

GAO

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

September 1988

MAJOR ACQUISITIONS

Summary of Recurring Problems and Systemic Issues: 1960-1987



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National Security and
International Affairs Division

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September 13, 1988

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

Dear Mr. Chairman:

In response to the Committee's request, we have explored the questions of whether (1) the problems in acquiring defense weapon systems today are different than those in the past and (2) if the problems are similar, whether the problems are more serious, less serious, or almost the same?

To address these questions, we reviewed our prior reports on problems with weapon systems since 1960, five major studies¹ of the Department of Defense's (DOD) weapon acquisition system, and the Selected Acquisition Reports on weapon systems being acquired by DOD.

Our reports on individual weapon systems show that DOD has had to deal with the problems of cost growth, schedule slippage, and performance shortfalls in the acquisition of major weapon systems constantly since the 1960s. Likewise, the five major studies, which cover the period from 1970 to 1986, show that the problems being experienced today in the weapons acquisition process are similar to those of the past.

In 1986 we issued a report² assessing the changes which had been implemented as part of the Carlucci Initiatives. As part of this assessment, we compared weapon systems being

¹The Blue Ribbon Defense Panel Report in 1970, the Report of the Commission on Government Procurement in 1972, DOD's Assessment of Its Weapons Systems in 1981 (Carlucci Initiatives), The President's Private Sector Survey on Cost Control in 1983 (Grace Commission), and the President's Blue Ribbon Commission on Defense Management in 1986 (Packard Commission).

²Acquisition: Defense Acquisition Improvement Program: A Status Report (GAO/NSIAD-86-148, July 23, 1986).

developed and procured in the 1980s with systems at similar stages of development in the 1970s. Our analysis showed that the 1980s systems were experiencing cost growth and schedule slippages, but at a lower rate than had been experienced by the 1970s systems. While this was encouraging, our analysis also showed that the 1980s systems were entering that stage in their development when the 1970s systems incurred their greatest problems with cost growth, schedule slippage, and performance shortfalls.

It is unclear whether the problems being experienced today are more or less serious than those experienced in the past. It is clear that the problems being encountered today are similar to those of the past. This is indicative of the high level of difficulty in developing lasting solutions to the seemingly intractable problems of affordability and stability.

PROBLEMS ARE SIMILAR

Over the past 18 years, our reviews of individual weapon systems along with the five major studies of DOD's weapon acquisition system have identified the same systemic problems and issues. As a rule, the studies stressed that a major weapon program encounters problems of cost growth, schedule slippage, and performance shortfalls when the program becomes unstable. The cause of the instability can be from a variety of sources both outside of and within the program.

Problems stemming from external influences

A common problem frequently caused by forces outside the program was that funding for developing and testing the weapon design was not stable. In its 1972 report, the Commission on Government Procurement emphasized that funding levels which limit exploration of alternatives force the military services to focus prematurely on one design and then spend substantial amounts of resources defending the initial choice. In addition, the report stated that premature commitment to an unproven design, concept, or technical approach often leads to cost growth, performance shortfalls, and schedule delays.

In 1981, 9 years later, the Carlucci Initiatives addressed the same problems and systemic issues, and reported that while a revolutionary weapon design can offer dramatic

potential payoffs, it frequently ends up with large cost increases and schedule slippages.

In a May 1986 report,³ after studying 17 major weapon system programs, we found four types of major external influences that affected the programs. These external influences are not related to policy matters or normal oversight of individual programs, but rather to matters that unduly limit the program manager's and contracting officer's execution of their roles.

The first type of influence--observed on four programs--involved decisions made before establishment of the program. These preprogram decisions limited the program managers' latitude in formulating acquisition strategies and prevented them from obtaining the desired level of design competition.

The second type of influence--observed on five programs--involved instability in upper management's commitment to the weapons requirements or design. For example, the Guided Anti-Armor Mortar Projectile program was intended to develop a mortar which would be more effective against enemy armor. The system was to be 4.2-inch mortar system with an infrared seeker to enable it to home in and guide itself to enemy armored targets. Planning and executing the competitive acquisition strategy for this system had been underway over 2 years when the program was abruptly canceled on the day of the expected contract award. At that time, industry proposals had been extensively evaluated and contractors had been selected for full-scale development. Several reasons were given for program cancellation. The diversity of these explanations suggested that the program lacked high-level commitment. The explanation from the highest Army level was that the Army Chief of Staff had decided to replace the 4.2-inch mortar with a 120-mm mortar because it was considered more effective and had greater commonality with North Atlantic Treaty Organization forces.

The third type of influence--observed on eight systems--involved insufficient funding. In these cases, the design or implementation of competitive strategies was adversely affected by insufficient funding. When the funding was

³DOD Acquisition: Strengthening Capabilities of Key Personnel in Systems Acquisition (GAO/NSIAD-86-45, May 12, 1986).

reduced, it proved to be inadequate for executing the previously approved acquisition strategy.

The fourth and final type of influence--observed on three programs--involved inappropriate external management direction. In these cases, the external management direction stipulated the use of specific weapon designs to provide the desired military capability. Such directions constrained the program managers' ability to seek a competitively designed solution and prevented industry from offering alternative designs. If program managers and contracting officers are to develop and execute effective acquisition strategies--and be held accountable for the results--they must operate in a reasonably stable environment. However, such stability has proven very elusive.

Problems stemming from
internal influences

Not all of the factors which adversely affect a program come from sources outside the program office. Some come from within the program office itself. In some cases, they are similar in nature to the external factors, such as a premature commitment to a design without competing alternative designs being properly considered. In other cases, program sponsors often limit testing when funding is less than planned. In these cases, when operational problems occur, costly redesigns are frequently necessary.

In 1970 we issued two reports⁴ on major weapon system acquisitions, which exemplify the problems and issues identified in the five major studies. We found the primary cause of acquisition problems was the attempt to produce weapon systems on the basis of unproven designs. Also, in 1970, the Blue Ribbon Defense Panel recommended that:

"A new development policy for weapon systems and other hardware should be formulated and promulgated to cause the reduction of technical risks through demonstrated hardware before full-scale development, and to provide the needed flexibility in acquisition strategies."

⁴Status of the Acquisition of Selected Major Weapon Systems (B-163058, Feb. 6, 1970) and Adverse Effects of Large-Scale Production of Major Weapons Before Completion of Development and Testing (B-163058, Nov. 19, 1970).

More recently, in one of our weapon system reviews, we found that the program manager placed a greater priority on adhering to the system's development schedule than on correcting serious design problems. These problems eventually caused the program to be canceled in 1985.

COST GROWTH AND SCHEDULE
SLIPPAGES ARE NOT AS
SERIOUS AS IN THE 1970s

One of our recent analyses⁵ suggests that in terms of overall cost growth and schedule slippage, the situation during the 1980s seems to be somewhat better than in the 1970s. In other words, cost growth and schedule slippage on major weapon system acquisitions is being experienced, but at a lower rate than occurred for systems being acquired in the 1970s. In our analysis, we compared weapon systems entering full-scale development in the 1970s with systems entering full-scale development in the 1980s. While our analysis showed improvement, it should be noted that during the later years of program acquisition for the systems developed in the 1970s, the weapons experienced the most significant cost growth and schedule slippages as technical and other problems surfaced. The 1980s systems included in our analysis are now entering a period in their acquisition cycles during which significant cost growth or schedule slippages have historically occurred. Some of the improvement may also be attributable to the increase in defense budgets in the early 1980s. In other words, when funding is less constrained, budget and program estimates may be more realistic. These factors indicate a level of uncertainty about whether the improvement seen in the 1980s will be sustained.

ARE REFORM
INITIATIVES WORKING?

Instability within the acquisition process has been a continuing problem since the 1960s. The two 1970's studies recommended changes that would stabilize DOD's acquisition process. Likewise, the three studies of the 1980s concluded

⁵Acquisition: DOD's Defense Acquisition Improvement Program: A Status Report (GAO/NSIAD-86-148, July 23, 1986). As part of this analysis, we updated the data contained in this report with data from the December 31, 1986, Selected Acquisition Report.

that the acquisition process had to be stabilized. All of the studies identified the process which DOD uses to determine its weapon system requirements as a major destabilizing influence. The studies pointed out that the process does not match DOD's requirements with the available acquisition resources. As a result, meaningful trade-offs among DOD's competing requirements were not made, and the requirements process produced too many weapon system starts. This problem, which the studies have disclosed over the years, overloads the limited resources of the acquisition system and sets in motion the parade of problems caused by unstable requirements or commitments.

Since 1981, virtually every facet of DOD's acquisition process has been affected by reforms legislated by the Congress. The 1987 Defense Authorization Act (Public Law 99-661) included more than 30 reform provisions. The President's Blue Ribbon Commission on Defense Management's (Packard Commission) recommendations focused on changing the requirements process which produces too many system starts, changing the management of weapon programs through milestone budgeting and baselining, and using multiyear contracting and existing commercial products more frequently. While it is still too early to assess the total impact of DOD's actions in response to the Packard Commission's recommendations, what is apparent, based on the evaluations of past reform initiatives, is the need to focus on the systemic issues of stability and affordability.

Appendix I discusses the five major studies and systemic issues in more detail. Appendix II discusses our individual system reviews in greater detail.

We are not making recommendations and we did not request comments on this briefing report because all of the reports and studies from which this report was drawn received extensive comments when they were published.

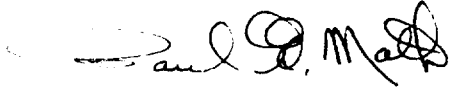
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As arranged with your Office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of the report. At that time we will send copies to interested parties and make copies available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

B-221205

If you need additional information, please call me on
275-4587.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Paul F. Math". The signature is written in a cursive style with some loops and flourishes.

Paul F. Math
Senior Associate Director

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ABBREVIATION

DOD Department of Defense

MAJOR SYSTEMIC CONCERNSREMAIN BASICALLY UNCHANGED

As part of our analysis, we examined five major studies, dating back to 1970, of DOD's weapon acquisition system. The purpose was to determine whether the same systemic issues or concerns were identified in these five studies. The studies were

- the Blue Ribbon Defense Panel Report in 1970,
- the Report of the Commission on Government Procurement in 1972,
- DOD's Assessment of Its Weapons Acquisition System in 1981 (Carlucci Initiatives),
- the President's Private Sector Survey on Cost Control in 1983 (Grace Commission Report), and
- the President's Blue Ribbon Commission on Defense Management in 1986 (Packard Commission).

Taken together, these studies provide a comprehensive overview of DOD's management of its weapon acquisition system.

PROGRAM STABILITY REMAINS
THE CENTRAL SYSTEMIC CONCERN

Our analysis shows these studies repeatedly identified a major interrelated theme or concern. This concern involves the necessity to bring about greater stability in the acquisition process. The studies recommended addressing the issue of stability through the requirements process. In simple terms, the studies call for DOD to develop a better process for satisfying its military requirements. The history of weapons acquisition since the 1960s is replete with examples of too many systems being developed and procured for the available financial resources.

DOD requirements process
linked to stability problems

On paper, DOD has a reasoned and logical approach for determining its requirements or needs. Based on available information, the threat is identified for the near and long term. DOD then examines its existing force structure and identifies where

potential deficiencies exist. These deficiencies become the basis for its postulated needs or requirements.

In practice, the available financial resources are insufficient to satisfy all of the identified needs. Instead of delaying the start for a number of weapon systems to match the needs with available financial resources, DOD has traditionally spread the limited funding over the total acquisition system. This practice has required program managers to amend their acquisition strategies, and these amendments introduce instability. Although this problem is well recognized and documented, a workable and effective method for matching DOD's needs with budgetary constraints has not been developed.

Funding instability

The history of DOD's weapon acquisition system since the 1960s suggests an inability to come to grips with the affordability problem. DOD is attempting to develop and procure more systems than is feasible with the available funding. In general terms, a military service identifies a need and determines that nothing currently available exists which can adequately address the identified need. Since many needs exist in each of the services, program sponsors are encouraged to develop an approach that appears reasonable. Often this means that a program's costs and schedules are developed under extremely optimistic assumptions.

Once the initial work begins and problems arise which cannot be addressed within the established schedules and funding profile, the program sponsors have very difficult choices. They can reduce the scope of the work to be performed to remain within the budget or they can attempt to get additional funds. Traditionally, program sponsors have chosen to reduce the scope of work hoping to make it up later. Frequently, in this situation, the program continues with some work segments or tests not being done. Almost invariably, the program encounters some operational difficulties that require expensive and lengthy redesigns to correct these problems.

Design instability

Going hand in hand with funding instability is design instability. Frequently, under the situation outlined above, the program sponsors develop an acquisition strategy designed to produce the desired weapon system, but are unable to follow through because the funding does not materialize. Too often, the program sponsors select a design for the program before all of the problems are solved. When the system experiences

unanticipated operational problems, some changes in the design are usually necessary to solve the problems.

The sequencing of events is such that by the time these operational deficiencies are identified, units have often already been produced which further complicates the situation. First, a solution to the operational deficiencies has to be developed. This design change is then incorporated into subsequent production models. After this is accomplished, the units that have already been produced have to be fixed, thus, requiring additional time and eventually additional funds.

Knowing that these problems still exist does not detract from the past efforts to address the problems, but it is an indicator of how difficult the problems are to solve. Each of the studies has attempted to address the problems of funding and design instability by proposing different solutions, such as mission budgeting, milestone budgeting, and 2-year budgeting. While some success has been achieved, the message is becoming increasingly clear--the problems cannot be solved by DOD alone, they require the cooperative efforts of the Congress, industry, and DOD.

Concerns closely
linked to stability

Three of the studies suggest that DOD and the government should use the strength of the free enterprise system to address the problem. More specifically, the studies recommend using competition more effectively. Programs are usually planned with the intention of using competition to ensure obtaining the best design. In addition, many programs attempt to keep competition going through the production phase. Unfortunately, the savings associated with competition tend to be long term in nature and require additional up-front expenditures. Consequently, when funds become scarce, program sponsors often reduce short-term costs by eliminating funding for the second or competing contractor. As a result, the program sponsors become committed to the design being advocated by one of the competing contractors. The history of weapons acquisition within DOD has shown that this approach has not worked well.

Another area addressed by the studies involves testing. The studies found that when operational problems occurred, inadequate or insufficient testing frequently was performed during the development process. Again, it was not because program sponsors did not recognize the value of testing--most program plans incorporate aspects of the "fly before you buy" concept. But rather, as funds became tight, program sponsors either canceled

some planned tests or combined the tests with other tests. Again, the history of weapons acquisition suggests that this approach has not worked well.

The studies, especially the more recent ones, identified the need to give program managers the responsibility and the accompanying authority they need to effectively manage a program. These studies describe an environment in which a program manager receives guidance from a multitude of external sources. The program manager is expected to respond to this guidance and incorporate it into the program where appropriate or possible. Problems occur because this increases the work load of the program manager and often complicates the tasks that have to be accomplished.

Another area of concern identified in the studies involves the industrial base. Our 1986 report¹ on DOD's Acquisition Improvement Program stated that program instability leads to uncertainties about the future that preclude opportunities to achieve efficiencies in the acquisition process. For example, the planning for production at the factory is done several years in advance of production to acquire the necessary plant capacity and equipment to produce needed quantities efficiently. Weapon systems cannot be produced at the most economical rates when production quantities do not use this plant capacity efficiently. Increased costs and inefficiencies occur when the quantities being produced result in expensive plant and equipment being idle. Frequently, production quantities of unstable programs change from year-to-year, precluding efficient plant use. Despite overall large budget increases and initial top-level management support for the Acquisition Improvement Program, the problems associated with instability have not been solved.

The Carlucci Initiatives were put in place in a period of increasing budgets. We have now entered a period of decreasing budgets. Between 1980 and 1985, the DOD budget grew from \$142 billion to \$286 billion. Since 1985 the rate of growth has slowed markedly, and the approved 1988 budget for DOD was for \$283 billion.

Our analysis indicates that DOD had not anticipated this slowdown in its internal planning documents and, in fact, had planned for much larger defense budgets during this period. How all of this will eventually work out is unclear at this time. However, what

¹See footnote 3 on page 3.

is clear is that a period of restrained or limited growth will exacerbate the stability problem.

The problems we are witnessing today are not new. They are deeply ingrained in the acquisition process and defy simple solutions. The instability within the acquisition process and its associated problems have plagued DOD's top managers since the 1960s. The solution, to the extent that a solution exists, will require the combined talents and resources of the executive and legislative branches, along with industry. The problems have, to date, proven too tough for piecemeal solutions.

PROBLEMS FOUND IN DOD'S WEAPON PROGRAMS
OVER THE PAST TWO DECADES ARE PART
OF TODAY'S WEAPON PROGRAMS

Summaries of our reports on weapon systems DOD acquired over the past two decades are discussed in this appendix. These reports exemplify the problems of cost growth, schedule slippage, and performance shortfalls that were identified in the five major studies of DOD's major weapon acquisition system discussed in appendix I.

BACKGROUND

Our involvement in DOD acquisition goes back as far as 1960. The Comptroller General's Annual Report for that year noted a review of the development and procurement of Army combat and tactical vehicles. The review disclosed that nine series of vehicles, including the M-48 and M-48-A1 tanks, M-103 heavy tank, M-59 personnel carrier, M-51 heavy tank recovery vehicle, and others, were seriously deficient in operational performance.

As mentioned in appendix I, there have been many initiatives introduced since the 1960s to control and reduce the problems of cost growth and delayed deployment of weapon systems that did not satisfy the operational requirements of the military services. More specifically, in February 1968, DOD established the Selected Acquisition Reporting system, which required program offices to submit a cost, schedule, and technical performance report on weapon acquisition, and provided a formal structure for overseeing the acquisition of a major weapon system from program initiation through deployment. In 1969 and 1970, Secretary of Defense and Deputy Secretary made major changes in weapon system acquisition management. These changes included requiring Development Concept Papers, later called Decision Coordinating Papers, on major weapon programs and establishing the Defense Systems Acquisition Review Council. The Development Concept Paper described a program's major elements and critical areas. It also established procedures which provided that the services would make day-to-day decisions on major programs while elements of the Office of the Secretary of Defense, in the form of the Defense Systems Acquisition Review Council, would review major milestone decision points and provide its recommendations to the Secretary of Defense.

Although many process and procedural changes have been introduced over the years, our reports on weapon system acquisition during the 1970s and 1980s showed the fundamental problems persisted.

OVERVIEW OF PROBLEMS
FOUND IN THE 1970s

In February 1970, we issued the first of a series of annual reports on the status of weapon system acquisition programs. In this report we used data from DOD's Selected Acquisition Reports to compare planning estimates with the reported status on 38 major weapon system programs. Our comparison showed that:

- Considerable cost growth had occurred on many development programs.
- Slippages in the originally established program schedules of from 6 months to more than 3 years either existed or were anticipated on many of the systems.
- Significant deficiencies either existed or were anticipated between the performance originally expected and the currently estimated performance for a number of the systems.

During the 1970s, we reviewed and reported on the progress of many weapon system acquisitions. These reports showed the problems as they were encountered on individual weapon systems. In 1970, we reported on the Navy's Deep Submergence Rescue Vehicle, designed for rescue of personnel from a disabled submarine. When the program was first proposed in 1964, the Navy estimated that a rescue system, including 12 vehicles, could be developed in 4 years at a cost of \$36.5 million, including the cost of 1 year's operation. By 1969, however, the Navy estimated a rescue system of six vehicles would require 10 years to develop (1964-74) and would cost about \$463 million.

Another Navy program we reviewed was the AN/SQS-26 Surface Ship Sonar program. We found that the performance of installed systems was below expectations; the system's cost estimate increased from a 1960 figure of \$12 million to a 1970 estimate of \$101 million; and that of the 75 sonars delivered through December 1969, 53 were delivered from 1 to 20 months late. Before the AN/SQS-26 Sonar was approved for service use in November 1968, the Navy had contracted for four different models; two of them had already undergone major modifications.

Our 1970s reports also disclosed the systemic issues we discussed in appendix I that are the sources of the problems of cost

growth, schedule slippages, and performance shortfalls. In 1973, we reported that certain development tests, included in the SAM-D Patriot Missile Program test plan to prove the missile's design concepts, were canceled due to funding shortages. Consequently, a less mature design model of the missile was used in developmental testing. The 1973 estimate of total program costs had increased only about 9 percent since 1967; however, the number of missiles to be purchased under the program had been severely reduced.

We issued reports in 1977 and 1978 on the Air Force's NAVSTAR Global Positioning System. The 1977 report discussed the program's schedule and performance requirements and the 1978 report emphasized the program's costs. Our 1977 report found:

- Performance requirements were established to meet the goals set by the program office rather than the specific needs of the users.
- Development problems with equipment for users and satellites caused a schedule delay of almost a year.
- By compressing the testing from 22 to 14 months, program officials expected to limit the schedule slippage for the program to 2 to 3 months.
- The revised test schedule was optimistic in that it provided no leeway for unforeseeable problems.
- Test plans specified neither the minimum amount of testing to be performed nor criteria for gauging successful performance.

Between our 1977 and 1978 reports, the NAVSTAR program was restructured. In the 1978 report we stated:

- Since program restructuring, additional delays expected in satellite development and delivery of critical user equipment had increased chances that the concept validation phase would not be completed by February 1979.
- Since concept validation approval in December 1973, cost estimates for development had increased from \$177.9 million to almost \$400 million. Scope changes contributed largely to the increase. Total program costs estimates increased to almost \$1.5 billion, approximately \$672 million more than originally estimated.

-- The program cost estimates did not include cost for acquiring user equipment, replenishing satellites, space shuttle launches, and other related activities.

DOD's introduction of new management procedures designed to improve the acquisition of major weapon systems showed little effect on the weapon programs we reviewed during the 1970s. It is possible that many of the programs had progressed too far through DOD's acquisition pipeline to be affected by the management changes. It is not unreasonable, however, to expect the programs we reviewed during the 1980s to reflect the effect of management changes.

OVERVIEW OF PROBLEMS
FOUND IN THE 1980s

Our review of weapon system programs during the 1980s showed that cost growth, schedule slippages, and performance shortfalls continued. During 1980 through 1983, we issued summary reports of our major acquisition reviews. Table II.1 shows the number and types of problems identified with some of DOD's programs during the 4-year period. While all programs were not covered, the more significant programs were generally included.

Table II.1: Problems Associated With Selected Major Acquisition Programs Reviewed by us, 1980 through 1983

	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>
Number of programs reviewed	21	21	24	17
System effectiveness problems:				
Operational/performance limitations	11	13	9	8
Survivability/vulnerability	11	7	4	-
Operational requirements	5	8	4	6
Reliability/availability	11	9	3	2
Force level requirements	4	6	1	3
Force capability	1	-	-	-
Operational use	1	-	-	-
Logistic support	-	4	5	4
Total	<u>44</u>	<u>47</u>	<u>26</u>	<u>23</u>
Program acquisition problems:				
Affordability	6	4	10	10
Data reporting	5	-	4	3
Concurrency	4	4	3	4
Testing	4	7	4	5
Cost effectiveness	3	3	7	3
Program management	3	2	3	6
Deployment strategy	2	-	-	-
System urgency	2	-	-	-
Technical/risk problems	2	8	10	4
A-109 inconsistency	-	5	-	-
Timeliness	-	1	2	1
Production readiness	-	-	2	2
Total	<u>31</u>	<u>34</u>	<u>45</u>	<u>38</u>
Total	<u>75</u>	<u>81</u>	<u>71</u>	<u>61</u>

In addition to the above problems, cost growth on weapon system programs continued to show up in the Selected Acquisition Reports. Table II.2 shows cost changes for the military services' acquisition programs from 1980 to 1982.

Table II.2: Cost Changes for Selected Active Weapon Systems

	<u>Sept. 30, 1980</u>	<u>Sept. 30, 1982</u>
	----- (millions) -----	
Air Force:		
No. of systems	25	23
Total costs	\$128,808.5	\$218,752.5
Yearly increase	2,682.2	61,805.6
Army:		
No. of systems	30	30
Total costs	\$ 75,001.7	\$106,863.1
Yearly increase	13,382.2	11,161.7
Navy:		
No. of systems	70	74
Total costs	\$232,203.9	\$391,172.1
Yearly increase	26,497.1	77,780.4
All DOD:		
No. of systems	125	127
Total costs	\$436,014.1	\$716,787.7
Yearly increase	42,561.5	150,747.7

Some examples of the problems we identified in our early 1980s reports are shown in the following summaries on individual weapon systems.

- In 1980 we reported that the XM-1 tank was achieving only 145-mean miles between failures in operational and developmental testing. This compared unfavorably with the 272-mean mile goal the Army had planned to reach.
- Another Army system we reviewed that year was the Bradley Infantry Fighting Vehicle. Unit cost of this system had been estimated by the Army in 1972 at \$172,000. We reported the current unit procurement cost estimate of \$600,000. Vulnerability of the vehicle to small arms fire was also questioned.
- A major Navy program we reviewed in 1980 was the Aegis weapon system. We reported an estimated 43 percent, or less, operational availability as compared to the established 80 percent operational availability goal. Displacement weight of the DDG-47 ship and vulnerability of the ship's combat information center were also reported as major issues.

-- In 1982 we concluded that the Army's AH-64 Advanced Attack Helicopter was not ready for production because two major subsystems would be changed for production aircraft, reliability and maintainability data was suspect, system supportability was questionable, and improvements were still needed in the Hellfire missile used on the AH-64 helicopter.

Our reports in 1983 repeated many of the same issues found on weapon systems in prior years. For example, in 1983 we reported that the Army's plans to test the reliability and maintainability of its new Sergeant York [division] air defense gun had to be abandoned when the prototype the prime contractor delivered for testing was found to be unacceptable. In a preliminary demonstration of the prototype, the radar fire control system failed to operate reliably, the graphic display unit failed intermittently, and the armament feed system's performance was unsatisfactory.

The results of our individual weapon system program reviews indicate that the problems since 1983 remain similar to those during and before 1983. For example, our 1985 review of a major Navy weapon system program showed the problems that can come from accelerating the development schedule of a system before testing and development prove it to be a stable weapon system. As a result of concurrent development and production, the Submarine Advanced Combat System program experienced significant cost, schedule, and technical performance problems that adversely affected program implementation. In its 1985 Five-Year Defense Program, the Navy estimated this system would require \$853 million more in research, development, test, and evaluation funding.

We also reviewed and reported on several aspects of the Army's Bradley Fighting Vehicle Program in 1986 and 1987. For example, in February 1986, we reported on the first of two phases of the live fire vulnerability testing held at the Aberdeen Proving Grounds, Maryland. The tests, completed in October 1985, showed that the Bradley, as configured, was highly vulnerable to all antiarmor weapons. These test results and Army vulnerability models further showed that ammunition stored inside the vehicle, when hit, was likely to be the major source of crew casualties and catastrophic vehicle losses.

Our 1987 reports on three Air Force systems illustrate the kinds of continuing issues being encountered. The first of these reports concerned a subsystem of the Peacekeeper (MX) missile-- the inertial measurement unit. We reported that:

- As of June 30, 1987, Northrop Electronics Division had manufactured 35 developmental (exclusive of engineering models) and 45 production inertial measurement units, of which almost all were delivered late. All of the 45 production inertial measurement units were delivered late, with the average delay being 128 days.
- As of June 30, 1987, 45 production and 2 full-scale development inertial measurement units were scheduled for installation in operational missiles. These 47 inertial measurement units have had 40 failures--19 in operational missiles and 21 before installation in missiles. Of the 40 failures, 12 were repeat failures, that is, the same measurement unit failed more than once.
- As of June 30, 1987, a total of 22 Peacekeeper missiles had been turned over to the Strategic Air Command. Fourteen missiles were in an operational status and 8 missiles were not operational due to shortages of inertial measurement units.

The second report concerned the Advanced Medium Range Air-to-Air Missile. Since its inception in 1975, this program experienced cost growth and schedule delays. The missile's estimated acquisition cost (both development and production) increased, in 1984 constant dollars, from about \$3.4 billion for 20,000 missiles to \$8.2 billion for 24,335 missiles. The scheduled initial deployment date slipped from 1986 to 1989.

In 1987 we reported and also testified on problems in the B-1B Aircraft Program.¹ An Air Force test team in late 1986 reported the bomber would have limited operational effectiveness at initial operational capability in areas such as navigation, terrain following, handling qualities, and defense systems. They also reported that weapons delivery and offensive systems would not have full capability. Developmental and production problems in B-1B subsystems had limited B-1B testing, necessitated operational restrictions, and prevented some operational training. A significant portion of B-1B combined development test and evaluation/initial operational test and evaluation was

¹Strategic Forces: Supportability, Maintainability, and Readiness of the B-1B Bomber (GAO/NSIAD-87-177BR, June 26, 1987) and The B-1B Aircraft Program (GAO/T-NSIAD-87-4A, Feb. 25, 1987).

yet to be accomplished. This testing had been extended by 32 months and was planned to be completed by February 1989, 8 months after all B-1Bs were scheduled to be fielded. The B-1B program cost was capped at \$20.5 billion in fiscal year 1981 dollars. Because current problems must be corrected and significant development and tests remain to be completed, there was no assurance the baseline program could be kept at or under current estimates.

In June 1987 we reported on supportability, maintainability, and readiness of the B-1B bomber. This report covered spare parts, contractor maintenance support, and crews and aircraft on alert.

- Spare parts shortages resulted in the temporary grounding of aircraft, some of which were cannibalized of parts for use in other aircraft. The primary cause was high demand resulting from spare parts that have not been as reliable as predicted and from false test failures of parts in operational aircraft.
- Air Force in-house maintenance was delayed primarily because of limited availability of repair instructions and lack of support equipment. Contractor repair costs, which were incurred until in-house capability was achieved, were substantially higher than original estimates.
- The Air Force was continuing to work toward its goals for readiness and training. Aircraft were unavailable at times for training because of fuel leaks, engine vane icing, and other problems. As of the end of April 1987, the Strategic Air Command had 1 B-1B on alert and 13 mission-ready crews for the 30 B-1Bs assigned to the strategic bombardment wings.

Technically challenging development programs that advance the state of the art, as in the case with the B-1B bomber, argue that development and tests be reasonably complete before production is started. Concurrent development and production requires the constant introduction of hardware and software changes during production. The fast paced B-1B production schedule, which was driven by the need to meet an early operational date, conflicted with the orderly completion of development, particularly the completion of system integration and flight tests.

SUMMARY

We have evaluated on a limited basis almost two decades of our experience in reviewing DOD's major weapon system acquisition programs. In short, problems in achieving desired performance, meeting planned schedules, and keeping within funding proposals

have been continuous during this period. From the earliest programs discussed to the most recent reports on the Air Forces' B-1B program, cost, schedule, and/or performance problems were common.

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