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WEAPONS ACQUISITION POLICY AND PROCEDURES: CURBING COST GROWTH

REPORT

OF THE

SPECIAL PANEL ON DEFENSE PROCUREMENT PROCEDURES

OF THE

COMMITTEE ON ARMED SERVICES
HOUSE OF REPRESENTATIVES
NINETY-SEVENTH CONGRESS
FIRST SESSION

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U.S. HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
Washington, D.C., February 12, 1982.

HON. MELVIN PRICE,
Chairman, House Committee on Armed Services, Rayburn House Office Building, Washington, D.C.

DEAR MR. CHAIRMAN: I am forwarding a report entitled *Weapons Acquisition Policy and Procedures: Curbing Cost Growth* with the recommendation that it be printed. This report contains the findings and recommendations of a Special Panel on Defense Procurement Procedures appointed by me on June 15, 1981, and composed of members of the Subcommittee on Procurement and Military Nuclear Systems. The report is based upon 18 days of panel hearings during which more than 100 witnesses were heard.

I want to commend Congressman Dave McCurdy, who chaired the special panel, and the other members who worked many long hours developing the issues highlighted in the report. The subcommittee will bring the report to the attention of the Secretary of Defense and request his comments.

Sincerely,

SAMUEL S. STRATTON,
Chairman, Subcommittee on Procurement, and Military Nuclear Systems.

Enclosure.

Approved for Printing: Melvin Price, Chairman.

DECEMBER 15, 1981.

Hon. SAM STRATTON,
Chairman, Subcommittee on Procurement and Nuclear Military System, House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: I am forwarding herewith the final report of the Special Panel on Defense Procurement Policy and Procedures entitled "Weapons Acquisition Policy and Procedures: Curbing Cost Growth." In preparing this report, the panel conducted 18 days of hearings, including six days of field hearings at several plants where major weapons are produced. We received testimony from 108 witnesses representing the Department of Defense, the Congressional Budget Office, the General Accounting Office, defense contractors and private organizations. I would like to thank you and Chairman Price for recognizing the need for this special panel.

The panel believes that the Congress not only has a need but an obligation to know how public funds are being managed. We maintain that current cost reports to the Congress are inadequate and interfere with proper oversight of acquisition programs. If more prospective information had been available, potential cost growth on many programs could have been identified much earlier. This has been illustrated quite vividly by the programs examined by the panel as case studies. It is the panel's unanimous conclusion that changes are required in the information provided to Congress with respect to the causes and potential for cost growth. It is our belief that the new reporting requirements developed by the panel would identify cost growth and afford the opportunity to save substantial sums of money through effective action by the Department of Defense and Congress alike. We recommend that the Secretary of Defense include the B–1 aircraft and the MX Missile programs in the March 1982 SAR.

It has been my privilege to chair this study. I would like to thank the members of the panel and, on their behalf, issue a special thanks to Mr. Don Campbell, professional staff member, and his secretary, Ms. Vera Oswald.

It will appreciate your early approval of the report so that it may be printed.

With kindest personal regards.

Sincerely,

DAVE MCCURDY,
Chairman, Special Panel on Defense Procurement Procedures.

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WEAPONS ACQUISITION POLICY AND PROCEDURES: CURBING COST GROWTH

EXECUTIVE SUMMARY

Objective of the Study

During the fiscal year 1982 defense authorization hearings before the Armed Services Subcommittee on Procurement and Military Nuclear Systems, it became increasingly apparent that significant cost growth [1] was occurring in the acquisition of major weapon systems and that the problem appeared to be systemic.

Consequently, the Chairman of the Procurement and Military Nuclear Systems Subcommittee, Representative Samuel S. Stratton, appointed a panel to focus specifically on increases in the cost of weapon systems. A five-member panel was created pursuant to rule 6(b) of the Rules of the Committee. (See Appendix A). The panel was directed to review weapon systems acquisition procedures and policies within the Department of Defense and to report its findings and recommendations to the subcommittee by December 15, 1981. While it was not possible during the time allotted to the panel to delve deeply into all details surrounding day-to-day acquisition management, the panel focused on those acquisition policies and procedures which often determine the ultimate cost of major weapon systems.

The panel recognized that unanticipated cost growth in the acquisition of major weapon systems had affected many vital military programs. This unanticipated cost growth causes major weapon systems to consistently cost more than originally estimated, thus reducing the Defense Department's ability to procure the numbers and types of weapons necessary to meet force structure requirements.

The panel is aware that Deputy Secretary of Defense Frank C. Carlucci has initiated acquisition management improvements within the Department of Defense to attempt to address many of the issues related to weapon systems cost growth. The panel subscribes to these management initiatives. These initiatives, if fully implemented, will demonstrate a resolve by the Department of Defense to curb cost growth trends. These acquisition management initiatives embrace the principles of enhancing program stability, delegating authority for weapon systems program management, achieving more economic rates of production and realistically costing and budgeting for weapon systems. A more detailed discussion of the initiatives are embodied in this report.

The panel maintains that cost growth can be divided into two areas: Controllable and uncontrollable. It is fully recognized that inflation

[1] Cost growth for the purpose of this report is defined as all increases, including unanticipated inflation in program cost except for cost increases attributed to increases in quantity, as measured against an established baseline estimate.

is a cost growth factor uncontrollable by the Defense establishment alone, that is, inflation experienced throughout the national economy has an affect on prices for defense articles that DOD managers cannot control. Consequently, the effect of national inflationary trends on the cost of major defense weapon systems cannot be minimized, whether it be within weapon systems procurement, as addressed in this report, or within weapon systems research and development or defense operations.

However, it is controllable cost-growth factors such as unrealistic inflation estimates, poor cost estimates, program stretch-outs, changes in weapon systems specifications, inadequate budgeting and lack of competition among defense contractors that concern the panel. Other controllable factors include high-risk system design and poor management.

Case Study Approach to the Problem

The overall complexity of the weapons system acquisition process led the panel to use the case study approach to review acquisition policies and procedures. This approach allowed the panel to examine a wide range of acquisition issues influencing weapon systems cost growth. Over 100 witnesses testifying before the panel during eight days of hearings related specifically to the case studies and ten days of hearings which addressed acquisition problems in general. The three case study programs were the Black Hawk helicopter, the Patriot Missile and the Air Launched Cruise Missile (ALCM).

The primary reason the panel selected the Black Hawk program as a case study was because of its history of significant, unanticipated cost growth due largely to poor cost estimating. The ALCM case study provided an opportunity to examine the impact of competition in the acquisition process which appears to account for the ALCM program's relatively low cost growth. The Patriot Missile program has endured cost growth due to an unusually long development period. A detailed discussion of each case study is included as Appendix B to this report.

The Black Hawk helicopter is manufactured by Sikorsky Aircraft in Stratford, Connecticut. Field hearing testimony pointed to Sikorsky's poor estimates of initial production requirements as the major factor in the Black Hawk's 237 percent cost growth—$5.4 billion—since 1971. Other factors, according to testimony, are unrealistic inflation estimates; program stretch-outs and the lack of recent production experience early in the program. One of Sikorsky's managers told the panel that his company did not fully understand the complexities of manufacturing the number of helicopters requested by the U.S. Government.

Manufactured by the Raytheon Company of Andover, Massachusetts, the Patriot Missile program evolved from the original SAM-D Missile, in 1966. The first full-scale production will not take place until 1982, some 16 years after development started, and deployment is not scheduled until 1983. Since June, 1979, alone, the estimated production cost of the Patriot program has increased by approximately $2.5 billion. Testimony indicated the reasons for cost growth in the Patriot program are program stretch-outs, scheduling changes, unrealistic inflation estimates, changes in performance testing requirements, in-

creases in the cost of government furnished equipment, poor cost estimating and design changes.

The Air Launched Cruise Missile program evolved from the Subsonic Cruise Armed Decoy program. In 1977 a decision was made to establish a joint Navy/Air Force cruise missile project. The purpose of establishing a joint program was to take full advantage of tasks which were common to all cruise missiles. The prime contractor, Boeing Aerospace Company in Seattle, Washington, produces the missile and an associate contractor, Williams International Company, manufactures the F107 engine. Since October 1977, the ALCM has experienced development and procurement cost increases of $474 million—26 percent for development and 8 percent for procurement. Some of the prime contributors to cost growth were poor cost estimating, inefficient production rates, and changing performance requirements. The ALCM was the only case of the three studied in which the concept of dual-sourcing, where more than one major contractor is involved in production, was introduced early in the acquisition process. Dual-sourcing is being utilized for the Inertial Navigation Element (INE), the engine, and the missile radar altimeter.

Causes of Weapon Systems Cost Growth

The case studies assisted the panel in identifying these major causes of weapon systems cost growth: Poor cost estimates, program stretchouts, unrealistic inflation estimates, changes in specifications, inadequate budgeting, high risk designing, and the lack of competition throughout the acquisition process.

Contractors, subcontractors and program managers testifying before the panel listed several recommendations to reduce cost growth in each of the three cases studied. The panel has detailed many of these suggestions in Appendix B of the report. Some include: Increase program stability by multiyear contracting; use realistic inflation estimates in the Department of Defense Budget; improve contractor and Defense Department cost estimating; improve the budget and acquisition process; implement design to cost studies early in the acquisition program, and pursue production competition and dual sourcing where appropriate.

Concerning the issue of production competition, the panel is fully aware that procurement from a single source may frequently be necessary when the production quantities and rates are so small or when the costs of multisource procurement are so large, that competition may not be in the best interest of the Government. The panel finds, however, that competition in the production phase should generally be encouraged when significant quantities, rates, and potential savings justify more than a single source.

The panel also finds that good contract administration practices and procedures provide the "first line of defense" against unanticipated cost growth. The panel did not delve into the Department's contract administration functions in sufficient depth to recommend changes. There appears to be, however, evidence to suggest that the Secretary should review present contract administration policies and procedures. Secretary Carlucci is among those who acknowledged that there may be some potential benefits to be derived from reviewing present con-

tract administration organizations and functions. Further, relative to contract administration, the panel sees the need for stability in the department's personnel assignment policy for program managers. Current policy does not routinely provide the longevity, expertise and stability necessary to promote consistent and effective program management, including the management of cost growth.

Current Department of Defense Acquisition Procedures

While the case studies more narrowly define cost growth factors as they exist between contractors and the Department of Defense, there exist other factors which consistently are associated with cost growth in weapons systems. Among the most major of these factors is the lack of synchronization between the weapons system acquisition process and the defense budget cycle. This commonly results in underfunding of some major weapon sytsems.

The Planning and Programming Budgeting System (PPBS) is the comprehensive management system utilized by the Department of Defense to plan and manage defense programs. The chart below illustrates the PPBS as it exists today.

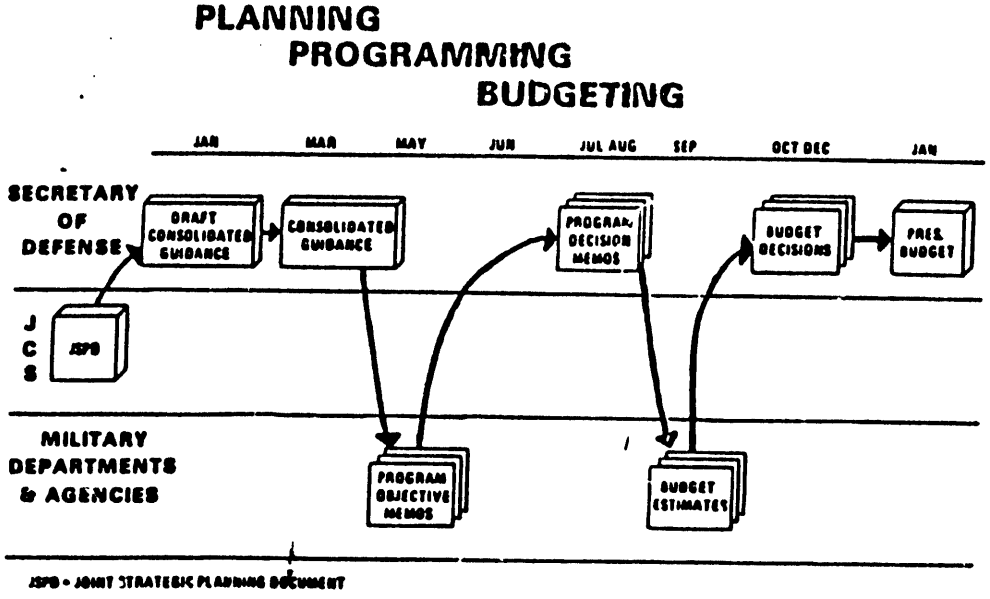

FIGURE 1

The PPBS process begins with an assessment of the threat, which is then used by the military departments in the planning stage to identify defense requirements over the next 10 to 15 years. The next stage is programming, which is, perhaps, the most critical portion of the PPBS process because it is where program priorities are established and dollar constraints are applied. During the early phase of programming, each of the services produce a Program Objective Memorandum (POM). The POM is the most important document within the programming stage because it expresses the total program requirement of each military department as approved by the Secretary of Defense. Information contained in the POM is utilized to advance to the budgeting phase of the PPBS process. Based on these

approved programs the annual defense budget is developed and submitted to the Congress and with congressional approval, the budget is executed.

The acquisition process consists of a series of management decisions within the Department of Defense where each major weapon system is evaluated from conception through the production stage. These management decisions are made by the Secretary of Defense based on recommendations by the Defense System Acquisition Review Council (DSARC), a panel made up of key Defense Department personnel. Through its review, the DSARC is able to determine whether a weapons program may proceed to the next stage in the acquisition process. The figure below shows the acquisition cycle.

ACQUISITION CYCLE

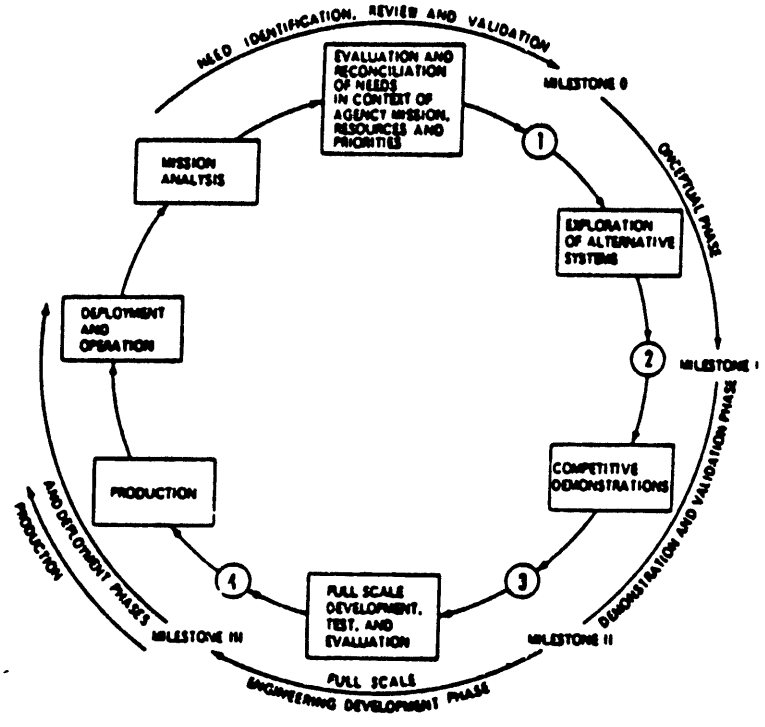

FIGURE 2

Throughout the acquisition process and the PPBS process, however, there are few links between the two. One of these so-called "windows" is the POM development phase where new requirements are routinely considered. A weapon system generally completes at least one of the review stages in the acquisition process before being included in the POM. As stated earlier, POM development is the most critical part of the PPBS programming stage.

However, the POM development process generally ends about 18 months before budget execution. Therefore, in most cases, the cost information which is used to formulate the budget is based on esti-

mates made nine months prior to the submission of the defense budget to the Congress and 18 months before the beginning of the budget execution year. This frequently means the defense budget submitted to the Congress does not contain the most recent program cost estimates.

The problem of lack of synchronization occurs when a program is not identified early enough in the PPBS process to enter the POM. Therefore, there is no assurance that adequate resources and funds will be available. The absence of timely-committed resources to support programs often creates a funding problem which results in DSARC-approved programs being delayed and stretched-out.

Deputy Secretary Carlucci noted during testimony before this panel that the Department is aware of the problem when he stated: ". . . it does no useful purpose to review a weapon system out of the funding cycle, and then find yourself short of money and having to go up [to Congress] with a supplemental". Secretary Carlucci also said, "It made a lot more sense to review it in sync with the funding cycle. So it is much more meaningful in my judgment to have a review that is integrated with the budget process."

The panel agrees that synchronization between the weapon systems acquisition process and the PPBS process must be improved. As to the problem of outdated cost estimates being included in the defense budget, the evidence suggests that Defense Department program managers must be allowed increased opportunities to input their own and the contractor's most recent cost assessment data into the budget before it reaches the Congress.

Cost Reporting

Budget enactment in the Congress begins with a series of committee hearings. Through these hearings, testimony is received from Department of Defense personnel. Also documentation is routinely provided by the department, which contains cost and schedule information about those major weapon systems identified in the defense budget.

The panel, seeking the causes of unanticipated cost growth, turned its attention to one of those documents, the Selected Acquisition Report (SAR).[2] Selected Acquisition Reports are quarterly reports to Congress that summarize the status and cost of major defense acquisition programs. Among the panel's findings is that the SAR is inadequate in its reporting on major weapon systems to the Congress, thus inhibiting proper oversight.

Defense Department personnel have agreed in testimony before the panel that the SAR is primarily a historical document and does not provide timely assessment of factors identified as potential cost problems.

Among the panel's major findings are that the department is not complying with the intent of Public Law 96–107 (10 U.S.C. 139 Note) concerning providing SAR information and that there is a need for

[2] The Selected Acquisition Report (SAR) is the standard, comprehensive, summary status report on major defense acquisition programs which reflects the system Program Manager's current "best estimate" of key performance, schedule, and cost goals, compares these estimates with baseline parameters (established at the time the program was approved for full-scale development), and explains all variances from the baseline.

an additional reporting requirement aimed at identifying potential cost growth problems.

The intent of Public Law 96-107 (10 U.S.C. 139 Note) is to establish dollar thresholds for weapon systems to be reported in SARs. However, under the department's reporting practices, unless a system is designated by the Secretary as a "major system," it may not be reported in the SAR even though the dollar threshold is exceeded. This appears to differ from the intent of Public Law 96-107 as set forth in the Committee on Armed Service's Report No. 94-199, Section 809. Also, it would appear that current reporting practices are at variance with Public Law 96-107. The law requires reports to be provided to the Congress on all acquisition programs that are *estimated to exceed* $75 million for research, development, testing and evaluation or $300 million for procurement. It is clear that once the department estimates that a program will exceed these thresholds, the program should be reported in SARs at that time and not 9 or 10 years later when the weapon system is entering the latter stages of the acquisition process.

The panel, therefore, recommends that the subcommittee consider legislation to clarify criteria for selecting programs on which Selected Acquisition Reports are required and direct the department to modify the SAR system to provide for early identification and tracking of program costs.

Exception Reporting

The Congress has already found it necessary to increase visibility into weapon system cost growth through a provision within the Department of Defense Authorization Act of 1982 (Public Law 97-86, Section 917), the "Nunn Amendment," which requires unit cost reporting. However, the panel believes that the new law may not go far enough in providing early warning concerning potential cost growth problems.

The Unit Cost Report required by the Nunn Amendment directs that if the total program acquisition unit cost or the current procurement unit cost of a weapon system exceeds 15 percent of the March 31, 1981, SAR estimates at any time during fiscal year 1982, then a report on that system must be submitted to the Congress. Also, when the total program unit cost or the current procurement cost of a weapon system exceeds 25 percent of the March 31, 1981, SAR estimate, the Secretary of Defense is required to make certifications concerning that program to the Congress. This reporting requirement is effective for only one year—fiscal year 1982—and applies to acquisition programs which are reported in the SAR system.

Virtually every witness who appeared before the panel shared the panel's view that SAR's are historical and do not provide clear insight into potential cost growth problems. Secretary Carlucci stated, "it is true that the vast majority of the information in the SAR is *retrospective*." He also stated, "I have some difficulty in providing a great deal of *prospective* information to the Congress. That difficulty stems from the problems we have in negotiating contracts. We have to protect our negotiating position. That being said . . . we are prepared to share it [prospective information] with the Congress to the maximum extent."

The panel acknowledges the fact that there now exists a large amount of information routinely reported by the Department to the

Congress. However, the panel believes that establishment of a new "exception" reporting system is justified.

The Nunn Amendment which requires weapon systems unit cost reporting qualifies as an "exception report" because it is triggered only when weapon systems exceed certain levels of cost growth.

In recommending one step beyond the intent of the Nunn Amendment, the panel believes that creating a permanent exception reporting system that includes *contract information* is one of the most important actions the subcommittee could take to achieve more effective oversight by the Congress into weapon system cost growth problems.

As described in Appendix D, the panel has proposed a Program Cost Assessment Report (PCAR) which would be an exception reporting system required when dollar threshold increases on programs or contracts for major weapon systems are breached.

A weapon system would be subject to PCAR reporting requirements when it is defined as a major system, or when the total financing for research, development, test and evaluation exceeds $75 million (based on fiscal year 1980 constant dollars) or when the total production investment exceeds $300 million (based on fiscal year 1980 constant dollars). Reports would also be required on programs designated to be of special congressional interest. Contracts associated with a given weapon system would also be subject to PCAR requirements. Contract reporting criteria would be based on: (1) prime, associate and Government furnished equipment (GFE) contracts that represent the six largest dollar investments; or (2) the sum of all contracts representing at least 90 percent of the total contract cost for current contracts, whichever is greater.

The contract reporting requirement established by the PCAR is significant because it would provide the Congress an opportunity to assess, whether additional program costs will be incurred in future years.

The panel found it is not alone in considering contract reporting essential to monitoring cost growth. Mr. Gary Christle, Director, Acquisition Management Information Division, Department of Defense, in testimony before the panel stated: "The SAR is always going to be a report of something that has happened and what you are asking for is something else." He said, "the contractor cost performance reports are the closest to real time information on the execution of a program and provide the kind of information needed to get a handle on what downstream costs are going to be." The panel is proposing that only cost and schedule variance information now contained in the contractor cost performance reports be reported in the PCAR.

Dollar thresholds that trigger a PCAR would be first breached when either program unit costs or contractor costs have increased by more than 15 percent from a current unit baseline cost, which is reflected in a SAR. Further reports would be required for every additional 5 percent growth in program unit or contract cost.

The panel applied the PCAR reporting requirements to the historical cost information available from the three case study programs. In each case, Black Hawk helicopter, ALCM, and Patriot Missile programs, cost information was taken from time periods immediately preceding periods when significant cost growth was first identified. The panel maintains that if the PCAR were available and utilized during

development of these three systems, there would have been greater congressional awareness and more informed inquires into the causes of this cost growth problem. (See Appendix D, Enclosures 2-3.)

In summary, the panel strongly believes that implementation of "exception" reporting, such as PCAR, coupled with the proposed changes to the current SAR system would be instrumental in assisting the Congress to exercise its oversight responsibilities in the area of cost management.

The following sections contain discussions of findings and a summary of the recommendations which are submitted to the subcommittee for consideration.

FINDINGS AND DISCUSSION

SUMMARY OF MAJOR FINDINGS

A summary of the panel's major findings is as follows:

1. The recent history of major defense acquisitions has witnessed significant increases in the cost of weapon systems. Some of the factors influencing these increases have been within the control of the Defense Department, but other factors have not been. While the Defense Department has responded in the past with management improvements, the pattern of significant cost growth continues.

2. The Selected Acquisition Report (SAR) system does not consistently provide timely and complete information. Further, SAR's are generally historical and fail to identify potential problems that might lead to cost growth. The absence of timely and complete cost information that more clearly identifies potential cost growth hinders the efforts of the Armed Services Committees in exercising legislative and oversight responsibilities.

3. While Public Law 96–107 (10 U.S.C. 139 Note) sets dollar thresholds for SAR's, the Secretary of Defense actually determines which weapons systems are reported by his designation of "major systems." The Defense Department's new policies governing the acquisition process would appear to delay such a designation even further.

4. SAR's originate too late in the acquisition process to include cost estimates made early in the development phase, and this appears to be inconsistent with the intent of Public Law 96–107 (10 U.S.C. 139 Note). Before major acquisition programs can be reported in the SAR, they must have been approved by the Secretary of Defense to enter the full-scale development phase. This typically takes several years. Therefore, under the present reporting criteria the SAR system does not provide information on anticipated problems and potential cost growth while programs are in the early stages of the acquisition process and before significant investment decisions are required.

5. Substantive program changes are generally reported in the SAR's only once a year in the December 31 report, which coincides with the President's annual budget submission to Congress. Thus, quarterly updates generally do not provide the Congress with the most recent information on programs encountering large cost increases.

6. The Planning, Programming, and Budgeting System (PPBS) is not fully integrated with the Defense Department's weapon systems acquisition process. Consequently, the PPBS process does not, among other things, routinely permit the use of the most recent cost assessment data from contractors and program managers developing the Program Objective Memorandum (POM). The POM is the prime document used in developing the defense budget. Therefore, the lack of the most recent cost information in the POM often results in inad-

equately funded programs which, in turn, leads to unanticipated cost growth. Also, since the PPBS is not synchronized with the acquisition decision process, funds are often not provided at the time required to efficiently execute programs.

7. The current Department of Defense contract administration policy provides for a single government representative to cover all contracts at a particular plant. However, the lack of standard procedures for cost reporting and a complex organizational structure appear to diffuse the responsibility for detecting and dealing with cost growth problems.

8. Cost growth in defense programs has significantly affected the Defense Department's ability to budget for the quantities of weapon systems necessary to meet even peace time force structure requirements. This situation has contributed to the acquisition of weapon systems at less than economically efficient rates, termination of programs, delays in improved operating capability, and deferrals of property maintenance. As the full committee has stated on numerous occasions, the practice of procuring systems at inefficient rates of production results in program instability and stretch-outs, and ultimately results in program cost growth.

9. Several factors that contribute to *unanticipated* weapon systems cost growth are: The use of unrealistic inflation rate estimates; erroneous contractor and DOD cost estimates; program stretch-outs by DOD and the Congress; changes in mission requirements and technical specifications; unstable and inadequate budgeting; high risk designing; poor management; and the lack of competition particularly during the production phase of the acquisition process.

10. The Defense Department's present policies and procedures governing competition should be improved to encourage competition, where feasible, during *all phases* of the acquisition process for major weapon systems. Although competition is generally present during the development phase of a program, contracts for initial and full scale production are frequently let to a single contractor. This means that only one contracting source is available, which often results in unanticipated cost growth, generally in the form of higher production unit cost. The panel fully realizes that for several reasons competition during the production phase may not always be desirable or in the best interest of the Government. This is especially true when production quantities, rates or costs are not sufficient to support more than a single prime contractor. However, the panel believes that the Defense Department should explore every opportunity to provide competition during the production phase.

11. Although the Defense Department's recent initiatives to improve the Defense acquisition process address several of the major cost growth issues identified by the panel, there does not appear to be a concise and comprehensive plan, including timetables, for implementing these initiatives.

Reporting on Major Weapon Systems to the Congress

FINDING

The panel finds that the present Selected Acquisition Report (SAR) system does not consistently provide the Congress with timely

and complete information and that the SAR system is largely an historical reporting system. Therefore, SARs do not provide the forward looking cost information necessary for detecting *potential* cost growth problems.

Specifically, the panel finds that:

The absence of more timely and complete information hinders the efforts of the Congress in exercising its oversight responsibilities;

The present SAR system is a retrospective reporting system and does not routinely provide information when exceptional events occur which may result in significant cost growth. Hence, it does not provide information on program and contract costs that would assist in the early detection of potential cost growth problems;

The intent of Public Law 96-107 was to provide dollar thresholds for systems to be reported in the SAR system, but the DOD practice is such that, unless systems are designated by the Secretary of Defense as "major systems," they may not be reported in the SAR system, regardless of cost;

Under the new DOD acquisition procedure, SARs may not be initiated until after major programs have completed the Advance Development and System Demonstration/Validation phases of the acquisition process and are well into full-scale development. These phases typically require an average of 9 years. Therefore, generally 9 years may have elapsed before a major program is first reported in a SAR; (See figure 3.) and

Although the SAR system provides quarterly updates on major weapon systems, many substantive changes are reported only once a year and are reflected in the December 31 SARs. The December 31 SARs coincide with the President's budget submission and reflect program changes resulting from budget decisions for the next fiscal year. Therefore, the SAR system does not provide the Congress with continuous visibility of programs with potentially high cost growth.

DISCUSSION

The Selected Acquisition Report (SAR) system was initiated in 1967 as an internal Defense Department management reporting system. The SAR system has evolved into a comprehensive summary status report on major defense acquisition programs. A SAR, according to DOD, is not a decision document. It is a routine quarterly report that reflects DOD acquisition plans for those systems selected and contains estimated program cost. SARs are prepared as of March 31, June 30, September 30, and December 31 each year. Acquisition programs that are designated as major systems are normally reported in a SAR once they have received Defense System Acquisition Review Council (DSARC)[3] approval at acquisition Milestone II. This milestone occurs immediately prior to entering the full-scale development phase. (See figure 3.)

[3] The DSARC acts as the top level Department of Defense corporate body for system acquisition and provides advice and assistance to the Secretary of Defense on matters relating to the acquisition of major systems.

ACQUISITION PROCESS MILESTONES

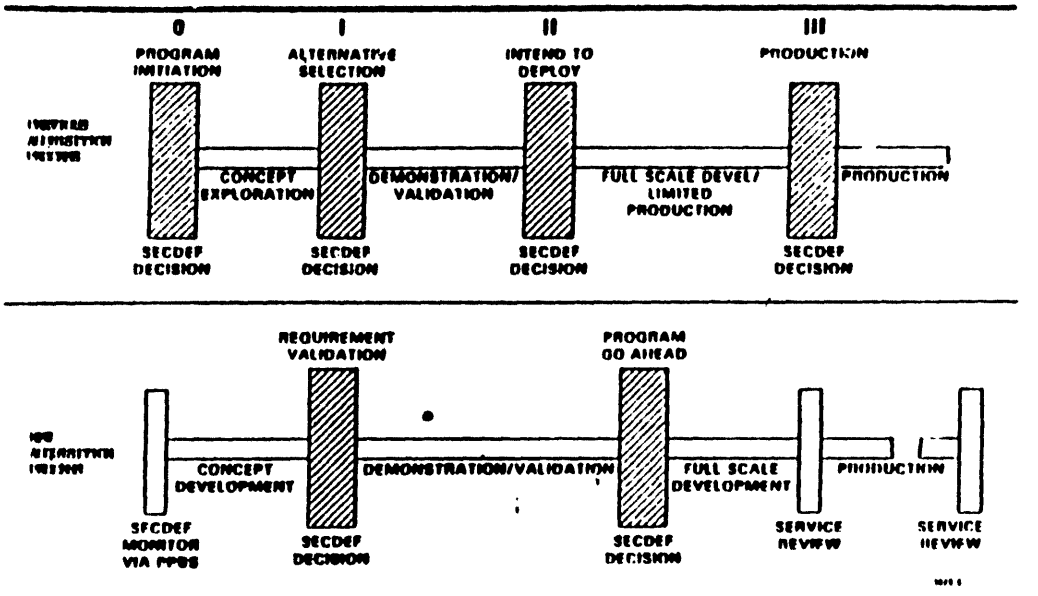

FIGURE 3

The initial SAR covering a major system establishes the "base year" for that acquisition program and contains estimates of total system costs, including R. & D., procurement and military construction. These cost estimates also attempt to include all economic inflation expected to occur throughout the acquisition process at inflation rates specified by the Office of Management and Budget. The initial cost estimates become the base line estimate against which all future quarterly SARs are measured. Program cost increases or decreases due to quantity changes, schedule changes, changes in estimated inflation rates, and other changes are applied to the base year estimates.

Since the initial SAR for a major system is usually issued 5 years before testing is completed, and full-scale production is approved, and often 10 to 15 years before program completion, SARs are merely "estimates against estimates".

While the panel recognized that the SAR system is only one of several methods available to the Congress for gathering information relating to major systems acquisitions, it is valuable for the purpose of disclosing program trends, the effects of management decisions, and decisions of the Congress.

The Congress started receiving limited SARs in 1969. Apparently, by 1975 the SARs were recognized as valuable information sources. Therefore, on October 7, 1975, the Congress directed the Defense Department to routinely provide complete SARs to the Congress. Specifically, section 811(a) of Public Law 94–106 (Department of Defense Appropriation Authorization Act, 1976) states:

> Beginning with the quarter ending December 31, 1975, the Secretary of Defense shall submit to the Congress within 30 days after the end of each quarter of each fiscal year, written

> selected acquisition reports for those major defense systems which are estimated to require the total cumulative financing for research, development, test, and evaluation in excess of $50,000,000 or a cumulative production investment in excess of $200,000,000. If the reports received are preliminary then final reports are to be submitted to the Congress within 45 days after the end of each quarter.

During the 96th Congress, section 811(a) of Public Law 94–106 was amended by Section 809 of Public Law 96–107 (10 U.S.C. 139 Note) to increase the reporting thresholds and to change reporting dates as follows:

> Beginning with the quarter ending December 31, 1979, the Secretary of Defense shall submit quarterly to the Congress written selected acquisition reports for those major defense systems which are estimated to require a total cumulative financing for research, development, test, and evaluation in excess of $75,000,000 or a cumulative production investment in excess of $300,000,000. The report for the quarter ending on December 31 of any fiscal year shall be submitted within 20 days after the President transmits the Budget to the Congress for the following fiscal year, and the reports for the other three quarters of any fiscal year shall be submitted within 30 days after the end of the quarter. If a preliminary report is submitted for any quarter, then the final report for such quarter shall be submitted to the Congress within 15 days after the submission of such preliminary report.

Clarification of SAR Requirements

The intent of the 1979 amendment was to change reporting dates and dollar thresholds for systems to be reported in SARs. However, under the reporting practices of the Department of Defense, unless a system is designated by the Secretary of Defense as a "major system," it may not be reported even though the dollar thresholds are exceeded.

The key factor that determines how the SAR system is implemented is DOD's interpretation of Public Law 96–107. This interpretation is reflected in Department of Defense Instruction (DODI) 7000.3, Selected Acquisition Reports, which states: "Reporting will usually be limited to those major system acquisition programs that have reached milestone II (full-scale development) and are estimated in the Five Year Defense Plan (FYDP) . . . to require (1) a total cumulative financing for Research, Development, Test and Evaluation in excess of $75 million or (2) cumulative production investment in excess of $300 million."

Major systems are designated in accordance with the policy outlined in DODI 5000.2, Major System Acquisition Procedures. The designation is made based on the following: "The Secretary of Defense shall designate certain acquisition programs as major systems. The Defense Acquisition Executive (DAE) [Deputy Secretary of Defense] may recommend candidate programs to the Secretary of Defense at any point in the acquisition process, but normally recommendations shall be made in conjunction with Mission Element Need Statement

(MENS) approval. The DAE is authorized to withdraw the designation of major systems when changing circumstances dictate. The DAE shall advise the Secretary of Defense before such an action is taken." A MENS is a document which identifies and defines mission requirements, and a MENS is only required for defense investments exceeding $100 million for R.D.T. & E. and $500 million for procurement.

The panel was concerned that the above DOD definition of a major system may result in high-cost systems not being reported in the SAR system, although they meet the dollar reporting thresholds specified by section 809 of Public Law 96-107 (10 U.S.C. 139 Note). This appears to differ from the intent of section 809, as set forth in the Committee on Armed Services Report to accompany H.R. 6674 (Rept. No. 94-199). The report states:

> This section directs the Secretary of Defense to submit quarterly Selected Acquisition Reports on major defense systems to the Congress within thirty days after the end of each quarter of each fiscal year. "Major defense systems" which are to be the subjects of these reports are those which require total cumulative financing of more than $50 million in R.D.T. & E. or a cumulative production investment of more than $200 million.

The panel believes that the provisions of section 809 should be amended to specifically require that a system be reported in a SAR if it is designated as a major system *or if it exceeds either the $75 million R.D.T. & E. threshold or if it exceeds the $300 million procurement threshold.*

The SAR system has allowed routine visibility into major acquisition programs and cost trends that previously had not been provided. This insight, together with increasing defense budget pressures, seem to have motivated increased interest in the issue of weapon systems cost growth. The Congress, in fact, now requires additional cost visibility through a provision in the Department of Defense Authorization Act of 1982 (Public Law 97-86, section 917)—the so-called "Nunn Amendment," authored by Sen. Sam Nunn (D.-Ga.)—which requires unit cost reporting.

Unit Cost Reporting

The Unit Cost Report under the "Nunn amendment" requires that if the total program acquisition unit cost or the current procurement unit cost of a weapon system exceeds 15 percent of the March 31, 1981, SAR estimates at any time during fiscal year 1982, then a report on that system must be submitted to the Congress. Also, when the total program unit cost or the current procurement unit cost of a weapon system exceeds 25 percent of the March 31, 1981, SAR estimate, the Secretary of Defense is required to make certifications concerning that program to the Congress. This reporting requirement is effective for one year—fiscal year 1982—and applies only to acquisition programs which are currently reported in the SAR ssytem.

The panel believes, however, that the Unit Cost Report will not address several significant issues associated with improving cost reporting to Congress. Specifically, it does not solve the problems of retrospective reporting and the absence of cost data early in the acquisition process.

The SAR System is a Retrospective Reporting System

The panel believes that one of the major problems with the SAR system is that it is retrospective and, as such, it does not provide clear insight into potential cost growth problems. This observation was shared by virtually every witness appearing before the panel, including Deputy Secretary of Defense, Frank Carlucci. He stated, "It is true that the vast majority of the information in *the SAR is retrospective.*" The Secretary qualified his statement, however, by saying, "*I have some difficulty in providing a great deal of prospective information to the Congress.* That difficulty stems from the problems we have in negotiating contracts . . . we have to protect our negotiating position. That being said . . . we are prepared to share it [prospective cost information] with the Congress to the maximum extent." (Emphasis added.)

The panel clearly does not desire to propose reporting requirements which would adversely affect contract negotiations. However, the panel believes that some contract and cost information could be made available to the Congress without jeopardizing contract negotiations.

During its discussions with prime and subcontractors, the panel reviewed contract cost and performance data reported in the Cost/Schedule Control System Criteria (C/SCSC) management reporting system. The C/SCSC management reporting system is the primary system for routine reporting of contract cost and performance information. The purpose of C/SCSC is to provide a management approach to ensure that DOD contractors use effective management control systems and together with the Cost Performance Report (CPR), routinely provide cost, schedule and performance data. The panel understands that the C/SCSC reporting system may contain some contractor information that is sensitive and which should be protected. However, there is a considerable amount of information which is not sensitive and, therefore, could be shared with the Congress. Mr. Norman Augustine, present Chairman of the Defense Science Board, Vice President of Martin Marrietta Aerospace and a former assistant secretary at the Department of Defense, expressed a similar view when he said, ". . . I don't really see any reason to keep information on the acquisition process from anybody who has a clearance and a *need to know* what it says." (Emphasis added.)

The Congress not only has a *need to know* how public funds are being managed, it has an obligation. The panel maintains that if more prospective information were available, potential cost growth on many programs could be identified much earlier, including those systems that were examined during the panel's case studies. The panel has prepared sample reports for the Black Hawk, Patriot and ALCM programs to illustrate the usefulness of certain prospective information. (See Appendix D) Further, witnesses agreed that "exception" reporting, which will assist in detecting and controlling potential cost growth problems, is desirable.

Dr. Jacques Gansler, vice president of the Analytic Sciences Corporation and a former Deputy Assistant Secretary of Defense, best summarized the situation when he said: "I think the idea of Congress having a 'management by exception' visibility is a desirable one. There is far too much reporting throughout the whole system, and, therefore,

I think that is a desirable one. The concept of monitoring against objectives and alerting the Congress when programs appear to be growing for one reason or another, and the reasons for it, I think is also desirable."

The necessity for prospective information reporting on major weapon systems was highlighted by one of the witnesses during a discussion of SARs. The witnesses, Mr. Patrick Renehan, Chief of Defense Cost Unit, Budget Analysis Division, Congressional Budget Office, (CBO) stated:

> SAR reports do not provide sufficient cost performance data to permit adequate early warning of potential cost overruns. For example, one pre-production prototype contract was found in April to be over cost by 55 percent and behind schedule by 12 percent. If the pre-production prototype contract was over cost by 55 percent, one could conclude that the production program might incur a similar overrun. The June SAR did not include this information, which is not required, or its impact on total program cost. At the end of July the contract was over cost by 58 percent and behind schedule by 14 percent.

Prospective Reporting

The panel believes that effective reporting systems should not only provide information, but they should also focus on areas which deserve management attention. It is the panel's view that an "exception" report containing prospective program and contract cost information would provide for more effective oversight and control. The panel, therefore, recommends that the subcommittee request that the Defense Department provides the "exception" report identified and discussed in Appendix D.

The panel is aware of and understands the purpose and scope of the new Unit Cost Report and does not intend to recommend a reporting requirement that is either redundant or inconsistent. The reporting requirement discussed in Appendix D should complement the Unit Cost Report by providing prospective cost information concerning potential cost increases on major contracts.

Cradle to Grave Program Cost Reporting

The panel is of the opinion that the current practice of waiting until a major system reaches the start of the full-scale development phase, which takes an average of nine years, before reporting it in the SAR system does not provide for routine cost visibility at critical times during the life of the program. In fact, once the new acquisition review process proposed by DOD is implemented, systems may not be reported in the SAR until the new "program go ahead" milestone which occurs even later in the acquisition process than the current milestone. (See figure 3.)

The panel believes that even the current reporting milestone does not provide the appropriate cost visibility while programs are in their early stages. The panel points to the fact that, although major investments have been made in some systems, they have not been included in SARs because they have not passed milestone II—start of full-scale development.

Therefore, it would appear that the current reporting practices of DOD are not consistent with the intent of Public Law 96–107 (10 U.S.C. 139 Note) as set forth in House Report 94–199. The intent of that provision is to require that reports be provided to the Congress on acquisition programs that are *estimated to exceed* $75 million for R.D.T. & E. or $300 million for procurement. This clearly suggests that once the Department of Defense estimates that a program will exceed these thresholds, the program should be reported in SARs at that time and not 9 or 10 years later when the weapon system is entering full-scale development. The panel, therefore, recommends that the Department of Defense modify the SAR system to provide for early identification and tracking of program costs in accordance with Public Law 96–107 (10 U.S.C. 139 Note).

Timeliness Is Critical to Any Reporting System, the SAR System Is No Exception

The panel finds that the present SAR system provides quarterly updates that do not always reflect substantive fact-of-life changes that may have occurred in a program since the December 31 SARs. Mr. Renehan, Budget Analysis Division, CBO, touched on the frustration the panel experienced during its review of the SAR system when he testified that:

> What is so frustrating with the SAR is that, if you read the narratives, in many cases, you will discover that DOD admits in the SAR that the estimates they are presenting in the SAR are outdated, that they well know that the costs are higher than the costs that are presented in the SAR.
>
> If you look at our report you can see case after case where fact-of-life changes that don't represent a change in the size of the program and are not POM-driven, are not reflected in that SAR.

Another example of this timeliness problem recounted during panel hearings, was a potential cost growth of 65 percent in constant dollars first identified in January of 1979, but not identified in the SAR system until December 1979, and reported to the Congress until February 1980—fully 13 months after the potential cost growth was identified by the program manager. The panel recommends more expeditious processing and review of the most recent SARs data on a quarterly basis.

The panel takes special note of a report that was recently issued by CBO.[4] This report highlights, in several pages, changes from the previous SARs and analyzes cost information which might suggest potential cost growth. The panel believes that this report fills an information void and recommends that CBO continue to provide this report to the Congress within 15 days after receipt of quarterly SARs.

Summarizing, the panel believes that the implementation of "exception" reporting coupled with the proposed modifications to the SAR system would be instrumental in assisting the Congress in exercising its oversight responsibilities in the area of cost management.

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[4] A review of the Department of Defense September 30, 1981, Selected Acquisition Report (SAR), Special Study, December 1981, CBO.

Weapon Systems Acquisition and the Defense Budget Process

FINDING

The panel finds that the Planning, Programming, and Budgeting System (PPBS) within the Department of Defense is presently not integrated nor synchronized with the weapon systems acquisition process.

Specifically, the panel finds that:

the lack of integration that exists between the PPBS process and the acquisition process frequently does not provide an opportunity to consider system requirements and recent cost assessment data after the development of the Program Objective Memorandum (POM), resulting in inadequate budgets and ultimately contributing to unanticipated weapon systems cost growth;

resources required to support the acquisition of major systems are not always included in the budget, although the systems may have been approved by the Secretary of Defense to proceed to the next milestone in the acquisition process; and

integrating the PPBS and acquisition process may provide increased opportunities to anticipate and manage budget increases which frequently occur when large numbers of systems are reaching the full scale development and production phases within a short period of time.

DISCUSSION

The defense acquisition process for major systems is very complex and generally spans 15 years. Recent management initiatives by the Defense Department are directed at reducing the complexity of the process and decentralizing many of the decision making functions; however, it remains complex and lengthy. The complexity is compounded by the fact that there is insufficient correlation between the acquisition and budget processes within the Department.

The budget process is an integral part of the Planning, Programming, and Budgeting System (PPBS). The PPBS system, instituted by former Secretary of Defense Robert S. McNamara, starts with the assessment of the threat. The threat assessment is developed by the intelligence community and is documented in the National Intelligence Estimate (NIE). One witness, Major General William J. Campbell, Jr., USAF, Director of Programs, Deputy Chief of Staff for Programs and Resources, said of this phase, "It [NIE] allows the planners of all of our combatant commands, the joint chiefs, and the planners at the U.S. Air Force Air Staff to get a look at what is facing us in the way of an adversarial threat, where is it located, what its capability is in terms of quality and quantity."

The threat assessment information is then utilized by the services in the planning phase to project military requirements 10 to 15 years in the future. It is important to note that the planning phase is not constrained by dollars.

The programming phase of the PPBS is the first time that fiscal constraints are applied. During the programming phase, requirements are prioritized by program, and decisions are made concerning which programs will be funded. This is the most critical phase of the process

and leads to the creation of a Five Year Defense Plan (FYDP). Based on the FYDP, an annual defense budget is generated and submitted to the Congress.

Even before the end of the planning phase, the programming phase has started. During the early stage of this phase, a Program Objective Memorandum (POM) is produced by each of the services which reflects the first year of their 5-year program. The POM building stage represents one of the few "windows" available in the budget process during which new requirements are routinely considered, and it generally ends about 18 months before budget execution. Therefore, in most cases the cost information which is used to formulate the budget is based on estimates made nine months prior to the submission of the defense budget to the Congress and 18 months before the beginning of the budget execution year.

During one of the case studies, Colonel Ronald Andreson, Army Black Hawk helicopter program manager, gave a vivid illustration of the problem when he said, "The POM figure that supported the budget submission [FY 82 budget] last December [1980] was formulated about six months prior to that time, so there is about an 18-month lead time in the budget process to put the costs in [the budget to be executed in fiscal year 1982]." He continued, "Now it is easier [to develop more accurate estimates in September 1981] because we have a big data base, and we are being a little more realistic. . . ."

On the acquisition side, there is a different set of selection procedures operating that is driven primarily by major systems acquisition decisions. These decisions are made by the Secretary of Defense through the Defense System Acquisition Review Council (DSARC) review process and determine if a program may proceed to the next stage in the acquisition process. Once a program has been approved by the DSARC, it is assumed that funds will be available through the budget process to finance the investment.

However, because a program may not have been identified during the PPBS process in sufficient time to enter the POM, there is no assurance that adequate resources and funds will be committed to the program or committed at the appropriate time. The absence of timely-committed resources to support programs often creates a funding problem which results in DSARC-approved programs being delayed and stretched-out. In fact, General William Campbell, testified that "very often history has shown us that the budget doesn't really contain all of the resources that the program hoped it would. As a result, the force levels programmed are not always as ready, or as fleshed out, or as capable as the program would have hoped."

Lack of Integration Causes Unanticipated Cost Growth

The panel finds that due to the lack of integration between the PPBS and the acquisition processes information frequently used to estimate cost is outdated and unrealistic when applied to annual budget requests. Mr. Norman Augustine testified that, "It would be helpful if people who were prescribing those [program] requirements would have available a realistic source of cost estimating for the requirements they impose . . ." He further stated that, "In terms of the [program] requirements, there is really little consideration given in the budgeting process until it is too late".

The evidence suggests that one method for improving the realism of cost estimates during the programming phase of the PPBS process is to provide increased opportunities for program managers to input their own and the contractors' *most recent cost assessment* data into the POM. This should increase the possibility of programs being funded at required levels and decrease the necessity for the Department to submit supplemental budget requests to cover unanticipated costs.

Deputy Secretary Carlucci summarized how the Department views the problem when he stated, ". . . it does no useful purpose to review a weapon system out of the funding cycle, and then find yourself short of money and having to go up [to Congress] with a supplemental. It made a lot more sense to review it in sync with the funding cycle." He continued, "So it is much more meaningful in my judgment to have a review that is integrated with the budget process."

The projected defense investments for research and development, procurement, and military construction are estimated to increase to $175 billion by the year 1986. The panel believes that this increase in budget authority will present new budgeting and cost control challenges to the Defense Department. For this reason, it is essential that the Department manage available funds through a better integration of the acquisition process with the PPBS process. The panel believes this could improve the opportunity to plan for and manage programs and to achieve possible savings during a period when large numbers of systems reach the full-scale development and production phases within a short period of time.

Contract Management in Major Weapon Systems Programs

FINDING

The panel finds that the Defense Department's present decentralized approach to contract management for major weapon systems does not appear to encourage consistent contract administration and cost control procedures.

Specifically, the panel finds that:

effective management and control of cost growth below the program manager level appears to be impaired by ambiguous cost reporting lines of authority and fragmented areas of responsibility for cost control; and

the present personnel assignment policy, including short-duty tours for program managers, does not routinely provide the longevity, expertise, and stability necessary to promote consistent and effective program management including the management of cost growth.

DISCUSSION

During the panel's examination of the Black Hawk helicopter, Patriot Missile and ALCM programs, one of the issues which quickly surfaced, was the manner in which acquisition contracts are administered. Weapon systems contracts within the Defense Department are administered by either the Defense Contract Administration Services

(DCAS) office, an element of the Defense Logistics Agency (DLA), or by the individual military departments.

The DCAS has field offices in nine regions throughout the United States, but most are in locations east of the Mississippi River. There are 36 Defense Contract Administration Services Plant Representatives Offices (DCASPRO's) serving at 36 contractor facilities. The 36 DCASPRO's provide full-time, extensive services when continuous oversight is required. Additionally, there are 900 different plants in which DCAS personnel are located, and they provide full-time services, but not to the extent provided by DCASPRO's. Finally, there are 37 Defense Contract Administration Management Areas (MA's). The 37 MA's provide contract administration services at contractors' plants as the situation requires. DCAS has a total of 16,279 personnel and administers approximately 300,000 contracts worth $104 billion.

The military departments, if assigned plant cognizance by the OSD, provide contract administration services through the use of Air Force Plant Representatives Offices (AFPRO's), Naval Plant Representatives Offices (NAVPRO's) or Army Plant Representatives Offices (ARPRO's). If a military department is assigned plant cognizance, it is normally responsible for all DOD Contract Administration Services (CAS) at that plant. Plant cognizance is generally assigned to one of the military departments when a particular program is of sufficient priority.

Although under stated policy, plant cognizance is assigned to either DCAS or one of the military departments, it is not clear to the panel that this is true in all cases.

The panel is of the opinion that the basic issue is whether further centralization or clarification of functions related to contract administration would provide more effective management and cost control.

Cost Control and Contract Administration Services (CAS)

The panel believes that the present decentralized approach to contract management within DOD does little to encourage consistent contract administration and management procedures. The panel feels that effective cost growth control appears to be hampered by ambiguous lines of authority for cost reporting and fragmented areas of responsibility for cost control.

The Government's representatives at the contracting facility constitute the "*first line of defense*" in the fight against cost growth. General Charles Drenz, U.S. Army, Deputy Director of DCAS, in response to a question concerning plant representatives, agreed that because plant representatives are stationed at the contractor's facility, they should be able to detect cost growth rather quickly. General Drenz added, however, that on occasions the contractor will inform the program manager of cost growth before notifying the plant representative.

The record reflects that although most of the DOD and military departments' plant representatives understood their lines of reporting authority and functional responsibilities, there was sufficient ambiguity, specifically concerning the reporting channels, to merit review by the Defense Department. In fact, in one case, it was not clear if the plant representative should be reporting cost growth information to the program manager or to his CAS supervisor.

The panel was told that the scope and nature of cost reporting requirements are outlined in a memorandum of agreement between the DCASPRO and the program manager for a particular facility. Further, it was explained that the memorandum of agreement might be different for different contracting facilities and program managers.

General Drenz, in response to a question concerning cost reporting responsibility, indicated "that [a reporting channel] is tailored, depending on the program, the facility, and so forth. It depends on the memorandum of agreement, the delegation of authority on that particular contract, and it depends on a lot of things, so each individual plant will tailor their particular functional environment to the requirements of that contractor to contract in the procurement activity and the program manager."

The panel's findings concerning the Defense Department CAS functions are not unprecedented. A 1978 study by Booz, Allen and Hamilton, Inc., titled *Analysis of Alternative Structures for Contract Administration in the Department of Defense* stated:

> The study team found that the current CAS organizational structure displays some significant strengths. *Nevertheless, numerous problems exist in the current CAS environment which could theoretically be solved under the present organizational arrangements. Realistically, however, restructuring is required if the advantages of improvement opportunities are to be fully realized.* Moreover, it was concluded that the rationale for preserving the current structure is based upon several weak premises, and that the risks of reorganization are minimal. (Emphasis added.)

Secretary Carlucci also acknowledged that there may be some potential benefits to be derived from reviewing present CAS organizations and functions. He indicated that, "However, there is a problem in this area [CAS]. There is no question that the different services and DCAS tend to take different approaches."

The panel has not delved into the Department's CAS functions in sufficient depth to be able to recommend specific changes in contract administration services activities. There does, however, appear to be sufficient evidence to suggest that the Secretary of Defense should review present CAS activities. This review should include assessing the potential benefits to be derived from clarifying ambiguities that exist in cost reporting procedures and cost control responsibilities below the program manager level.

Program Management Turn-over

The panel's record clearly reflects a consensus among its witnesses that program managers are perhaps the most critical individuals in the acquisition systems and, as such, have the best opportunity to detect and, frequently, to influence cost growth factors. The witnesses, however, expressed concern that present assignment policy for program managers does not consistently encourage the longevity, expertise, and stability required to promote the most effective program management.

During the hearings, one witness indicated that if he were asked what he would add to the DOD's 32 acquisition improvement initiatives, recently proposed by Deputy Secretary Carlucci, his first sug-

gestion would deal with rewarding people, including program managers, for good performance. Mr. Augustine went on to say that, "I would seriously conside · that [the same people stay with the project through completion], and I would consider, in fact, as a minimum, staying with a project through a major milestone." He added, "Maybe we need a new approach to career programs. Managing a major defense acquisition program was simply too important to be left to people who are going to be there for a couple of years and then leave."

The panel was told a 1973 study showed that the average tour for a program manager was about 13 months and that the average system development time was about 3 years. Today the average tour is about 3 years and the average development time is between 8 to 15 years with major acquisition milestones occurring approximately every 4 years. In his testimony, Secretary Carlucci indicated, "I agree fully with that [extending assignment tours for program managers] and have asked the services to look at extending the tours of the program managers and to provide contrary incentives for them."

Summarizing, the panel believes that the Secretary of Defense should review present CAS functions within the Department and assess the potential benefits to be derived from clarifying and standardizing cost detection and reporting procedures below the program manager level. Further, the panel recommends that the Secretary of Defense should continue to pursue practices to improve program management by encouraging longer assignment tours and providing appropriate incentives for program managers.

Major Cost Growth Factors

FINDING

The panel finds that the unanticipated cost growth experienced in the acquisition of major weapon systems has significantly impaired the Defense Department's ability to budget for the quantities and types of weapon systems necessary to meet force structure requirements.

Specifically, the panel finds that:

the factors contributing to cost growth are unrealistic inflation estimates, poor cost estimates, program stretch-outs, changes in specifications, inadequate budgeting, high risk system design, poor management, and lack of competition;

cost growth contributes to the practices of procuring weapon systems at inefficient production rates which results in program instability and, ultimately, additional cost growth;

the absence of a consistent policy promoting the routine use by contractors of cost/performance trade-offs during the development phase has contributed to unanticipated cost growth: and

although the Defense Department's recent initiatives (see page 28) to improve the defense acquisition process address several of the major cost growth issues surfaced during the panel's investigation, there does not appear to be a comprehensive plan for implementing these initiatives.

DISCUSSION

Defense Department outlays have increased from about $14 billion in 1950 to approximately $184 billion for 1982. The intervening years

have witnessed some startling increases in the cost of acquiring, deploying, and operating vital military weapon systems. This has occurred amidst claims that crippling cost growth has infested defense weapon systems programs. In fact, one of the witnesses testifying before the panel, appropriately summarized the situation when he said, "Enough material has been written on the subject of cost growth during the past 10 years to fill a Minuteman silo. Unfortunately, cost growth is still with us, and it is time for some serious efforts to be made to put existing machinery into action".

Recently the Congressional Budget Office (CBO), in reviewing 37 weapon systems, found that the projected cost for the systems was $4.3 billion dollars more than had been projected the previous year.[5] The $4.3 billion increase was determined after adjusting for inflation and quantity differences. Therefore, it represents a real cost growth which suggests that unanticipated cost growth has reduced the purchasing power of the defense dollar by, at least, $4.3 billion.

Many Factors Contribute to Weapon Systems Cost Growth

The panel finds that the Department of Defense each year continues to base its budget request on unrealistically low inflation estimates established by the Office of Management and Budget (OMB). In fact, the Defense Department's own analysis of recent cost growth data indicates that approximately 30 percent of the cost growth experienced by the 47 major weapon systems reported in Selected Acquisition Reports is due to low inflation estimates. During one of the panel's hearings, Deputy Secretary Carlucci, referring to the Department's recent management initiatives to improve the acquisition process, indicated that, ". . . budgeting for inflation is perhaps the most difficult of all the initiatives." He continued, "I can claim some progress in a lot of other initiatives, but at this point I can't claim that we have solved that problem."

Another significant contributor to cost growth is erroneous cost estimating by contractors. The panel found several examples of poor estimating by contractors during its investigation. For example, during the panel's case study of the Black Hawk helicopter program, it was determined that for the period 1977 through 1979 the contractor underestimated the man-hours required to produce the first 163 Black Hawk helicopters by over 54 percent. This means that instead of the 97,200 man-hours initially estimated, the true requirement was approximately 150,077 man-hours which resulted in a significant, unanticipated cost growth. This is not an isolated example. The panel's record is replete with discussions of poor estimating, and it is clear that such errors are major contributors to cost growth. Incentives are required to force more accuracy and realism into estimates.

The panel finds that program instability, which may include schedule changes, engineering, and estimating errors, is estimated to cause a higher percentage of cost growth than any other single factor. The Defense Department has estimated that of the 47 major systems reported in the December 31, 1980 SAR, estimating errors, schedule changes, and engineering changes account for approximately 38 percent of the unanticipated cost growth.

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[5] This information was received during the testimony of Mr. Patrick Renehan, CBO, before the special panel on October 22, 1981.

Inadequate defense budgeting results in unanticipated cost growth in the acquisition of major weapon systems. This is especially true when budgetary pressures force program stretch-outs and when unrealistic inflation and poor cost estimates are used to develop defense budgets. The panel believes that the Office of Management and Budget and DOD should provide the most accurate and reliable inflation estimates and cost estimates to the Congress that are available during the budget formulation process. This will assist in providing adequate program funding and, thus, mitigate the effects of unanticipated cost growth.

Why have these cost growth problems been permitted to continue over the years? Mr. Norman Augustine best pinpointed the "group of suspects" when he said:

> How have problems such as these been permitted to arise and persist over many years . . . and who is to blame? Unfortunately, there is enough blame to be shared by all, including the Department of Defense, the defense industry, and I would respectfully point to the Congress as well. . . .

During the course of its investigation, the panel heard nothing to cause it to disagree with Mr. Augustine's assessment.

Inefficient Production Rates Result in Cost Growth

The panel believes that inefficient production rates result in higher unit costs and, thus, limit the purchasing power of the Defense Department. This reduction in purchasing power frequently results in program instability which ultimately causes unanticipated cost growth. Historically, in order to respond to budgetary pressures, production rates for major systems have been reduced, thus pushing program cost and compound inflation further into future budget years. This results in immediate program unit cost growth since contractors are forced to produce units at less than economically efficient rates.

The panel believes that the alternatives are clear, if one accepts efficient production rates as a goal: either to *fully fund all weapon systems procurement to the level required to produce economic efficiencies or to fully fund selected high priority systems while cancelling or deferring those programs with a lesser priority.* Deputy Secretary Carlucci supported this position during the panel's investigation when he stated that, "Perhaps the most significant thing we can do is relieve some of the budget pressures on weapon systems by taking a final position to terminate a number of weapon systems so that those that are left in the budget can be adequately funded." Another witness, Dr. Gansler, in discussing several of the Defense Department's recent initiatives to improve the acquisition process, outlined some of the difficulties associated with encouraging more economically efficient production when he said:

> . . . one of the initiatives is to have efficient production rates, but if the budget then is at low production rates because 'that is all we can afford', then he [Deputy Secretary Carlucci] is not implementing the initiative. It will require a great deal of guts to implement those initiatives *because the only way you can have efficient production rates on some programs is to cancel others.* (Emphasis added.)

However, given the current economic climate, the panel does not feel that all weapon systems will be funded at the most economically efficient rates. Further, the panel believes that in view of the requirement to field considerable numbers of new weapon systems to meet expanding threats and to maintain a production base for attrition, it is not realistic to expect that many programs will be canceled. Therefore, the panel believes that realistically while some programs may be cancelled or delayed, most weapon systems will have to continue to be produced at less than an economically efficient rates. However, the panel notes that the DOD and the Congress are pursuing policy changes to provide more efficient production rates through the use of multiyear procurement and advance procurement funding.

Improved Military Capability and Cost Growth

The panel would like to make it clear that it does not believe all cost growth can be avoided. For example, if cost growth results in improved defense capability, such as cost-effective engineering changes or additional defense systems, then program cost growth is acceptable. Mr. Walton Sheley of the General Accounting Office, expressed the views of many of the witnesses when he stated: "It is important to recognize, in any analysis or discussion of cost growth, *that not all cost growth can reasonably be prevented and that some cost growth, even though preventable, may be desirable.* For instance . . . changes in technology may make it possible to incorporate modifications that result in an overall increase in the effectiveness of the system." (Emphasis added.)

Cost/Performance Trade-Offs Help To Control Cost Growth (value engineering)

The importance of cost/performance trade-off studies to assist in reducing the cost of weapon systems appear to be fully recognized by the Defense Department; however, the panel believes that more emphasis should be placed on promoting the use of these studies by defense contractors. The use of cost/performance trade-off studies is particularly relevant during the development stage because a small cost avoidance in the design of a high volume, high cost weapon system could result in significant cost reductions during the production stage.

During the panel's review of this issue several of the witnesses argued rather convincingly that, generally the last five percent improvement in performance may result in a 30–50 percent increase in the cost of the system. Deputy Secretary Carlucci referred to this as the "last five percent syndrome" when he said, ". . . as the last five percent syndrome is a little harder to cope with . . . All we can do is to encourage all our managers to shy away from it. We have tried to do so by emphasizing the evolutionary approach, and hopefully experience would be a good teacher here because it is generally that *last 5 percent that has caused them* [military services and program managers] *the most problems.*" (Emphasis added.)

It was clear during the investigation that program managers were acutely aware of the value of cost/performance trade-off studies, and one program manager said, ". . . yes, it is good to do cost trade-off studies, and for some penalty in performance you can incur a significant advantage in cost, but it becomes a judgment call when you start creeping below your floors [minimum performance]."

The panel finds that the practice of conducting cost/performance trade-off studies is generally widely praised by the defense community, including the Office of Secretary of Defense, the military departments, and defense contractors. However, the Department of Defense does not have a consistent approach for encouraging contractors to initiate cost/performance studies.

Implementation of Acquisition Improvement Initiatives

During the panel's investigation each of the witnesses applauded the Defense Department's recent initiatives to improve the acquisition process. The Defense Department's recently announced acquisition management philosophy embraces the following principles:

improve long-range planning to enhance acquisition program stability;

delegate more responsibility, authority and accountability for programs, in particular, the service program manager should have the responsibility, authority and resources adequate to execute efficiently the program for which he is responsible;

examine evolutionary alternatives that use a lower risk approach to technology rather than solutions at the frontier of technology;

achieve more economic rates of production;

realistically cost, budget, and fully fund in the Five Year Defense Plan (FYDP) and Extended Planning Annex, procurement, logistics and manpower for major acquisition programs;

consider as a primary objective the readiness and sustainability issues from the start of weapon system programs; and

recognize that a strong industrial base is necessary for a strong defense and that the proper arms-length relationships with industry should not be interpreted by DOD or industry as adversarial.

Deputy Secretary Carlucci stated before the panel that, "When we announced our new initiatives, we recognized the problem of implementation and admitted it was as important as the decisions themselves. We recognized fully that not only had the acquisition process been studied numerous times, but many of our initiatives had been tried before and never really got very far." His statement concisely summarizes the apprehensions expressed by many of the witnesses and the panel. Mr. Augustine placed the difficulties associated with implementing the improvements in proper prospective when he said:

> I believe the initiatives are soundly conceived and address many if not most of the underlying ailments of the defense acquisition process. The easiest task in addressing the defense acquisition process is that of identifying the symptoms of the problems. It is somewhat more difficult to identify the problems themselves, and harder yet to determine the solutions. *But it is incredibly more difficult still to make any of it happen.* (Emphasis added.)

The panel, although optimistic about the possibility that the proposed improvements will be implemented, is concerned, nevertheless, that without a comprehensive implementation schedule the probability of successfully implementing these important improvements is significantly diminished. The panel, therefore, recommends the Secretary of Defense be asked to provide the committee with a schedule which iden-

tifies milestone objectives for implementing these initiatives. This schedule should be submitted to the committee early in 1982.

In summary, the panel finds that strong management action on the part of the Defense Department is necessary to help moderate the serious cost growth trends which threaten to continue to reduce the buying power of the Defense Department. The panel believes the Department's recent initiatives to improve the acquisition process, if implemented, would help to stabilize the rate of cost growth experienced by many military programs and provide an opportunity for improved cost management and control.

Competition in the Weapon Systems Acquisition Process

FINDING

The panel appreciates that it is not always possible to promote competition throughout the acquisition process. This is particularly true when the production quantities and rates are insufficient to support more than a single contracting source. The panel, however, finds that the Defense Department's policies and procedures could do more to promote competition where feasible, particularly during the production phase. The panel notes that although competition is generally present during the development phases, once the weapon system enters full-scale production, frequently only one contracting source is available.

Further, the panel finds that the Department of Defense does not have effective policies and procedures for reducing the opportunity for "competitive optimism"—the unrealistic bid pricing that lead to suspicion of "buying in" on contracts—among those contractors competing on major weapon systems.

Specifically, the panel finds that:

the lack of competition in the production phase may ultimately contribute to weapon systems cost growth;

contractors may "buy-in" to contracts which is a practice that inevitably results in unanticipated cost growth during subsequent phases of the acquisition process and ultimately leads to higher unit cost in the production phase;

a consistent policy of using the Office of Secretary of Defense, Cost Analysis Improvement Group (CAIG) or some similar organization to conduct independent cost analyses for major weapon systems would encourage the development of more realistic cost estimates by contractors and the military services; and

cost performance studies, such as "should-cost" and "will-cost," should be used more frequently during appropriate stages of the acquisition process to provide greater visibility of potential cost growth and to improve cost estimating.

DISCUSSION

It has become a truism that major weapon systems entering the acquisition process will experience some cost growth over their programmed lives. The panel believes that the management and oversight challenge is to identify, and, where possible, control weapon systems

cost growth. During the course of the investigation, the panel's record convincingly documented the desirability of encouraging competition throughout the acquisition process. Dr. Gansler best summarized how the lack of competition is contributing to cost growth when he testified:

> In defense, there customarily is a fierce rivalry during the initial competition for an award of a research and development contract. After this initial competition—frequently awarded based upon a firm's "buy-in"—the winner becomes the sole developer and producer for the military system over the next 20 years. Thus, a program—such as a missile system—may once have had an initial competition, but after that first step there is no alternative source for this much-needed piece of equipment. Therefore, the sole-source producer increases the price, the government has little choice but to attempt to "negotiate," and basically to accept the cost increases.

The panel believes that the Defense Department should encourage production competition and reduce the opportunity for competitive optimism by providing for, at least, dual-sourcing on production contracts, where feasible; institute more frequent independent cost analyses; and encourage the use of "should cost"[6] and "will cost" studies by program managers, prime contractors, and sub-tier contractors.

Production Dual-Sourcing Should Be Used More Often

The panel believes that procurement from a single source may frequently be necessary when the production quantities and rates are so small, or when the costs of multisource procurement are so large, that competition may not be in the best interest of the Government. However, the panel finds that competition in the production phase should generally be pursued when there is a significant procurement investment and the quantities, rates, costs, and potential savings are appropriate to support more than a single production contracting source.

The panel understands that competition may not initially come cheap and that the Government, in order to realize some long-term cost savings and to sustain a viable defense industrial base, may have to pay some initial entry fees for introducing a contractor into the production process. The government may also incur some additional cost for idle capacity.

During the investigation, the panel did not identify a specific set of conditions under which production competition is *always desirable*. It appears, however, that the possibility of competition during the production stages for high cost investment programs offers significant potential for cost savings and is deserving of attention by the Department of Defense. One of the witnesses, Dr. Gansler, testi-

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[6] A "should cost" is defined as a technique of contract pricing that employs an integrated team of Government acquisition, audit, engineering, and contract administration representatives to conduct a comprehensive cost analysis at the contractor's or subcontractor's plant. A "will cost" is an evaluation of contractors' estimates of what contract performance will cost in a specific future period.

fied that a typical cost savings of 30 percent could be realized upon introducing dual-sourcing in the production stage of some programs.

Mr. Augustine, while addressing the issue of competition stated, "[It is appropriate] to use dual-source in production or at the beginning of an R. & D. program wherever you can to have as much competition as you can." In response to a question concerning what procurement conditions should exist before the infusion of competition in the production stage is appropriate, Mr. Augustine said, "It depends a great deal on the program. If you take a B–1, I think there is no way you can maintain competition for B–1 or have two parallel lines all the way through its existence. Smaller systems with a higher or greater replication and production [rate], then it is very appropriate . . . one *needs to have a remaining production program that is a factor of 5 or 10 larger than the cost of tooling this additional source*, or else it does not pay, *but there are instances where that occurs and in those cases, I think a second source is a very appropriate thing to do.*" (Emphasis added.)

The panel is aware that increasing competition in the acquisition process is one of the Defense Department's 32 initiatives to improve the acquisition process. However, it is not clear when and how these initiatives will be implemented. The panel, therefore, recommends that the subcommittee should inquire into the implementation of these policies during its review of the fiscal year 1983 defense budget request. Further, the panel recommends that the Secretary of Defense should inform the committee, early in 1982, of the department's specific actions to infuse competition into the production phase.

"Competitive Optimism" Contributes to Cost Growth

The panel record clearly documents contractors' propensity for competitive optimism—"buying-in". During one of the case study hearings, a contractor stated, "It is almost impossible to weed the competitive optimism out of the system, but there are two approaches to recognizing that up front, and one is to provide somehow . . . for a level of cost performance and schedule performance perhaps well beyond that required by the contract, that is, to have people working on that . . . so that in effect to offset the things that you know are going to go wrong you . . . try to improve it beyond the levels that you are targeting for." The other approach mentioned was to essentially provide additional funds to account for uncertainties on high technology, high risk systems. The panel offers a third approach: To encourage more frequent use of analytical techniques to conduct independent cost estimates, to determine more precisely the "most-likely" cost of a system, and to ensure that those estimates are used during the defense budget process. This should not only reduce the contractor's competitive optimism, but it should also reduce the tendency for cost optimism on the part of the military departments.

Independent Cost Estimates

The Defense Department has an organization that is responsible for performing independent cost analyses. The organization is the Cost Analysis Improvement Group (CAIG), and it functions within the Office of the Secretary of Defense (OSD). The functions of CAIG are set forth in the Department of Defense Directive 5000.4. The directive states that the primary function of CAIG is "providing the Defense

Systems Acquisition Review Council (DSARC) with reviews and evaluations of independent and program office cost estimates prepared by DOD components [military departments] for presentation at each DSARC. These cost reviews shall consider all elements of system life cycle cost, including research and development, investment and operating and support."

Although Secretary Carlucci testified that, "We do have the CAIG, as you know, which works with the DSARC to provide the independent cost analysis", the record is not clear on whether CAIG cost analyses actually influence the final cost estimates which appear in defense budget proposals. Mr. Augustine testified that, "They [CAIG] have some competent people, but I would fault their efforts in two regards: One, their methodology is not sufficiently accurate to give high-cost [highly accurate] cost estimates; and, secondly, *they are too seldom listened to. If we had listened to them more carefully in the past, we might not be sitting here today.*" (Emphasis added.)

The panel agrees with several witnesses who stated that "buying-in" is not totally the contractors' fault. The system with its "winner-take-all" approach requires the contractor to exercise as much optimism as possible in order to win the contract because there is no room for the losers. Consequently, the panel believes that the increased use of cost analysis techniques, such as "will-cost" and "should-cost" studies and independent cost analyses, are necessary.

The panel recommends that the Secretary of Defense investigate the benefits to be derived from developing procedures to ensure that at least two independent cost analyses are conducted by the OSD Cost Analysis Improvement Group or a similar organization for all major weapon systems. The panel believes that one of the two cost analyses should occur not later than the start of the advance development phase—milestone I—with the other cost analysis occurring immediately prior to the start of the full-scale development phase—milestone II.

SUMMARY OF RECOMMENDATIONS

The panel recommends that the Procurement and Military Nuclear Systems Subcommittee:

1. Consider legislation amending P.L. 96–107 (10 U.S.C. 139 Note) to clarify criteria for selecting programs on which Selected Acquisition Reports for major weapon systems are required.

2. Request the Department of Defense to provide:

"exception" reporting of program and contract cost data when a greater than 15 percent cost growth occurs in either program unit cost or contract cost, *for major weapon systems programs reported in Selected Acquisition Reports (SARs)*, and for those programs provide an explanation of cost and schedule variances by major contracts including an assessment of the potential cost impact of variances on program cost and schedule; and

early identification and reporting of program cost consistent with Public Law 96–107 (10 U.S.C. 139 Note).

3. Request that the Congressional Budget Office (CBO) provide to the subcommittee within 15 days after receipt of the quarterly Selected Acquisition Reports (SARs), an analysis of each SAR including information related to unit price changes, inflation assumptions, and the impact of price changes on future program costs;

4. Request the Secretary of Defense to:

develop acquisition procedures to address the lack of competition during the production phase and advise the Congress, by June 1, 1982, of the Department's recommendations and schedule for corrective action;

report to the committee by April 15, 1982, the Department's plans to develop and use realistic inflation estimates in defense budgeting;

provide a status report to the Congress by April 15, 1982 on the 32 management initiatives proposed by the Deputy Secretary of Defense to improve the acquisition process;

review present contract administration services functions within the Department, determine potential benefits to be derived from standardizing operating and reporting procedures, and provide the committee with a report of his findings and recommendations;

review current cost estimating methods and assess the value of developing procedures to ensure that cost analyses, independent of the military department concerned, are conducted by the Office of the Secretary of Defense, Cost Analysis Improvement Group, or a similar organization, for those systems reported in SAR's; and

provide budget estimates that reflect the program manager's latest, "most likely" cost estimate to execute a specific program;

5. Encourage the committee to direct its attention to several issues affecting cost and program management developed during the panel's investigations. The issues are:

the lack of adequate competition at the lower tiers of the defense industrial base;

costly designing of high risk, high performance weapon systems;

the military departments' system modification processes;

unanticipated changes in system specifications;

the effect of cost accounting standards on the cost of procuring major weapon systems;

the increasing cost of developing and procuring software for major weapon systems; and

policies and procedures governing contractors' overhead rates and cost estimating by contractors and the Defense Department.

APPENDIX A

U.S. HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
Washington, D.C., June 15, 1981.

Hon. DAVE MCCURDY,
U.S. House of Representatives,
Washington, D.C.

DEAR MR. MCCURDY: Pursuant to Rule 6(b) of the Rules of the Committee on Armed Services, I am appointing a special panel composed of Members of the Subcommittee on Procurement and Military Nuclear Systems to be designated as the Special Panel on Defense Procurement Procedures. In view of your interest in this matter, I am designating you to be Chairman. Other Members designated are Mrs. Byron, Mr. Leath, and on the recommendation of Mrs. Holt, Mr. Kramer and Mr. Hunter.

The panel will inquire into and take testimony on the procurement procedures and policies of the Department of Defense, including the military departments, with emphasis on any procedures and policies that may tend to increase the costs of weapons systems.

At the conclusion of the panel's inquiry, the panel will report its findings and recommend to the subcommittee such revisions that the panel may find necessary or desirable to effect more economical and efficient procurement procedures and methods to determine predictable costs of weapons systems and other items by the Department of Defense.

Pursuant to Rule 6(a) and (c), the panel will expire six months after the date of this letter and may not have legislative jurisdiction.

Sincerely yours,

SAMUEL S. STRATTON,
Chairman, Subcommittee on Procurement,
and Military Nuclear Systems.

APPENDIX B

SUMMARY OF CASE STUDIES

GENERAL

The panel believes that the case study approach provides a vehicle for identifying factors that contribute to weapon systems cost. Further, case studies present an opportunity to discuss cost growth on specific programs with Defense Department officials, program managers, prime contractors, subcontractors, and government plant representatives. The programs studied were selected because they offered a mix of procurement issues that would be representative of major weapon systems presently being acquired.

The panel selected for study the Black Hawk helicopter, the Patriot Missile, and the Air Launched Cruise Missile (ALCM) Programs. Each study commenced with a hearing during which the program managers briefed the panel on their respective programs. The initial briefings were followed by field trips to prime and subcontractors' facilities where the panel conducted hearings and toured production plants. During the field trips the witnesses included management and supervisory contractor personnel, Defense Contract Administration Services Plant Representatives Office (DCASPRO) personnel, Air Force Plan Representatives Office (AFPRO) personnel, Navy Plant Representatives Office (NAVPRO) personnel, program managers, and other DOD personnel.

This section contains a brief discussion of cost and schedule history, major causes of cost growth, and major recommendations related to each of the cases studied. The hearing records for each of the cases provide detailed discussions of the issues summarized in this section.

Black Hawk Helicopter Program

During the panel's study of the Black Hawk program, one day was devoted to on site inspections and hearings at the General Electric Company in Lynn, Massachusetts, and a day at Sikorsky Aircraft in Stratford, Connecticut. Subsequent to the visit with Sikorsky, the panel held hearings with Black Hawk subcontractors at the Wyman Gordon Company in Worcestor, Massachusetts, and also discussed cost growth issues with representatives from the National Tool and Die Company, Hamilton Standard Company, Fenn Manufacturing Company, and Fafnir Bearing Company.

The genesis of the Black Hawk program can be traced to the Vietnam War when the helicopter became an integral element of the air mobility doctrine. The principal aircraft used in Vietnam was the UH-1, "Huey". During the Vietnam War a wealth of technical and operational knowledge was compiled on air mobility and troop air assault requirements. The Black Hawk program evolved from these requirements. Field testing of Black Hawk helicopters by several elite Army units, such as the 101st Airborne, Air Assault Division, 82nd Airborne Division, and the 9th Infantry Division, convincingly demonstrated that the performance characteristics of the Black Hawk are superior to the Huey. Figure 4 demonstrates the improvements in capability provided by the Black Hawk.

	Black Hawk	UH-1H
Cruise speed	145 KTAS	105 KTAS.
Vertical Climb (95 percent IRP)	637 FPM/11 troops	0 FPM 0 troops.
Endurance	2.3 hrs	2.1 hrs.
Single engine	109 KTAS/11 troops	Autorotation.
Empty weight	10,624 lbs	5,200 lbs.
Design gross weight	16,260 lbs	6,600 lbs.
Maximum gross weight	20,250 lbs	9,500 lbs.

Figure 4.—Performance comparison at 4,000 feet 95 degrees with 3 crew, mission fuel

Cost and Schedule History

In 1977 the Black Hawk program projected a total program procurement of 1,107 helicopters with an average production rate of 14 per month from fiscal year 1977 to 1985. However, while developing the fiscal year 1980 Five-Year Defense Plan (FYDP), the Army and DOD determined that the procurement of the Black Hawk based on the initial 1977 schedule was not possible with the funds available. The Black Hawk program manager, Colonel Andreson, stated the situation best when he said:

> Subsequently, the Army in formulating the five-year defense program for fiscal years 1980–84 determined that procurement of Black Hawk to the DCP schedule was not within planned total obligational authority, when consideration was given to acquisition of other major high priority systems during this time frame. Accordingly, for affordability reasons the procurement plan was restructured for a maximum rate extending into fiscal year 1986.

As a result, the Black Hawk program was "restructured"—starting in fiscal year 1979 to remain within the approved budget. This resulted in reducing the fiscal year 1979 and fiscal year 1980 production from 129 to 92 helicopters and from 145 to 94 helicopters, respectively. As Colonel Andreson testified:

> Projection of the revised cost estimates resulting from the restructured contracts, plus inclusion of the SOTAS . . . procurements within the overall H–60 production schedule, necessitated further revision to the procurement schedule. The result was that H–60 series aircraft would be planned for an average production of eight per month with procurement ending in fiscal year 1991. Although several variations have occurred since the fiscal year 1981 budget submission, the current Army schedule for H–60 systems is essentially as envisioned in the fiscal year 1981 budget submission with procurement extending through fiscal year 1991 at an average rate of eight per month.

A review of the Black Hawk procurement schedule (figure 5) reveals that the program has been stretched an additional 6 years.

Fiscal year	DCP No. 13	Fiscal year 1980	Fiscal year 1981	Current
1977	15	15	15	15
1978	56	56	56	56
1979	129	129	92	92
1980	168	145	94	94
1981	168	145	80	80
1982	168	145	96	96
1983	180	145	75	96
1984	180	145	29	84
1985	43	145	31	63
1986		37	65	54
1987			96	54
1987			96	70
1988			96	54
1989			96	96
1990			96	96
1991			90	61
Total	1,107	1,107	1,107	1,107

FIGURE 5.—Black Hawk Procurement Schedules

During the investigation the program manager reported that the estimated cost for 1,107 Black Hawk helicopters has increased from $1,924.5 million in December 1971 to $7,240.3 million. This represents a cost growth of $5,315.8 million or about 275 percent. A summary of the history of Black Hawk cost growth is in figure 6.

	Aircraft quantity	Estimate (in millions)	Change (in millions)	Change (in percent)
DCP No. 13 (June 1971)	1,107	$1,897.4		
December 1971 SAR	1,107	1,924.5	+$27.1	1.4
December 1972 SAR	1,107	1,924.5	0	0
December 1973 SAR	1,107	2,249 6	+325.1	16.9
December 1974 SAR	1,107	3,483.4	+1,233 8	54.8
December 1975 SAR	1 107	2,864.0	−619.4	−17 8
December 1976 SAR	1,107	2,937.0	+73.0	2.5
December 1977 SAR	1,107	3,147.0	+210.0	7 2
December 1978 SAR	1,107	3,175.4	+28.4	0.9
December 1979 SAR	1,107	5,242.7	+2,067.3	65.1
December 1980 SAR	1,107	6,099.6	+856.9	16.3
Fiscal year 1982 HASC hearing	1,107	7,721.6	+1,622.0	26.6
Current	1,107	7,240.3	−481.3	−6.2

FIGURE 6.—Procurement Cost Growth

During the panel's field hearings at the Sikorsky facility, Sikorsky management indicated that the increases in cost of the Black Hawk since 1976 are due to inflation, airframe and engine costs, stretch-outs, added equipment and changes in assumptions. Further, Sikorsky representatives indicated that prior to 1976 *all* the cost increase was attributed to inflation.

Sikorsky management said that the key factors contributing to the cost growth in the airframe were: Rapid-rate buildup of multiple models; impact of new technologies; overlap of development and production (program concurrency); fluctuation in delivery rates; less than effective cost controls in early years and supplier base uncertainties.

Colonel Andreson testified that those factors that contributed to cost growth in the Black Hawk program are inflation, production startup problems at Sikorsky, procurement schedule stretchouts, and unrealistic budgeting. Colonel Andreson said, "The first of those [contributors to cost growth] is *actual inflation in excess of OSD inflation projections that we are given to utilize in the preparation of our budget*, and is also reported in the Selected Acquisition Reports." (Emphasis added.) Figure 7 is a chart which compares OMB/DOD inflation indices with those actually experienced.

Fiscal year	Projected inflation factor		Actual inflation factor	
	Simple	Compound	Simple	Compound
Procurement				
1972	1.026	1.026	1.0523	1.0523
1973	1.028	1.055	1.0410	1.0954
1974	1.025	1.081	1.0847	1.1882
1975	1.067	1.154	1.1935	1.4181
1976	1.100	1.269	1.0939	1.5512
1977T	1.025	1.301	1.0252	1.5903
1977	1.075	1.398	1.0396	1.6533
1978	1.062	1.485	1.0826	1.7900
1979	1.060	1.574	1.0974	1.9643
1980	1.062	1.672	1.1444	2.2479
RDTE:				
1972	1.038	1.038	1.056	1.056
1973	1.046	1.086	1.046	1.105
1974	1.044	1.134	1.076	1.189
1975	1.068	1.211	1.082	1.286
1976	1.070	1.295	1.074	1.381
1977T	1.018	1.319	1.041	1.438
1977	1.060	1.398	1.054	1.515
1978	1.069	1.494	1.070	1.621
1979	1.062	1.587	1.084	1.758
1980	1.063	1.687	1.094	1.923

Fiscal year 1971 base.

FIGURE 7.—Comparison of OMB/DOD inflation estimates with actual for the Black Hawk rogram

Production Start-up Problems Resulted in Cost Growth

Early in 1977, Black Hawk production started, and it was not without its problems. In 1976 Sikorsky had reduced its work force by about 33 percent because of a reduced business base. When the Black Hawk contract was awarded, a new production line had to be installed and new people had to be hired and trained.

The lack of sufficient plant tooling and inefficient production plant layout resulted in increases in direct labor due to increases in overtime and parts shortages. In order to respond to these tooling problems, Sikorsky bought additional tooling and nearly doubled the Black Hawk work force. One of Sikorsky's managers summarized the situation when he said:

> Within a few years, in the late seventies, associated with the buildup of production, there was significant investment of capital, both plant and equipment—the heaviest part being equipment—totaling $135 million which more than doubled our physical plant investment. *This scale of investment was not an unknown at the time we entered into the first contract but the complexities of that process perhaps were not fully appreciated at the time.*
>
> Finally, in terms of manpower, we have grown from about 6,000 up to just about 12,000 at this point, in effect doubling

> the work force. That really sets the stage for the kind of environment that we have lived under during the last five years. (Emphasis added.)

Initiatives To Improve Cost Management

During the hearing Sikorsky management said that in order to improve cost management it has: implemented major management reorganization, reduced the backlog of work, instituted better overtime controls, developed more efficient labor redistribution, increased vendor competition, provided for greater materials substitution, and initiated vendor "should cost" visits.

The Department of the Army's recent cost controls initiated for the Black Hawk program include: encouraging level product buying, recommending congressional approval of multiyear contracting, conducting "should cost" studies and follow-ups, and implementing procedures to place more emphasis on cost reduction goals in contracting practices.

Contractors' Major Recommendations

Sikorsky and several of its Black Hawk subcontractors recommended some ways to control costs in the future. These ideas included: (a) increase program stability by multiyear contracting and decreasing program uncertainty; (b) include realistic inflation estimates in the budget and if not in the budget, in the SAR, at least, as an alternative; (c) expand use of cost trade-off studies; (d) reduce competitive optimism; (e) improve the budget process and obtain contractor proposals before POM submittals; and (f) standardize dimensions on engineered components for revised and new equipment design.

Conclusion

Two major issues emerged from the Black Hawk study. First, it vividly illustrated that the primary factors which contributed to program cost growth are: (a) unrealistic estimates of inflation; (b) poor contractor estimates in the early production stage; (c) questionable management procedures; (d) program stretch-outs; and (e) the failure to budget for the "most likely" cost.

Secondly, the case study highlighted the need for DOD source selection panels to closely review recent production experience, availability and composition of work force, production capacity, and capital investment planning during the program evaluation process.

Patriot Missile System

During the study of the Patriot Missile System program, the panel visited the Raytheon Company's plant in Andover, Massachusetts. The panel received testimony from representaives of the Raytheon Company and subcontractors including the Martin Marietta Corporation, Bendix Corporation, and Craig Systems Corporation. Discussions were also held with Defense Contract Administration Services Plant Representatives Offices (DCASPRO) personnel and personnel from the program manager's office. The Patriot Missile System's major program participants are displayed in figure 8.

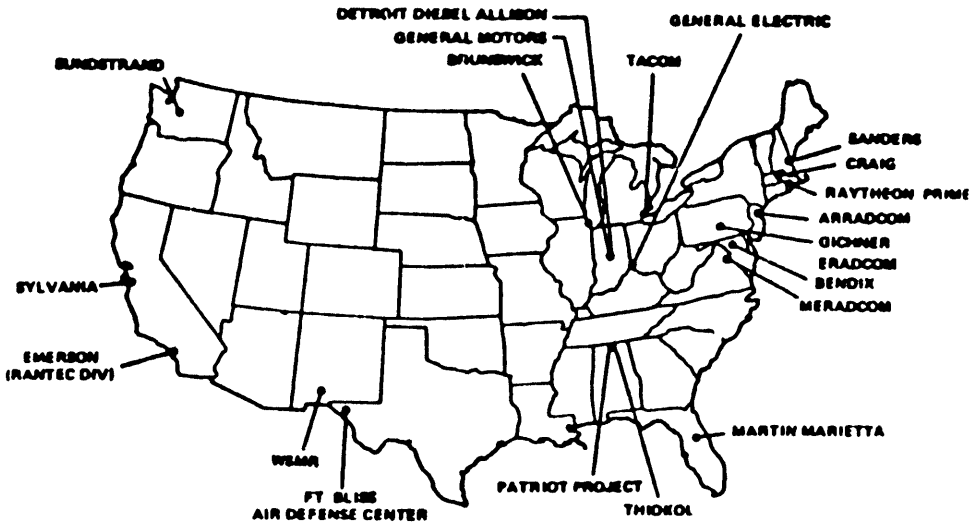

FIGURE 8.—Patriot Major Program Contributors.

The Patriot Missile System was initially approved for full scale engineering development in March 1972. The Patriot Missile System evolved from the SAM–D Air Defense Missile program which began in 1966. In 1967 Raytheon won the competitive contract, and by 1970 had competed in the advanced development phase.

In 1972 the first engineering development contract was signed. Figure 9 shows the current program schedule.

PROGRAM SCHEDULE

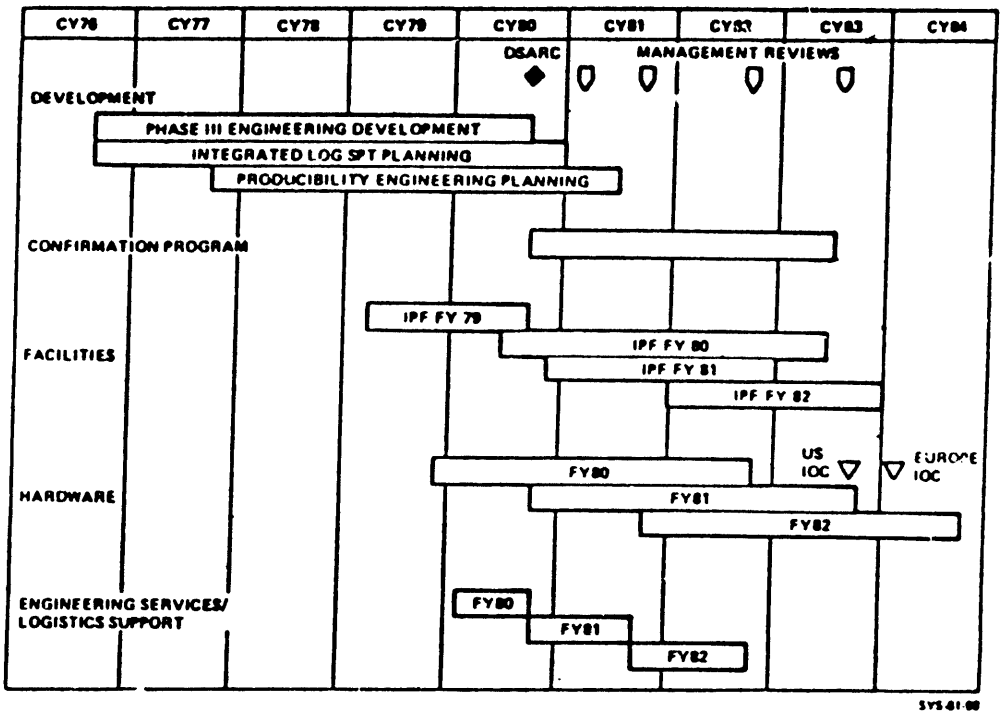

FIGURE 9.—Program Schedule.

The development effort was subsequently reoriented in January 1974 to prove the principle of the track-via-missile guidance concept. Although the concept was approved in November 1975, full scale development was not resumed until February 1976. During the period August 1978–June 1980, development testing and operational testing (DT/OT) occurred. The program completed its DSARC III review in August of 1980 which authorized limited production, and directed additional operational readiness testing. The program manager, General Jerry Bunyard, discussed the reasons for the limited production decision when he said:

> During fiscal year 1980, Patriot completed a series of stringent tests and evaluations culminating in a limited production decision. It was determined that the basic design of the system was demonstrated, but there were concerns that performance in all electronic countermeasure conditions were not demonstrated.

The Patriot Missile System is now scheduled to be deployed starting in 1983.

Cost and Schedule History

The current production program reflects annual production rates of 5 fire units in fiscal year 1980, 5 units in fiscal year 1981, 12 units in fiscal year 1982, 18 units in fiscal year 1983, and 18 fire units in subsequent years for a total by fiscal year 1986 of 103 fire units.

Since June 1979, the estimated production cost for the Patriot program has increased by approximately $2.5 billion, and the factors contributing to this cost growth are outlined in figure 10 below.

(ESC $ IN MILLIONS)

	ESC
JUN 79 SAR	3806.6
INCREASED TESTING	+95.4
DESIGN	+257.6
SCHEDULE	+511.6
INITIAL SPARES	+578.5
ESTIMATING	+599.9
ECONOMIC	+754.9
CONTINGENT LIABILITY	+40.0
CURRENT ESTIMATE (5, 5, 12, 18 PROGRAM)	6644.5[1]
ECONOMIC (MAR 81 INDICES)	-343.7
JUN 81 SAR	6300.8
DELTA	2494.2

[1] CONGRESSIONAL RECORD (AUG 80 INDICES)

FIGURE 10.—Production Cost Track June 19, 1979 to June 19, 1981.

General Bunyard, in explaining the cost growth which resulted from the additional testing, said:

> Increased testing ($95.4 million) reflects corrective measures and additional testing in fiscal year 1981–82 to eliminate minor shortfalls experienced during development and operational tests. The cost of the testing is $61.7 million. However, because of funding constraints the equipment deleted to fund the testing was rescheduled in fiscal year 1987–88 at an increased cost for inflation of $30.7 million. The total program impact of additional testing is $95.4 million.

As is obvious from figure 10, the largest cost increase ($754.9 million) is due to economic factors—inflation. General Bunyard expressed some of the same frustration the panel heard throughout its investigation when he said that inflation estimates are consistently below the inflation rates actually experienced. In the case of the Patriot, it was said that the use of unrealistic inflation estimates "*reduced the buying power by $87 million in fiscal years 1979, 80, and 81.*" The panel found that unrealistic inflation estimates account for 34 percent of the total unanticipated cost growth experienced by the Patriot program since 1972.

During the case study, the difficulty of developing cost estimates for high technology systems without the advantage of having a historical data base, was highlighted. Inaccurate estimating accounts for $599 million of the cost growth which occurred during the period June 1979 to June 1981. Since 1972, poor estimating has accounted for 29 percent of the total cost growth.

Program instability to include schedule changes resulted in production rates being reduced from 24 to 18 per year and contributed $511.6 million to program cost growth. Schedule changes account for 18 percent of the total program cost growth to date. General Bunyard discussed those factors contributing to program instability during the 1979–1981 time period when he said:

> Funding restraints in recent years have caused the planned sustained fire unit production rate to be reduced from 24 to 18 per year. The cost model being used at the time of this rate change did not consider the impact of production rate changes correctly. Consequently, the costs reflected in the June 1979 and earlier Selected Acquisition Reports were understated by $229.3 million. The SDDM, amended program decision memorandum, and the $25 million cut in fiscal year 1981 have caused 13 fire units and 283 missiles to be moved to the end of the program. These actions extended production by one year and added $282.3 million to the program, for a total schedule increase of $511.6 million.

Additionally, the $578.5 million cost growth in the spare parts accounts resulted from poorly estimating initial spare parts requirements. This estimating error accounted for 10 percent of the total program cost growth.

Controllable and Uncontrollable Cost Factors

The panel was told during this case study that fully 53 percent of the program cost growth which occurred in 1979 resulted from factors

beyond the program manager's control. The contributors to cost growth were: Scheduling changes (21 percent), unrealistic inflation estimates (16 percent), increases in GFE (12 percent), and increased testing requirement (4 percent). The remaining 47 percent cost growth was attributed to program decisions over which the program manager could exercise some control. Those controllable cost growth factors were underestimating initial spare parts requirements (23 percent), design changes (10 percent), and poor estimating (14 percent).

Summarizing, those controllable and uncontrollable factors which contributed to the cost growth experienced by the Patriot program are: Funding constraints resulting in economically inefficient production rates, unrealistic inflation estimates, changes in requirements to include additional performance testing, and increases in the cost of Government Furnished Equipment (GFE).

Systems for Managing Cost Growth

The Patriot program manager indicated that among the management systems used to control cost are: Integrated management reports, monthly internal program status reviews, management reviews, contract incentives, schedule management, and Selected Acquisition Reports. Several of these management systems require schedule and cost performance reporting which provides prospective management information on contract and program cost growth. Figure 11 is an example of one of the more useful reports.

CONTRACT	COST OF WORK PERFORMED TO DATE				TOTALS AT COMPLETION		
	ACTUAL COST	C/B[1]	VARIANCE SCHEDULE	VARIANCE COST	BUDGETED	LRE[2]	VARIANCE
ED & PEP	1,137,852	1,383	(3,218)	(60,685)	1,108,265	1,159,911	(51,646)
GROWTH PROGRAM	1,028	127	(441)	298	9,235	9,235	-0-
IPF 1	56,227	1,139	(2,789)	(5,335)	54,307	58,391	(4,084)
IPF 2	50,518	3,528	(10,729)	1,848	73,930	72,770	1,160
IPF 3	508	801	(1,092)	340	11,014	10,827	187
PRODUCTION 1	106,879	17,899	(5,154)	(4,795)	225,717	210,766	14,951
PRODUCTION 2	13,081	24,555	-	(13,081)	132,505	132,505	-
ENG SERVICES FY 81	51,793	775	38	2,131	72,896	72,896	-
BOA	4,677	495	(652)	(311)	9,314	8,944	370
I & KPC NO. 2	85	-0-	-0-	-0-	3,256	3,256	-0-
					1,700,439	1,739,501	(39,062)

[1]COMMITTMENT BALANCE

[2]LATEST REVISED ESTIMATE

SYS-81-183

FIGURE 11.—Patriot Program Integrated Cost Performance Report (July 1981) Cumulative Data ($1,000's)

Major Recommendations From Contractors—Prime and Sub-Tier

The major recommendations from Raytheon, Martin Marietta, Craig, and Bendix were to: Encourage economically efficient production rates, use multiyear contracting, provide for adequate funding through the budget process, and improve program stability.

Conclusion

The panel believes that in addition to highlighting cost growth factors, this case demonstrates the cost impact of protracted research, development, testing, and evaluation. The Patriot was started as SAM-D in 1966. The first full scale production will not take place until 1982, some 16 years later, and deployment is not scheduled until 1983.

Air Launched Cruise Missile (ALCM) Program

The ALCM case study involved detailed hearings conducted at the Boeing Aerospace Company in Seattle, Washington, at the Litton Industries, Advanced Electronics Group facility in Los Angeles, and at the General Dynamics plant and the Loral Data Systems, Conic Corporation plant in San Diego. In addition to receiving testimony from Boeing management, the panel heard from the management of Williams International, an associate contractor. The panel also inspected the Oklahoma City Air Logistics Center, Tinker Air Force Base, Oklahoma, and met with the commander and his staff.

The ALCM program evolved from the Subsonic Cruise Armed Decoy program which was cancelled in 1972. The project was reinstituted as the non-decoy program, AGM-86A, in 1973. After the AGM-86A had completed six flights and passed its Defense System Acquisition Review Council review (DSARC II) in 1977, a decision was made to establish a joint Navy/Air Force Cruise Missile project. The purpose of the joint cruise missile project was to take full advantage of tasks which were common to all cruise missiles.

Full scale engineering development contracts were awarded to Boeing and General Dynamics in 1978, which marked the beginning of 2 years of competition between the two companies. In February 1980, Boeing was selected, and in April Boeing was awarded a contract to produce 225 missiles in fiscal year 1980 with an option of 480 missiles in fiscal year 1981. Figure 12 shows the evolution of the ALCM program.

Early in the program, the Joint Cruise Missile Project Office (JCMPO) was assigned the responsibility of managing the cruise missile program. However, in May 1980, the responsibility for actually building the missile and integrating it with the B-52 aircraft was transferred to the Aeronautical Systems Division Strategic Systems System Project Office (SPO), Air Force Systems Command and the B-52 system manager at the Oklahoma City Air Logistics Center. Contracts and programs associated with the navigation and guidance systems and the engine continued to be managed by the JCMPO.

Since the ALCM will utilize the B-52G as a launch platform; modifications to the B-52G have to be accomplished. Colonel Rutter, ALCM program manager, in discussing the status of the program stated:

> We have been working diligently to accomplish the many varied tasks required to have available for the Strategic Air Command (SAC) one B-52G, with updated offensive avionics, equipped with 12 ALCMs, and associated support equipment, by the end of this month (September). We are happy to report that, in spite of a high degree of concurrency in the ALCM and OAS development programs, we will meet that

date of 30 Sept. 1981. At the same time we have been working to achieve this milestone, we have been devoting a great deal of attention to the progress of the FY 1980 production of the missiles, airplanes and necessary support equipment to achieve the Initial Operational Capability (IOC) of 16 fully equipped B-52Gs at Griffiss AFB NY in Dec. 1982.

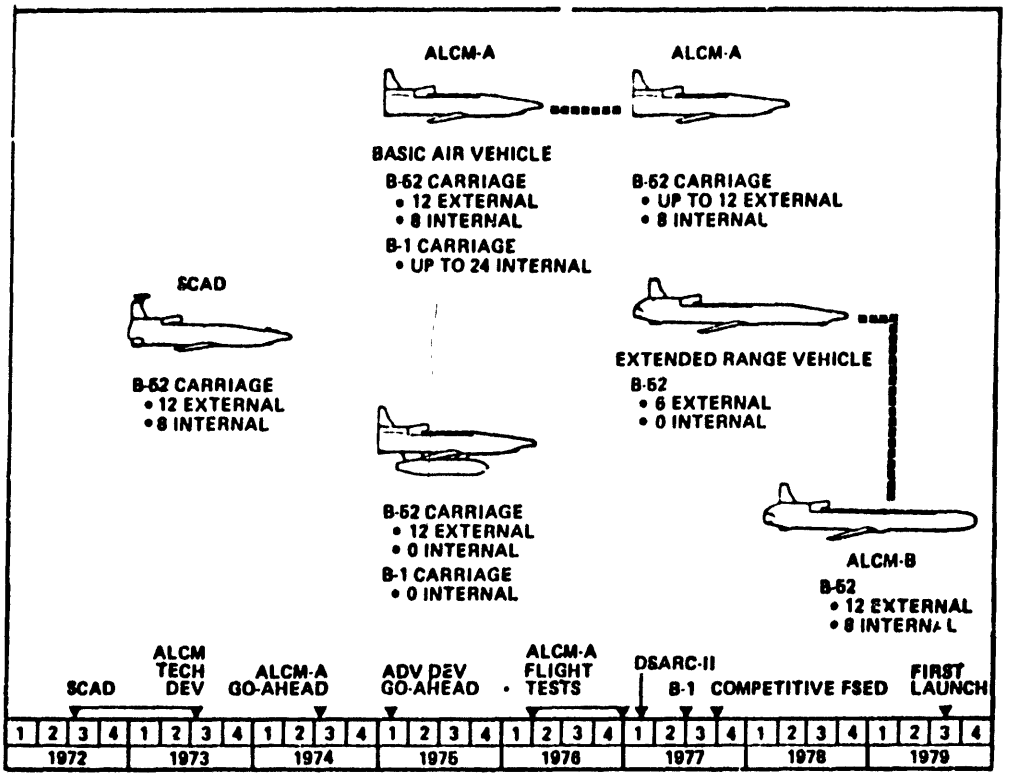

FIGURE 12.—Weapon system evaluation.

Cost and Schedule History

Since 1977 when the initial development and procurement estimates were made, the ALCM program has experienced a cost growth of approximately 50 percent for development and 36 percent for procurement. The primary contributor, according to Colonel Rutter, was the uncertainty of engineering design and development. He stated, "The larger percentage cost growth in the development portion is indicative of the uncertainty in making development estimates and reflects our desire to provide adequate 'up front' investment to assure reasonable procurement and support costs in the future."

The case study revealed that major ALCM program problems which impacted upon costs were: Meeting compressed schedules, changing performance requirements, split management responsibilities, cost estimating, competition, and achieving efficient production rates. Although unrealistic inflation estimates are not included in the list of cost contributors, figure 13 illustrates the actual effects of OMB/DOD—directed inflation estimates.

Inflation rates originally programmed by OSD/AF and reflected in the first ALCM Selected Acquisition Report dated December 31, 1977.

	FY 77	FY 78	FY 79	FY 80	FY 81	FY 82
RDT&E						
Budgeted %	4.2	7.0	8.7	5.8	5.5	4.8
Actual %	5.2	8.5	9.7	11.8	11.2	11.5
Variance %	-23.8	-21.4	-11.5	-103.4	-103.6	-139.6
PROCUREMENT						
Budgeted %	1.6	7.0	5.3	5.4	5.5	5.3
Actual %	5.2	8.5	9.7	11.8	11.2	11.5
Variance %	-225.0	-21.4	-83.0	-118.5	-103.6	-117.0

FIGURE 13.—Budget versus Actual Inflation Rates.

In response to a question concerning life-cycle cost, it was indicated that life-cycle cost is an issue which is included in DSARC reviews; therefore, program managers are required to develop life-cycle cost estimates early in the acquisition program. The current life-cycle cost estimates for the ALCM program is shown in figure 14.

ALCM **($ M - BASE YEAR FY77)**

		(OCT 77) DEVELOPMENT ESTIMATE	(JUN 81) CURRENT ESTIMATE	PERCENT VARIANCE
● DEVELOPMENT A	QUANTITY	35	24	-32
	DOLLARS	696.1	939.3	26
● PROCUREMENT B	QUANTITY	3424	3418	-0.2
	DOLLARS	2311.6	2542.5	9
● CONSTRUCTION		121.4	156.5	23
● OPERATING & SUPPORT (15 YRS) (3370 ALCMs)		1132.1	933.9	-18

A. INCLUDES $122.7M IN DEVELOPMENT COSTS, PRIOR TO THE BASE YEAR WHICH HAVE NOT BEEN ESCALATED TO CONSTANT FY77 DOLLARS

B. EXCLUDES CARRIER AIRCRAFT EQUIPMENT

FIGURE 14.—ALCM Life Cycle Cost Estimate Track.

As the above figure shows, the largest percentage—25 percent—of unanticipated cost growth occurred during the development phase.

Cost growth during the development phase can be attributed to those initiators identified in figure 15.

FIGURE 15.—*Estimated Cost Growth Initiators*

	Cost (millions)
Government initiated:	
Delay Competition While Awaiting Supplemental	$79.7
B-52 Integrations	109.2
Guidance	14.0
Propulsion	14.1
Develop depot support equipment—airframes	8.2
Total	225.2
Contract initiated:	
Boeing: Competitive flyoff extension	4.0
Williams: Problem resolution	5.0
McDonnell Douglas: Problem resolution	5.0
General Dynamics: Competitive flyoff extension	4.0
Total	18.0
Grand total	243.2

Associate Contractor Interface

The ALCM program manager office, in addition to contracting with prime contractors, also deals with manufacturers of major subsystems and components. It contracts with Williams International, an associate contractor, for the development and production of the F107 engine. Although the use of associate contractors requires a more direct technical and production management by the Government, the ALCM program appears to have used this approach successfully.

Competition—Dual Sourcing

The "fly-off" between Boeing and General Dynamics was described as "hard fought", but the panel was also interested in the testimony received regarding the use of a "dual-sourcing" approach to increase competition for major subsystems and components. While the ALCM was in full scale development, a decision was made to provide dual-sourcing for the Inertial Navigation Element (INE), the engine, and the missile radar altimeter. Colonel Rutter said:

> We now have two independent sources, which both happen to be divisions of Litton, for the INE. However, we have a formal agreement between the Government and Litton which guarantees the two divisions will operate at arms length from one another and will be fully price competitive. This venture has been highly successful, and we have already seen the benefits in lower than expected prices for INE's in the FY 81 buy. We are on the verge of substantiating that the Teledyne Continental Aircraft Engine (TCAE) division can independently produce the Williams International developed F-107 engine under a licensing agreement between the Government and Williams International. A technology transfer program to get TCAE to this point has been costly and TCAE early production engines will not yet be competitive in price with the Williams product. However, we believe

TCAE will become competitive within two years and the ALCM and other cruise missile programs will benefit from this competition.

During the panel's deliberations, it became clear that most DOD policies concerning cost control were aimed at the Government's relationship with prime contractors. However, the capacity, financial soundness, and availability of subcontractors was left to the individual practices of prime contractors. While the panel would not wish to intrude into the private, contractual relationships of individual firms, it is clear that actions aimed at controlling cost growth must consider fully the role of subcontractors and vendors. The ALCM program benefited from several such actions, including *dual-sourcing*. Colonel Rutter said, "I am convinced the ALCM competition reduced the cost of the AGM-86B substantially from what it would have been in the absence of competition, and it also provided the leverage to induce the Boeing Company to invest $50 million in a new plant which will allow them to produce more efficiently."

Major Recommendations

The major recommendations from ALCM prime and subcontractors for reducing weapon systems cost growth are to: Provide for program stability; use realistic cost estimates in budget proposals; employ multiyear contracting procedures, utilize appropriate contract types with reasonable risk sharing; use realistic inflation estimates; pursue production competition and second sourcing where appropriate; implement "design-to-cost" and "will-cost" studies early in the acquisition program; and determine if a second production source is appropriate early in the full scale development phase.

Conclusion

The recommendations made during the ALCM case study generally were identical to those identified in the other case studies. However, the ALCM study was the only case in which the concept of dual-sourcing was actively pursued as a conscious policy early the full scale development phase.

It was clear from testimony given during this case study that competition, not only during the development stage but also during the production stage, is highly desirable for a program of this nature.

APPENDIX C

Witness List

List of witnesses appearing before the Special Panel on Defense Procurement Procedures of the Procurement and Military Nuclear Systems Subcommittee on the matter of the Defense Department's procurement policies and practices.

JULY 21, 1981

Honorable Russell Hale, Assistant Secretary of the Air Force for Financial Management.

Mr. John Beach, Director of Plans and Systems, Office of the Assistant Secretary for Programs and Budget, Department of Defense.

JULY 23, 1981

Major General William Campbell, Director of Programs, DCS Programs and Resources, U.S. Air Force.

Major General Patrick Roddy, Director, Program Analysis and Evaluation, Office of the Chief of Staff, U.S. Army.

JULY 28, 1981

Major General Robert Herriford, Director for Procurement and Production, U.S. Army Materiel Development and Readiness Command.

JULY 30, 1981

Mr. John Quelsch, Principal Deputy Assistant, Secretary of Defense, Comptroller, Department of Defense.

SEPTEMBER 10, 1981

Colonel Ronald Andreson, Project Manager, Black Hawk, U.S. Army Materiel Development and Readiness Command (DARCOM).

Mr. Mark Barkley, Program Management Division Chief, Black Hawk Program Management Office.

Mr. Jim Brennan, Procurement and Production Directorate, U.S. Army Aviation, Research and Development Command (AVRADCOM).

Mr. Charles Crawford, Director, Development and Qualifications Directorate, U.S. Army Aviation, Research and Development Command (AVRADCOM).

Brigadier General Jerry Max Bunyard, Project Manager, Patriot Missile System, U.S. Army Materiel Development and Readiness Command (DARCOM).

SEPTEMBER 18, 1981 (FIELD HEARING)

Mr. Charles E. Jacobs, Vice President and General Manager, Marketing, Patriot Program, Raytheon Corporation.

Mr. John P. Shanley, Vice President and Program Manager, Patriot Program, Raytheon Corporation.

Mr. Albert H. Bryan, Jr., Vice President, Corporate Development, Raytheon Corporation.

Mr. Wayne A. Diehl, Manager, Marketing, Patriot Program, Raytheon Corporation.

Lt. Col. V. J. Soron, Commander, Defense Contract Administration Services Plant Representatives Office (DCASPRO), U.S. Army.

Lt. Col. Daniel Vooys, Chief, Patriot Raytheon Field Office, U.S. Army.

Mr. Ronald Schille, Electronic Engineer, Production Division, Defense Contract Administration Services Plant Representatives Office (DCASPRO), U.S. Army.

Mr. Philip Metivier, Corporate Administrative Contracting Officer, Defense Contract Administration Services Plant Representatives Office (DCASPRO), U.S. Army.

Major Richard Brownell, Chief, Contract Administration Division, Air Force Systems Command, U.S. Air Force.

Mr. Frank Malatesta, Patriot Program Director, Martin Marietta Corporation.

Mr. Palmer Arnold, Director of Marketing, Communications Division, Bendix Corporation.

Mr. John Chapman, Vice President, Government Relations, Bendix Aerospace Electronics Group, Bendix Corporation.

Mr. Richard Estes, President, Craig Systems Corporation.

SEPTEMBER 19, 1981 (FIELD HEARING)

Mr. H. Gerard Donohie, Manager, T-700 Programs, General Electric Company.

Captain F. B. Stumcke, Navy Plant Representatives Office (NAVPRO), U.S. Navy.

Mr. Louis Bevilacqua, General Manager, T-700/T-58/T-64 Projects Department, General Electric Company.

Mr. Edmund McKeown, Counsel, Military Engine Operations, General Electric Company.

Mr. Robert Leavitt, Manager, MEPD Finance, General Electric Company.

Mr. A. Bill Daly, Manager, Production Engineers Management, General Electric Company.

Mr. Anthony Coit, Head, Price Analysis Branch, Navy Plant Representatives Office (NAVPRO), U.S. Navy.

Colonel Ronald Andreson, Program Manager, Black Hawk, U.S. Army Materiel Development and Readiness Command (DARCOM).

Mr. William Crawford III, Vice President and General Manager, Military Engine Projects Division, General Electric Company.

SEPTEMBER 21, 1981 (FIELD HEARING)

Mr. R. F. Daniell, President, Sikorsky Aircraft, United Technologies.

Mr. L. Allison, Senator Vice President, Finance, Sikorsky Aircraft, United Technologies.

Mr. G. Rast, Director, Government Business, Sikorsky Aircraft, United Technologies.

Mr. William Paul, Executive Vice President, Sikorsky Aircraft, United Technologies.

Mr. Harvey White, Vice President, Materiel, Sikorsky Aircraft, United Technologies.

Mr. William Minter, Vice President, Black Hawk Program, Sikorsky Aircraft, United Technologies.

Colonel Ronald Andreson, Program Manager, Black Hawk, DARCOM.

Mr. James R. Brennan, Industrial Management Officer, U.S. Army Aviation Research and Development Command.

Mr. John Lovkay, Senior Vice President, Electronic Systems Department, Hamilton Standard, Division of United Technologies.

Mr. Thomas West, Business Manager, Controls, Hamilton Standard, Division of United Technologies.

Mr. Douglas Hess, Program Manager, Hamilton Standard, Division of United Technologies.

Mr. Joseph Fucci, Contracts Administrator, Hamilton Standard, Division of United Technologies.

Mr. George Kopochus, President, National Tool and Die Company.

Mr. William Gauthier, Vice President, The National Tool and Die Company.

Mr. V. Keith Baldwin, Manager, Product Marketing, Aerospace, Fafnir Bearing Division, Textron Inc.

Mr. Harold Brodsky, Executive Vice President, Fafnir Bearing Division, Textron Inc.

Mr. John Bullock, President, Wyman-Gordon Company.

Mr. Jack Odell, Acting Director, Sales and Marketing, Wyman-Gordon Company.

Mr. M. L. Hansen, President, The Fenn Manufacturing Company.

Mr. Alan Carlson, Vice President, Sales and Engineering, The Fenn Manufacturing Company.

Mr. John Matson, Corporate Manager, Communications and Government Relations, Wyman-Gordon Company.

Mr. Paul Wisniewski, President, Reisner Metals, Inc., Subsidiary of Wyman-Gordon Company.

SEPTEMBER 24, 1981

Colonel Joseph Rutter, Air Launched Cruise Missile (ALCM) Program Manager, Air Force Systems Command (AFSC), U.S. Air Force.

Colonel Charles Whelan, Chief, ALCM Program Control, Air Force Systems Command, U.S. Air Force.

Lt. Colonel Ronald Finkbiner, Chief, ALCM Production, Air Force Systems Command, U.S. Air Force.

SEPTEMBER 25, 1981 (FIELD HEARING)

Mr. J. R. Ray Utterstrom, Vice President/General Manager, Air Launched Cruise Missile (ALCM) Program, Boeing Aerospace Company.

Mr. H. K. Hebeler, President, Boeing Aerospace Company.

Colonel Joseph Rutter, ALCM Program Manager, U.S. Air Force.

Mr. Glenn Martin, Business Manager, Air Launched Cruise Missile (ALCM) Program, Boeing Aerospace Company.

Mr. Dan Pinick, Vice President/Business Manager, Boeing Aerospace Company.

Mr. Howard Stuverude, Vice President, Boeing Aerospace Company.

Colonel Donald Dill, Air Force Plant Representative Office (AF PRO), U.S. Air Force.

Mr. Michael Goers, Vice President, Operations, Williams International Corporation.

Mr. Michael Busch, Director, Contracts and Proposals, Williams International Corporation.

Mr. Robert Ingram, Chief, Air Force Contract Administration Division, AFSC, U.S. Air Force.

Major Gary Kelley, Air Launched Cruise Missile (ALCM) Program Manager Office, U.S. Air Force.

Colonel Lloyd Rowe, Deputy Air Force Plant Representative, U.S. Air Force.

Mr. David Stromberg, Acquisition Information Management Specialist, Air Force Contract Management Division, AFSC, U.S. Air Force.

Mr. Andris Zommers, Contract Administrator, Air Force Contract Management Division, AFSC, U.S. Air Force.

SEPTEMBER 26, 1981 (FIELD HEARING)

Mr. Roland O. Peterson, President, Litton Systems.

Mr. John Preston, Group Vice President, Group Counsel, Litton Systems, Litton Industries.

Mr. Roger Caldwell, Director, Space and Missile Programs, Litton Systems, Litton Industries.

Mr. Seymour Tennenberg, Vice President, Business Development, Litton Systems, Litton Industries.

Mr. Stanley Przybylski, Vice President, Contracts, Litton Systems, Litton Industries.

SEPTEMBER 27, 1981 (FIELD HEARING)

Mr. Kenneth Years, President, Conic Corporation.

Mr. Hugh Bennett, President, Loral Data Systems, Conic Corporation.

Mr. Tom Sheffler, Director of Programs, Loral Data Systems, Conic Corporation.

Mr. William Kirk, Vice President of Marketing, Loral Data Systems, Conic Corporation.

Mr. Robert Giese, Controller, Loral Data Systems, Conic Corporation.

Mr. William McClure, Development Program Manager, Loral Data Systems, Conic Corporation.

Mr. Thomas Heywood, Deputy Materiel Manager, Air Launched Cruise Missile (ALCM) Program, Boeing Aerospace Company.

Mr. Kenneth Cooley, Manager, Marketing Projects, National Steel and Shipbuilding Company.

Mr. John Johnson, Assistant Manager, Contracts Repair, National Steel and Shipbuilding Company.

Mr. Arthur Engel, President, South West Marine, Inc.

Mr. William Wild, Atkinson Marine Corporation.

Mr. Robert McKay, Manager of Contracts, South West Marine, Inc.

Mr. Irving Refkin, General Manager, Bay City Marine, Inc.

Mr. Quanah Hanes, Production Engineer, Ship Repair, Kettenburg Marine.

Mr. George Parker, General Manager, Arewel Corporation.

OCTOBER 7, 1981

Dr. Jacques Gansler Vice President, the Analytic Sciences Corporation.

OCTOBER 15, 1981

Brigadier General Charles Drenz, U.S. Army, Deputy Director for Defense Contract Administration Services (DCAS), Defense Logistics Agency (DLA).

Mr. William Gordon, Executive Director for Contract Management, DCAS, DLA.

Brigadier General Joseph Connolly, U.S. Air Force, Director of Contracting and Manufacturing Policy, DCS/Research, Development and Acquisition.

OCTOBER 20, 1981

Mr. Charles Starrett, Director, Defense Contract Audit Agency.

Mr. Gary Christle, Director, Acquisition Management Information Division, Department of Defense.

OCTOBER 22, 1981

Mr. Walton Sheley, Jr., Director, Mission Analysis and Systems Acquisition Division, General Accounting Office.

Mr. Donald Day, Senior Associate Director, General Accounting Office.

Mr. Fred Fenstermaker, Evaluator, General Accounting Office.

Mr. Patrick Renehan, Chief, Defense Cost Estimates Unit, Congressional Budget Office.

Mr. Edward Swoboda, Analyst, Congressional Budget Office.

Mr. William Myers, Analyst, Congressional Budget Office.

OCTOBER 27, 1981

Mr. Norman Augustine, Vice President, Operations, Martin Marietta Aerospace.

OCTOBER 28, 1981

The Honorable Frank Carlucci, Deputy Secretary of Defense.

Mr. John Smith, Office of Research and Engineering, Department of Defense.

Mr. Gary Christle, Office of the Comptroller, Department of Defense.

APPENDIX D

New Reporting Requirement: Program Cost Assessment Report (PCAR)

The proposed PCAR is an "exception" report which contains program, contract cost and performance information.

1. Definition of Terms: The following definitions are provided for the purpose of this report.

Program Unit Cost is defined as the estimate of the sum of all research and development costs, procurement cost, and military construction cost identified in the Selected Acquisition Report (SAR) divided by the total number of units produced to include prototypes.

Current Change is defined as the estimated change since the last report was provided to the Congress.

Current Cost is defined as the most recent estimate of the cost of the program or weapon system.

Total Cost to-Date is defined as the sunk cost incurred over the life of the program or contract as of the reporting date.

Base-Year is same year as reflected in the SAR for the particular program.

Original Baseline is defined as the planning estimates established at Milestone I. (Requirement validation.)

Current Unit Cost Baseline is the most recent December 31 SAR baseline.

2. Selection Criteria:

A weapon system program will be reported in the Program Cost Assessment Report (PCAR) when it is defined as a major system, or when the total financing for research, development, test and evaluation exceeds $75 million (fiscal year 1980 constant dollars) or when the total production investment exceeds $300 million (constant FY 1980 dollars). Reports may also be provided on programs designated to be of special congressional interest.

Once a program is selected, contracts associated with the program will also be selected based on the following:

Prime, associate, and Government furnished equipment (GFE) contracts that represent the *six* largest dollar investments; or

the sum of all contracts representing at least 90 percent of the total contracting costs for current contracts, whichever is greater.

3. Reporting Requirement:

Since the PCAR system is an "exception" reporting system, reports are required only when dollar thresholds are breached. The dollar thresholds are first breached when either program costs or contractor costs have increased by more than 15 percent from the current unit baseline cost. The current unit baseline cost is reflected in the most recent December 31 Selected Acquisition Report (SAR). Subsequent reports are required for every additional five percent growth in current program unit or contract cost.

4. Format: Example 1 contains an example of the proposed format for the PCAR.

5. Examples of Program Cost Assessment Report: The utility of the PCAR as a prospective management tool can be demonstrated by asking the question, "Would the use of the PCAR have resulted in the early identification of cost growth in the systems reviewed during the case studies?" The panel, therefore, used the costing information available for the three case study programs, Black Hawk helicopter, ACLM, and Patriot Missile, and developed a PCAR for each system. (See examples 2 through 4) The cost information on the Black Hawk, ALCM, and Patriot, was, when possible, taken from the time periods immediately preceding those in which significant cost growth was first identified. A review of these examples will quickly show that if the PCAR were available and utilized in the case of these three systems, there would have been sufficient cause for concern, either because of program cost increases or contract cost increase.

Enclosures.

1. Example of PCAR
2. Black Hawk PCAR
3. Patriot PCAR
4. ALCM PCAR

EXAMPLE
PROGRAM COST ASSESSMENT REPORT

Program Name: Maxthreat
Program Phase: Full Scale Development
Baseline Program Cost (constant $): $1.3 billion
Current Program Cost (constant $): $1.6 billion (23% growth from base line)
Current Program Cost: (escalated $) $2.8 billion (115% growth from base line)
Percent Program Completed: 35% 1/
Percent Program Cost appropriated: 55%
Base Year: fiscal year 1977
Unit Cost Baseline:
Original: December 31, 1977 SAR
Current: 2/ December 31, 1980 SAR

As of: 15 December 1981

	Escalated $ (%) (million)				Constant $(FY 77)(%) (million)				Quantity		
	Original Baseline	Current Chg 3/	Total Chg	Current Cost	Original Baseline	Current Chg 3/	Total Chg	Current Cost	Current Chg 3/	Total Chg	Present Qty
Program Unit Cost Data											
* Program unit cost	1.89	.5(26%)	.7(37%)	2.59	1.2	.1(8%)	.2(17%)	1.4		--	--
* Quantity	1,107	--	--	--	1,107	--	--	--	0	7	1,114

Contract Performance Assessment 4/

* Contractor 5/	Phase	% Completed	Cost Variance ($) (%) Current	Cost Variance ($) (%) Total To-Date	Schedule Variance (%) Total To-Date
General Aircraft	Dev	1%	$1.1 (50%) over	$10.1 (20%) over	1% ahead
Best Engine	Pro	10%	$.1 (1%) over	$.3 (6%) under	20% behind
Top Gun	Pro	15%	$1.0 (10%) under	$.5 (6%) over	3% ahead
Best Engine	Dev	25%	$1.3 (50%) over	$34.1 (50%) over	20% behind
General Aircraft	Pro	90%	--------	$.1 (2%) under	3% ahead
General Aircraft	Dev	20%	$.5 (5%) under	$1.2 (15%) over	11% behind

1/ Years appropriated divided by years planned

2/ Presumes resetting at each "budget" SAR

3/ Measured from the current unit cost baseline

4/ Contracts to be Reported The report should identify the six prime, associate, or GFE contracts, by phase--research and development--that represent the largest dollar investments or contracts that represent at least 90 percent of the total contract cost for current contracts whichever is the greater. Initial reports will be submitted when program or contract current change or total increases by more than 15 percent. Subsequent reports are provided for every additional five percent growth in current change cost for the program or contractors.

5/ Narrative Required

A. Explain problems: Provide a summary explanation of the most significant cost and schedule variances contributing to the changes.

B. Discuss Impact: Quantify the impact these variances will have on future program costs. Also identify any potential schedule slips which could result.

Program Name: UH-60A
Program Phase: Production
Baseline Program Cost (constant $): $1941.7M

Current Program Cost (constant $): $1940.7M
Current Program Cost (escalated $): $3614.7M
3/ Percent Program Completed: 53%
Percent Program Cost Appropriated: 23%
Base Year: FY 1971
Unit Cost Baseline:
Original: December 31, 1971 SAR
1/ Current: December 31, 1977 SAR

As of: June 30, 1978

	Escalated $ (%)				Constant $ (FY71) (%)				Quantity		
	Orig Baseline	Current Chg 1/ 2/	Total Chg	Current Cost	Orig Baseline	Current Chg 1/ 2/	Total Chg	Current Cost	Current Chg 1/ 2/	Total Chg	Current Qty
Program Unit Cost Data											
o Program unit cost	2.05	0	+1.19 (58%)	3.24	1.73	0	-0.23 (-13%)	1.50	-	-	-
o Quantity	1123	-	-	-	1123	-	-	-	0	-6	1117

Contract Performance Assessment

o Contractor	Phase	% Completed	Cost Variance ($) (%) Current 1/	Cost Variance ($) (%) Total-To-Date	Schedule Variance (%) Total-To-Date
Sikorsky	Dev	66%	3.0 (20%) over	7.5 (19%) over	16% behind
General Electric	Dev	92%	1.1 (24%) under	1.0 (3%) under	on schedule
Sikorsky	Prod	39%	3.8 (20%) over	4.2 (14%) over	34% behind
General Electric	Prod	43%	0.8 (8%) over	0.7 (5%) over	9% behind

1/ Presumes resetting at each "budget" SAR.
2/ Measured from the Current Unit Cost Baseline.
3/ Years appropriated divided by years planned

Program Name: PATRIOT
Program Phase: Production
Baseline Program Cost (constant $): $4239.6M

Current Program Cost (constant $): $3672.9M
Current Program Cost (escalated $): $7916.5M
3/ Percent Program Completed: 70%
Percent Program Cost Appropriated: 37%
Base Year: FY 1972
Unit Cost Baseline:
Original: March 31, 1972 SAR
1/ Current: December 31, 1979 SAR

As of: September 30, 1980

	Escalated $ (%)				Constant $ (FY72) (%)				Quantity		
	Orig Baseline	Current Chg 1/ 2/	Total Chg	Current Cost	Orig Baseline	Current Chg 1/ 2/	Total Chg	Current Cost	Current Chg 1/ 2/	Total Chg	Current Qty
Program Unit Cost Data											
o Program unit cost	21.8	+35.0 (+61%)	+51.5 (+136%)	73.3	17.7	+11.4 (+64%)	+16.3 (+92%)	34.0	-	-	-
o Qty (Firing Units)	240	-	-	-	240	-	-	-	0	-132	108

Contract Performance Assessment

o Contractor	Phase	% Completed	Cost Variance ($) (%) Current 1/	Cost Variance ($) (%) Total-To-Date	Schedule Variance (%) Total-To-Date
Raytheon	Dev	95%	12.0 (19%) over	49.8 (5%) over	1% behind
Raytheon	Prod (IPF)	29%	4.2 (17%) over	3.6 (10%) over	28% behind
Raytheon	Prod (E. SER.)	47%	1.9 (19%) under	1.9 (19%) under	on schedule
Raytheon *	Prod	4%	1.9 (48%) over	1.9 (48%) over	31% behind

1/ Presumes resetting at each "budget" SAR.
2/ Measured from the Current Unit Cost Baseline.
3/ Years appropriated divided by years planned.

Program Name: ALCM
Program Phase: Production
Baseline Program Cost (constant $): $3129.1M

As of: December 31, 196

Current Program Cost (constant $): $3564.0M
Current Program Cost (escalated $): $6059.5M
3/ Percent Program Completed: 57%
Percent Program Cost Appropriated: 37%
Base Year: FY 1977
Unit Cost Baseline:
Original: December 31, 1977 SAR
1/ Current: December 31, 1979 SAR

	Escalated $ (%)				Constant $ (FY77) (%)				Quantity		
	Orig Baseline	Current Chg 1/ 2/	Total Chg	Current Cost	Orig Baseline	Current Chg 1/ 2/	Total Chg	Current Cost	Current Chg 1/ 2/	Total Chg	Current Qty
Program Unit Cost Data											
o Program unit cost	1.210	+.24 (16%)	+.550 (+45%)	1.760	0.905	+.09 (+9%)	+.130 (+14%)	1.035	-	-	-
o Quantity	3459	-	-	-	3459	-	-	-	0	-17	3442

Contract Performance Assessment

o Contractor	Phase	% Completed	Cost Variance ($) (%) Current 1/	Cost Variance ($) (%) Total-To-Date	Schedule Variance (%) Total-To-Date
Boeing	Dev	34%	2.3 (8%) over	2.3 (8%) over	2% behind
Williams Res.	Dev	85%	5.8 (190%) over	8.7 (25%) over	1% behind
McDonnell Douglas	Dev	89%	1.5 (10%) over	9.9 (10%) over	1% behind
Boeing	Prod	8%	2.1 (20%) over	2.1 (20%) over	15% behind
McDonnell Douglas	Prod	3%	0.1 (6%) under	0.1 (6%) under	on schedule

1/ Presumes resetting at each "budget" SAR.
2/ Measured from the Current Unit Cost Baseline.
3/ Years appropriated divided by years planned.