily related to the reclassification of MINUTEMAN rebasing costs, to MINUTEMAN III force modernization, and to the MINUTEMAN II upgrade silo program.

The Navy had sundry changes of $561 million related to management problems, restoration costs of a submarine and underestimates on the SSN-637 program, contractor claims on the DE-1052, and contractor overruns on the PHOENIX missile.

Unidentified changes--$2,296.4 million

Our report last year showed that, for certain Navy systems, the cumulative variance analysis and the variance analysis changes since the previous reporting period either had not been provided or were not complete. For this reason cost changes totaling $2,296.4 million were not allocated specifically to cost growth categories. Our review this year showed that the Navy had corrected this matter and allocated all cost variances to the nine cost categories established for the SAR system.

SYSTEM SCHEDULE EXPERIENCE

Schedule changes reflect adjustments in delivery dates, completion dates, initial operational capability dates, or other major program milestones. GAO findings have indicated that schedule variances are not the cause of program problems but are rather the result of technical, financial, or other management problems. We found that the reasons most frequently cited for schedule slippages are technical development and production problems, funding problems, system design and contract changes, overly optimistic original schedule estimates, program stretchouts, or late availability of Government- or contractor-furnished equipment.

A key schedule milestone is the initial operational capability (IOC) date. The IOC date is normally established by a military service as the time when the capability of a new system is required to counter a specific enemy threat or to provide another essential need of the military service. It is essential that schedule slippages and the reasons for slippages be identified as early as possible so management can make prompt decisions.

The following chart shows schedule slippage between the planned IOC date and the current estimate of the IOC date at June 30, 1971.

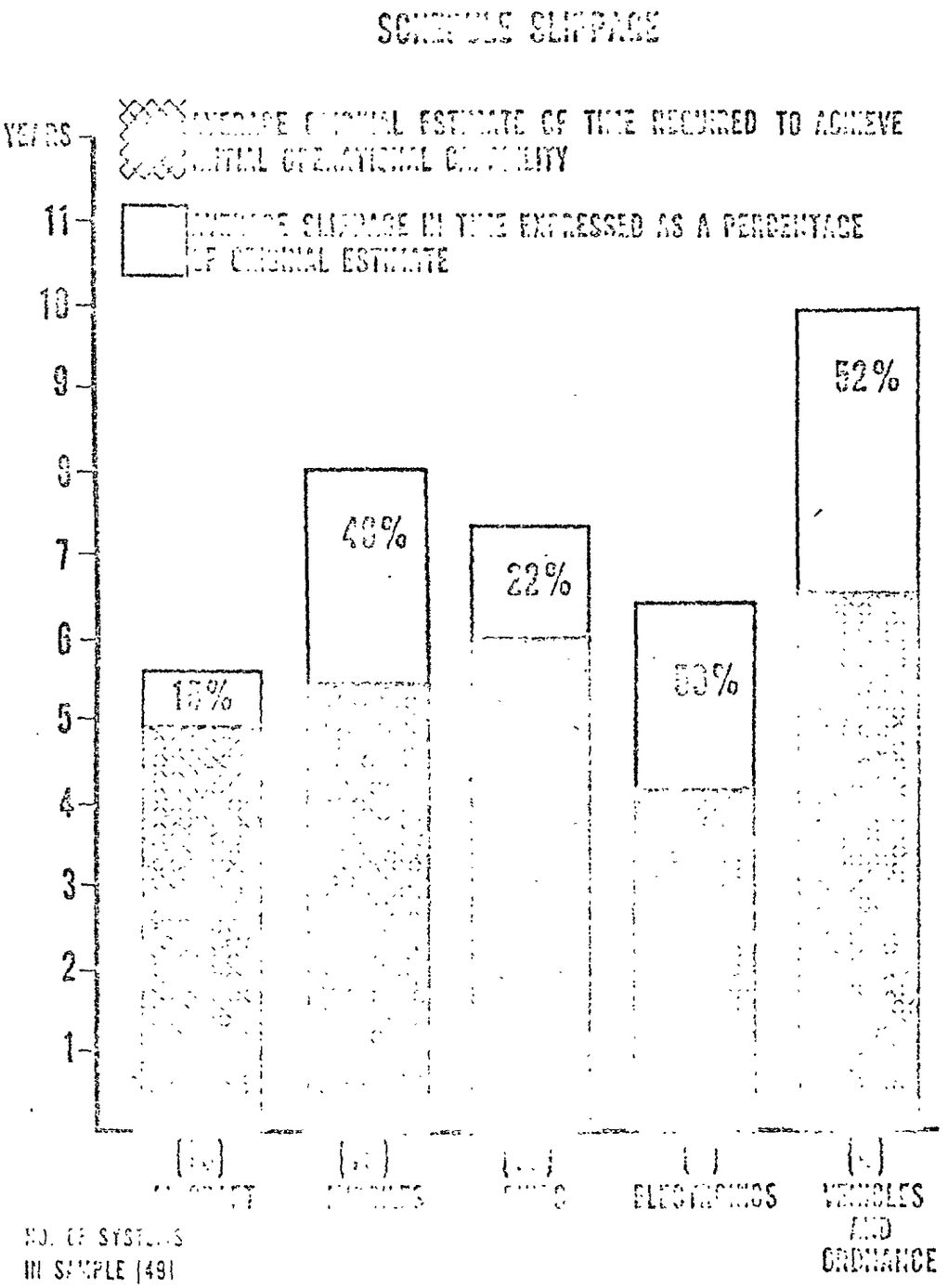

FIGURE IV

SYSTEM PERFORMANCE EXPERIENCE

The justification for selecting a particular major defense system to fulfill a need includes analysis of many existing and alternative capabilities and the establishment of a relative priority of need. In establishing the capabilities required of a new system, it is important that clear performance goals be defined early in the development process. The achievement of performance goals is dependent on the solution of known and unknown technical theories and concepts. The successful development of a major defense system is most likely to depend on solutions to technical unknowns or changing techniques between stated operating requirements, engineering design, and cost considerations.

In our reviews of major defense systems, we have found that the reasons for significant performance variances fall into three principal categories: (1) desire to upgrade performance and reliability as technological advancements are recognized, (2) inaccurate or overly optimistic estimates of performance, and (3) changed design to increase capability and/or to correct deficiencies. However, this is not to say that system performance characteristics, once defined, must never be changed. For management to be effective, it must be kept apprised of unanticipated technical unknowns and their potential effects on a system's performance in order that proper change analyses can be performed and up-to-date decisions can be made.

CHAPTER 6

SELECTED ACQUISITION REPORTING SYSTEM

Our initial review of the SAR system was undertaken in August 1969, and the results were published in our report "Status of the Acquisition of Selected Major Weapon Systems" (B-163058, Feb. 6, 1970).

In that report we concluded that the SAR system, in concept, represented a meaningful management tool for measuring and tracking the progress of major acquisition systems. Like any new reporting system, the SAR system had some serious shortcomings and improvements were essential. We found that SAR had failed to show such significant matters as (1) a comparison of technical performance actually demonstrated with that specified in the contract, (2) the status of key subsystems essential to mission accomplishment, (3) costs incurred in relationship to the costs that should have been incurred, (4) significant pending decisions that may have an impact on the program, and (5) a comparison of quantities delivered with those scheduled to be delivered at the same point in time.

DOD--in an attempt to improve the format, content, and data in SAR--revised DODI 7000.3 in December 1969 and again in June 1970.

Our second review of the SAR system was undertaken in August 1970, and the results were published in our report "Acquisition of Major Weapon Systems" (B-163058, Mar. 18, 1971). That review confirmed that improvements had been made since our first report was issued but that some improvements were still needed. We concluded that SAR still did not (1) contain a summary statement regarding overall acceptability of the system for part or all of its mission, (2) recognize the relationship of other weapon systems complementary to the subject system, or (3) reflect the current [illegible].

RESULTS OF CURRENT REVIEW

Over the past 18 months the SAR system has been increasingly accepted throughout DOD as a useful management tool. Thus SAR has changed from a report used to monitor progress of selected major acquisitions to a comprehensive

summary status report for management within DOD. The wide acceptance of SAR as a key management report is a significant achievement in itself, and our review this year was directed at evaluating SAR from the standpoint of its value to management.

In August 1971 we initiated our third review of the SAR system. This review showed that DOD was continuing to improve the SAR system. Two principal problems identified related to changing baselines for measuring progress and credibility of cost estimates. Their effect on management decisions is discussed below.

Need to report static baselines

To accurately evaluate the progress of a major defense system, it is essential to have a static baseline from which changes can be measured and evaluations can be made. When a system is initiated in the acquisition process, DOD establishes a planning estimate in SAR as the baseline from which progress is to be measured. However, this baseline is dropped from SAR when the system moves into development. From then on the development estimate becomes the baseline for management analysis purposes. The development estimate for cost, schedule, and performance characteristics is to be that estimate which is approved by the Secretary of Defense authorizing the program to move into full-scale development. Once the development estimate is established, it is not to be changed unless specific permission is granted by the Assistant Secretary of Defense (Comptroller). A change to the baseline tends to obscure important data requiring management actions subsequent to baseline setting.

The acquisition process covers a time span of many years, and the management within DOD changes from time to time. Thus, it is extremely important that proper baselines be established and maintained so that management can always evaluate the progress of the program and can make proper decisions.

The first HARRIER SAR was not prepared until June 30, 1971, although the Navy had been buying the aircraft for some time.

The HARRIER program did not follow the normal acquisition process since it represented an off-the-shelf procurement of an existing aircraft. Procurement was initially approved by the Secretary of Defense in September 1968, and the first production contract was awarded in December 1969. In the appropriation hearings requesting funds for fiscal years 1970 and 1971, the program cost was estimated to be about $385 million. We believe this estimate represents the program estimate at the time the Secretary of Defense approved the program and should be shown in SAR as the baseline for tracking the progress of the HARRIER. However, the June 30, 1971, SAR uses a January 1971 estimate of $503 million as the baseline. As a result of using this January 1971 program estimate, SAR will not disclose to management the program cost changes or the reasons for these changes which have occurred since the Secretary of Defense approved the program over 3 years earlier.

Need for complete and realistic cost estimates

The acquisition of a major defense system is a highly complex operation which involves a substantial long-range commitment of future expenditures. As discussed in chapter 4 of this report, accurate, complete, and realistic cost estimates are essential in evaluating the progress of major defense systems and in making decisions on the system's future progress. We found that the most common reasons for incomplete and unrealistic cost estimates on SAR are (1) a lack of complete program definition, (2) overoptimism on the part of program personnel to perform tasks and solve problems, (3) the uncertainty of the effects of economic and world political factors on a system during the long acquisition process, and (4) a requirement for current estimates to comply with budgetary documents.

CONGRESSIONAL VISIBILITY OVER MAJOR DEFENSE ACQUISITIONS

The effectiveness of the Congress in reviewing and considering budget proposals and contract awards for procuring weapon systems is directly proportional to the adequacy and timeliness of information upon which it is to base its judgment. The Congress has stated that its need for such information on a recurring basis is a direct reflection of the frustration it has experienced in being surprised by cost overruns.

Requirements of section 506

In making its judgments on DOD requests for funds for major defense systems, the Congress gets information from numerous sources, such as hearings, congressional authorization data sheets (submitted annually for the past 3 years), and SARs (submitted quarterly). However, the Congress has stated that these reports either have been too late or have been lacking in sufficient detail to satisfy its needs. To improve this situation the Congress included in Public Law 92-156, dated November 17, 1971, section 506 which requires the Secretary of Defense to submit annual reports, starting in 1972 on development schedules and procurement schedules, then in 1973, including data on operational testing and evaluation for weapon systems for which procurement funds are requested. In addition, supplemental reports are required to be submitted 30 to 60 days prior to awarding a procurement contract.

DOD's compliance with section 506

DOD has responded to section 506 by formalizing and adding information to the congressional data sheets forwarded to the Congress in January for each major defense system for which procurement funds are requested. In January 1972 congressional data sheets containing development and procurement schedules, together with year-by-year funding information, were submitted to certain congressional committees for some 70 major defense systems. Also, a procedure was recently established by DOD to submit a supplemental report to the Congress not less than 30 and not more than 60 days before awarding a contract or exercising an option in a contract

for the procurement of a major weapon system. DOD is in the process of formalizing requirements to incorporate operational test and evaluation data in the congressional data sheets and expects to have this data in its January 1973 data sheets.

Observations

There is a need to reassess the criteria for including weapon systems on SARs and the number of systems for which the Congress should receive status-type information.

In response to our request, DOD assembled a listing of major defense systems as of June 30, 1971. This list totaled 141. However, as of June 30, 1971, 52 systems were reported on SAR and only 37 of the 52 were sent to the Congress. Major weapons are considered for SAR reporting if they meet certain dollar guidelines or are designated for coverage by the Secretary of Defense.

We believe a dollar criteria for including a system on SAR is not enough. One additional criteria could be to report the cost, performance, and schedule status of a complete weapon system by including all subsystems within the system. For example, the AX and B-1 SARs could contain data on armament and avionics subsystems and the DE-1052 SAR could include data on ship subsystems. This type of reporting would provide more comprehensive reporting and would also provide management with a better basis for evaluating complete systems.

Regarding the type of information which is of vital interest to the Congress, both SAR and congressional data sheets contain pertinent information. Section 506 certainly will improve this information. However, as the Congress has stated, it is interested in being provided with consolidated development and test data before key decision points, such as the initial major procurement award of a system.

It is our belief that there will be some gaps in the testing information which will be provided to the Congress. For instance, there is no provision for the Congress to be advised, either in SAR or in congressional data sheets, on all testing and evaluation which occurs prior to the

production phase of the acquisition process. It is our understanding that the congressional data sheets provided by DOD will contain information on operational testing and evaluation only for systems which are in production or which are ready to enter production.

GAO intends to continue work in these areas in cooperation with DOD to assist the Congress in obtaining the information required to exercise its authorization and appropriation responsibilities.

CHAPTER 7

GENERAL OBSERVATIONS, CONCLUSIONS, AND RECOMMENDATIONS

The stages of development in the acquisition process of the systems we reviewed during the year did not provide an opportunity to look at all critical management actions, but our overall assessment supports our previous observation that certain areas remain particularly troublesome. Included are stability of programs and organization for program management, which we also discussed in last year's report.

As previously reported OSD and the services had instituted improvement programs that, when fully implemented, should lead to better management. More than 2 years have passed since these programs started, but measurable progress is difficult to assess. Those problems we reported last year, insofar as we can see, continue to plague management. These include compromised performance, delayed availability, and increased costs.

General observations on the matters we have studied, conclusions we have drawn from that review, and our recommendations follow.

PROGRAM STABILITY

Although it may be too early for the influence of DOD's revised PPBS system to be felt, we find little evidence of any significant progress in implementing this system at the service level. Stability of programs is highly dependent on stable program direction and on effective early requirement planning. There is considerable evidence that weapon systems are conceived and justified as independent systems, and history shows that such systems are subject to substantially greater instability in requirements.

Changes to weapons programs are related to delivered products (hardware), and these changes were not consistent with original statements of need or with earlier indications of the important relationships between one system and

another. There is a question whether, in the conceptual stages, attempts are made to establish clearly the precise use to which the weapon will be put or the impact of one weapon proposal on other programs and on the total force structure of a service.

Other reasons for program changes are the increasing cost of the item itself or the need to make funds available for a newer system just coming into development as a result of the possible ceiling on dollar resources.

Changes in weapon system development are inevitable, but in view of the fact that the dynamic changes involving systems represent, to a large degree, a matter of judgment, checks and balances become imperative.

This situation becomes even more critical since in many cases there was no clear indication that the changes we saw in weapon system development were related in a major way to a changing threat.

Last year we talked about the possibility of program management's evolving along mission lines--acquisition planning that thinks of weapon systems as components of a larger mission system in terms of their being available at the same time and working together. DOD is currently working on the development of a total-force concept in which the men and equipment of each service are used most effectively. These are steps in the right direction.

Recommendations

We recommend that the Secretary of Defense take action to supplement the changes made to date by ensuring the accomplishment of:

1. A continuing rigorous analysis (accompanied, where possible, with test data) of the needs of new weapon systems and the use to which they will be put.

2. A careful analysis of the impact of proposed needs on the manpower and dollar resources of the total force as well as the implication to the plans for the usefulness of the equipment already in the inventory.

3. Continuing cost-effectiveness studies of proposed needs versus alternative solutions and of major changes subsequent to initial system development approvals.

4. The inclusion throughout the acquisition process of a properly structured process which makes trade-offs between different means of fulfilling a function.

ORGANIZATION, STAFFING, AND PROCEDURES

There are major differences within the three military departments in the organization, operation, and staffing of the program management offices that are charged with the responsibility of acquiring major weapon systems. Although the differences in military rank, organizational levels, and numbers of people are fairly apparent, the differences in actual authority and operating decisionmaking powers are more significant but less apparent.

Although the project management concept has evolved into a fairly precise and highly effective method of acquiring major weapon systems, implementation of the concept has been less than effective. Systems selected for project management appear to have been based primarily on total resources involved, rather than degree of technical risk, aggressive management, and/or system interface and integration that is necessary. Similarly, the relationship of one weapon system to another, the relationship of interdependent systems and subsystems, and the role of a weapon being acquired in a total capability do not seem to be part of the selection criteria.

Once a system is selected for project management, there are inherent technical, system interface, and economic problems of a magnitude to challenge any program manager. His job becomes inordinately more difficult when he encounters organizational problems, functional disputes, and procedural delays.

We see evidence of considerable progress in improving the project manager's stature and training--further progress can now be achieved in his operating environment. We

believe it is not practicable to create a model project manager structure that will fit automatically every major weapon acquisition, but we are convinced that the management structure for each acquisition should be tailored to that particular program.

This would entail easing the constraints on the project manager's decisionmaking power, and to that extent the organizational layering problem should diminish. Clear lines of authority and responsibility have to be drawn to permit realistic decisions on balanced staffing between activities that are project managed and functionally managed.

Recommendations

We recommend that the Secretary of Defense and the military services reexamine the criteria by which projects are selected for project management. For those acquisitions selected under that criteria, the functions that are to be performed by a particular project manager and those which are not, on a case-by-case basis, should be spelled out more specifically in each program or project manager's charter.

COST ESTIMATING FOR MAJOR ACQUISITIONS

Realistic cost estimating is a valuable tool available to both the Congress and agency management for program selection, evaluation, and cost control during the weapon system's acquisition process. Previous GAO reports have shown that estimates of the cost to develop and produce a weapon system are frequently understated for a number of reasons. A considerable amount of the cost growth related to the acquisition of weapon systems is directly attributed to unrealistic cost estimates. The two overriding factors influencing the quality of cost estimates are the lack of completeness of a plan stating what should be done and inadequate documentation on what was done and how and why it was done.

We believe that, without these two essential ingredients--a plan and a record of actions--it is virtually impossible for management to intelligently select proper systems for development and then to control those systems and manage the total acquisition process.

We recommend that the Secretary of Defense develop and implement DOD-wide guidance for consistent and effective cost-estimating procedures and practices particularly with regard to (1) an adequate data base of readily retrievable cost data, (2) uniform treatment of inflation, (3) an effective independent review of cost estimates, (4) more complete documentation of cost estimates, and (5) dependable program definitions. The Secretary concurred in these suggestions and advised us that several programs were currently underway to improve this cost-estimating process.

TESTING AND EVALUATION IN ACQUISITION MANAGEMENT

Testing, another key management control in the acquisition process, provides visibility to problem areas and enables management to make informed judgments on the progress of weapon development. Our study revealed no uniformity of procedure or universally accepted terminology in the testing area. In those areas where various testing processes had been established, there were so many approved deviations, substitutions, waivers, and examples of special circumstances that we concluded that there was a need for better

understanding of the basic theory and application of testing in DOD.

We believe OSD needs to examine the services' criteria for granting exceptions to the overall policy with a view to reducing this practice.

OSD feels that the new guidelines set forth in its July 1971 DODI 5000.1 on the acquisition of major defense systems will go far in minimizing problems of the past.

Recommendations

We recommend that the Secretary of Defense develop and implement DOD-wide guidance to provide that (1) appropriate testing and evaluation be completed prior to making key decisions and (2) adequate controls be set over the granting of any waivers from required testing and evaluation.

COST-EFFECTIVENESS STUDIES

Cost-effectiveness studies are one of the techniques used in reaching decisions as to which among several competing weapons systems is more likely to achieve a predetermined mission goal at the lowest cost. The overall goal of such studies is to assist a decisionmaker by arraying significant factors to help in identifying a preferred system among the alternatives.

The selection of the specific base line for a weapon acquisition program from the available options must depend on the type of comparisons which the cost-effectiveness techniques can provide. These are essentially paper analyses with limitations which can be alleviated only as the weapon progresses in definition.

As a result of our review, we are convinced of the definite usefulness of cost-effectiveness studies. We believe the greatest advantage of the cost-effectiveness technique is that it forces advocates of a weapon system to examine in depth factors to be considered in making the decision and that it provides the decisionmaker with a body of knowledge which may otherwise be unavailable. From what we observed sound information was not available in a number of instances.

PERFORMANCE MEASUREMENT FOR SELECTED ACQUISITIONS

A fundamental responsibility of managers of major weapon systems in DOD is to ensure that visibility of the contractors' progress on their systems is sufficient to indicate the reliability of results being displayed in terms of established cost, schedule, and performance milestones. To achieve this, program managers must have management information and control systems referenced to baselines which will provide early identification of developing programs. One way to obtain this is to compare, on a regular basis, the actual cost of specific work being performed with the planned cost for that same work. DOD has been working on this for some time, and procedures do exist for measuring program progress.

Use of approved performance management systems will not prevent overruns or ensure achievement of schedule or technical goals. Through proper surveillance by the Government, such systems should provide early identification of problems related to cost and progress, which should enable alternative or corrective action in the early phases of a program.

Technical performance measurement has been recognized as a troublesome area. Until some way is found to more closely relate technical performance achievement to cost and schedule, emphasis should be placed on ensuring that sufficient critical technical milestones are included in contracts and that achievement is ensured through a comprehensive test and evaluation program.

SYSTEM COST EXPERIENCE

Our analysis of the estimated costs to develop 77 major weapon systems which are prepared at various points in the development cycle shows that the current estimates through program completion have grown 31 percent in comparison to the planning cost estimates for these programs. This is down from last year's 40 percent reported on 61 systems. The decrease is attributed primarily to (1) the addition of a number of new systems to our review this year, which has reduced the program planning base on which the percentage computation is made and (2) the significant number of quantity decreases on many of the 77 systems.

The latter point has been of particular concern to us in our review this year, along with the other categories into which DOD segregates its weapon systems cost growth. As reported last year, DOD instructions provide for classifying cost changes into nine categories of cost variance and the segregations being made are useful in focusing attention on areas where improvements can be made. An analysis of fiscal year 1971 alone clearly shows the great amount of cost changes that took place. For the 46 systems on which information was available at June 30, 1971, we found that cost changes totaled $30.8 billion in fiscal year 1971. About $12.2 billion is directly related to changes in the quantity of units to be purchased, and nearly all of that, or $11.7 billion, results from decreased units to be bought. This, of course, means the unit cost of the remaining items to be bought is increased. Not so obvious, however, but perhaps far more significant, is the impact of these quantity reductions on interrelated weapons programs, all of which are part of an overall plan.

This is not to say that cost growth or changes that may result in increase or decrease to a system's totaled anticipated cost or the reason for cost growth is bad. In many instances change is desired and should be implemented when in the Government's interest. It does seem that the constant fluctuation in the cost estimates is indicative of some of the serious problems which management is faced with and which are discussed in this report.

SELECTED ACQUISITION REPORTING SYSTEM

DOD is continuing to improve the SAR system. Our review was directed at evaluating SAR from the standpoint of management. Two principal problems identified relate to changing baselines for measuring progress and credibility of cost estimates. A recurring problem is what we consider to be an unduly long delay in submitting SAR to top management through DOD. Instructions require SAR to be completed in 45 days. More often than not it takes more than 75 days beyond the closing date. At June 30, 1971, there were 141 major weapon systems in the DOD inventory; 52 were reported on SAR. We believe visibility on the others would be improved if they also could be included in the SAR system.

Recommendation

We recommend that the Secretary of Defense reassess the criteria for designating weapon systems for reporting on SAR in an effort to expand the system.

SCHEDULE OF PROGRAM COST DATA AS OF JUNE 30, 1971, ARRANGED BY

ACQUISITION PHASE AND MILITARY SERVICE

	Planning estimate	Development estimate	Cost change Quantity	Cost change Other	Current estimate	Additional procurement costs	Total costs
	(millions)						
CONCEPTUAL PHASE (1):							
Army:							
None	$ —	$ —	$ —	$ —	$ —	$ —	$ —
Navy:							
[illegible]	640.6	640.6	—	—	640.6	—	640.6
Air Force:							
None	—	—	—	—	—	—	—
VALIDATION OR DEFINITION (3):							
Army:							
UTTAS	1918.1	1918.1	—	—	1918.1	114.2	[illegible]
Navy:							
DLGN-38	769.2	769.2	-70.2	190.8	889.8	—	889.8
Air Force:							
SCAD	920.0	920.0	—	—	920.0	—	920.0
DEVELOPMENT (34):							
Army:							
SAFEGUARD	4165.0	4155.0	830.0	1169.0	6184.0	—	6184.0
TOW	[illegible]	[illegible]7.3	-252.4	269.7	714.6	31.6	746.2
DRAGON	38[illegible]	[illegible]4.2	-232.7	98.8	270.3	42.2	312.[illegible]
SAM-D	4916.6	4031.0	-1791.4	1682.2	3921.8	8.5	3930.3
LANCE	586.7	652.9	7.7	104.8	765.4	89.1	[illegible]
BUSHMASTER	595.3	596.3	-381.1	-7.2	208.0	.01	208.0
HOWITZER XM198	129.5	129.5	-1.7	2.4	130.2	—	130.2
MICV	209.4	209.4	—	.5	209.9	1.4	211.3
MBT-70	2126.5	2100.9	-602.4	721.2	2219.7	180.3	2400.0
SCOUT	191.7	191.7	—	—	191.7	14.0	205.7
AAH	119.3	119.3	—	—	119.3	—	119.3
CHEYENNE (note a)	125.9	125.9	—	167.1	293.0	—	293.0
[illegible]	527.5	533.5	3.2	-6.1	530.6	—	530.6
TACFIRE	123.6	160.5	11.9	29.1	201.5	4.1	205.6
Navy:							
SPARROW F (note b)	151.5	707.7	135.4	403.7	1246.8	50.6	1297.4
CONDOR	356.3	441.0	-137.7	77.0	380.3	2.8	383.1
S-3A	1763.8	2891.1	—	247.7	3138.8	34.0	3172.8
F-14	6166.0	6166.0	-1111.5	157.4	5211.9	102.8	5314.7
SSN-688	1658.0	5747.5	902.5	174.9	6824.9	—	6824.9
AEGIS	365.0	427.6	—	46.0	473.6	—	473.6
SIDEWINDER (AIM-L)	234.5	234.5	—	—	234.5	—	234.5
LAMPS (note c)	574.1	574.1	—	—	574.1	—	574.1
HARPOON	CLASSIFIED						
ULMS (note d)	—	—	—	—	—	—	—
PHOENIX	370.8	536.4	185.5	529.8	1251.7	26.4	1278.1
[illegible]-13 [illegible]	CLASSIFIED						
Air Force:							
AWACS	2656.[illegible]	2661.6	—	-.3	2661.3	65.6	2726.9
[illegible]-5	[illegible]	[illegible]	—	[illegible]	104.8	—	104.8
MAVERICK	[illegible]7.9	383.4	-63.5	.3	374.2	9.5	383.7
B-1	[illegible]	11[illegible]8.8	-[illegible]3.8	[illegible]	11122.6	829.5	119[illegible].1
AX (note e)	[illegible]	84.5	—	—	84.5	—	84.5
F-15	[illegible]	[illegible]	—	-1.3	[illegible]97.3	75.5	772.8
[illegible]	[illegible]	[illegible].2	—	-[illegible].5	[illegible]	836.1	8144.8
DCA:							
[illegible]	251.6	[illegible]1.8	—	7.8	259.6	1.9	261.5
[illegible]							
[illegible]							
[illegible]	35[illegible].4	[illegible]7.4	-[illegible]1.4	147.[illegible]	483.2	30.3	513.5
[illegible]	[illegible]4.2	[illegible]8.4	-1[illegible]8.9	390.8	[illegible]0.3	80.8	[illegible]41.1
[illegible]	[illegible]5	[illegible]1	-111.6	275.6	752.1	94.7	846.8
[illegible]	[illegible]	[illegible]6	-[illegible]1	95.7	458.2	31.5	489.7
[illegible]	[illegible]9.1	1[illegible]3.9	-5.5	21.7	181.1	11.3	192.4
[illegible]	[illegible]1	[illegible]6	-[illegible]6.8	202.1	391.9	16.4	408.3
[illegible]							
[illegible] (note g)	1215.8	12[illegible]3	-710.4	4.0	562.9	51.9	614.8
[illegible]	[illegible]	[illegible]7	—	26[illegible]	[illegible]	—	177.9
[illegible]	[illegible]	[illegible]9	—	98.3	50[illegible]	—	507.2
[illegible]	1[illegible]6	1[illegible]6	-70.5	711.5	[illegible]	111.[illegible]	[illegible]18.5
[illegible]	[illegible]	[illegible]8	—	433.0	[illegible]8.8	—	29[illegible]8.8
[illegible]	1[illegible]3	1[illegible]3	-[illegible]6	60.3	960.0	12.1	972.1
[illegible]	[illegible]	1[illegible]8	[illegible]8	653.4	[illegible]	7.1	[illegible]1
[illegible]	1[illegible]2	1[illegible]	[illegible]1.1	83.5	[illegible]8.8	[illegible]	[illegible]

APPENDIX I

	Planning estimate	Development estimate	Cost change: Quantity	Cost change: Other	Current estimate	Additional procurement costs	
	(millions)						
EXPLORATORY/OPERATIONAL (cont'd):							
Navy:							
[illegible]	$ 95.7	$ 88.6	$ -	$ 30.8	$ 119.6	$ 39.0	$ 1
[illegible]	689.7	817.7	-50.7	295.3	1062.3	91.4	[illegible]
[illegible]	946.5	1063.2	-	170.6	1233.8	-	1
[illegible]	698.8	698.8	-	307.8	1006.6	-	1
[illegible]	241.1	312.0	-180.7	299.4	430.7	14.4	[illegible]
[illegible]	49.8	57.5	-26.6	22.5	53.4	-	[illegible]
[illegible]	1285.1	1259.7	-	156.1	1415.8	-	1
[illegible]	1784.4	2581.2	-	134.0	2715.2	-	2
[illegible]	4568.7	4568.7	-243.6	729.5	5054.6	1623.6	[illegible]
[illegible]	157.1	170.5	-62.7	94.6	182.4	52.5	[illegible]
[illegible]	324.4	328.5	-126.9	.4	202.0	13.0	[illegible]
[illegible]	503.6	503.6	-	-13.1	490.5	9.4	[illegible]
[illegible]	100.2	115.1	-34.8	93.0	173.3	49.7	
[illegible]	126.9	179.0	-	81.4	260.4	33.5	
[illegible] SM (note h)	180.3	241.6	-	-17.0	224.6	-	[illegible]
[illegible] (MR) and (RR) (note h)	822.6	822.6	-	53.6	876.2	-	[illegible]
[illegible]	586.2	586.2	-	270.9	857.1	11.0	[illegible]
Air Force:							
C-5A (note i)	3423.0	3413.2	-736.3	1878.3	4555.2	326.3	488
485L (note j)	177.2	177.2	-	-	177.2	-	1
A-7D	1379.1	1379.1	-282.6	280.7	1377.2	337.8	1 1
F-111	4686.6	5505.5	-2686.6	3849.0	6667.9	903.4	[illegible]
Fb-111	1781.5	1781.5	-1043.3	546.6	1284.8	129.[illegible]	1
MINUTEMAN II	3014.1	4254.9	4.0	485.7	4744.6	631.4	[illegible]
MINUTEMAN III	2695.5	4673.8	-155.3	1463.2	5981.7	206.7	6188.
[illegible]	932.2	814.1	80.5	329.7	1224.3	-	1
SRAM (note k)	167.1	236.6	125.6	941.9	1304.1	448.7	1

[a] The CHEYENNE costs represent research and development costs only. These estimates do not include termination costs related to the canceled production contract.

[b] Estimates include Air Force cost for research, development, and procurement.

[c] Estimate for LAMPS is a preliminary estimate and does not include a factor for inflation.

[d] No costs provided since program has not been approved by OSD.

[e] SAR for the AX reflects costs of $64.5 million to cover the competitive prototype phase only. The AX planning estimate of $1,025.5 million represents the total program estimate as cited in DCP.

[f] The original development concept paper number 19, dated September 28, 1968 contained a preliminary planning estimate for a lower quantity of F-15s as $5,157 million.

[g] Costs include estimates for Air Force procurement.

[h] Cost changes between development and current estimates were not identified as to quantity or other changes.

[i] Estimates do not include costs to correct defects are not included.

[j] [illegible] as of January 31, 1972, covers only five of a total of six tasks under this program. The remaining task has not been totally established.

[k] The planning estimate for research and development only. Production costs are not included.

SUMMARY OF MAJOR ACQUISITIONS OF

THE DEPARTMENT OF DEFENSE

AS OF JUNE 30, 1971

Service		Estimated cost through completion				Funds programed through June 30, 1971			
		RDT&E	Proc.	MCA	Total	RDT&E	Proc.	MCA	Total
		(millions)				(millions)			
Army	(32)	$ 5,714.3	$ 21,293.0	$ 906.7	$ 27,914.0	$ 3,393.1	$ 9,301.2	$ 703.4	$13,397.7
Navy	(90)	10,384.2	66,651.4	930.8	77,966.4	5,751.9	26,073.5	276.8	32,102.2
Air Force	(18)	13,876.3	42,361.2	539.1	56,776.6	8,995.2	14,829.5	526.4	24,351.1
DCA	(1)	96.4	102.3	.9	259.6	56.6	149.3	.2	206.1
Total	141	$30,071.2	$130,407.9	$2,377.5	$162,916.6	$18,196.8	$50,353.5	$1,506.8	$70,057.1

Note: RDT&E--research, development, test, and evaluation appropriations

PROC.--procurement appropriations

MCA--military construction appropriations

15 MAY 1972

The Comptroller General
U.S. General Accounting Office
441 G Street, N. W.
ATTN: Mr. Hassell Bell, Deputy Director,
Major Acquisitions
Washington, D. C. 20548

Dear Mr. Bell:

In order to expedite our response to your draft report, "Acquisition of Major Weapon Systems," to be submitted to Congress, we are providing comments in two parts. This letter covers our comments on the Digest of the report attached to this letter as Enclosure 1. If, upon completion of the review of the entire report, we have further substantive comments they will be submitted to you no later than 25 May 1972.

We are pleased with your overall assessment that since last year's report, meaningful and measurable progress has been made in the management of the acquisition process. We have carefully reviewed the report Digest and are in general agreement with the findings, conclusions and recommendations. Because the report is based largely on data as of June 30, 1971 it does not consider steps that we have taken since that date which are responsive to your recommendations. We have identified these and other actions that we have taken and suggest that you consider providing this letter to the Congress with your final report.

With regard to your first recommendation concerned with the requirements planning process, we are continuing to emphasize the development and use of the Area Coordinating Paper (ACP) which was briefly described in our letter response to your last year's report. In the ACP's we establish functional mission areas corresponding to the various facets of military operations and in this framework the adequacy of specific related development programs is addressed. The ACP also identifies mission deficiencies and capability duplication in the process of formulating a general plan for the future which will satisfy the operational need. We have found that the time and effort involved in the preparation of ACP's is greater than anticipated; however, we are confident of the usefulness of these documents in our future planning processes. While only four ACPs have

been completed as of this time, 34 more are in preparation. We have also taken steps to more closely relate our mission areas and ACPs to the Joint Strategic Planning System of the Joint Chiefs of Staff (JCS). All ACPs are being reviewed by the JCS. The Joint Strategic Planning System similarly has been improved in that the Joint Research and Development Objectives Document (JRDOD) now develops R&D objectives with indicators of relative military importance. This revision adopts mission areas similar to those in OSD management documents which has resulted in a close relationship between JCS objectives and ACPs.

Most of the defense systems designated as "major" in accordance with DoD Directive 5000.1 have project managers assigned, 82 as of the last count, of which approximately 25 are general/flag rank officers. While there may be additional programs that warrant program management organizations, we believe that most of these will be picked up in the normal Defense Systems Acquisition Review Council (DSARC) review system. The management structure of each major defense system is presented at the DSARC reviews and in some cases major changes result. In the future the project manager's charter will be presented for review at the first DSARC and at later DSARC's if significant changes are proposed.

In the area of improved cost estimating the Secretary of Defense, in December 1971, asked each of the Services to make independent cost estimates, in addition to other appropriate cost analyses, on major weapon systems at each key decision point and to make these estimates available for DSARC reviews. This action was followed in January 1972 with the establishment, within OSD, of a Cost Analysis Improvement Group (CAIG) to review the Service estimates and to develop uniform criteria to be used by all DoD units making such cost estimates. Under the CAIG's leadership, policies and procedures are also being developed to provide a retrievable and well-documented data base upon which more accurate cost estimates can be made.

As for the recommendation concerning a uniform approach to inflation the Assistant Secretary of Defense (Comptroller) has issued factors for the treatment of inflation throughout the DoD and the Selected Acquisition Report (SAR) now also requires identification of inflation factors.

With regard to DoD guidance on testing the Secretary of Defense has, within the past year, issued instructions designed to improve the organization for,

quality of and timeliness of necessary test and evaluation. Continued attention will be provided to insure that programs are adapted to these instructions to the degree possible and as rapidly as possible. Also, further attention will be given to the matter of establishing increased controls over the granting of waivers from required testing and evaluation.

As for the adequacy of Selected Acquisition Report coverage we believe that the criteria of DoD Instruction 7000.3 are adequate and that the lack of SAR coverage on any major program is from failure to implement these criteria. Most of the newer programs have had SARs initiated at the appropriate time and we will insure that future defense systems, meeting the criteria, will have SAR coverage.

We appreciate the opportunity to submit these comments and hope that you will find them useful.

John Foster Jr.

John S. Foster, Jr.

Enclosure

U.S. GAO, Wash., D.C.