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United States Government Accountability Office
Washington, DC 20548

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Congressional Committees

Subject: *Presidential Helicopter Acquisition: Effort Delayed as DOD Adopts New Approach to Balance Requirements, Costs, and Schedule*

In June 2009, the Department of Defense (DOD) terminated the Navy's VH-71 presidential helicopter acquisition program because of cost growth, schedule delays, and a projected shortfall in system performance. The Navy subsequently began efforts to define a follow-on program (the VXX program) to develop aircraft to replace the current, aging presidential helicopter fleet. The Ike Skelton National Defense Authorization Act for Fiscal Year 2011 (the act) directed that we review and report annually to the congressional defense committees on the VXX program through 2013.[1] We issued the first of the required reports last year.[2] In that report, we identified major lessons learned from the terminated VH-71 program that should be applied to the follow-on program and discussed the VXX acquisition approach and the sufficiency of the underlying acquisition plans and related documentation. This is the second of the required GAO reports. It discusses (1) the progress of the program since our last report and (2) DOD's planned upgrades to the fleet of in-service, legacy helicopters and approach for moving the VXX program forward.

To determine the progress of the VXX program since our last report and DOD's planned approach for the future program, we examined available program documents and interviewed program officials. To assess the progress of the Analysis of Alternatives (AOA)[3] effort that was underway when we last reported, we met with and were briefed by officials from the Office of the Under Secretary of Defense for Acquisition, Technology and Logistics (OUSD(AT&L)); the Deputy Assistant Secretary of the Navy, Air Programs; the Navy's Program Manager, Presidential Helicopters Program Office; and the director of the Navy's AOA efforts—the Military Director, Warfare Analysis and Integration Department, Naval Air Systems Command. To determine DOD's planned future approach for the VXX program, we met with OUSD(AT&L) officials and obtained information from the Navy's Presidential

[1]Pub. L. No. 111-383 § 233.
[2]GAO, *Defense Acquisitions: Application of Lessons Learned and Best Practices in the Presidential Helicopter Program*, GAO-11-380R (Washington, D.C.: Mar. 25, 2011).
[3]An AOA is an evaluation of the performance, effectiveness, suitability, and estimated costs of alternative systems to meet a capability. The AOA is normally conducted during the Materiel Solution Analysis phase of the Defense Acquisition Management System to support a Milestone A decision to begin technology development for a preferred solution.

Helicopter program manager on plans for the VXX program and on plans to extend the life and capabilities of the existing presidential helicopters. In addition, we met with officials of the Sikorsky Aircraft Corporation to discuss their work in sustaining the current presidential helicopter fleet until a replacement platform can be fielded.

We conducted this performance audit from March 2011 to February 2012 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

The Marine Corps' HMX-1 squadron currently uses two types of helicopters—the VH-3D and the VH-60N—to carry out the presidential helicopter mission. Over the years, modifications and improvements have been made to both helicopters, which added weight to the aircraft—decreasing other aspects of mission capability, like range, and limiting the ability to incorporate future improvements because of the negative effect of further weight growth. As a result, it has become increasingly difficult to accommodate the demands placed on the HMX-1 aircraft in support of presidential lift requirements. The events following the September 11, 2001 terrorist attacks on the United States highlighted the need for improved transportation, communication, and security capabilities for presidential support aircraft. As a result, a replacement helicopter program, later designated the VH-71 program, was initiated in April 2002 to begin fielding a new helicopter in the 2011 time frame. In response to a November 2002 White House memorandum, the Navy subsequently adopted an accelerated plan to develop and field the new helicopter by the end of 2008.

In January 2005, the Navy entered into a contract with Lockheed Martin Systems Integration to develop the replacement helicopter based on the AgustaWestland EH101 helicopter. By December 2007, the Navy was starting to report that the program was experiencing schedule slips and significant cost increases. In June 2009, as a result of continued cost increases and schedule delays, DOD terminated the VH-71 program after the expenditure of close to $3 billion. However, the need for a replacement helicopter remains and an Initial Capabilities Document (ICD)[4] was drafted by the Marine Corps and approved by DOD in August 2009 to start a successor VXX Helicopter Replacement Program.

In March 2011, in the first of the reports required by the act, we discussed acquisition best practices that GAO has been identifying since the late 1990s and described a knowledge-based acquisition framework in line with those practices. We reported that the VH-71 program's failure to follow best practices was a critical factor in the program's poor performance—leading to its termination—and reported that one of

[4]A sponsor, usually a military service, submits a capability proposal called an ICD through DOD's requirements determination process—the Joint Capabilities Integration and Development System. An ICD justifies the requirement for a solution (may be hardware or some other means like training or changed doctrine) or a combination of solutions to address specific capability gap(s).

the primary lessons learned from the VH-71 experience is that there must be an early, solid business case with a rational balance between requirements, costs, and schedule. We reported that the VH-71 program started with a faulty business case, did not perform appropriate systems engineering analysis to gain knowledge at the right times, and failed to make necessary trade-offs between resources and requirements. We also noted, though, that program officials for the current VXX program took stock of the lessons learned and had stated that their aim was to establish an initial knowledge-based acquisition business case—emphasizing early systems engineering; mature technologies; an incremental, knowledge-based approach; and the ability to trade capability, cost, and schedule.

Summary

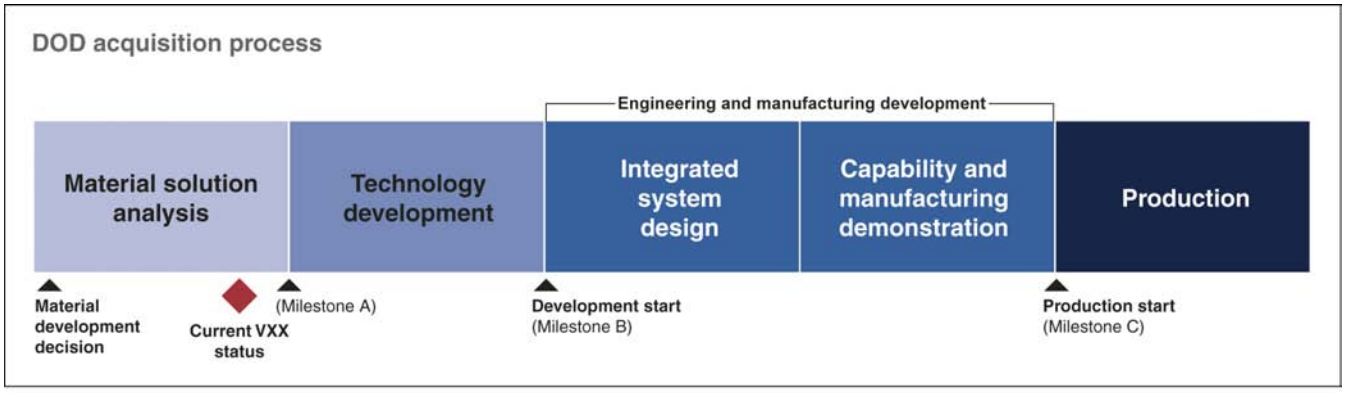
The formal start of the VXX presidential helicopter program has been delayed, as finding an acceptable solution has proved elusive. Last year, we reported that the VXX effort was in the earliest stages of development--still developing a business case to launch product development. At that time, an AOA—required for a Milestone A decision initiating the program—was nearing completion and a Milestone A decision was expected to occur sometime in fiscal year 2011. In March 2011 the Navy sent DOD its VXX AOA study, which Navy officials stated was done in compliance with DOD-provided guidance. DOD did not, however, approve the study as it did not find that the study provided a cost effective solution. Rather, OSD and the Navy subsequently decided to update the analysis of alternatives using an acquisition strategy that might result in a more timely and affordable program using additional guidance provided by OSD in December 2011. That guidance reflects insights on requirements gained in the last year and expectations of using a streamlined acquisition approach proposed by the Navy. This has delayed the VXX program's entry into development. Navy officials expect that this new AOA will identify a solution that sets a foundation for achieving a solid initial business case with a rational balance between requirements, costs, and schedule—an acquisition best practice and something that was missing from the terminated VH-71 program.

To achieve a balance of resources and requirements and provide a new presidential helicopter in a timely manner, DOD's additional guidance reflects an incremental approach to achieving the full capabilities desired for the VXX. First, the Navy is going to extend the service life of the existing helicopters and at the same time upgrade their capabilities by developing and incorporating mature technologies. Second, it would define open systems architectures for the VXX aircraft to enable the insertion of those and other technologies in the future. Third, it would select an existing, available aircraft for the VXX program and then oversee the integration of the technologies matured and incorporated on the legacy helicopters into the VXX aircraft. Finally, in the future, new technologies would be developed and integrated onto the VXX aircraft as pre-planned, product improvements. While the program's new approach would establish a more knowledge-based acquisition in line with best practices, challenges will remain as technologies will still need to be successfully matured and then integrated into the VXX aircraft.

Program Delayed as Acceptable Solution Proves Elusive

DOD has delayed making an initial acquisition milestone decision for the VXX program as an acceptable solution proves elusive. Last year, we reported that the VXX was in the earliest stages of development—still working on a business case to launch product development.[5] At that time, the Navy was working toward a Milestone A decision that was then expected to occur in fiscal year 2011. An initial set of requirements captured in an ICD had been approved and an AOA was being finalized—both required for a Milestone A decision. The Navy provided DOD the results of its AOA study in March 2011, but DOD has not yet approved the study as it did not find a cost-effective solution in it. DOD has re-directed the AOA study with updated guidance to reflect extensive refinement of requirements and expectations of using a streamlined acquisition strategy. This has delayed the VXX program's entry into development as the program works to provide a solid business case for development, one that reflects a rational balance between requirements, costs, and schedule. Figure 1 illustrates DOD's acquisition process and where the VXX program currently stands in that process.

Figure 1: Current VXX Program Status within DOD's Acquisition Process



Source: GAO analysis of the VXX program and DOD's acquisition process.

The June 2010 guidance under which the Navy performed the AOA study it provided DOD in March 2011 reflected DOD's desire for a robust AOA. That guidance directed that the Navy VXX AOA study team (1) assess the operational effectiveness, readiness, and logistics implications of each alternative relative to the base case and all other viable alternatives (taking into account the deployability, sustainability, survivability, reliability, maintainability, suitability, security requirements, communication capabilities, acquisition schedules, and total ownership costs of the respective system); and (2) present a balanced set of alternatives that facilitate decisions on the composition of the successor fleet. It also directed that the final study report include the following information:

- an effectiveness analysis of the potential Key Performance Parameters[6] and attributes;

[5]Product development starts at the Milestone B decision point in DOD's Defense Acquisition System.
[6]Key Performance Parameters are those attributes or characteristics of a system that are considered critical or essential to the development of an effective military capability.

- a discussion of tradeoffs possible between potential Key Performance Parameters and capability objectives;
- an analysis of design, development and qualification efforts and the associated cost, schedule, and risk necessary to attain certification of each alternative, and the cost and schedule differences compared with the existing certification of the alternative aircraft;
- a discussion of major cost drivers, including any significant inflection points in the cost versus performance curve, to evaluate trade-offs in performance when treating cost as an independent variable;
- a discussion of the risks and benefits associated with each alternative;
- an assessment of the required scope of service life extension programs for legacy aircraft, based on the potential initial operational capability date for each alternative; and
- an affordability analysis of the proposed alternatives, both within and beyond the Future Years Defense Program.

Navy officials believe the AOA study complied with DOD's guidance. They also stated that the Navy cost estimates in the study for the candidate aircraft were done using the same cost estimating process that the Office of the Secretary of Defense (OSD), Cost Assessment and Program Evaluation uses in conducting its independent cost estimates of programs.[7] Although OSD officials did not comment on whether the AOA complied with their guidance, they did not approve the VXX AOA study report. OSD officials concluded that the AOA found no acceptable alternative for moving the VXX effort forward—one for which a balance of resources (cost and schedule) was reached with user needs (requirements).[8] Thus, the AOA was never finalized. OSD and the Navy subsequently decided to update the analysis of alternatives using an acquisition strategy that might result in a more timely and affordable program using additional guidance provided by OSD in December 2011. That guidance reflects insights on requirements gained in the last year and expectations of using a streamlined acquisition strategy proposed by the Navy. It is now anticipated that the revised AOA will be briefed to OSD no later than March 2012.

[7]According to Navy officials the NAVAIR-led VXX AOA study team evaluated 52 possible solutions using platforms derived from the Bell-Boeing V-22 tilt-rotor, the Boeing H-47F helicopter, the Boeing 101 helicopter which is based on the AgustaWestland 101, the Sikorsky S-92 helicopter, the Sikorsky H-60M helicopter, the Sikorsky H-53K, and others.

[8]As stated in our March 2011 report on the VXX program, when the AOA is issued we will assess it for its robustness—the range of alternatives it considers, its depth of analysis, and its consideration of trade-offs.

Revised Acquisition Strategy Reflects an Incremental Approach to Achieving Requirements

To achieve a balance of resources and requirements and provide a new presidential helicopter in a timely manner, DOD's guidance to the Navy now reflects an incremental approach to achieve the full capabilities desired for the VXX. First, it would extend the service life of the existing helicopters and at the same time upgrade their capabilities by developing and incorporating matured technologies. Second, it would define open systems architectures to enable the insertion of those and other technologies into VXX aircraft in the future. Third, it would select an existing, available aircraft for the VXX program and then oversee the integration of the technologies matured and incorporated on the legacy helicopters onto the selected aircraft. Finally, it would pursue pre-planned, product improvements to provide future system enhancements. While this approach would be a step toward establishing a more knowledge-based acquisition in line with acquisition best practices, challenges will remain.

The termination of the VH-71 program and delays in the current VXX effort have necessitated efforts to extend the life and upgrade the capabilities of the current presidential helicopters. In its fiscal year 2011 budget, the Navy requested funding for modifications to maintain the VH-3D and VH-60N until the VXX is fielded. These efforts will extend the ability of the VH-3Ds and VH-60Ns to carry out their missions.

Those modifications include:

- VH-60N Cockpit Upgrade effort—to upgrade to all-glass instrumentation panel;
- Communication Suite Upgrades for both aircraft—to provide radio and cryptographic upgrades and improved data transfer;
- VH-3D Lift Improvement program—to provide all 11 VH-3Ds with composite main rotor blades to improve the weight they can lift; and
- Service Life Extension Program for both aircraft—to extend the VH-3D's service life by 4,000 flight hours to 18,000 hours and the VH-60N's by 4,000 flight hours to 14,000 hours.

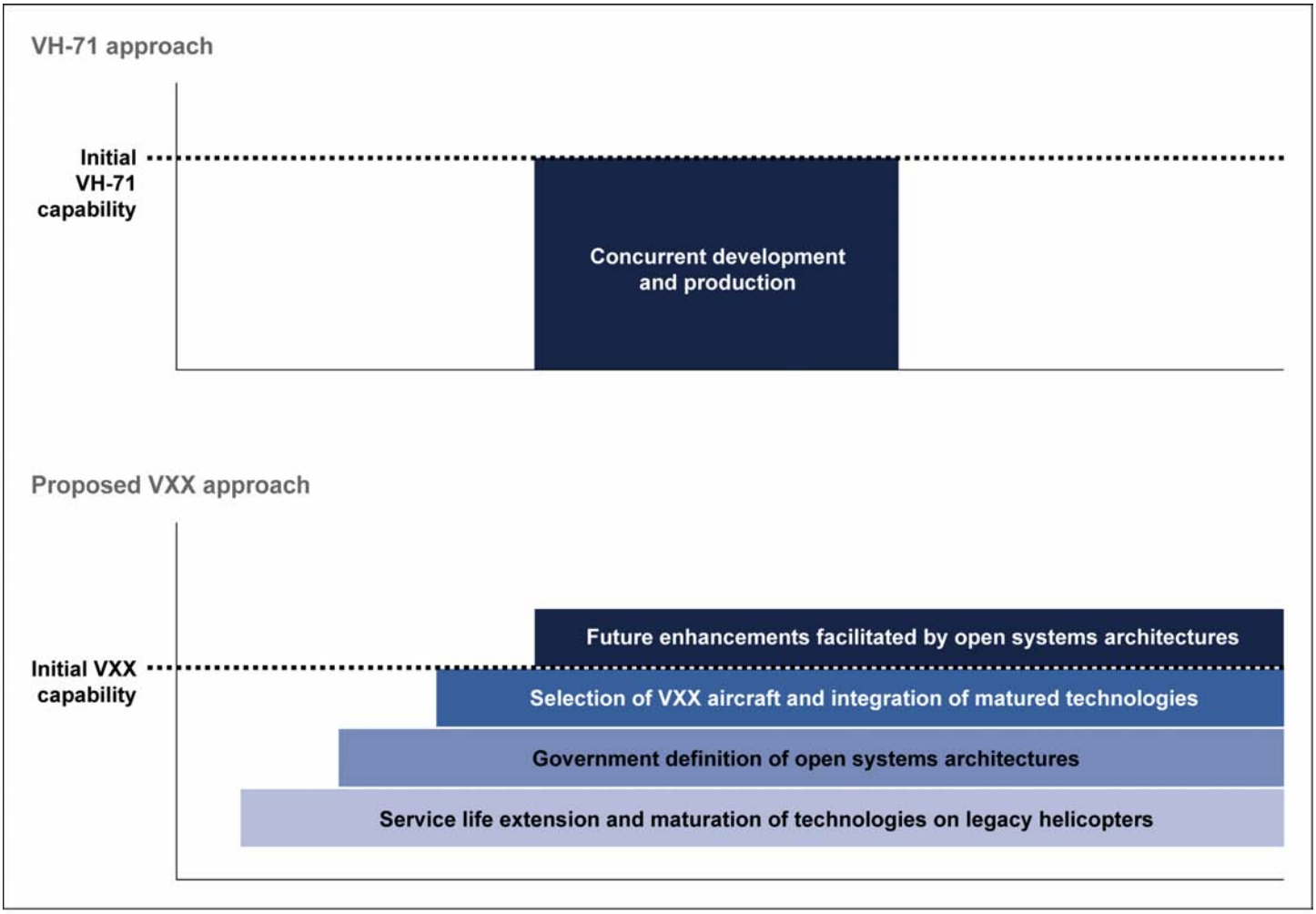
In addition, further upgrades for the VH-3D and VH-60N are being considered as a result of the delays in the VXX program. While these enhancements would improve the capabilities of the existing legacy aircraft, according to Navy officials not all of the capability gaps in the VH-3D and VH-60N helicopters can be overcome with these upgrades due to physical limitations of the aircraft and limits on the amount of time they can be taken out of service. For instance, they stated that the upgraded VH-3Ds will continue to face significant capability gaps in communications, transportability, and other areas. Navy officials stated that the ability to further upgrade the current aircraft is hindered by (1) the physical limitations of the aircraft—including the helicopters' structure, wiring, interior/exterior space, and performance and (2) the need to keep them available for use—limiting the time they can be taken out of service for upgrades. There currently are 19 VH-3D and VH-60N helicopters, while

current plans are to acquire 23 VXX aircraft. According to Navy officials, the current inventory of 19 aircraft is sometimes stressed in meeting the operational demands placed on them--demands that have been growing--making it difficult to take them out of service for further upgrades. The larger VXX inventory is expected to help address this.

Given that the capability shortfalls of the current fleet cannot be totally overcome, the Navy wants to field replacement aircraft as quickly as possible. Navy and DOD officials believe that a streamlined acquisition approach can be developed that will enable the VXX program to leverage current and planned legacy system upgrades and incorporate other new technologies into the VXX program in the future to accomplish this. This approach is expected to be less costly than a "clean sheet" purely developmental effort similar to the failed VH-71 program.

The Navy's new acquisition strategy plans to leverage mature technologies that are being developed outside of the VXX program before including them on the VXX aircraft. The program plans to define open systems architectures to facilitate technology adoption. For example, the VXX communications capabilities would be achieved through Navy development of a communications system architecture and maturing associated communication technologies as legacy helicopter upgrades and then providing those to contractors for integration into VXX aircraft. The Navy then plans to select an available off-the-shelf helicopter to serve as the VXX aircraft. It is at this point, Milestone B approval to enter system development, that the Navy may formally start the VXX acquisition—bringing together the VXX aircraft, systems architectures and matured technologies to provide an initial VXX capability. Over the service life of the VXX, the Navy envisions enhancing the aircrafts' capabilities through a series of preplanned product improvements that would incorporate new concepts and technologies facilitated by its open systems architectures. As illustrated in figure 2, this approach differs significantly from the VH-71 approach, which resulted in the program entering development and production concurrently.

Figure 2: Proposed VXX Approach Compared to VH-71 Approach



Source: GAO analysis of VXX and VH-71 program information.

DOD's recent additional AOA guidance to the Navy reflects this approach, directing the program to consider a more streamlined acquisition approach that includes maturing technologies for upgrades to in-service aircraft and then incorporating those mature technologies into the VXX acquisition strategy, thereby keeping technology risk to a minimum. It notes that the maturity of the technologies that could be integrated should be the basis for investigation of a tailored acquisition approach. As a result, program officials envision a streamlined approach that enables entry into the acquisition process at Milestone B rather than at Milestone A as originally planned. OSD officials expect that this alternate acquisition strategy will be presented to the VXX Milestone Decision Authority no later than the second quarter of fiscal year 2012.

While DOD's revised VXX acquisition approach may reflect a more knowledge-based acquisition approach, challenges will remain. Technologies will still need to be matured and then successfully integrated in the VXX aircraft. In the past, we found such integration can be significant. For example, in March 2007, we reported that in fiscal year 2004 DOD rebaselined the Joint Strike Fighter program extending its

development by 18 months and adding resources to address problems discovered during systems integration and the preliminary design review.[9] Furthermore, any new delays in fielding a replacement for the legacy helicopters may require additional efforts to further extend the service life and capabilities of the legacy VH-3D and VH-60N helicopters.

Concluding Observations

Our work has long shown the need to follow acquisition best practices—of achieving a match between requirements and resources in programs and of not pursuing overly ambitious and lengthy product developments—sometimes referred to as revolutionary or big bang acquisition programs—but rather of taking an incremental approach to development. The delay in starting the VXX program may be beneficial if it results in an acquisition strategy that avoids these risks as appears may now be occurring–if it results in developing knowledge earlier by maturing technologies outside of the VXX program before integrating them into the VXX aircraft. As a result, the development challenge of the VXX aircraft should be lessened. This approach contrasts with that tried in the VH-71 program. As we reported last year, the VH-71 program's failure to follow acquisition best practices was a critical factor in the poor performance that led to its termination. The VH-71 program was started with a faulty business case, did not perform appropriate systems engineering analysis to gain knowledge at the right times, and failed to make necessary trade-offs between resources and requirements even after years of development. Furthermore, it did not seek to develop knowledge incrementally, but rather sought to develop the desired capability in a single step. Had the VH-71 program instead followed an approach similar to that now proposed for the VXX program, DOD might be closer today to fielding the improved presidential helicopters needed. This is a lesson not unique to this program and thus has application to other DOD programs.

The VXX development efforts are just beginning with many significant acquisition events ahead. As stated in our report last year, we will continue to monitor the VXX program by assessing its adherence to key acquisition best practices. Enclosure I reprises from our report of last year some of the key acquisition points yet to occur and the best practice controls we will be looking for.

We are not making recommendations in this report.

[9]GAO, *Joint Strike Fighter: Progress Made and Challenges Remain*, GAO-07-360 (Washington, D.C.: Mar. 15, 2007).

Agency Comments and Our Evaluation

DOD provided technical comments on the information in this report, which GAO incorporated as appropriate, but declined to provide additional comments.

We are sending copies of this report to interested congressional committees; the Secretary of Defense; the Under Secretary of Defense for Acquisition, Technology and Logistics; and the Secretary of the Navy. This report also is available at no charge on GAO's website at http://www.gao.gov.

Should you or your staff have any questions on the matters covered in this report, please contact me at (202) 512-4841 or sullivanm@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors to this report are listed in enclosure II.

Michael J. Sullivan, Director
Acquisition and Sourcing Management

Enclosures - 2

List of Committees

The Honorable Carl Levin
Chairman
The Honorable John McCain
Ranking Member
Committee on Armed Services
United States Senate

The Honorable Daniel K. Inouye
Chairman
The Honorable Thad Cochran
Ranking Member
Subcommittee on Defense
Committee on Appropriations
United States Senate

The Honorable Howard P. "Buck" McKeon
Chairman
The Honorable Adam Smith
Ranking Member
Committee on Armed Services
House of Representatives

The Honorable C. W. Bill Young
Chairman
The Honorable Norman D. Dicks
Ranking Member
Subcommittee on Defense
Committee on Appropriations
House of Representatives

Enclosure I: Best Practices Model Controls at Key Acquisition Process Points

Key acquisition process points	Criteria
Milestone A: Occurs as programs begin the technology development phase.	• Complete robust Analysis of Alternatives.
Milestone B: Occurs as programs begin the engineering and manufacturing development phase (Milestone B). Match exists between requirements and resources. Completed when technologies needed to meet essential product requirements have been demonstrated to work in their intended environments and the producer has completed a preliminary design of the product.	• Demonstrate high technology readiness levels. • Ensure that product requirements are informed by the systems engineering process. • Establish cost and schedule estimates for the product based on knowledge from preliminary design using systems engineering tools. • Complete preliminary design review. • Conduct decision review for program launch.
Critical design review: Occurs at the critical design review between integration and demonstration. Completed when design is stable and has been demonstrated through prototype testing and 90 percent of engineering drawings are releasable to manufacturing organizations.	• Complete 90 percent of design drawings. • Complete subsystem and system design reviews. • Demonstrate with prototype that design meets requirements. • Obtain stakeholder concurrence that drawings are complete and producible. • Complete failure modes and effects analysis. • Identify key system characteristics. • Identify critical manufacturing processes. • Establish reliability targets and growth plan based on demonstrated reliability rates of components and subsystems. • Conduct design review to enter system demonstration.
Milestone C: Occurs at low-rate initial production commitment. Completed when product is ready to be manufactured within cost, schedule, and quality targets and all key manufacturing processes are under statistical control and product reliability has been demonstrated.	• Demonstrate manufacturing processes. • Build production-representative prototypes. • Test production-representative prototypes to achieve reliability goal. • Test production-representative prototypes to demonstrate the product in a realistic environment. • Collect statistical process control data. • Demonstrate that critical processes are capable and under statistical control. • Conduct decision review to begin production.

Source: GAO.

Enclosure II: GAO Contact and Staff Acknowledgments

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Staff Acknowledgments

Key contributors to this report were Bruce H. Thomas, Assistant Director; Jerry W. Clark, Analyst-in-Charge; Teakoe S. Coleman; Marie P. Ahearn; Hai V. Tran; and Robert S. Swierczek.

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