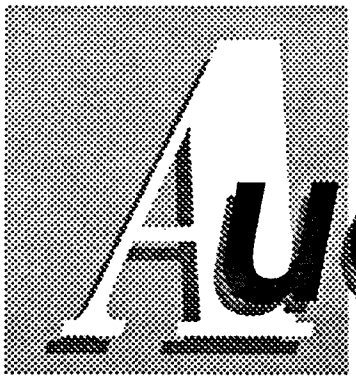

OFFICE OF THE INSPECTOR GENERAL

AIR-TO-AIR INTERCEPT MISSILE-9X PROGRAM

Report No. 97-064 January 10, 1997

This special version of the report has been revised to omit contractor proprietary data.

Department of Defense

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Acronyms

AIM-9X	Air-to-Air Intercept Missile-9X
ASRAAM	Advanced Short Range Air-to-Air Missile
IPT	Integrated Product Team

INSPECTOR GENERAL
DEPARTMENT OF DEFENSE
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Report No. 97-064 January 10, 1997

MEMORANDUM FOR UNDER SECRETARY OF DEFENSE FOR ACQUISITION AND TECHNOLOGY
ASSISTANT SECRETARY OF THE NAVY (FINANCIAL MANAGEMENT AND COMPTROLLER)
ASSISTANT SECRETARY OF THE AIR FORCE (FINANCIAL MANAGEMENT AND COMPTROLLER)

SUBJECT: Audit of Air-to-Air Intercept Missile-9X Program (Project No. 6AE-0037)

Introduction

We are providing this memorandum report for information and use. This report discusses the adequacy of the program management of the Air-to-Air Intercept Missile-9X (AIM-9X) program and the planned test and evaluation of the British Aerospace Defense Limited's (British Aerospace) Advanced Short Range Air-to-Air Missile (ASRAAM) as an alternative to developing and procuring the AIM-9X.

The AIM-9X is a joint Navy and Air Force program with the Navy designated as the lead Military Department. As the next generation to the Navy Sidewinder missile (the AIM-9M), the AIM-9X is designed to provide increased missile maneuverability and capability to operate at day or night and improved target acquisition, discrimination, and tracking through an advanced guidance system. Stretching over 25 years, the Navy and the Air Force plan to incur nearly $3.8 billion (then-year dollars) in AIM-9X development and procurement costs for 10,000 production missiles.

Audit Results

Although the AIM-9X program is still early in development, the AIM-9X Program Office, a sub-office of the Navy Air-to-Air Missile System Program Office, was effectively managing the acquisition of the AIM-9X and planning the test and evaluation of the ASRAAM as an alternative to developing and procuring the AIM-9X. As a DoD flagship program for implementing the Cost as an Independent Variable initiative, the AIM-9X Program Manager had effectively established the framework for the competing contractors to establish realistic cost objectives and gave the contractors incentives to reduce program costs through value engineering modifications. We also noted that the AIM-9X Program Office staff were knowledgeable and committed to the successful completion of the program. Management controls were adequate in that we did not identify any systemic management control weakness applicable to our primary audit objective.

Audit Objective

The audit objective was to evaluate the overall management of the AIM-9X program to determine whether the Navy and Air Force are cost-effectively developing the system and making it ready for the engineering and manufacturing development phase of the acquisition process. We followed our critical program management elements approach for the audit and tailored the approach to the demonstration and validation[1] phase of the acquisition process. We reviewed program definition, program structure, program design, contracting, program assessments and decision reviews, periodic reporting, and the management controls related to those objectives. We also reviewed the adequacy of the Navy test and evaluation plans for the ASRAAM. Enclosure 1 discusses the scope and methodology used to accomplish the objective as well as management controls and prior audit coverage. Enclosure 2 discusses the audit results for each area reviewed.

Audit Background

Complementing the "Beyond Visual Range" fire and forget Advanced Medium Range Air-to-Air Missile, the next generation AIM-9X will reestablish short range air-to-air combat superiority for U.S. aircraft. The AIM-9X will allow first-shot, first-kill opportunities against opposing aircraft targets in stressed countermeasure environments.

The AIM-9X Program Office manages the AIM-9X acquisition for the Navy and the Air Force. In December 1994, the Defense Acquisition Executive approved the AIM-9X program for the demonstration and validation phase of the acquisition process. During demonstration and validation, Hughes Missile Systems Company (Hughes) and Raytheon Company (Raytheon) were awarded cost-plus-incentive-fee contracts to demonstrate the potential capabilities of their prototype AIM-9X guidance systems and to prepare preliminary system designs for the all-up-round AIM-9X. In addition, Congress tasked DoD to evaluate the operational performance capabilities of the ASRAAM (a nondevelopmental item) as an acceptable alternative to the AIM-9X. In response, the AIM-9X Program Manager established a foreign comparative test program to independently evaluate the ASRAAM. On October 31, 1996, a joint Navy and Air Force "4-Star" summit concluded from the results of the ASRAAM Foreign Comparative Test program that the standard ASRAAM did not meet minimum AIM-9X requirements. At the December 1996 engineering and manufacturing development decision review, the Defense Acquisition Executive approved the selection of the Hughes AIM-9X variant for the engineering and manufacturing development phase and low-rate initial production phase of the acquisition process.

[1]Under the DoD Directive 5000.1, "Defense Acquisition," and DoD Regulation 5000.2-R, "Mandatory Procedures for Major Defense Acquisition Programs (MDAPS) and Major Automated Information System (MAIS) Acquisition Programs," March 15, 1996, the demonstration and validation phase was renamed the program definition and risk reduction phase.

The Principal Deputy Under Secretary of Defense for Acquisition and Technology also selected the AIM-9X program as a Cost as an Independent Variable "flagship" program. Cost as an Independent Variable is a strategy that entails setting aggressive yet realistic cost objectives when acquiring Defense systems and managing the achievement of those objectives. A key tenet of Cost as an Independent Variable is that users are to state system requirements in terms of capabilities and that developers, in coordination with users, may exchange, substitute, or adjust the system requirements to achieve the program cost objectives.

Discussion

The Navy AIM-9X Program Office effectively managed the acquisition of the AIM-9X. Specifically, the AIM-9X Program Office had effectively tailored the approach to the demonstration and validation phase of the acquisition process to ensure that it provides the Defense Acquisition Executive with sufficient information to evidence the satisfaction of the AIM-9X demonstration and validation exit criteria. Further, the AIM-9X Program Office took appropriate action to establish and implement a foreign comparative test program to independently evaluate the ASRAAM as an alternative to developing and procuring the AIM-9X. Enclosure 2 discusses the results of audit for each of the critical program management elements reviewed.

In implementing its acquisition strategy for the AIM-9X, the Program Office emphasized DoD acquisition reform initiatives for Cost as an Independent Variable, integrated product teams (IPTs), modeling and simulations, and single process initiatives. The following paragraphs discuss the AIM-9X Program Office's positive efforts in implementing the acquisition reform initiatives.

Cost as an Independent Variable. The AIM-9X Program Office had effectively incorporated Cost as an Independent Variable principles contained in DoD Directive 5000.1, "Defense Acquisition," March 15, 1996, and DoD Regulation 5000.2-R, "Mandatory Procedures for Major Defense Acquisition Programs (MDAPS) and Major Automated Information System (MAIS) Acquisition Programs," March 15, 1996, in the AIM-9X acquisition strategy. The DoD 5000 series documents require program managers for Defense systems to establish aggressive and realistic cost objectives for production and for operating and supporting systems when deployed in the field. The DoD 5000 series documents also require program managers to have well-defined steps and events that will lead to achieving those objectives at milestone reviews. Further, program managers are to require contractors to develop and implement a management approach for achieving cost objectives through requests for proposal and contract statement of work requirements.

The AIM-9X Program Manager implemented aggressive and realistic cost objectives in the requests for proposal for the engineering and manufacturing development contract. In responding to the requests for proposal, the AIM-9X Program Manager required contractors to commit to an average unit production cost and schedule delivery targets for low-rate initial production lots one through three. The AIM-9X Program Manager included provisions for cost performance incentive fees in the requests for proposal to encourage contractors to make target commitments for the options. Specifically, the AIM-9X Program Manager specified in the requests for proposal that the AIM-9X Program Office would share 50 percent of the savings with the performing contractor if the contractor's actual average unit production cost and schedule delivery dates were less than the committed targets. Additionally, the AIM-9X Program Manager specified in the requests for proposal that the AIM-9X Program Office would award the engineering and manufacturing development contractor an incentive fee for meeting cost curve objectives and implementing value engineering modifications. The requests for proposal will require the winning engineering and manufacturing development contractor to initiate cost reduction actions through innovative designs and manufacturing processes to meet targeted costs.

IPTs. The AIM-9X Program Manager formed and led IPTs in the demonstration and validation phase to support the development of strategies to effectively manage the AIM-9X acquisition within the program office and by the contractor in accordance with the DoD 5000 series of documents. Within the program office, the AIM-9X Program Manager established two IPTs and provided integrated product and process development training to the program staff. In the demonstration and validation contracts, the AIM-9X Program Manager required Hughes and Raytheon to establish, implement, and document concurrent systems engineering processes to include the formation of IPTs.

Program Office IPTs. The AIM-9X Program Manager formed two separate IPTs to oversee and manage Hughes and Raytheon development efforts on the demonstration and validation contracts. The IPTs operated separately to avoid potential conflicts involving contractor proprietary information. To expedite the completion of the contracts, the IPTs conducted formal and informal reviews and meetings with the contractors and facilitated contractor technical reviews, working groups, and interchange meetings with assistance from Navy technical representatives.

Through the Navy Integrated Product and Process Development training course, the AIM-9X Program Manager provided the program office staff with information and instructions on writing integrated product and process

development requirements into requests for proposal and contract statements of work and on the application and use of integrated master plans[2] and integrated master schedules.[3] As a result of the training, the program office IPTs were able to eliminate 35 military standards and 26 of 30 military specifications that were included in the demonstration and validation contracts when preparing the requests for proposal for the engineering and manufacturing development contract.

Contractor IPTs. The AIM-9X Program Manager required Hughes and Raytheon to prepare systems engineering management plans as a deliverable data item in their AIM-9X demonstration and validation contracts. The systems engineering management plans were to identify product and functional IPTs, document the responsibility of each IPT, and discuss how each IPT managed work and interacted with other contractor IPTs. Also, the AIM-9X Program Manager required the contractors to prepare monthly status reports evaluating the effectiveness of the cost, schedule, and performance of each IPT. Further, the AIM-9X Program Manager required the contractors to develop a systems engineering process structure that will enable the program office staff to be integrated with the contractors' IPTs during the AIM-9X engineering and manufacturing development phase of the acquisition process.

Modeling and Simulations. The DoD 5000 series documents emphasize the use of models and simulations to reduce the time, resources, and risks of the acquisition process and to increase the quality of the systems being acquired. In line with that direction, the AIM-9X Program Manager will rely on evaluations from models and simulations to support acquisition decisions because demonstrating the full range of AIM-9X and ASRAAM performance capabilities was not feasible through missile flight testing.

Modeling and Simulations During Demonstration and Validation. As contractually required, Hughes and Raytheon developed models and simulations during demonstration and validation to predict missile system performance. To determine the "potential" operational effectiveness of the preliminarily designed AIM-9X systems and the operational performance capabilities of the ASRAAM, the AIM-9X Program Manager required the three contractors to model and simulate their proposed missile systems and components against a broad range of parameters that cannot be practically replicated in live-fire tests. The contractors' models were to simulate the entire performance and operational envelope of their respective AIM-9X candidates from target acquisition through intercept. The AIM-9X Program Manager also requested that British Aerospace verify and validate its simulation models with

[2]The integrated master plan is the management tool that describes all key program events and accomplishments that are required in an acquisition program. The plan specifies all significant activities and criteria necessary to complete the effort as defined by the statement of work and ties those activities to key program events.

[3]The integrated master schedule is a time-phased chart showing the significant activities, milestones, and dependencies of an acquisition program. The schedule is the basis for all lower level planning, describes the program's critical path, and must relate requirements in the statement of work to the contract work breakdown structure.

corroborating software algorithms, source codes, and actual flight test data because the ASRAAM is a nondevelopmental item. Besides contractor modeling and simulation exercises, the Navy and Air Force have also applied modeling and simulation techniques to independently verify and validate contractors' conclusions. Because the integrity of the contractor and Government models and simulations depended on the quality of software products that Hughes and Raytheon developed, the AIM-9X Program Manager made independent verification and validation tests on contractor-developed software products to concurrently determine compliance with AIM-9X system performance requirements and to build confidence in the maturity of the software products.

Modeling and Simulations During Engineering and Manufacturing Development. During engineering and manufacturing development, the AIM-9X Program Manager also plans to use extensive modeling and simulation demonstrations if the ASRAAM is not selected at the engineering and manufacturing development decision. The AIM-9X Program Manager will use the results of modeling and simulations to supplement the results of actual test and evaluation for determining the operational effectiveness and suitability of either Hughes' or Raytheon's AIM-9X. To fulfill that plan, the AIM-9X Program Manager incorporated the modeling and simulation requirements in the requests for proposal for the AIM-9X engineering and manufacturing development contract. The requests for proposal specify that the winning AIM-9X contractor will be required to provide high fidelity performance predictions through modeling and simulation for all missile subsystem and system tests before the start of captive carry, ground-to-air, environmental, guided, and programmed free flights as well as for design verification tests and evaluations.

In the requests for proposal, the AIM-9X Program Manager also required that the contractor validate the models and simulations at least quarterly with data obtained from flight and subsystem tests. Accordingly, the program office will use actual missile system and subsystem test and evaluation results to determine the efficacy of modeling and simulation demonstrations, and the results from modeling and simulation demonstrations will supplement actual test and evaluation results used to determine AIM-9X operational effectiveness and suitability. As with demonstration and validation, the Navy and Air Force will independently verify and validate contractors' models and simulations and will require certification for verifying and validating the performance of applied models and simulations.

Single Process Initiatives. The AIM-9X Program Manager has supported contractors' participation in single process initiatives. In June 1994, the Secretary of Defense directed DoD to start eliminating multiple business and manufacturing processes within contractor facilities by reducing the use of Defense-unique military standards and specifications in existing contracts. The DoD is accomplishing the elimination of Defense-unique military standards and specifications in existing contracts through the block change process on a facility-wide basis rather than negotiating contract changes on a contract-by-contract basis.

Through October 1996, Raytheon had proposed 32 block process changes and DoD had approved 11 block process changes that will impact contract costs for the AIM-9M, the Advanced Medium Range Air-to-Air Missile, the Patriot missile, and the Sparrow missile. The 32 proposed block process changes affected Raytheon's procedures for quality, manufacturing, business practices, configuration management, subcontract issues, military soldering, property management, calibration, material review, tests requirements, software, and cost data reporting. By approving the 11 block process changes, DoD will put $5.1 million to better use in the form of more goods on existing missile contracts. Hughes has also proposed 24 block process changes that DoD is in the process of reviewing.

Management Comments

Although no comments were required, the Under Secretary of Defense for Acquisition and Technology provided comments concurring with the report results. Enclosure 3 contains the complete text of management comments.

We appreciate the courtesies extended to the audit staff. For additional information on this report, please contact Mr. John E. Meling, Audit Program Director, at (703) 604-9090 (DSN 664-9090) or Mr. David M. Wyte, Audit Project Manager, at (703) 604-9027 (DSN 664-9027). Enclosure 4 lists the distribution of this report. The audit team members are listed inside the back cover.

David K. Steensma

David K. Steensma
Deputy Assistant Inspector General
for Auditing

Enclosures

Scope and Methodology

Scope

We conducted this program audit from March through October 1996 in accordance with auditing standards issued by the Comptroller General of the United States, as implemented by the Inspector General, DoD. Accordingly, we included tests of management controls considered necessary. We reviewed acquisition documents dating from September 1993 through September 1996 covering acquisition planning, risk management, logistics and other infrastructure, cost performance, contracts and agreements, affordability, system requirements documentation, engineering and manufacturing development efforts, and test and evaluation. To perform the audit, we interviewed and obtained program documentation from the Office of the Secretary of Defense and Military Department officials involved with the AIM-9X program.

Methodology

The audit was performed in accordance with the Inspector General's critical program management elements approach. We reviewed program definition, program structure, program design, contracting, program assessments and decision reviews, periodic reporting, and management controls related to those objectives. The methodology was tailored because the Under Secretary of Defense for Acquisition and Technology chose the AIM-9X program as a Cost as an Independent Variable "flagship" program to implement innovative and creative acquisition management techniques. We did not rely on computer-processed data or statistical sampling procedures to develop conclusions on this audit.

At the completion of the audit survey, we determined that additional audit work was not necessary based on audit results.

Organizations and Individuals Visited or Contacted

We visited or contacted individuals and organizations within the DoD. Further details are available on request.

Management Control Program

DoD Directive 5010.38, "Internal Management Control Program," April 14, 1987,* requires DoD organizations to implement a comprehensive system of management controls that provides reasonable assurance that programs are operating as intended and to evaluate the adequacy of the management controls.

Scope of Review of the Management Control Program. We limited our review because of the relevant coverage in Inspector General, DoD, Report No. 96-028, "Implementation of the DoD Management Control Program for Major Defense Acquisition Programs," November 28, 1995. The report discusses the effectiveness of the management control program that the Defense Acquisition Executive and Component Acquisition Executives used for major Defense acquisition programs. The report concludes that the acquisition community had not effectively integrated DoD Management Control Program requirements into its management assessment and reporting processes. As a result of the report recommendations, the Under Secretary of Defense for Acquisition and Technology integrated DoD Directive 5010.38 requirements into the March 15, 1996, revision to DoD Directive 5000.1, "Defense Acquisition," and DoD Regulation 5000.2-R, "Mandatory Procedures for Major Defense Acquisition Programs (MDAPS) and Major Automated Information System (MAIS) Acquisition Programs." Acquisition managers are now to use program cost, schedule, and performance parameters as control objectives to implement the DoD Directive 5010.38 requirements. The managers are to identify material weaknesses through deviations from approved acquisition program baselines and exit criteria in the "Defense Acquisition Executive Summary" report. Consequently, we limited our review to management controls directly related to the critical program management elements of the AIM-9X acquisition.

Adequacy of Management Controls. Management controls were adequate in that we did not identify any material control weakness applicable to our primary audit objective.

*DoD Directive 5010.38 has been revised as "Management Control (MC) Program," August 26, 1996. The audit survey was performed under the April 1987 version of the directive.

Prior Audits and Other Reviews

During the last 5 years, the General Accounting Office; the Office of the Inspector General, DoD; and the Naval Audit Service have not issued reports addressing the AIM-9X acquisition. On July 16, 1996, the General Accounting Office announced a review on the status of the development and acquisition plans for the AIM-9X (General Accounting Office Code 707185). The overall objective of that review is to examine technical requirements, technology development efforts, cost and operational effectiveness of existing and candidate systems, and the acquisition strategy for the AIM-9X program. The General Accounting Office was still conducting the review at the completion of our audit.

Audit Results for Program Management Elements Reviewed

Program Definition

Requirements. The Navy adequately documented and the Joint Requirements Oversight Council validated the requirement and quantities for the AIM-9X as required by the DoD 5000 series of documents. In the September 1994 "Joint System Threat Assessment Report," the Joint Requirements Oversight Council and the Defense Intelligence Agency recognized that the AIM-9X is a superior missile when compared with other short range air-to-air missiles. The AIM-9X will replace the AIM-9M and will complement the Advanced Medium Range Air-to-Air Missile on the F/A-18 C/D and E/F, F-15, F-16, and F-22 aircraft. Although superior in performance, the unit cost of the AIM-9X will range between $144,000 and $213,000, or two to three times the $70,000 unit cost for the AIM-9M.

Affordability. The Navy and the Air Force had adequately structured the funding for the AIM-9X in the FY 1997 Future Years Defense Program. With the goal of reducing AIM-9X unit costs, the AIM-9X Program Manager implemented the Cost as an Independent Variable initiative by establishing aggressive and realistic cost objectives in the request for proposal for the AIM-9X engineering and manufacturing development contract. In the request for proposal, the AIM-9X Program Manager applied Cost as an Independent Variable tenets by emphasizing the use of contractor design-to-cost and producibility programs to reduce AIM-9X unit costs. AIM-9X affordability will be an issue, however, if the Navy and the Air Force are unable to fund the annual quantities planned through FY 2018.

Program Structure

Acquisition Planning. The AIM-9X Program Manager established an event-driven strategy that explicitly linked program decisions to demonstrated accomplishments in development, testing, initial production, and life-cycle support as specified in the DoD 5000 series of documents. In tailoring the acquisition strategy, the AIM-9X Program Manager effectively addressed program cost, risk, test, and contractual issues in accordance with acquisition reform initiatives and Cost as an Independent Variable guidelines. The acquisition strategy not only addressed the development of the AIM-9X but also the testing and potential procurement of the ASRAAM as an alternative to developing and procuring the AIM-9X. A cohesive acquisition strategy was possible because the AIM-9X program office management team, made up of Navy and Air Force officers, were actively engaged in the daily management of the AIM-9X acquisition and jointly concurred in program management decisions.

In a May 7, 1996, memorandum, the Principal Deputy Under Secretary for Acquisition and Technology praised the AIM-9X program management for a well-run program. The Principal Deputy was pleased about the ways that the AIM-9X Program Manager had incorporated Cost as an Independent Variable principles into the program, used contract innovation to drive down production and life-cycle costs, streamlined its requests for proposal process, and accessed the best thinking in the Navy and the Air Force to develop its acquisition strategy.

Risk Management. Although the AIM-9X Program Office did not prepare an independent risk management plan for the AIM-9X acquisition, it submitted a quality risk assessment in the "Integrated Program Summary" report, dated December 1, 1994, supporting the AIM-9X demonstration and validation decision point as required by the DoD 5000 series of documents. During demonstration and validation, the AIM-9X Program Manager manages program performance, cost, and schedule risks through risk management plans submitted as part of the Hughes and Raytheon demonstration and validation contracts. Hughes and Raytheon established risk management plans that adequately identified, assessed, mitigated, and initiated systems to effectively manage identified program performance, cost, and schedule risks. In the requests for proposal for the AIM-9X engineering and manufacturing development phase, the AIM-9X Program Manager is assigning the AIM-9X Program Office and the contractor IPTs joint responsibility for implementing an effective AIM-9X risk management program as specified in the DoD 5000 series of documents.

Cost Performance. The AIM-9X Program Office had effectively monitored Hughes and Raytheon's cost performance through contractor cost and schedule control systems as required in the DoD 5000 series of documents. At the onset of the contracts, the AIM-9X Program Manager was aware of the need to closely monitor contractor cost performance because of technology risks and the compressed 18-month demonstration and validation schedule for completion. As a result, the AIM-9X Program Manager budgeted adequate reserves to fund the potential contractor cost overruns. As anticipated, Hughes and Raytheon experienced cost overruns ranging from * percent to * percent over contract cost baseline estimates.

Hughes. Hughes costs exceeded the demonstration and validation contract cost baseline by * percent. Hughes experienced cost overruns in *.

Raytheon. Raytheon costs exceeded the demonstration and validation contract cost baseline by * percent. Raytheon experienced cost overruns relating to *.

*Contractor proprietary data removed.

Test and Evaluation. The Navy adequately planned and tested Hughes and Raytheon's AIM-9X prototype guidance systems and preliminary weapon system designs, in accordance with the DoD 5000 series of documents. The AIM-9X Program Manager was able to reduce technical risks and reach conclusions about the potential capabilities of the contractor-developed prototypes and weapon system designs using contractor data from ground and flight tests and using results from modeling and simulation demonstrations.

Planning. In November 1994, the Office of the Director, Operational Test and Evaluation, approved the Test and Evaluation Master Plan for the AIM-9X. During the demonstration and validation phase, the Office of the Director, Operational Test and Evaluation, actively participated on the AIM-9X Test and Evaluation Working Group and was involved in test planning and conduct. The Office of the Director, Operational Test and Evaluation, will also participate on AIM-9X IPTs during the engineering and manufacturing development phase.

Independent Testers. The AIM-9X independent testers from the offices of the Naval Commander, Operational Test and Evaluation Force, and the Air Force Operational Test and Evaluation Center indicated that Hughes and Raytheon had developed AIM-9X prototype seekers that were potentially operationally effective and suitable. The independent testers based their conclusions on contractor data generated during ground and flight tests and results from modeling and simulation demonstrations. In December 1996, the Office of the Naval Commander, Operational Test and Evaluation Force, with the Office of the Air Force Operational Test and Evaluation Center's concurrence, issued an Early Operational Assessment report for the AIM-9X that reiterated their preliminary conclusions concerning the potential operational effectiveness and suitability of the Hughes and Raytheon AIM-9X prototype seekers.

Program Design

Engineering and Manufacturing. During the demonstration and validation phase, the AIM-9X Program Office and contractor prepared engineering and manufacturing documentation that adequately addressed systems engineering, software, human resources, and producibility as specified in the DoD 5000 series of documents.

Systems Engineering. As contractually required, Hughes and Raytheon submitted systems engineering management plans in accordance with requirements in Military Standard 499A, "Engineering Management." The systems engineering management plans adequately documented the systems engineering process for the various contractor IPTs; translated AIM-9X performance requirements into stable, interoperable, producible, supportable, and cost-effective designs for testing and manufacturing; and provided design traceability. Design traceability originated with the missile performance requirements and was traced to the guidance system designs and prototypes and to the preliminary missile system designs.

Software. The AIM-9X Program Office prepared the AIM-9X Computer Resources Life-Cycle Plans and requested Hughes and Raytheon to provide other software deliverable documentation. Also, the AIM-9X Program Office conducted contractor milestone reviews for software requirements and development. Hughes and Raytheon took appropriate actions to correct action items resulting from the software reviews. Software development has become the primary development risk for the AIM-9X program because precise algorithms are needed to track targets when countermeasures, such as flares, are released from enemy aircraft.

Human Resources. During the demonstration and validation phase, the AIM-9X Program Manger developed a human systems integration strategy and plan and implemented a human systems action item reporting system with Hughes and Raytheon. Further, Hughes and Raytheon were contractually required to perform studies and analyses of people and equipment interfaces. The contractor studies concluded that the Navy and Air Force would not require additional personnel or increased personnel skills to operate and maintain the AIM-9X.

Producibility. The AIM-9X Program Manager aggressively addressed producibility of the AIM-9X through implementation of acquisition reform initiatives and Cost as an Independent Variable guidance. During demonstration and validation, the AIM-9X Program Manager established cost and producibility technical working groups with Hughes and Raytheon and conducted quarterly program reviews to discuss contractor producibility issues. Further, the contractors' producibility and manufacturing plans contained sufficient information to answer an exit criteria requirement addressing production rates of critical missile system components, such as the seekers for the advanced guidance system.

Logistics. The AIM-9X Program Manager adequately addressed logistics requirements through the acquisition strategy, the integrated logistics support plan, and the demonstration and validation contracts as required by the DoD 5000 series of documents. Logistics requirements addressed include special system support equipment requirements, depot maintenance, access to contractors' data bases, configuration management, and related missile system interfaces and integrations.

Support Equipment and Depot Maintenance. Existing AIM-9M and Advanced Medium Range Air-to-Air Missile support equipment is expected to satisfy AIM-9X system support requirements. As with the Advanced Medium Range Air-to-Air Missile program, the Navy plans to have one contractor-operated depot level maintenance facility to support the AIM-9X system when missile maintenance transitions from production to logistics support.

Database Access and Configuration Management. During demonstration and validation, Hughes and Raytheon were required to conduct studies on the implementation of management information database systems accessible to contractor and Navy management personnel. During engineering and manufacturing development, the winning contractor will be required to activate the management information database system for on-line access by IPT members. Also, the engineering and manufacturing development contractor will be required to retain configuration management responsibility through the engineering and manufacturing development phase.

System Interfaces and Integrations. The Navy and the Air Force are actively coordinating the AIM-9X system and Helmet-Mounted Cueing System interfaces and integrations of the two systems with the program managers for host aircraft platforms. The AIM-9X Program Office's ability to demonstrate the off-boresight angle capability of the AIM-9X is dependent on the availability of the Helmet-Mounted Cueing System. As planned, the AIM-9X weapon system and the Helmet-Mounted Cueing System will concurrently obtain initial operational capability shortly after FY 2000.

Contracting

Contracts and Agreements. The AIM-9X Program Office established contracts and agreements and provided administrative oversight that adequately addressed the AIM-9X demonstration and validation objectives to reduce technical risk and to test and evaluate an alternative short range air-to-air missile system. In accordance with the DoD 5000 series of documents, the AIM-9X Program Manager implemented contract actions and agreements necessary to provide engineering and manufacturing development decisionmakers with sufficient information to evaluate the merits of their options. Their options were either to proceed with one of the two demonstration and validation contractors into engineering and manufacturing development or to select the ASRAAM as an acceptable alternative to the development and production of the AIM-9X. Since the demonstration and validation decision in December 1994, the AIM-9X Program Manager awarded two demonstration and validation contracts, issued a request for information to British Aerospace, and issued a request for proposal for the engineering and manufacturing development contract. To determine whether the ASRAAM is an acceptable alternative to the AIM-9X, the AIM-9X Program Manager executed a Foreign Comparative Test Government Working Team Plan Agreement with British Aerospace. At the December 1996 engineering and manufacturing development decision review, the Defense Acquisition Executive approved the selection of the Hughes AIM-9X variant for the engineering and manufacturing development and low-rate initial production phase of the acquisition process.

Contracts. In December 1994, the AIM-9X Program Office awarded Hughes and Raytheon cost-plus-incentive-fee contracts to demonstrate their prototype AIM-9X guidance systems and to submit preliminary system designs for the complete weapon system. The Hughes contract totaled $22.1 million, and the Raytheon contract totaled $24.9 million. During the demonstration and validation phase, the AIM-9X Program Office awarded incentive fees to both contractors for timely delivery of their preliminary system designs.

Request for Information. In May 1996, the AIM-9X Program Manager issued a request for information to British Aerospace to determine the demonstrated operational effectiveness and suitability capabilities of the ASRAAM. British Aerospace's response to the request for information will allow the AIM-9X Program Office to evaluate the technical, managerial, logistical, and cost aspects of the ASRAAM for potential integration as a nondevelopmental item into U.S. Navy fighter/attack aircraft and Air Force fighter aircraft.

Requests for Proposal. In May 1996, the AIM-9X Program Manager released a request for proposal for the AIM-9X engineering and manufacturing development contract. The request for proposal includes engineering and manufacturing development requirements as well as low-rate initial production requirements for the first 1,000 production missiles.

Foreign Comparative Test. In January 1995, the AIM-9X Program Manager awarded British Aerospace a $9.2 million firm-fixed-price contract for the purpose of conducting a foreign comparative test. Independent test organizations for the Navy and the Air Force observed testing of the performance capabilities of the ASRAAM guidance system to assess the missile's infrared counter-countermeasures capabilities, off-boresight angle performance, acquisition range, and target aim-point selection.

Foreign Comparative Test Working Team. Under a $5 million funding agreement, the AIM-9X Program Manager assembled a Foreign Comparative Test Working Team to evaluate the ASRAAM. The team will analyze data from the request for information and the foreign comparative test to determine whether the ASRAAM is capable of meeting the U.S. operational requirement for a short range air-to-air missile that will counter threats described in the AIM-9X System Threat Assessment Report.

Program Assessments and Decision Reviews

Program Assessments. In December 1994, the Conventional Systems Committee* assessed the readiness of the AIM-9X program to proceed into the demonstration and validation phase of the acquisition process. To perform the assessment, the committee prepared an integrated program assessment of the AIM-9X program as required by the DoD 5000 series of documents. The assessment was based on the:

o AIM-9X Program Office documentation submitted on the program acquisition strategy, baseline parameters, technical risks, streamlining initiatives, requirements flow down from the operational requirements document, design-to-cost processes, and cooperative strategies with foreign governments;

o Director, Operational Test and Evaluation, documentation submitted on the quality and completeness of the AIM-9X Test and Evaluation Master Plan;

o Director, Cost Analysis Improvement Group, documentation evaluating life-cycle cost estimates and affordability; and

o Joint Requirements Oversight Council documentation validating the key performance parameters for the AIM-9X.

The submitted documentation showed that all tasks and activities needed to bring the AIM-9X program to the demonstration and validation phase had occurred.

Decision Reviews. At the December 1994 demonstration and validation decision review, the Defense Acquisition Board approved the AIM-9X program for entry into the demonstration and validation phase. At the December 1996 engineering and manufacturing development decision review, the Defense Acquisition Executive approved the selection of the Hughes AIM-9X variant for the engineering and manufacturing development and low-rate initial production phases of the acquisition process.

*The Conventional Systems Committee has been replaced by the Overarching Integrated Product Team.

Periodic Reporting

DoD Regulation 5000.2-R describes mandatory reports that must be prepared periodically to provide acquisition executives and Congress with adequate information to oversee the acquisition process and to make necessary decisions. Mandatory reports include the Defense Acquisition Executive Summary reports and the Selected Acquisition Reports.

Defense Acquisition Executive Summary Reports. As required by the DoD 5000 series of documents, the AIM-9X Program Manager had prepared adequate and accurate Defense Acquisition Executive Summary reports, issued quarterly from March 1995 through June 1996, that highlighted potential and actual program problems to the Under Secretary of Defense for Acquisition and Technology before the problems became significant. The quarterly reports realistically reported the AIM-9X program's status, including program assessments, unit costs, current estimates of the acquisition program baseline parameters, status reporting of exit criteria and contract costs, and vulnerability assessments on the AIM-9X program.

Selected Acquisition Reports. The AIM-9X Program Manager prepared annual Selected Acquisition Reports for calendar years 1994 and 1995, dated March 31, 1995, and March 31, 1996, respectively, in accordance with instructions in the DoD 5000 series of documents. The annual AIM-9X reports realistically reported information on total program cost, schedule, and performance; program unit cost; and unit cost breaches.

Office of the Under Secretary of Defense for Acquisition and Technology Comments

OFFICE OF THE UNDER SECRETARY OF DEFENSE

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20 December 1996

MEMORANDUM FOR THE INSPECTOR GENERAL (ACQUISITION MANAGEMENT DIRECTORATE)

Subject: Comments on DoD IG Draft Audit Report 6AE-0037, "Air-to-Air Intercept Missile-9X Program," November 29, 1996

This is in response to your request to review and comment on the subject draft audit report concerning the AIM-9X missile program.

The draft report has been reviewed by my staff and found to be accurate. The report is a factual account of the program management of the AIM-9X program and the foreign comparative test program of the Advanced Short Range Air-to-Air Missile (ASRAAM). No findings or recommendations were made in the report. We have no additional comments to provide.

George Schneiter
Director
Strategic & Tactical Systems

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