

A *udit*



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POWERED-LOW COST AUTONOMOUS ATTACK SYSTEM
ADVANCED TECHNOLOGY DEMONSTRATOR

Report No. D-2001-106

May 7, 2001

Office of the Inspector General
Department of Defense

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Abstract The Air Force Research Laboratory, Munitions Directorate, established the Powered-Low Cost Autonomous Attack System Advanced Technology Demonstrator program to demonstrate an affordable, miniature, autonomous, powered submunition. The submunition was to provide the ability to search, detect, identify, track, and destroy ground mobile targets in different weather and terrain. The Advanced Technology Demonstrator program was to demonstrate its technical feasibility and military utility for suppression of enemy air defense and missile attack capabilities. On December 15, 1998, a 36-month, \$33.2 million cost share other transaction agreement was awarded to Lockheed Martin Corporation, Vought Systems, for development of the advanced technology demonstrator.		Monitoring Agency Acronym
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Acronyms

AFRL	Air Force Research Laboratory
ATD	Advanced Technology Demonstrator
LOCAAS	Low Cost Autonomous Attack System
P-LOCAAS	Powered-Low Cost Autonomous Attack System
LORISK	Low Cost Anti Armor Submunition Risk Reduction



INSPECTOR GENERAL
DEPARTMENT OF DEFENSE
400 ARMY NAVY DRIVE
ARLINGTON, VIRGINIA 22202-4704

May 7, 2001

MEMORANDUM FOR ASSISTANT SECRETARY OF THE AIR FORCE
(FINANCIAL MANAGEMENT AND COMPTROLLER)

SUBJECT: Audit Report on the Powered-Low Cost Autonomous Attack System
Advanced Technology Demonstration (Report No. D-2001-106)

We are providing this audit report for information and use. We considered management comments on a draft of this report in preparing the final report.

Comments on the draft of this report conformed to the requirements of DoD Directive 7650.3 and left no unresolved issues. Therefore, no additional comments are required.

We appreciate the courtesies extended to the audit staff. Questions on the audit should be directed to Mr. Raymond A. Spencer at (703) 604-9071 (DSN 664-9071) (rspencer@dodig.osd.mil) or Mr. Roger H. Florence at (703) 604-9067 (DSN 664-9067) (rflorence@dodig.osd.mil). See Appendix C for the report distribution. The audit team members are listed inside the back cover.

A handwritten signature in cursive script, appearing to read "Thomas F. Gimble".

Thomas F. Gimble

Acting

Deputy Assistant Inspector General
for Auditing

Office of the Inspector General, DoD

Report No. D-2001-106

(Project No. D2001AB-0021)

May 7, 2001

Powered-Low Cost Autonomous Attack System Advanced Technology Demonstrator

Executive Summary

Introduction. The Air Force Research Laboratory, Munitions Directorate, established the Powered-Low Cost Autonomous Attack System Advanced Technology Demonstrator program to demonstrate an affordable, miniature, autonomous, powered submunition. The submunition was to provide the ability to search, detect, identify, track, and destroy ground mobile targets in different weather and terrain. The Advanced Technology Demonstrator program was to demonstrate its technical feasibility and military utility for suppression of enemy air defense and missile attack capabilities. On December 15, 1998, a 36-month, \$33.2 million cost share other transaction agreement was awarded to Lockheed Martin Corporation, Vought Systems, for development of the advanced technology demonstrator.

Objectives. Our audit objectives were to evaluate the Powered-Low Cost Autonomous Attack System development, operational and system requirements, planned testing for the program, and the use of the prototype other transaction authority.

Results. The Air Force Research Laboratory plans to continue refining the P-LOCAAS technology beyond satisfying the system requirements (exit criteria) identified in the technology transition plan. As a result, the Air Force Research Laboratory will spend an additional \$24 million in FYs 2002 and 2003 to refine the system capability although no assessment has been made to support this continued expenditure.

Summary of Recommendations. We recommend that the Director, Air Force Research Laboratory, Munitions Directorate, update and coordinate the Powered-Low Cost Autonomous Attack System Technology Transition Plan with the Air Force Aeronautical Systems Center and the Air Combat Command to assess the planned additional development beyond the established exit criteria before obligating any additional funding to the demonstrator development agreement.

Management Comments. The Chief, Science and Technology Division, Deputy Assistant Secretary of the Air Force (Science, Technology, and Engineering), concurred and stated that the Air Force Research Laboratory will update the existing Technology Transition Plan if an additional \$24 million becomes available and will re-coordinate the Plan. A discussion of the management comments is in the Finding section of the report, and the complete text of the management comments is in the Management Comments section.

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Background

The Air Force Research Laboratory, Munitions Directorate, established the Powered-Low Cost Autonomous Attack System (P-LOCAAS) Advanced Technology Demonstrator (ATD) program to demonstrate an affordable, miniature, autonomous, powered submunition. The mission of P-LOCAAS was to provide the ability to search, detect, identify, track, and destroy ground mobile targets in different weather, and terrain conditions. The ATD program will demonstrate the technical feasibility and military utility of the P-LOCAAS technology for suppression of enemy air defense and missile attack.

On December 15, 1998, the Air Force Research Laboratory (AFRL) issued a 36-month other transaction agreement to Lockheed Martin Corporation, Vought Systems, to develop the ATD. The other transaction is a firm-fixed-price agreement with cost sharing. The total amount of the agreement was \$32.9 million, with the Air Force funding \$15.3 million and Lockheed funding \$17.7 million. As of September 26, 2000, the agreement had been modified six times, increasing the value to \$33.2 million, and with increased Air Force cost sharing.

Prototype Other Transaction Authority. The development of the P-LOCAAS was acquired under the other transaction authority. In 1989, Congress enacted section 2371, title 10, United States Code (10 U.S.C. 2371), which authorized the use of other transactions for basic, applied, and advanced research projects. The National Defense Authorization Act of FY 1994, section 845, augmented the other transaction authority to allow its use for prototype projects directly relevant to weapons or weapon systems. That authority waives many of the Federal Acquisition Regulation contracting procedures. One of the reasons Congress granted the other transaction authority was to obtain research and development from nontraditional defense contractors and to pursue commercial solutions to defense requirements. Nontraditional contractors can participate as the prime contractor or the subcontractor. The prototype other transaction authority can only be used for prototype development, while procurement of prototype production items requires the use of Federal Acquisition Regulation contracting procedures. On December 21, 2000, the Under Secretary of Defense for Acquisition, Technology, and Logistics issued other transaction authority guidance on the use of the prototype. The authority to use other transactions for prototype development has been extended until September 30, 2004.

Objectives

Our audit objectives were to evaluate the P-LOCAAS development, operational and system requirements, planned testing for the program, and the use of the prototype other transaction authority. See Appendix A for a discussion of the audit scope and methodology.

Powered-Low Cost Autonomous Attack System Advanced Technology Demonstrator Transition Planning

The AFRL plans to continue refining the P-LOCAAS technology beyond satisfying the system requirements (exit criteria) identified in the technology transition plan. This condition exists because the AFRL had not received direction on whether continued development is warranted. As a result, the AFRL will spend an additional \$24 million in FYs 2002 and 2003 to refine the system capability although no assessment has been made to support this continued expenditure.

The P-LOCAAS Requirements

The AFRL, Munitions Directorate, developed the P-LOCAAS ATD as a potential materiel alternative to meet the Air Combat Command's Miniaturized Munitions Capability mission need. The Air Combat Command developed the mission need statement, performed the analysis of alternatives, and will develop the Operational Requirements Document for the Miniaturized Munitions Capability.

Mission Need Statement. The mission need statement documents a mission need in terms of required capability or operational deficiency. In the Miniaturized Munitions Capability mission need statement, September 4, 1997, the Air Combat Command identified the need for miniaturized munitions that include:

- multiple kills per pass;
- multiple ordinance carriages;
- accurate and precise adverse weather munitions capability;
- medium-to-high altitude accuracy of free-fall weapons;
- capability against hardened targets;
- a munitions package;
- increased weapons effectiveness against area targets;
- real-time target location and kill capability against small mobile targets;
- prevention of susceptibility to camouflage, concealment, and deception;

-
- minimization of collateral damage; and
 - prevention of susceptibility of munitions to countermeasures.

Current aircraft, ballistic missile, and future aircrafts, such as the F-22, Joint Strike Fighter, and Military Spaceplane, will be capable of carrying a limited number of existing and planned munitions systems. The development of miniaturized munitions will increase the number of munitions that aircraft can carry and the number of targets attacked per mission.

The Miniaturized Munitions Capability mission and objectives include air and space superiority; support of surface operations; and the ability to divert, disrupt, and destroy enemy capabilities and war-sustaining capability. Targets of the Miniaturized Munitions Capability include fixed structures such as hardened aircraft shelters, bunkers, power plants, industrial buildings, and naval ships in port; and mobile or movable armor and missile sites. The P-LOCAAS was identified as a potential materiel alternative capable of satisfying portions of the mission need statement.

Analysis of Alternatives. The analysis of alternatives is an evaluation of the advantages and disadvantages of alternatives to satisfy a requirement, including the sensitivity of each alternative to possible changes in key assumptions or variables. The analysis aids decisionmakers in determining whether an alternative offers sufficient benefits. The analysis of alternatives for the Miniaturized Munitions Capability included 26 systems, of which 6 were compared because they best met the requirements. The P-LOCAAS was one of the alternative submunitions in the comparison. The P-LOCAAS ATD will demonstrate technologies key to defeating mobile and relocatable targets, which are the most challenging targets. The P-LOCAAS could demonstrate technology(ies) that will satisfy the requirements of the Operational Requirements Document.

Operational Requirements Document. The Air Combat Command plans to develop an Operations Requirements Document by September 2001 to further define the mission needs statement, establish performance parameters, and document the user's objectives and minimum acceptable requirements for operational performance.

LOCAAS Evolution

The P-LOCAAS ATD program has evolved from several technology development programs awarded and managed by the Defense Advanced Research Program Agency; the AFRL, Munitions Directorate; and the Army Research Laboratory. Those programs include the Low Cost Autonomous Attack Submunition (LOCAAS), LOCAAS Risk Reduction (LORISK), the Anti-Materiel Submunition Warhead Technology, and the LOCAAS Engagement and Analysis Program and Simulation programs. Prior funding for those programs was \$67 million.

Low Cost Autonomous Attack Submunition. In September 1990, the Army and Air Force began a joint effort of the LOCAAS program with Loral Vought Systems. The program included a solid state pulsed Laser Radar seeker, a highly maneuverable airframe, and a single explosively formed penetrator warhead. The LOCAAS program successfully accomplished proof-of-principle type testing for the seeker, airframe, and warhead. The LOCAAS program was in development between FYs 1990 to 1994 at a cost of \$37.4 million.

Low Cost Anti Armor Submunition Risk Reduction. In December 1994, Loral Vought Systems (now Lockheed Martin Corporation, Vought Systems) was awarded the LORISK effort as a follow-on to the joint Army and Air Force LOCAAS program. The LORISK program added a multi-mode Anti-Material Submunition warhead to the design of the LOCAAS program. The multi-mode Anti-Material Submunition warhead was effective against heavy armor, surface-to-air missiles and surface-to-surface missiles. The LORISK program was in development from FYs 1995 through 1998 at a cost of \$13 million.

Anti-Materiel Submunition Warhead Technology. The Anti-Materiel Submunition Warhead Technology Program provided a tactically sized warhead, capable of three detonation types from a single warhead, for armored, heavy armored, and soft target attack. The warhead projectile types include an aerostable slug, a long stretching rod, and divergent spray of explosively formed fragments. The warhead and electronics were demonstrated in the Anti-Materiel Submunition Warhead Technology program from FY 1994 through FY 1998 at a cost of \$15 million.

LOCAAS Engagement and Analysis Program and Simulation. The LOCAAS Engagement and Analysis Program and Simulation converted the Army LOCAAS mission planner to an Air Force version. The mission engagement simulation allowed the study and optimization of LOCAAS target-search patterns in various terrain and combat scenarios. The LOCAAS Engagement and Analysis Program and Simulation was used during the P-LOCAAS program to refine the concept of operations and provide a technology base for future LOCAAS mission planning. This effort was performed from FYs 1996 through 1998 at a cost of \$1.6 million.

P-LOCAAS Development

Advanced Technology Demonstrator. In December 1998, the AFRL entered into a 36-month other transaction agreement with Lockheed Martin Corporation, Vought Systems. P-LOCAAS requirements have evolved from the LOCAAS, LORISK, and Anti-Materiel Submunition Warhead programs and is a potential material alternative for the Miniaturized Munitions Capability mission need statement. The mission need statement provides mission and threat analyses that address various warfighting needs, objectives, and general capabilities. P-LOCAAS is envisioned as a miniature, autonomous, powered munition capable of broad area search, identification, and destruction of a range of mobile ground targets. Typical targets include theater ballistic-missile launchers, air-defense sites, and ground vehicles. This cost share effort, begun in FY 1999 and is scheduled to end in FY 2002, was valued at \$33.2 million.

P-LOCAAS Status. The P-LOCAAS ATD had completed 25-months of its 36-month development. The development capitalized on the previous 10-year development attributed to LOCAAS and the related advanced technology program as discussed above. The P-LOCAAS ATD had achieved all major milestones to date, including successful completion of 4 of the planned 13 tests. Officials from AFRL, Munitions Directorate, and inprocess review reports from the contractor identified that the P-LOCAAS development program is on schedule and is expected to satisfy all performance requirements in the exit criteria as identified in the technology transition plan.

Exit Criteria

In July 1998, the AFRL, Munitions Directorate, and Aeronautical Systems Center developed the technology transition plan for the P-LOCAAS. The technology transition plan provides the ATD exit criteria for performance parameter measures, quantitative goals, levels of demonstration, affordability, producibility, supportability, safety and environmental considerations, data and documentation deliverables, technology capability date, and lethality and effectiveness assessment. The technology transition plan commits AFRL, the developer of the technology; Aeronautical Systems Center, the recipient of the technology; and Air Combat Command, the primary user of the technology to the expected performance goals for the P-LOCAAS ATD. Based on current development efforts, the ATD effort will achieve the goals established in the technology transition plan and the established exit criteria.

Request for Additional Funding. On December 15, 2000, AFRL, Munitions Directorate, provided the Office of the Assistant Deputy Secretary of the Air Force (Science, Technology, and Engineering) a proposal list for P-LOCAAS unfunded priorities with additional development tasks and options totaling \$24.2 million to continue ATD development during FYs 2002 and 2003. The proposal exceeds the current exit criteria for the P-LOCAAS ATD and includes baseline tasks and additional options.

Baseline Tasks Proposal:

- Demonstration of warhead functionality in two separate live-fire flight tests at a cost of \$7.3 million.
- Further development and maturation of the Automatic Target Acquisition algorithms at a cost of \$3.5 million.
- Environmental hardening of the Laser Radar Seeker at a cost of \$3 million.

Priced Options:

- Flight-test a guided test vehicle with data capability and no live warhead at a cost of \$3.1 million.
- Validate a tactical turbojet engine wind mill start at a cost of \$951 thousand.
- Flight test a tactically sized vehicle without a warhead at a cost of \$3 million.
- Integrate the Tactical Munitions Dispenser/Smart Munitions Dispenser at a cost of \$2.2 million.
- Perform a study and test of fuel tank aging at a cost \$504,000.
- Perform a Producibility and Cost As an Independent Variability Study at a cost of \$630,000.

The tasks and options listed in the AFRL, Munitions Directorate, proposal were in addition to the current P-LOCAAS ATD exit criteria.

Conclusion

In September 2001, the Air Combat Command plans to complete the operational requirements document for the Miniaturized Munitions Capability. The P-LOCAAS ATD is developing technologies that should be applicable to concepts that will satisfy the requirements set forth in the operational requirements document, and ATD development is scheduled for completion in December 2001. It is unclear whether continued development of the ATD is warranted because the exit criteria in the technology transition plan will be satisfied. Before the AFRL, Munitions Directorate, continues the program development beyond the exit criteria, it should update and coordinate the technology transition plan with the Aeronautical Systems Center and the Air Combat Command to determine whether continued development and expenditures is warranted.

Recommendation and Management Comments

We recommend that the Director, Air Force Research Laboratory, Munitions Directorate, update and coordinate the Powered-Low Cost Autonomous Attack System Technology Transition Plan with the Air Force Aeronautical Systems Center and the Air Combat Command to assess the planned additional development beyond the established exit criteria before obligating any additional funding to the Advanced Technology Demonstrator development agreement.

Management Comments. The Chief, Science and Technology Division, Deputy Assistant Secretary of the Air Force (Science, Technology, and Engineering), concurred and stated that the Air Force Research Laboratory will update the existing Technology Transition Plan if an additional \$24 million becomes available and will re-coordinate the Plan with the Air Force Aeronautical Center and the Air Combat Command.

Appendix A. Audit Process

Scope and Methodology

Work Performed. We reviewed the overall management of the P-LOCAAS program as awarded under the other transaction authority. We evaluated the program to determine the status of the development, what system requirements were in place, and the testing achievements. We reviewed the applicable criteria for transitioning from an ATD to user procurement.

We conducted interviews with officials at the Air Force Acquisition Research and Technology, and personnel at the Program Manager's office and the Air Combat Command. We examined documentation for the P-LOCAAS program including the basic agreement, the proposals, modifications and other contracting and project documentation. We did not question the technical merits of the proposal. We did not use computer-processed data to perform the audit.

We performed this program results audit from October 2000 through January 2001, in accordance with auditing standards issued by the Comptroller General of the United States, as implemented by the Inspector General, DoD. We did not review the management control program because the audit focus was on the technology development program. However, the condition cited in this report, continued development beyond the established exit criteria, is a management control weakness. The implementation of the recommendation in this report will correct this weakness.

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

DoD-Wide Corporate Level Government Performance and Results Act Coverage. In response to the Government Performance and Results Act, the Secretary of Defense annually establishes DoD-wide corporate level goals, subordinate performance goals, and performance measures. This report pertains to achievement of the following goal and subordinate performance goal.

- **FY 2000 DoD Corporate Level Goal 2:** Prepare now for an uncertain future by pursuing a focused modernization effort that maintains U.S. qualitative superiority in key warfighting capabilities. Transform the force by exploiting the Revolution in Military Affairs, and reengineer the Department to achieve a 21st century infrastructure. (00-DoD-2)
- **FY 2000 Subordinate Performance Goal 2.4:** Meet combat forces' needs smarter and faster, with products and services that work better and cost less, by improving the efficiency of DoD acquisition processes. (00-DoD-2.4)

DoD Functional Area Reform Goals. DoD did not establish performance improvement reform objectives and goals for this functional area.

High-Risk Areas. The General Accounting Office has identified several high-risk areas in the DoD. This report provides coverage of the Defense Contract Management and the Defense Weapons System Acquisition high-risk areas. Although other transactions are not considered to be contracts, we grouped the other transactions in this high-risk area because their purpose is similar to contracts. Because the P-LOCAAS vehicle is an ATD, this review provided coverage in the Defense Weapons System high-risk area because the ATD or the emerging technology could transition to defense weapon systems.

Prior Coverage

During the last 5 years, the General Accounting Office and the Inspector General, DoD, issued five reports discussing other transaction agreements. There have been no prior audits on P-LOCAAS. Unrestricted General Accounting Office reports can be accessed over the Internet at <https://www.gao.gov>. Unrestricted Inspector General, DoD, reports can be accessed at <https://www.dodig.osd.mil/audit/reports>.

General Accounting Office

GAO Report No. NSIAD-00-33 (OSD Case No. 1944), “Acquisition Reform, DoD’s Guidance on Using Section 845 Agreements Could be Improved,” April 7, 2000

GAO Report No. NSIAD-96-11 (OSD Case No. 1074), “DoD Research, Acquiring Research by Nontraditional Means,” March 29, 1996

Inspector General, DoD

Inspector General, DoD, Report No. D-2000-065, “Costs Charged to Other Transactions,” December 27, 1999

Inspector General, DoD, Report No. 98-191, “Financial and Cost Aspects of Other Transactions,” August 24, 1998

Inspector General, DoD, Report No. 97-114, “Award and Administration of Contracts, Grants, and Other Transactions Issued by Defense Advanced Research Projects Agency,” March 28, 1997

Appendix B. Use of Other Transaction Agreement

In December 1998, Lockheed Martin Corporation, Vought Systems, and the AFRL, Munitions Directorate, signed a prototype other transaction agreement for the P-LOCAAS. The agreement stated that the principal purpose was for the Government to “support and stimulate” the contractor to provide its best effort in the development of a prototype. The use of the language “support and stimulate” is inappropriate in the development of a prototype.

In addition, AFRL awarded a fee of \$1.7 million to the contractor on the P-LOCAAS cost share agreement that was inappropriate. The P-LOCAAS other transaction agreement was for \$32.9 million, with a Government cost share of \$15.3 million and a contractor cost share of \$17.7 million. Contractors are willing to share costs on development efforts because of the potential future production contract if the emerging technology is used on military systems. Awarding a fee in a cost share prototype agreement is inappropriate because it mitigates the cost share contribution by the contractor, and the contractor retains all data rights to the development of P-LOCAAS.

The condition of inappropriate agreement language and awarding fees on cost share agreements was noted in previous audit reports with recommendations to the Director, Defense Procurement. In response to those recommendations, the Under Secretary of Defense for Acquisition, Technology, and Logistics issued guidance in the “Other Transaction Guide for Prototype Projects,” December 21, 2000. The guidance states that terms such as “support or simulate” are not appropriate for prototype projects. The guidance also states that, generally, profits or fees should not be permitted on projects that are cost shared. We believe that the guidance issued by the Under Secretary of Defense for Acquisition, Technology, and Logistics should preclude future use of the inappropriate language and the awarding of fees; therefore, we are not making any recommendations for the use of other transaction agreements in this report.

Appendix C. Report Distribution

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House Subcommittee on National Security, Veterans Affairs, and International Relations, Committee on Government Reform
House Subcommittee on Technology and Procurement Policy, Committee on Government Reform

Deputy Assistant Secretary of the Air Force (Science, Technology, and Engineering) Comments



Office Of The Assistant Secretary

DEPARTMENT OF THE AIR FORCE
WASHINGTON DC

17 April 2001

MEMORANDUM FOR ASSISTANT INSPECTOR GENERAL FOR AUDITING OFFICE OF
THE INSPECTOR GENERAL DEPARTMENT OF DEFENSE

FROM: SAF/AQRT
1060 Air Force Pentagon
Washington DC 20330-1060

SUBJECT: Powered-Low Cost Autonomous Attack System Advanced Technology
Demonstrator, February 23, 2001, Project No. D2001AB-0021

This is in reply to your memorandum requesting the Assistant Secretary of the Air Force
(Financial Management and Comptroller) provide Air Force comments on the subject report.

SAF/AQRT concurs with the subject report recommendation. The current Powered Low
Cost Autonomous Attack System (PLOCAAS) Technology Transfer Plan (TTP) contains exit
criteria that is consistent with the currently funded program. If an additional \$24 million
becomes available for additional PLOCAAS risk reduction, AFRL will update the existing TTP
and re-coordinate the PLOCAAS TTP with the Air Force Aeronautical Systems Center and the
Air Combat Command.


GRÉG R. SCHNEIDER, Col, USAF
Chief, Science and Technology Division
Dep Asst Sec (Science, Technology &
Engineering)

Audit Team Members

The Acquisition Management Directorate, Office of the Assistant Inspector General for Auditing, DoD, prepared this report. Personnel of the Office of the Inspector, DoD, who contributed to the report are listed below.

Mary L. Ugone
Raymond A. Spencer
Roger H. Florence
Rudolf Noordhuizen
Gary B. Dutton
Trisha L. Staley
Jacqueline N. Pugh