Report No. DODIG-2013-118

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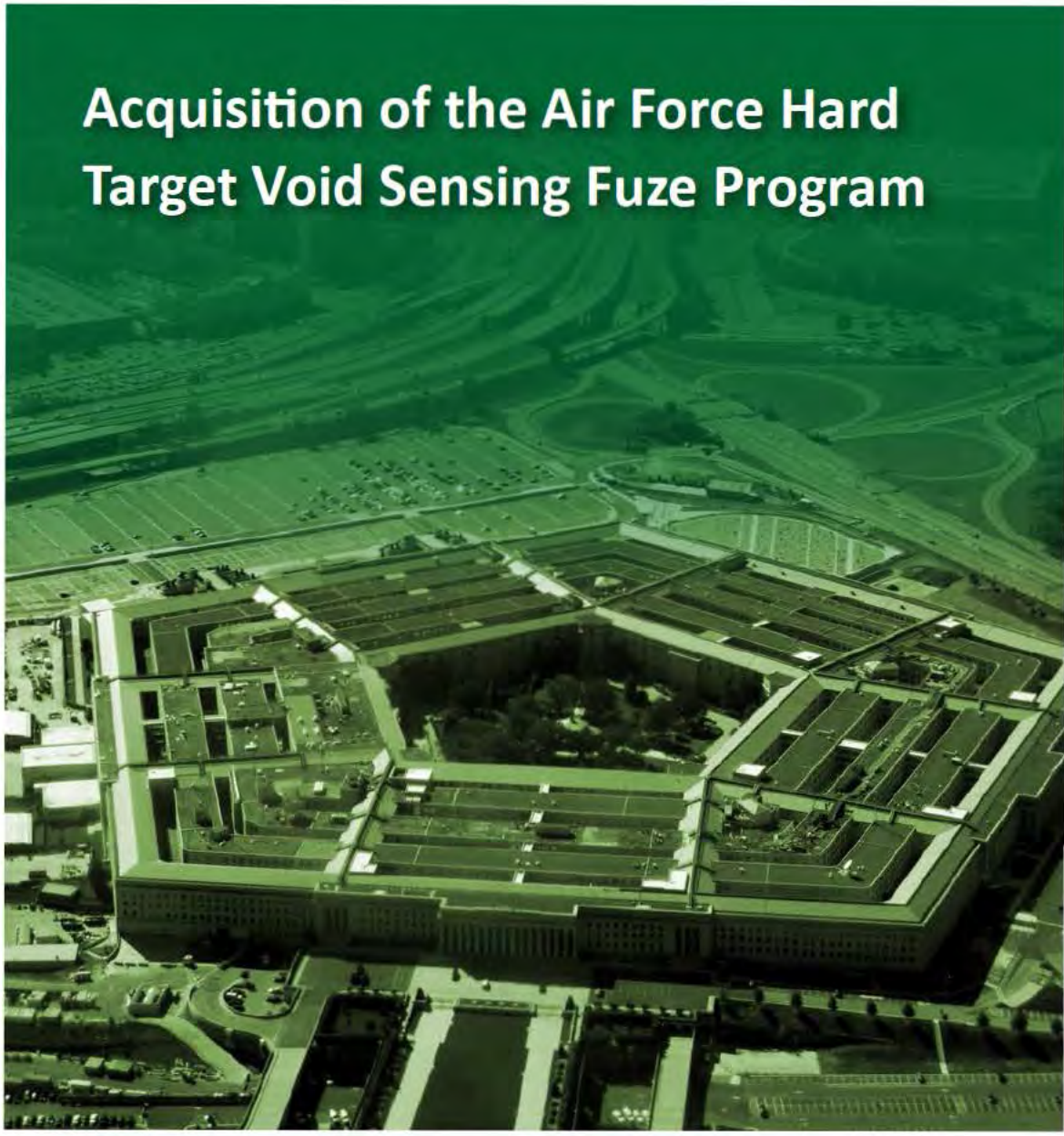
INSPECTOR GENERAL

Department of Defense

AUGUST 20, 2013

Acquisition of the Air Force Hard Target Void Sensing Fuze Program



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Results in Brief

Acquisition of the Air Force Hard Target Void Sensing Fuze Program

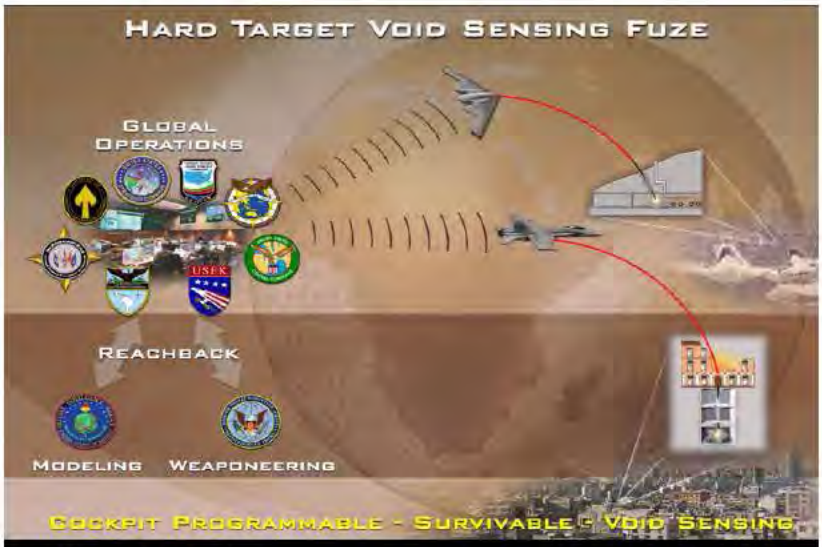
August 20, 2013

Objective

Our audit objective was to determine whether the Air Force effectively prepared the Hard Target Void Sensing Fuze (HTVSF) program for the production and deployment phase of the acquisition process. We evaluated the Air Force strategy to acquire, develop, and test the program. Specifically, we evaluated the HTVSF requirements, acquisition strategy, funding, contracting, design and systems engineering, and testing.

Findings

The HTVSF program manager was effectively preparing the program for the production and deployment phase of the acquisition process. As of August 2013, there were no reportable conditions with this program. This occurred because HTVSF program officials established a strategy and implemented effective controls to acquire, develop, and test the program that complied with DoD guidance. As a result, the HTVSF program was within the established baseline parameters for cost, schedule, and performance and on target for the low-rate initial production (LRIP) decision scheduled for third quarter FY 2014. We did not make recommendations in this report.



Hard Target Void Sensing Fuze
Source: HTVSF Life Cycle Management Plan

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INSPECTOR GENERAL
DEPARTMENT OF DEFENSE
4800 MARK CENTER DRIVE
ALEXANDRIA, VIRGINIA 22350-1500

August 20, 2013

MEMORANDUM FOR UNDER SECRETARY OF DEFENSE FOR ACQUISITION, TECHNOLOGY, AND LOGISTICS
ASSISTANT SECRETARY OF THE AIR FORCE (FINANCIAL MANAGEMENT AND COMPTROLLER)
DIRECTOR, DEFENSE CONTRACT MANAGEMENT AGENCY

SUBJECT: Acquisition of the Air Force Hard Target Void Sensing Fuze Program (Report No. DODIG-2013-118)

We are providing this report for your information and use. We determined that program office personnel were effectively managing the engineering and manufacturing development phase of the Hard Target Void Sensing Fuze program acquisition.

No written response to this report was required, and we are publishing this report in final form.

We appreciate the courtesies extended to the staff. Please direct questions to Ms. Jacqueline L. Wicecarver at (703) 604-9077 (DSN 664-9077).

Daniel R. Blair
Deputy Inspector General
for Auditing

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Introduction

Objective

(U) The audit objective was to determine whether the Air Force effectively prepared the Hard Target Void Sensing Fuze (HTVSF) program for the production and deployment phase of the acquisition process. Specifically, we evaluated the Air Force's strategy to acquire, develop, and test the program. See Appendix for scope and methodology.

Background

(U) The HTVSF is an Acquisition Category II major defense system that is in the engineering and manufacturing development (EMD) phase of the acquisition process. The Air Force Program Executive Officer for Weapons,[1] the milestone decision authority, Eglin Air Force Base (AFB), Florida, approved the Milestone B program initiation decision for the HTVSF program on March 21, 2011, and recommended the program office award an EMD contract. As of March 21, 2011, the Air Force and Navy[2] estimated total cost to develop and procure the HTVSF was $350.9 million. The low-rate initial production (LRIP) Milestone C decision[3] is planned for third quarter FY 2014 with a planned production quantity of 5,500 HTVSF systems.

System Description and Mission Objectives

~~(FOUO)~~ The HTVSF system consists of the fuze, bomb fuze initiator (commonly known as FZU), retaining ring, lanyards and adapter cables as shown below.

~~(FOUO)~~ *Figure 1. HTVSF System*

Source: Test and Evaluation Master Plan for the HTVSF program

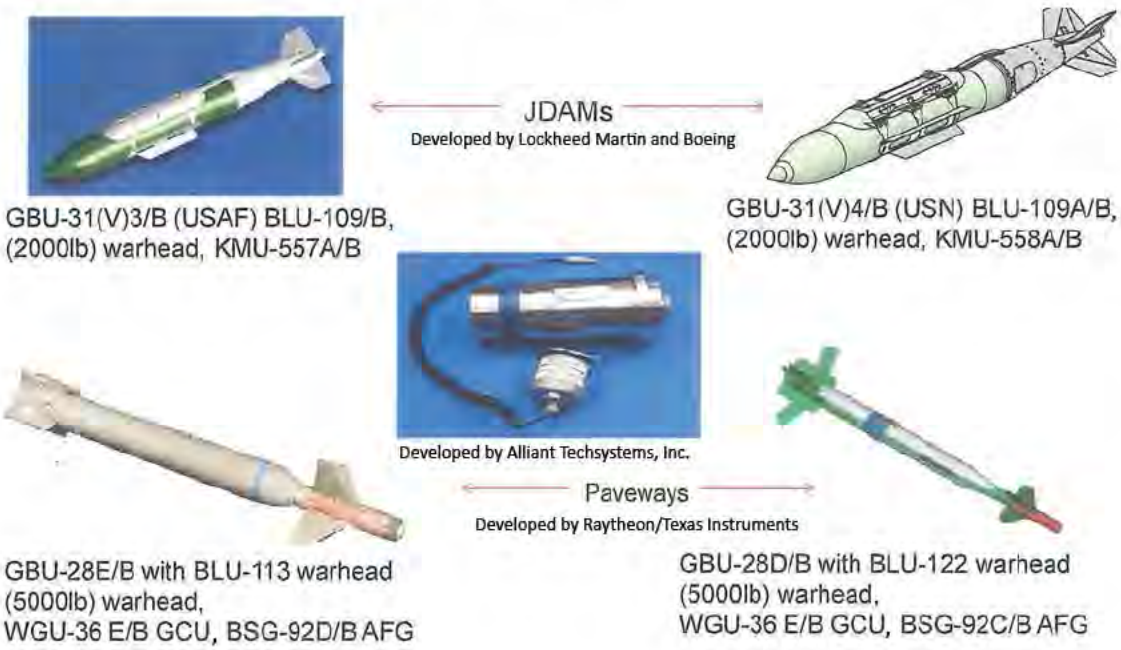
[1] The Air Force Program Executive Officer for Weapons also serves as the Director of Armament Directorate, Air Force Life Cycle Management Center, Air Force Materiel Command at Eglin AFB.

[2] Although not a joint program, the Navy plans to employ the HTVSF.

[3] The LRIP decision, Milestone C decision, is the first effort of the production and deployment phase.

~~(FOUO)~~ The HTVSF, shown in Figure 2, will be installed in Air Force and Navy penetrator weapons for use against targets protected by multiple layers of soil, reinforced concrete, or both. The fuze was designed to initiate the warhead at a predetermined location within the target to maximize warhead effects. HTVSF helps overcome intelligence and target data uncertainties to defeat hard and deeply buried targets, and reduces the number of weapons required to achieve target destruction objectives. The HTVSF program provides additional capability to support current operations.

~~(FOUO)~~ *Figure 2. HTVSF Weapons Integration*



Source: HTVSF Introduction and Program Overview Briefing

~~(FOUO)~~ The Air Force and Navy penetrating munitions fuzes lack the capability to detect voids. A void is an air space bounded by a deceleration media consisting of multiple layers of soil, reinforced concrete, or the equivalence of both. [redacted] AF: (b) (1), Sec. 1.7 (e); (b) (3), 10 USC, Sec. 130 [redacted] HTVSF munitions provide added capability to penetrate targets, shown in Figure 3, protected by multiple layers of soil, reinforced concrete, or both. This is achieved by fuze survivability, void sensing capability, time delay option, and backup timer function—all selectable from the aircraft cockpit through mission planning and aircraft weapon systems.

~~(FOUO)~~ *Figure 3. HTVSF Penetrating Multiple Layers*

Source: HTVSF program office

Review of Internal Controls

(U) DoD Instruction 5010.40, "Managers' Internal Control Program Procedures," May 30, 2013, requires DoD organizations to implement a comprehensive system of internal controls that provides reasonable assurance that programs are operating as intended and to evaluate the effectiveness of the controls. The Air Force's internal controls over the HTVSF program were effective as they applied to the audit objective.

Air Force Effectively Managed Hard Target Void Sensing Fuze Program

(U) The program manager for HTVSF was effectively preparing the program for the production and deployment phase of the acquisition process. Specifically, we evaluated the HTVSF requirements, acquisition strategy, funding, contracting, design and systems engineering, and testing. As of August 2013, the HTVSF program officials established a strategy and implemented effective controls to acquire, develop, and test the program that complied with DoD guidance. As a result, the HTVSF program was within established baseline parameters for cost, schedule, and performance and on target for the LRIP decision scheduled for third quarter FY 2014.

Requirements Were Adequately Developed, Documented, and Validated

(U) We determined that HTVSF requirements were adequately developed, documented, and validated. The U.S. Strategic Command and the Air Force Air Combat Command established a valid need for the HTVSF program and prepared program capabilities documentation. The U.S. Strategic Command and the Air Combat Command developed the consolidation requirement for a Hard and Deeply Buried Target Defeat Capability mission need statement. The Joint Requirements Oversight Council validated the Air Combat Command mission need statement and recommended that the U.S. Strategic Command and Air Combat Command adopt the Hard and Deeply Buried Target Defeat Capability mission need statement as a single umbrella mission need. Hard and deeply buried targets are fixed, high value facilities with considerable structural strengthening that are designed to impede or stop U.S. penetrating weapons. For example, buried targets could be located within rock tunnels or in a below-ground facility that is covered with materials such as soil, gravel, rock, or reinforced concrete.

(U) The HTVSF capabilities development document, approved January 2010, supported the March 2011 Milestone B decision approving entry into the EMD phase of the acquisition process. However, the HTVSF user representative, Air Combat Command, did not plan to prepare a capabilities production document for the upcoming LRIP decision in third quarter FY 2014. Since there were no major changes to the program, the HTVSF program office plans to submit the capabilities development document in lieu of a capabilities production document to the milestone decision authority. However, the

Air Force Requirements Oversight Council must revalidate the capabilities development document before the LRIP decision.

(U) The Manual for the Operation of the Joint Capabilities Integration and Development System, January 19, 2012, states that updates to a capabilities development document are required if changes to the key performance parameters are made after validation, or if changes are made in the Joint Concepts, Concept of Operations, or the DoD Enterprise Architecture and solution architecture, which affect the capability requirements and solution documented in the capabilities development document.

(U) The HTVSF program system threat assessment is out dated. As of August 2013, the National Air and Space Intelligence Center was conducting its review and efforts to update the HTVSF program system threat assessment before the LRIP decision scheduled for third quarter FY 2014.

Acquisition Strategy

(U) The HTVSF program acquisition strategy addressed the program requirements, the acquisition approach, contracting, schedule, funding and risk defined in DoD Instruction 5000.02, "Operation of the Defense Acquisition System," December 8, 2008. The program is progressing towards achieving its objectives for cost, schedule, and performance as identified in the acquisition program baseline dated March 21, 2011. The acquisition strategy established a four-phased approach: joint capability technology demonstration (JCTD); EMD; production and deployment; and operations and support.

Joint Capability Technology Demonstration Phase

~~(FOUO)~~ The JCTD represents the first phase of the HTVSF to both reduce risk and mature technology. During a full and open competition, two contractors, Alliant Tech Systems, Inc. (ATK) and Thales, were awarded firm-fixed-price contracts. Each contractor designed a HTVSF system, developed and tested subsystems, and conducted system level risk reduction efforts necessary to finalize a design. During the JCTD phase, the HTVSF program met required entrance criteria for the EMD phase. Specifically, the system requirements were defined and documented. The system concept met the key performance parameter and achieved the technology readiness assessment and manufacturing readiness assessment level 6.[4]

[4] The DoD Technology Readiness Assessment Guidance states that a level 6 technology maturity is a system model or prototype demonstrated in a relevant environment. The Manufacturing Readiness Level Deskbook states that a level 6 manufacturing readiness is the capability to produce a prototype system or subsystem in a production relevant environment.

Engineering and Manufacturing Development Phase

~~(FOUO)~~ The program office down selected ATK for the EMD; production and deployment; and operations and support phases. The Air Force Life Cycle Management Center (formerly the Air Armament Center) awarded a fixed-price incentive firm target contract for the EMD phase. The three major program risks are void detection, fuze power dropouts, and fuze producibility. The milestone decision authority established the following LRIP entrance criteria for the HTVSF program office:

- meet the key performance parameter requirements,
- successfully complete developmental and qualification tests,
- meet Air Force Operational Test and Evaluation Center operational assessment and certification requirements to begin LRIP,
- attain and demonstrate required technology readiness and manufacturing readiness level 8[5],
- receive a successful production readiness review for LRIP, and
- establish full funding and affordability.

Production and Deployment Phase

~~(FOUO)~~ The EMD contract included options for two LRIP production lots, one full-rate production lot, and an option to qualify a second contractor for two additional full-rate production lots. The Air Force Life Cycle Management Center, Eglin AFB planned to award a sole source firm-fixed-price contract to the EMD contractor for the second contractor's two additional full-rate production lots.

Operation and Support Phase

(U) This phase included a limited maintenance requirement (life cycle testing every 3 years); no spares, training or additional manpower. A 10-year service life and a 20-year shelf life warranty were included in the production price, in addition to a lifecycle surveillance test set and testing every 3 years.

[5] A technology readiness level 8 is an actual system completed and qualified through test and demonstration. A manufacturing readiness level 8 is an initial production line capability demonstrated; ready to begin LRIP.

Program Funding

(U) As of June 5, 2013, the HTVSF program was fully executable to the end of the EMD phase. However, sequestration and future funding reductions may extend the cost and schedule over the acquisition program baseline. We reviewed the President's Budget (FY 2011-2014) for the Air Force, the February 2013 cost estimate, the monthly program acquisition reports, and the ATK's earned value management system monthly performance reports to determine whether the HTVSF program was executable.

(U) The HTVSF program office lost funding due to an 8-month delay in the award of the EMD contract. However, the President's Budget, FY 2013 restored the funding to the HTVSF program, as shown in the table below.

Table. HTVSF President's Budget FY 2010 through FY 2016 (In Millions)

	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	Total
PB2011	$18.8	$32.5	$27.0	$5.2	$0	$0	$0	$83.5
PB2012	0.09	32.5	24.5	5.2	0	0	0	62.3
PB2013	0	22.4	24.5	9.4	26.7	4.5	0	87.5
PB2014	0	22.4	23.5	8.7	21.2	7.8	2.2	85.8

(U) The HTVSF program office also requested additional funding for the fuze. They received $6.3 million in September 2012.

(U) The Air Force Lifecycle Management Center Cost Estimating Branch independently reviewed and validated the HTVSF program office cost estimate in its FY 2013 annual cost sufficiency review. The HTVSF program office identified cost-saving opportunities. For example, the HTVSF program office identified another source to obtain parts for the test data recording capability that cost significantly less than the original source for parts. In addition, the program office consolidated flights when performing tests to reduce test costs. The test cost efficiencies saved $3.6 million over FY 2012 through FY 2014.

Contracting and Earned Value Management System

(U) The contracting office appropriately awarded and managed the EMD contract for the HTVSF. On March 25, 2011, the Air Force Life Cycle Management Center (formerly the Air Armament Center), Eglin AFB awarded contract FA8681-11-C-0039, to ATK. The contract included both fixed-price incentive firm target and firm-fixed-price contract line item numbers. A fixed-price incentive firm target contract is appropriate when the parties can negotiate at the outset a firm target cost, target profit, and profit adjustment

formula that will provide a fair and reasonable incentive and a ceiling that provides for the contractor to assume an appropriate share of the risk. The second source qualification and production contract line items were firm-fixed price.

(U) The program office effectively used the earned value management data to manage contractor performance. The program office received monthly contractor performance reports prepared through the contractor's earned value management system. The program office and the Defense Contract Management Agency (DCMA) analyzed these monthly contractor performance reports to determine whether the HTVSF program cost, schedule, and performance met contract requirements. The program office met monthly with the contractor to discuss cost, schedule, and performance variances and identify corrective actions.

~~(FOUO)~~ Based on the earned value management system contractor performance reports submitted from November 2012 to April 2013, the HTVSF EMD contract had cost and schedule overages. As of April 28, 2013, the latest contractor performance report showed that ATK was over cost by $3,045,249 (12 percent) and behind schedule by $1,111,549 (4 percent).[6] However, in November 2012, the percentage of cost and schedule overages was 12 percent and 8 percent, respectively. ATK and the HTVSF program office officials attributed the cost and schedule overages to the initial determination that the EMD phase would be similar to the JCTD phase. ATK and the HTVSF program office agreed to an aggressive schedule and costs similar to the JCTD phase. The aggressive schedule led to delays in testing of 1 to 3 months and delays in the review process, including the critical design review. The programs underestimation of costs, particularly in the earned value management system support, led to cost overages. Since November 2012, the cost overage has remained constant and the schedule slippage has decreased by half. The HTVSF program office estimated that the contract would be over contract target cost (12 percent) but would not exceed the contract ceiling, and would end on schedule.

(U) The HTVSF program office and ATK implemented incremental integrated baseline reviews to jointly assess technical areas to provide coverage of contractor requirements, logical scheduling of work activities, adequate resources, methodologies for earned value management, and identification and mitigation of risk. The HTVSF program office and ATK managed the cost, schedule, and performance to adequately meet contract requirements.

[6] A program is over cost when the actual cost of work is greater than the value of completed work when compared to the budgeted work; and a program is behind schedule when the value of completed work is less than the budgeted work.

Systems Engineering Process Complied With DoD Regulations

(U) We determined that the HTVSF program implemented an adequate systems engineering process. Specifically, the program office adequately planned and executed the systems engineering process and complied with DoD regulations.

(U) The HTVSF program maintained the required documentation such as the acquisition strategy, systems engineering plan, integrated master schedule and plan, technical reviews, life cycle management plan, and acquisition decision memorandum. The program had a systems engineering chief with staff that assisted in the application of systems engineering throughout the program. The program office used subject matter experts for tests and reviews, system safety, guidance, and support as needed. The systems engineering group integrated technical aspects of the program with the overall program planning, systems engineering activities, and tracking execution. Specifically, the group monitored test results and progress, incorporated verifiable and measurable testing criteria, recorded controls, used integrated product teams, and performed required technical reviews and risk analyses. System engineers ensured there were metrics in place for the system verification review and functional configuration audit (a Milestone B exit criteria).

Testing

(U) The HTVSF EMD program was setup in two separate phases: design maturation (pre-qualification) and developmental testing (qualification). The purpose of the design maturation phase was to gather data to calibrate models, stress the limits of the HTVSF void sensing algorithm, and to prepare for qualification testing during the development testing phase of the program. ATK submitted 11 design maturation tests between October and December 2012. We determined that:

- ATK's design maturation sled test identified a critical system failure with the circuit board the accelerometer is mounted on. The accelerometer vibrated to read negative deceleration (acceleration when impacted). ATK remedied the problem with stabilizing parts. The parts stabilization was part of the void detection mode key performance parameter.
- During March and April 2013, ATK performed three developmental tests. ATK and the Navy and Air Force Joint Reliability and Maintainability Evaluation team separately performed favorable analysis of these initial qualification

tests. On June 4, 2013, the Navy and Air Force Joint Reliability and Maintainability Evaluation team officially accepted the test results.

- As of June 4, 2013, HTVSF had met the void sensing requirement, which is part of the requirement for the void detection mode key performance parameter.

(U) Developmental testing performed, as of July 2013, had not shown any performance challenges for the HTVSF. Additional developmental and operational tests are planned through FY 2015.

Conclusion

(U) The HTVSF program had progressed through the EMD phase and, as of July 2013, was within approved thresholds for cost, schedule and performance established in the March 21, 2011, Acquisition Program Baseline Agreement. The HTVSF program is on schedule for their LRIP decision in May 2014. However, the March 21, 2011, acquisition decision memorandum required specific LRIP decision entrance criteria which must be met in order for the program to successfully complete EMD.

Appendix

Scope and Methodology

(U) We conducted this performance audit from February 2013 through August 2013 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.

(U) We interviewed staff from the office of the Program Executive Officer for Weapons and the HTVSF program office, Eglin AFB. We also interviewed staff from the Air Combat Command, Langley AFB, Virginia; and contacted and received documents from DCMA offices in Petersburg, Virginia; Philadelphia, Pennsylvania; and Twin Cities, Minnesota.

(U) We collected, reviewed, and analyzed documents dated from August 2000 through June 2013. The documents included the "EMD Acquisition Decision Memorandum," March 2011; the Acquisition Baseline, March 2011; the President's Budget (FY 2011-2014); ATK's Earned Value Management System Contractor Performance Reports from November 2012 to April 2013; the Cost Sufficiency Review February 2013; the "Capabilities Development Document" for HTVSF, January 2010; the "Systems Requirement Document," May 2010; the "Systems Engineering Plan," January 2013; the "Test and Evaluation Master Plan for the HTVSF," March 2011; and various development test reports.

(U) To determine whether the Air Force effectively prepared the HTVSF program for the production and deployment phase of the acquisition process, we reviewed program requirements; acquisition strategy; funding; contracting; design and systems engineering; and testing documentation against the policies and guidance in the following DoD and Air Force issuances:

- Chairman of the Joint Chiefs of Staff Instruction 3170.01H, "Joint Capabilities Integration and Development System," January 10, 2012;
- Chairman of the Joint Chiefs of Staff "Manual for the Operation of the Joint Capabilities Integration and Development System," January 19, 2012;
- DoD Instruction 5000.02, "Operation of the Defense Acquisition System," December 8, 2008;

- Defense Acquisition Guidebook, November 1, 2012; and
- Air Force Instruction 10-601, "Operational Capability Requirements Development," July 12, 2012.

Use of Computer-Processed Data

(U) We relied on computer-processed data from ATK's earned value management system. ATK used the earned value management system to prepare monthly contractor performance reports that track cost and schedule data for the HTVSF program. Furthermore, these reports identified cost and schedule variances by work breakdown structure element. We used cost and schedule data from the contractor performance reports to determine whether the HTVSF program was above or below cost and behind or ahead of schedule. We did not access ATK's system to assess the reliability of the data; however, we obtained reports where both the DCMA and HTVSF program office reviewed earned value management data provided by ATK.

(U) When we received the contractor performance reports ATK provided to the HTVSF program office, we also requested a list of the calculations based on the earned value management data. With these reports and the list, we recalculated all of the data using the information provided by ATK. We compared our calculations to ATK's contractor performance reports, to the HTVSF program office's monthly review, and DCMA's periodic review. These calculations included cost and schedule performance index, cost and schedule variance in dollars and percentage, the percentage completed, scheduled, and spent, and the estimates at completion. Based on our recalculations of the data, with few exceptions all of the data provided to us matched ATK's contractor performance reports as well as DCMA and the HTVSF program offices' reports. Therefore, we determined that the data was sufficiently reliable to address our audit objectives.

Prior Coverage

(U) No prior coverage has been conducted on the HTVSF program during the last 5 years.

Acronyms and Abbreviations

AFB	Air Force Base
ATK	Alliant Tech Systems, Inc.
DCMA	Defense Contract Management Agency
EMD	Engineering and Manufacturing Development
HTVSF	Hard Target Void Sensing Fuze
JCTD	Joint Capability Technology Demonstration
LRIP	Low-Rate Initial Production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