Audit Report

OFFICE OF THE INSPECTOR GENERAL

AIR FORCE MICROWAVE LANDING SYSTEM

Report No. 94-190 September 20, 1994

Department of Defense

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September 20, 1994

MEMORANDUM FOR ASSISTANT SECRETARY OF DEFENSE (COMMAND, CONTROL, COMMUNICATIONS AND INTELLIGENCE)
ASSISTANT SECRETARY OF THE AIR FORCE (FINANCIAL MANAGEMENT AND COMPTROLLER)

SUBJECT: Audit Report on the Air Force Microwave Landing System (Report No. 94-190)

We are providing this report for your review and comments. The report discusses the Air Force plans for the implementation of the Microwave Landing System for precision landing. Managements comments on a draft of this report were considered in preparing the final report.

DoD Directive 7650.3 requires that all audit recommendations be resolved promptly. After the issuance of our draft report, we met with management officials from the Office of the Assistant Secretary of Defense (Command, Control, Communications and Intelligence), the DoD Policy Board on Federal Aviation, and the Air Force. The Air Force has initiated some corrective actions, and we revised our recommendations for the final report. Therefore, we request that the Assistant Secretary of Defense (Command, Control, Communications and Intelligence) and the Assistant Secretary of the Air Force (Acquisition) provide comments on the final report by November 18, 1994.

The courtesies extended to the audit staff are appreciated. If you have questions on this audit, please contact Mr. Robert M. Murrell, Audit Program Director, at (703) 604-9506 (DSN 664-9506) or Mr. Ronald M. Nelson, Audit Project Manager, at (703) 604-9534 (DSN 664-9534). The distribution for this report is listed in Appendix C. The audit team members are listed inside the back cover.

David K. Steensma

David K. Steensma
Deputy Assistant Inspector General
for Auditing

Office of the Inspector General, DoD

Report No. 94-190 **September 20, 1994**
(Project No. 4RD-6001.01)

AUDIT REPORT ON THE AIR FORCE MICROWAVE LANDING SYSTEM

EXECUTIVE SUMMARY

Introduction. In the approach and landing phase of aircraft flights, precision approach landing systems are the primary means of navigation during inclement weather or other adverse conditions that limit visibility. During the early 1980's, the Federal Aviation Administration demonstrated that the Microwave Landing System (Microwave System) could replace the Instrument Landing System. Based on congressional direction, the Federal Aviation Administration stated in a biennial Federal Radionavigation Plan that the Microwave System would be the standard precision landing aid for civilian and military aviation. In January 1983, the Air Force was designated the lead Military Department for Microwave System activities and was tasked to submit a plan, in coordination with the other Military Departments to the Office of the Secretary of Defense. On June 2, 1994, the Federal Aviation Administration decided to halt further development of the Microwave System for categories 2 and 3 precision approach landings and canceled two contracts for that development. Category 2 and 3 precision landing systems can guide an aircraft to a 100-foot and 50-foot or under decision point, respectively. The Federal Aviation Administration indicated that the Global Positioning System can already handle nonprecision approach landings and that the Global Positioning System has great potential to provide precision approach landings. The Air Force Microwave System program is valued at about $224.5 million.

Objectives. The audit objective was to assess the DoD evaluation of current technologies to satisfy precision landing requirements.

Audit Results. The Office of the Assistant Secretary of Defense (Command, Control, Communications and Intelligence) had not made the final selection of the best precision landing technologies to support the DoD precision landing requirements. After issuance of our draft report, we met with management officials from the Air Force. The Air Force is commended for reducing the Microwave System program requirements. The Air Force also showed that the Microwave System will satisfy the requirement for a tactical precision landing aid. The Air Force still needs to determine the number of Mobile Microwave System ground stations.

Internal Controls. We did not assess internal controls because of the time sensitivity of the report.

Potential Benefits of Audit. The Air Force could put $27.8 million to $38.9 million to better use by decreasing its requirements for the Microwave System program (see Appendix A).

Summary of Recommendations. After issuance of our draft report, we met with management officials from the Office of the Assistant Secretary of Defense (Command, Control, Communications and Intelligence); the DoD Policy Board on Federal Aviation; and the Air Force. The Air Force has initiated action to cancel the purchase and installation of 238 Commercial Microwave System Avionics kits and wiring sets

for the C-130 aircraft. As a result of that reduction in Microwave System program requirements, we changed the final report recommendation. We recommend that the Assistant Secretary of Defense (Command, Control, Communications and Intelligence) determine the DoD precision landing requirements and which precision landing technologies would best satisfy those requirements. Also, we recommend that the Air Force issue the request for proposal to purchase 11 Commercial Microwave System Avionics kits and determine the number of Mobile Microwave System ground stations needed to support Air Force tactical precision landing requirements.

Management Comments. The Assistant Secretary of Defense (Command, Control, Communications and Intelligence) and the Department of the Air Force neither concurred nor nonconcurred with the finding or recommendations. Management stated that the Air Force continued with a prudent, minimum investment in the Microwave System rather than cancel a potential solution for needed technology, while the DoD and Federal Aviation Administration evaluated precision landing system requirements and alternatives. Management did not comment on the recommendations and disagreed with the potential monetary benefits. A complete discussion of management comments and audit response is in Part II of this report, and the complete text of management's comments is in Part IV.

Audit Response. Management comments on the draft report were not totally responsive. However, we met with management officials from the DoD Policy Board on Federal Aviation and the Air Force twice after receiving the comments and the Air Force management showed that positive actions were in process. Based on those meetings, we revised the final report. We clarified the finding, deleted a recommendation, added a recommendation, and revised the monetary benefits. We deleted the draft report recommendation to terminate contracts for the Microwave System program because the Air Force showed that it has subsequently reduced program requirements and has a requirement for a tactical precision landing aid. We ask that the Assistant Secretary of Defense (Command, Control, Communications and Intelligence) and the Assistant Secretary of the Air Force (Acquisition) provide comments on the final report by November 18, 1994.

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Part I - Introduction

Background

Precision Approach Landing System. In the approach and landing phase of aircraft flights, precision approach landing systems are the primary means of navigation during inclement weather or other adverse conditions that limit visibility. The Instrument Landing System (Instrument System) has been the primary worldwide precision landing system in use for about 40 years at civilian and military fixed-base airports. Another system, the Precision Approach Radar, has been used by the DoD for about 40 years in military tactical operations. In 1970, the Federal Aviation Administration coordinated the development of a precision approach landing system program within the United States to replace the Instrument System.

In July 1971, the Federal Aviation Administration published the National Plan for the development of the Microwave Landing System (Microwave System). During the early 1980's, the Federal Aviation Administration demonstrated that the Microwave System could replace the Instrument System and, based on congressional direction, stated in a biennial Federal Radionavigation Plan that the Microwave System would be the standard precision landing aid for civilian and military aviation. At that time, the United States proposed to the International Civil Aviation Organization that the Microwave System should replace the Instrument System and become the international standard for worldwide implementation; the International Civil Aviation Organization agreed. Due to changes in international agreements concerning frequency protection, the International Civil Aviation Organization concluded that the Instrument System will experience frequency interference, congestion, and limited operational capability by 1998. Further, the International Civil Aviation Organization determined that the Microwave System should be implemented at that time. The International Civil Aviation Organization scheduled a meeting for March 1995 with international civil aviation authorities to make a final determination on whether the Microwave System will be the international standard for precision landing.

Precision approach landings are categorized by a decision point (measured in feet) at which the aircraft can land safely under visual control of the pilot.

- Category 1 - the precision landing system can guide the aircraft to a 200-foot decision point.

- Category 2 - the precision landing system can guide the aircraft to a 100-foot decision point.

- Category 3 - the precision landing system can guide the aircraft to a 50-foot or under decision point.

Global Positioning System. For nonprecision approach landings, the decision point is greater than 200 feet. The Federal Aviation Administration indicated that the Global Positioning System (Global System) was approved as a supplemental navigation aid to fly nonprecision approaches to within 250 feet above the runway at about 2,500 airports.

However, on June 2, 1994, the Federal Aviation Administration decided to halt further development of the Microwave System for categories 2 and 3 precision approach landings and canceled two contracts for that development. The Federal Aviation Administration indicated that the Global System could already handle nonprecision approach landings and has great potential to provide precision approach landings. Further, according to the Federal Aviation Administration, "continuing the MLS [Microwave System] development program is not an economically sound strategy, since all indications are that we will never need to deploy category 2 and 3 systems in any significant numbers."

The Global System is a satellite navigation system developed and operated by the DoD. The Global System constellation of 24 satellites emits signals to receivers on or near the surface of the earth. To achieve the full benefits of the Global System, the basic services, which DoD has made available for civilian use worldwide, must be enhanced in terms of accuracy, integrity, and availability.

On June 8, 1994, the Federal Aviation Administration issued a request for proposal for a wide area augmentation system for the Global System. According to the Federal Aviation Administration, the wide area augmentation system is a network of ground stations and communication systems that enhance the integrity and availability of Global System signals and that will allow the Global System to be used as the sole means of navigation for enroute travel in the United States and for making precision landing approaches. The Federal Aviation Administration anticipates that the initial wide area augmentation system will consist of 24 ground reference stations and ground and satellite communications systems scheduled for delivery by mid-1997. The Federal Aviation Administration further stated that the project has been flight-tested successfully in the United States and Canada and that initially, the wide area augmentation system will provide integrity and enhance availability of the Global System to support all phases of navigation from over-the-ocean flights through nonprecision approach operations.

Objective

The audit objective was to assess the DoD evaluation of current technologies to satisfy precision landing requirements.

Scope and Methodology

We evaluated the potential use of the Microwave System to satisfy the DoD precision landing requirements. Managers of the Air Force Microwave System estimated the value of the Air Force Microwave System program at about $224.5 million. Of that amount, about $168.5 million has been obligated and

about $56 million is planned for future obligation for research, development, production, and installation of the Microwave System. As of the time of the audit, the Air Force Microwave System was not operational.

We conducted interviews with management officials from the Office of the Assistant Secretary of Defense (Command, Control, Communications and Intelligence), the DoD Policy Board on Federal Aviation, the Federal Aviation Administration, and the Military Departments. We obtained and examined Microwave System and Global System program documentation for the period December 1981 through June 1994. We examined contracts and requests for proposal, dated from November 1987 through May 1994, that had been prepared for the research, development, purchase, and installation of Microwave System hardware on selected Air Force aircraft. We did not rely on computer-processed data or statistical sampling procedures to conduct this audit.

This program audit was made from March through June 1994. The audit was made in accordance with auditing standards issued by the Comptroller General of the United States as implemented by the Inspector General, DoD. A list of organizations visited or contacted is in Appendix B.

Internal Controls

We did not assess internal controls because of the time sensitivity of the report.

Prior Audits and Other Reviews

In the past 5 years, no audits have specifically involved the potential use of the Microwave System to satisfy the DoD precision landing requirements.

Part II - Finding and Recommendations

Implementation of the Microwave Landing System Program

The Office of the Assistant Secretary of Defense (Command, Control, Communications and Intelligence) had not made the final selection of the best precision landing technologies to support the DoD precision landing requirements. This condition occurred because the DoD Policy Board on Federal Aviation has not finalized evaluations of the DoD precision landing requirements or precision landing technologies. As a result, the Air Force continued the Microwave System program and began the development, purchase, and installation of Microwave System hardware on C-130 aircraft to satisfy a tactical requirement and to implement the potential international standard for precision landing. The Air Force could put $27.8 million to $38.9 million to better use during the FY 1994 through FY 1999 Future Years Defense Program by reevaluating its requirements for the Microwave System program.

Background

On December 21, 1981, the Mission Element Needs Statement for the Advanced Military Landing System was approved through the budget process in accordance with policy guidance, in an April 30, 1981, memorandum from the Deputy Secretary of Defense. The Air Force was designated the lead Military Department to conduct a joint study and to define a single interoperable, all-weather precision landing aid for use in tactical and fixed-base operations. In January 1983, the Air Force was designated the lead Military Department for DoD Microwave System activities and was tasked to submit an implementation plan, coordinated with the other Military Departments, to the Office of the Secretary of Defense. The international and domestic civilian plans to transition from the Instrument System to the Microwave System as the international precision landing standard have significant effects on Air Force precision landing requirements and the selection of a precision landing system.

Requirement for the Microwave System Program

In 1992, the Federal Aviation Administration, civilian users, and the DoD shifted direction away from the Microwave System as the precision landing aid to the use of the Global System as the potential precision landing aid. Due to the shift in focus, the Army and Navy deleted Microwave System funding from their budgets and the Air Force reduced funding in its budget. In an April 6, 1992, memorandum, the Assistant Secretary of Defense (Command, Control, Communications and Intelligence) requested "that the DoD Policy Board on Federal Aviation, with the Federal Aviation Administration, develop a plan to

systematically analyze this issue and develop recommendations on how to best support civil and military precision approach requirements." The memorandum also tasked the DoD Policy Board on Federal Aviation, to determine the:

o DoD requirements for precision landing approaches;

o Global System capability to provide precision approach services (in terms of accuracy and availability);

o current program schedules and funding profiles;

o cost of implementing the Global System versus the Microwave System should the Global System be determined an acceptable substitute; and

o financial and political implications of terminating the Microwave System and retaining the Instrument System and Precision Approach Radar for an extended period.

In response to the Assistant Secretary's memorandum, the Federal Aviation Administration and the DoD Policy Board on Federal Aviation undertook a joint study called the National Airspace System Precision Approach and Landing System Plan. That plan was developed to determine the technical feasibility and cost of certifying the Global System precision approaches for use at category 1, 2, and 3 airports and to compare Global System capability and cost to the Microwave System solution. Also, the DoD Policy Board on Federal Aviation established a Precision Landing Study Advisory Group to determine the DoD precision landing requirements and evaluate potential technologies. The advisory group developed a draft Mission Need Statement, dated May 16, 1994, for precision landing requirements that were being coordinated among the Military Departments for approval. However, as of June 1994, the DoD Policy Board on Federal Aviation had not finalized evaluations for the National Airspace System Precision Approach and Landing System Plan, the DoD precision landing requirements, or evaluations of potential precision landing technologies and was not ready to make recommendations to the Assistant Secretary of Defense (Command, Control, Communications and Intelligence) on those issues.

Air Force Microwave Landing System Program

Because of the potential to use the Global System as the precision landing aid, the Army and Navy deleted Microwave System funding requirements from their budgets and continued to use existing precision landing systems. Although the Air Force did not delete all Microwave System funding requirements from its budget, it also continued to use existing systems. The Air Force had plans to install fixed-base Microwave Systems at all Air Force bases worldwide, but canceled those plans. The Air Force also had planned to install commercial Microwave System avionics (the science and technology of electronics applied to aeronautics) on 1,859 aircraft, but limited the number to 788 C-130 aircraft.

Although the Air Force reduced Microwave System requirements, the Air Force had not determined its precision landing requirements. The Air Force stated that it implemented the Microwave System program because it was to be the international standard for precision landing and would satisfy a tactical requirement. The Microwave System can support DoD flying units to areas where precision approach and landing capabilities do not exist, through the use of the Mobile Microwave System Ground Stations. DoD requires a precision landing aid that is logistically supportable and rapidly deployable to provide all-weather precision landing service for contingencies, combat support missions, and tactical operations. To implement the Microwave System program, the Air Force has awarded eight contracts for the development, production, and installation of Commercial Microwave System Avionics Kits, Commercial Microwave System Avionics Wiring, and Mobile Microwave System Ground Stations.

Production of Commercial Microwave System Avionics Kits

In March 1991, Headquarters, Air Mobility Command (formerly the Military Airlift Command), Scott Air Force Base, Illinois, approved the Systems Operational Requirements Document for the development and production of the Commercial Microwave Landing System Avionics (Commercial Microwave System Avionics). The basis of need section in the Systems Operational Requirements Document states that the Commercial Microwave System Avionics program is based on a worldwide transition from the Instrument System and Precision Approach Radar to the Microwave System. However, the Federal Aviation Administration decision on June 2, 1994, to halt further development of the Microwave System for categories 2 and 3 precision approach landings may result in a change to the international standard.

On November 29, 1987, the Electronics Systems Center, (formerly the Electronics Systems Division), at Hanscom Air Force Base, Massachusetts, awarded a firm fixed-price contract (contract F19628-87-C-0203), with five options, to Canadian Commercial Corporation for the development and production of the 539 Commercial Microwave System Avionics kits and spares. Contract costs totaled about $3.9 million for research and development and about $14.8 million for the production of the Commercial Microwave System Avionics kits. Delivery of the Commercial Microwave System Avionics kits was scheduled from February 1993 through May 1996.

As of May 1994, the contractor had delivered about 210 Commercial Microwave System Avionics kits for installation on the C-130 aircraft. The remaining 329 kits will be delivered at a rate of 11 to 15 per month over the next 2 years. Further, the Air Force had plans to issue a request for proposal in July 1994 to purchase as many as 249 kits (in addition to the initial purchase of 539 kits) to complete the installation of the kits on the remaining C-130 aircraft. In a June 14, 1994, meeting with management officials from the Office of the Assistant Secretary of Defense (Command, Control, Communications and Intelligence), the DoD Policy Board on Federal Aviation, and the Air Force,

Air Force senior managers stated that as a result of our audit, the Air Force had reduced the number of Commercial Microwave System Avionics kits from 788 to 593, a decrease of 195 kits. At a July 21, 1994, meeting with the DoD Policy Board on Federal Aviation and Air Force management officials, the Air Force further reduced the number of Commercial Microwave System Avionics kits from 593 to 550, for a total reduction of 238 kits. The Air Force has purchased 539 kits and needs to purchase 11 more to complete installation in the 550 aircraft. Terminating the purchase of 238 Commercial Microwave System Avionics kits from the Microwave Landing System program will allow the Air Force to put $11.9 million to better use.

Purchase of Commercial Microwave System Avionics Wiring

The installation of Commercial Microwave System Avionics kits requires the purchase and installation of wiring or wiring harness within the aircraft. The Air Force has two contracts (contract F09603-85-C-1224 and contract F09603-93-C-0671) with Smith Industries for wiring for the C-130 aircraft that are in service. For the C-130 aircraft that are in production, the cost of wiring is included as part of the contract (contract F33657-90-C-0071) with Lockheed Corporation, Lockheed Aeronautical Systems Company. The Air Force has completed the purchase of wiring for 539 aircraft, including spares, at a cost of about $15.6 million. Air Force management officials stated that 11 wiring spares can be used to complete installation for the 550 aircraft. Terminating the purchase of 238 sets of wiring for the Commercial Microwave System Avionics kits will result in about $6.9 million put to better use.

Installation of Commercial Microwave System Avionics Kits and Wiring

The Air Force has three contractors, Lockheed Support Systems, Inc.; Lear Siegler; and Serv Air installing the Commercial Microwave System Avionics kits on the C-130 aircraft. Each contractor has an indefinite delivery order type contract. The contracting officer writes a delivery order for the work to be accomplished when installation of the Commercial Microwave System Avionics kits and wiring are required by the Air Force. Installation of Commercial Microwave System Avionics kits and wiring is also accomplished during programmed depot maintenance. As of May 1994, the Air Force had completed the installation of the kits and wiring on about 200 C-130 aircraft at a cost of about $7.6 million. Terminating the installation of 238 sets of Commercial Microwave System Avionics kits and wiring for the Microwave Landing System program will result in about $9 million put to better use.

Production of Mobile Microwave System Ground Stations

The purpose of the Mobile Microwave System ground stations is to support DoD flying units (equipped with the Microwave System) deployed to areas where precision approach and landing capabilities do not exist. DoD requires a precision landing aid that is logistically supportable and rapidly deployable to provide all-weather precision landing service for contingencies, combat support missions, and tactical operations. At the time of the audit, the DoD used the Precision Approach Radar to satisfy that requirement.

In September 1990, Headquarters, Air Force Command, Control, Communications and Computer Agency (formerly the Air Force Communications Command), Scott Air Force Base, approved the Joint System Operational Requirements Document for the development of the Mobile Microwave System ground stations. On August 18, 1989, the Electronics Systems Center at Hanscom Air Force Base, awarded a fixed-price contract, with incentives (contract F1962-88-C-0062), to Textron Defense Systems (formerly Bell Aerospace) for the development of the Mobile Microwave System ground stations with production options. Textron Defense Systems developed six prototype Mobile Microwave System ground stations. On July 29, 1993, the Electronics Systems Center decided to produce 37 ground stations. Delivery of the ground stations was scheduled from July 1995 through April 1996 at a rate of four ground stations per month. The contact costs for the Mobile Microwave System ground stations totaled about $48.4 million (about $25.3 million for research and development and about $23.1 million for production).

After issuance of our draft audit report, we met twice (June 27, and July 21, 1994) with DoD and Air Force management officials. At those meetings, we asked the Air Force to give us documentation supporting its requirements for the Mobile Microwave System ground stations. The Air Force gave us estimates of needed Microwave System ground stations, by major command. However, those estimates were not based on operational plans identifying flying units deployed to specific areas or contingencies, combat support missions, or tactical operations. The Air Force has a production contract for the Mobile Microwave System ground stations, but has not finalized analyses to determine and validate the number of ground stations needed to support tactical precision landing requirements. Further, the Air Force has expended significant efforts and resources on the procurement and installation of Commercial Microwave System Avionics kits for C-130 aircraft. Determining the number of needed ground stations could help the Air Force avoid potential unnecessary expenditures of about $11.1 million (production contract costs for a three year period from FY 1994 through FY 1996).

Conclusion

After more than 2 years, the DoD Policy Board on Federal Aviation has not finalized evaluations for the National Airspace System Precision Approach and Landing System Plan, the DoD precision landing requirements, or evaluations of potential precision landing technologies. Also, the Policy Board was not ready to make recommendations to the Assistant Secretary of Defense (Command, Control, Communications and Intelligence) on how to best support military precision landing requirements. Senior management officials of the DoD Policy Board on Federal Aviation have stated that those evaluations require a deliberate and lengthy process. The officials also stated that they have been working with the Federal Aviation Administration to establish a coordinated U.S. position for the March 1995 International Civil Aviation Organization meeting on precision landing. Expediting and finalizing the evaluations would provide the DoD with essential information in preparing for the March 1995 meeting and in evaluating potential precision landing technologies to determine how to best support DoD precision landing requirements.

The Air Force has initiated some corrective actions since issuance of the draft report. The Air Force initiated action to reduce the number of Commercial Microwave Landing System Avionics kits and wiring sets to be purchased and installed on C-130 aircraft from 788 to 550, for a reduction of 238 sets. This reduction in the Microwave System program requirements will allow the Air Force to put $27.8 million to better use (see Appendix A). However, the Air Force has not finalized analyses to determine and validate the number of Mobile Microwave System ground stations needed to support the Air Force tactical precision landing requirements, even though the Air Force has a production contract for the Mobile Microwave System ground stations. The analyses and validation process could help the Air Force avoid potential unnecessary expenditures of about $11.1 million. Until the Air Force completes its analyses and validation process, total monetary benefits are undeterminable.

Recommendations, Management Comments, and Audit Response

1. We recommend that the Assistant Secretary of Defense (Command, Control, Communications and Intelligence):

a. Determine the DoD precision landing requirements.

b. Determine the best precision landing technologies to satisfy the DoD precision landing requirements.

2. We recommend that the Assistant Secretary of the Air Force (Acquisition):

a. Issue the request for proposal to procure 11 Commercial Microwave Landing System Avionics kits for the remaining C-130 aircraft.

b. Determine the number of Mobile Microwave System ground stations needed to support the Air Force tactical precision landing requirements and develop a fielding plan.

Management Comments. The Assistant Secretary of Defense (Command, Control, Communications and Intelligence) and the Department of the Air Force neither concurred nor nonconcurred with the finding or recommendations. The Air Force stated that it continued with a prudent, minimum investment in the Microwave System rather than cancel a potential solution for needed technology, while the DoD and Federal Aviation Administration evaluated precision landing system requirements and alternatives. Management did not comment on the recommendations and disagreed with the potential monetary benefits.

Audit Response. The Assistant Secretary of Defense (Command, Control, Communications and Intelligence) and the Department of the Air Force comments were nonresponsive. We met with management officials from the DoD Policy Board on Federal Aviation and the Air Force twice after receiving the comments. Based on those meetings, we revised the final report. We clarified the finding and related discussion to show that the Assistant Secretary is responsible to select the best precision landing technologies. We deleted the draft report recommendation to terminate contracts for the Microwave System program because the Air Force showed that it has subsequently reduced program requirements and has a requirement for a tactical precision landing aid. We added Recommendation 2. and revised monetary benefits. We ask that the Assistant Secretary of Defense (Command, Control, Communications and Intelligence) and the Assistant Secretary of the Air Force (Acquisition) provide comments on the final report.

Part III - Additional Information

Appendix A. Potential Benefits Resulting from the Audit

Recommendation Reference	Description of Benefit	Amount and/or Type of Benefit
1.	Program Results. Determines DoD requirements and the best precision landing technologies to meet the DoD requirements.	Nonmonetary.
2.a.	Program Results. Reduces the procurement and installation of equipment for which the requirement was reassessed and reduced.	The Air Force could put $27.8 million to better use during the FY 1994 through FY 1999 Future Years Defense Program. (Appropriation: Other Procurement, Air Force)
2.b.	Program Results. Determines the number of ground stations needed to support the Air Force requirement for a tactical precision landing aid.	Funds put to better use. The actual potential monetary benefits* cannot be determined until the Air Force determines the number of ground stations needed to support tactical precision landing requirements.

*The 37 ground stations under production will cost the Air Force about $11.1 million for the period from FY 1994 through FY 1996.

Appendix B. Organizations Visited or Contacted

Office of the Secretary of Defense

Assistant Secretary of Defense (Command, Control, Communications and Intelligence), Washington, DC

Department of the Army

Headquarters, U.S. Army Training and Doctrine Command, Fort Monroe, VA
Office of the Deputy Chief of Staff for Operations and Plans, Washington, DC
Office of the Director of Information Systems for Command, Control, Communications and Computers, Washington, DC

Department of the Navy

Office of the Chief of Naval Operations, Washington, DC
Headquarters, Naval Air Systems Command, Arlington, VA

Department of the Air Force

Office of the Assistant Secretary of the Air Force (Acquisition), Washington, DC
Headquarters, Air Combat Command, Langley Air Force Base, VA
Headquarters, Air Materiel Command, Wright-Patterson Air Force Base, OH
- Aeronautical Systems Center, Wright-Patterson Air Force Base, OH
- Electronic Systems Center, Hanscom Air Force Base, MA
- Space and Missile Systems Center
  - Global Positioning System Joint Program Office, Los Angeles Air Force Base, CA
- Warner-Robins Air Logistics Center, Robins Air Force Base, GA

Headquarters, Air Mobility Command, Scott Air Force Base, IL

Non-Defense Organization

Federal Aviation Administration, Washington, DC

Appendix C. Report Distribution

Office of the Secretary of Defense

Comptroller of the Department of Defense
Assistant Secretary of Defense (Command, Control, Communications and Intelligence)
Assistant to the Secretary of Defense (Public Affairs)

Department of the Army

Secretary of the Army
Auditor General, Department of the Army

Department of the Navy

Secretary of the Navy
Auditor General, Department of the Navy

Department of the Air Force

Secretary of the Air Force
Assistant Secretary of the Air Force (Acquisition)
Assistant Secretary of the Air Force (Financial Management and Comptroller)
Auditor General, Department of the Air Force

Defense Organizations

Director, Defense Contract Audit Agency
Director, Defense Logistics Agency
Director, National Security Agency
Inspector General, Central Imagery Office
Inspector General, Defense Intelligence Agency
Inspector General, National Security Agency
Director, Defense Logistics Studies Information Exchange

Non-Defense Federal Organizations

Office of Management and Budget
Technical Information Center, National Security and International Affairs Division, General Accounting Office

Non-Defense Federal Organizations (cont'd)

Chairman and Ranking Minority Member of Each of the Following Congressional Committees and Subcommittees:

Senate Committee on Appropriations
Senate Subcommittee on Defense, Committee on Appropriations
Senate Committee on Armed Services
Senate Committee on Governmental Affairs
House Committee on Appropriations
House Subcommittee on Defense, Committee on Appropriations
House Committee on Armed Services
House Committee on Government Operations
House Subcommittee on Legislation and National Security, Committee on Government Operations

Part IV - Management Comments

Assistant Secretary of Defense (Command, Control, Communications and Intelligence) and Department of the Air Force Comments

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
6000 DEFENSE PENTAGON
WASHINGTON, D C 20301 6000

JUL 15 1994

COMMAND CONTROL
COMMUNICATION
AND INTELLIGENCE

MEMORANDUM FOR DIRECTOR, READINESS AND OPERATIONAL SUPPORT

SUBJECT: Quick-Reaction Audit Report on the Air Force Microwave Landing System (Project No. 4RD-6001.01)

The attached is a consolidated response conveying Air Force, DoD Policy Board on Federal Aviation, and OSD/C3I comments on the referenced draft report. As we discussed at the June 27th meeting in my office, we are concerned with the accuracy, content, and tone of the report. We are providing specific, detailed comments and, should you elect to pursue a final report, we would like to see another draft. If you have further questions after reviewing our comments, please contact me or my action officer, Mr. McNeff, at 695-6123.

Richard G Howe
Director, Theater & Tactical C3

Attachment

DOD
POLICY BOARD
ON FEDERAL AVIATION

OFFICE OF THE SECRETARY OF DEFENSE

WASHINGTON, D C 20301

15 JUL 1994

MEMORANDUM FOR DIRECTOR, THEATER AND TACTICAL C3

SUBJECT: Quick Reaction Report on the Air Force Microwave Landing System (MLS)

The referenced DoD IG Report focuses on two areas of concern: the Air Force MLS Program and the perceived failure of the DoD Policy Board on Federal Aviation (PBFA) to define DoD precision landing requirements. I will address each separately.

Regarding the MLS Program, this report argues that, since the FAA has decided to cancel two development contracts for Category II and III MLS, the USAF should also terminate any MLS-related procurements. That argument is not convincing. The Report does not differentiate between "requirements" and "material solutions," it does not recognize the Air Force's "requirement" to operate worldwide, it ignores the ICAO MLS transition date of 1998 and the NATO MLS STANAG, and it does not recognize the difference between fixed base and tactical deployable requirements.

The USAF supports FAA's decision to halt development of Category II and III MLS and, in fact, had withdrawn its funding request for fixed base MLS prior to the FAA decision It appears fixed base MLS missed its window of opportunity. The emergence of GPS as a potential precision landing system has convinced many in the aviation community that GPS will ultimately provide more capability at lower cost. However, it's important to remember it will require costly augmentations to the basic system which are neither developed nor funded. While GPS has great potential, it does not offer a "here and now" precision landing capability, and will not for many years.

Regardless of the ultimate national precision landing architecture, the USAF has a requirement to fly worldwide - not just in the United States The U.S. decisions regarding fixed base MLS do not obviate the USAF's requirement for a mobile precision landing capability. Intratheater airlift C-130s require such a capability to support USAF Global Reach-Global Power objectives by moving and resupplying combat forces within a theater of operations. The C-130 is the only theater dedicated tactical airlifter which can operate from austere locations on dirt, gravel, snow-covered, and grass runways as short as 3000 feet. C-130s routinely fly worldwide missions involving humanitarian relief such as in Bosnia (PROVIDE PROMISE) and Somalia (PROVIDE HOPE), earthquake and hurricane relief, and flood disasters. Mobile MLS (MMLS) is a mobile tactical precision landing system which will enable those C-130s to land in all weather,

austere environments. The system is designed for rapid deployment in tactical situations, can be set up in less than 60 minutes, and is transportable on a single standard pallet (equipment weight 1500 pounds) Our only existing tactical precision landing system is precision approach radar (PAR), which is embedded in two mobile radar approach control (MRAPCON) systems· the MPN-14 and the TPN-19. Under many scenarios, deployment of a MRAPCON may be impossible - or unwise. Deployment of the TPN-19 requires six C-130 sorties and the MPN-14 requires three C-130 sorties. Both may take as long as 72 hours to be fully set up and certified, and require a long-term commitment of manpower resources (on-the-ground, in potentially hostile areas) to operate and maintain the system.

The USAF stands firmly behind its requirement for a mobile precision landing capability, consisting of both ground equipment (MMLS) and C-130 avionics (CMLSA). In response to this draft audit report we again asked the Air Force major commands to validate their MMLS and CMLSA requirements. They validated a total requirement for 62 MMLSs - far in excess of the 37 systems funded in the baselined program. The USAF also validated requirements to equip a total of 580 aircraft (C-130Es, C-130Hs, and HC-130s) with CMLSA.

The third remaining component of the original MLS program is the Military MLS Avionics (MMLSA) program. MMLSA is a development program which will prototype a next generation precision landing avionics solution for space-constrained aircraft. While the need for a dual MLS/ILS (frequency compliant) avionics box is now uncertain, the need for a next generation precision landing avionics solution remains clear. Current ILS receivers do not meet new international frequency protection standards which take effect in 1998. GPS receivers currently being procured are not precision landing-capable and would require considerable receiver modification as well as extensive integration. We intend to restructure the current ILS/MLS avionics development contract to develop a dual GPS/ILS box which provides space constrained aircraft (i.e., the F-16) a frequency compliant ILS and GPS solution. The box would include the latest GPS receiver technology designed for landing applications. Termination of the MMLSA program would leave the USAF with no funded program to develop either a frequency compliant ILS receiver or a precision landing-capable GPS receiver.

I also take exception to the idea that the DoD PBFA has failed to comply with ASD/C3I's direction to define precision landing requirements. Although final decisions on precision landing requirements have not been made, we have been involved in a massive effort to define those requirements not only within DoD but also with the FAA and civil aviation interests The PBFA established a Precision Landing Study Advisory Group (SAG) to determine and document DoD precision landing requirements and evaluate potential technologies. This very deliberate process is being conducted IAW DoD 5000 direction. A Mission Need Statement (MNS) has been developed by the

Requirements Subgroup of the Precision Landing SAG and is in final stages of coordination prior to JROC validation. A COEA will probably be required to evaluate precision landing technologies - but can't be initiated until the precision landing requirement is validated

Detailed comments on the draft report are attached

1 Atch
Detailed Comments

FRANK J. COLSON
Executive Director
DOD Policy Board on
Federal Aviation

Detailed Comments on Draft Report

Executive Summary

1. Introduction, last sentence: Indicates that GPS can currently handle non-precision approaches and shows potential for precision approach.

Response: While this is technically accurate, it is misleading. GPS has not yet been certified for either sole-means enroute navigation or non-precision approach. Enhancements to the GPS receivers being procured by DoD would be required for sole-means navigation/precision approach and are not funded. While GPS does show potential for precision approach, it will require costly augmentations to the basic system which are neither developed nor funded. Therefore, these applications of GPS are not likely to be implemented for an extended period. Some of these facts regarding the technical risk, cost, and lengthy time frame for GPS to mature should be inserted into the report.

2. Audit Results: The IG states that the DoD PBFA has not determined DoD precision landing requirements nor evaluated precision landing technologies. Revised

Response: While it's true that final decisions on precision landing requirements have not been made, this is also misleading. DoD has been involved in a massive effort to define precision landing requirements. The PBFA has established a Precision Landing Study Advisory Group (SAG) to determine and document DoD precision landing requirements and evaluate potential technologies. This is a very deliberate and lengthy process and is being conducted IAW DoD 5000 requirements. A Mission Need Statement (MNS) has been developed by the Requirements Subgroup of the Precision Landing SAG and is in final stages of coordination prior to JROC validation. A COEA will probably be required to evaluate precision landing technologies - but can't be initiated until the precision landing requirement is validated.

Additionally, DoD decisions are subject to external agency decisions (e g., ICAO, NATO) which have yet to be made The PBFA is working with the FAA to establish a coordinated U S position for the March 1995 ICAO meeting on precision landing.

3. Potential Benefits of Audit. The IG states that AF could reduce costs by $65M by termination of MLS Revised

Response Estimated costs avoided by terminating the three MLS contracts by the end of July 1994 are $43 1M The details are shown below:

Atch 1

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Contract	Spent	Avoided	Equipment
MMLS	$37 3M	$11 1M	None
CMLSA	$37 2M	$22M	249 B-kits, 198 installed, no support
MMLSA	$71 2M	$10M	None

However, these figures are irrelevant since the USAF does not agree that it no longer has a requirement for the MMLS, CMLSA, and MMLSA procurements. The MMLS and CMLSA contracts should be completed to provide a near term deployment capability to replace PAR which is difficult to deploy and manpower intensive. Rather than being cancelled, the MMLSA contract should be modified to develop a next generation precision landing avionics solution which includes a GPS receiver. This would provide maximum flexibility enabling USAF aircraft to land in a variety of precision landing environments during what we've all agreed is likely to be a "messy transition period." This approach would also be consistent with activities being pursued by the national and international civil aviation communities.

Part I - Introduction

1. Page 3: The narrative describes FAA's plan for precision landing in the U.S. - which focuses on DGPS. Page 2

Response: While this is all good background, it's important to remain focused on the fact that the DoD has a requirement to fly worldwide - not just within the continental U.S. The AF has additional requirements for tactical deployments and precision landing outside the U S. These unique requirements dictate the AF make different equipment decisions and maintain multiple equipment configurations. Specifically, the near-term fielding of MMLS/CMLSA and the development of a multi-band receiver is needed to ensure worldwide interoperability.

2 Page 3, para 2: The statement that there is not a need for significant numbers of Category II/III systems is probably true for the U S. However, many European countries (which still plan to employ MLS) have significantly worse weather regimes. If the DoD needs to deploy U.S. aircraft to those countries and land on their airfields, they may need MLS avionics. The report ignores the fact that NATO, through a standardization agreement (STANAG), has adopted MLS as the the NATO standard precision approach system

3. Page 3, para 4: The report discusses the likelihood that the wide area augmentation system (WAAS) will enhance the availability and integrity of the GPS for sole-means use as an enroute and non-precision approach aid.

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Response: While this is true, GPS precision approach capability through the WAAS is still in doubt for the following reasons:

a) The DoD would have to agree to transmission of differential corrections via satellite. There is an ongoing national security debate concerning this issue which will be resolved at the highest levels of DoD and DoT.

b) The system must meet precision landing requirements. Thus far, wide area corrections have only demonstrated near-Category I accuracy, and then only under ideal conditions. As a result, the FAA has considered degrading the vertical accuracy requirements for wide area compared to the current ILS requirements. Additional testing and analysis needs to be performed to evaluate the wisdom of that approach.

c) The augmented GPS system will only provide increased integrity and availability in CONUS National Air Space. No additional provisions have been made to address world wide use of augmented GPS. Without significant (and costly) augmentation, GPS cannot meet precision approach needs.

d) Even if WAAS-augmented GPS is approved for Cat I minimums, it will likely require additional onboard augmentation such as inertial aiding which many of our aircraft do not have.

Page 3 Revised

4. Page 4: The dollar values cited are incorrect. The total program value at this time is $188.8M. Of this $145.7M has already been spent, $43.1M might be saved if termination proceeds by end of July 94.

5. Throughout this section the Global Positioning System is referred to as "Global System." "GPS" is the nationally and internationally accepted acronym for the Global Positioning System Replace all references to "Global System" with "GPS."

Part II - Finding and Recommendation

Page 6

1. Page 8, first para: States the AF continued with MLS and "began development, purchase and installation of Microwave System hardware on its C-130" because requirements and potential technologies were not evaluated completely.

Response: It is correct that the AF continued with a prudent, minimum investment in MLS while the DoD and FAA evaluated PLS requirements and alternatives rather than cancel potential solutions. However, the USAF began to install MLS Avionics on the C-130 only after satisfactorily completing a Milestone III acquisition decision for

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production and validating a continuing tactical requirement for both MLS ground equipment and avionics.

2. Page 9, first para: Indicates that the PBFA has not addressed the Apr 92 ASD/C3I tasking on PLS. Page 7 Revised

Response: The PBFA has addressed the tasking from ASD/C3I. That effort is still ongoing. It has been a lengthy process due to compliance with DoD 5000 requirements.

3. Page 9, last para: Indicates that the USAF did not delete funding for MLS even though the Army and Navy did in the FY94 POM. Page 7

Response: The Air Force, like the other Services, deferred funding for fixed base MLS until a national (and international) decision is made on which system will be used for fixed base precision approach. The USAF continued with MLS (MMLS and CMLSA) as the material solution to its tactical deployable precision approach because it is the only viable, readily available solution. The Army and Navy do not have the same requirements. The other Services make limited use of ILS and are therefore not interoperable with the civil and international communities. The USAF chose to maintain a minimum investment in MLS avionics (MMLSA) to provide a frequency compliant ILS, a hedge against MLS in Europe and NATO, and a platform on which precision GPS could be installed. In the absence of clear direction involving future precision landing systems, the USAF thought it prudent not to terminate potential solutions and incur costly restarts.

4. Page 9, last para, line 9. change to read "limited to 580 aircraft (C-130Es, C-130Hs and HC-130s). Page 7

5. Page 10, first para: While the USAF initially embarked on an MLS solution to be compliant with worldwide standards, an important derived benefit was the ability to field, for the first time, a lightweight, portable landing system for tactical use. The Mobile MLS ground system is considerably easier and quicker to transport, deploy and maintain than the tactical PAR system currently in use. The Mobile MLS requires one C-130 pallet to deploy, three people for setup, and has an installation time of less than 60 minutes. The PAR (MPN-14) requires three C-130s, up to 30 people, and up to 72 hours to setup and certify. The TPN-19 (which includes PAR) requires six C-130 sorties to deploy; it also requires a lengthy setup/cetrtification process and a long-term commitment of manpower resources (on-the-ground, in potentially hostile areas) to operate and maintain the system Page 8

6. Page 10, first para, line 10: The FAA cancellation of its research and development MLS contracts has not changed the European position. They have recently announced Page 8

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(Aerospace Daily, June 15, 1994) their plan to transition to MLS CAT II/III and their issues with GPS as a precision landing solution. The international position will not be settled until ICAO meets to review the MLS transition date in March 1995.

Deleted

7. Page 10, line 13: It is incorrect to state that the Requirements Document was approved 3 years after a production contract. In Feb 78, the Multi-Command General Operating Requirement (GOR) 702-78 was published addressing AF requirements for an Advanced Landing System; April 81, OSD approved Mission Element Need Statement (MENS); Jan 83, Under Secretary of Defense for Research and Engineering (USDR&E) Memorandum gave direction to acquire MLS Avionics and Ground Systems; Aug 83, DoD MLS Implementation Plan was approved; Jan 84, PMD was issued making the AF the lead agency for MLS; May 86, DRAFT Required Operating Capability (ROC) for MLS was issued, Oct 87, a FPIF development contract with FFP production options was awarded to CMC; Apr 88, MLS PMD 4030(7)35114F directed development of an ORD; Jun 89, a draft MAC ORD was released; Feb 91, a Milestone III production decision was approved; Mar 91, MAC SORD 005-90-I/II/III was approved; Jun 91, AF exercises first CMLSA production option for 230 kits at cost of $8.1M; Sep 91, AF exercises second CMLSA production option for 201 kits at a cost of $4.8M; Mar 92, AF exercises third production option for 108 kits at a cost of $3.6M. The Production SORD was approved for CMLSA prior to the exercise of any production options. Other: Change $16.7M to $14.8M, change $1.9M to $3.9M, change Nov 92 to Feb 93.

Page 8 Revised

Page 8 Revised

8. Page 10, second para: Change $5M to $2.3M. The number of C-130s in the Air Force inventory fluctuates yearly with aircraft being retired or lost and new aircraft being built by Lockheed. Our best estimate (coordinated through ACC and WR-ALC) is that by 1998 there will be 593 SCNS-equipped C-130s. Our current contract with CMC for 539 CMLSA B-kits is expected to cover all existing SCNS-equipped aircraft. The follow-on sole source buy of CMLSA B-kits is to be provided to Lockheed as GFE and integrated into all new C-130s as they are being built. The basic contract is for 36 kits, which will be installed on FY92 and FY93 C-130s. The contract also has 4 options, to be exercised yearly, which provide the vehicle to purchase up to 132 additional kits for FY94 and later model C-130s. Each one of these options may be exercised for a lesser quantity if fewer aircraft are produced in these years. Change 249 to 54, change 788 to 580, change $8M to $2 9M.

Page 9 Revised

Page 9 Revised

9 Page 11, first para, last two lines. Change $15.6M to $14.8M. Delete last sentence and replace with "The additional cost for Lockheed to produce C-130s with MLS A-kits built for these last 54 aircraft is $2.7M."

Page 9 Revised

10 Page 11, second para. Change $8.8M to $6M; change $26M to $10.7M; change 588 to 339.

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11. Page 12, first para. Change $23.2M to $25.3M; change $22.4M to $23.1M; change $45.6M to $48.4M.

Page 10 Revised

12. Page 12, second para: It is not true that the C-130 aircraft would not be usable until July 95 to fly against the MMLS. The FAA is installing 27 MLS CAT I systems, the AF currently owns 4 MMLS prototypes that could be used in a situation like Bosnia, and there are other MLS ground systems currently installed in CONUS and overseas. Change $15M to $11.1M.

Page 10 Deleted

13. Page 12, last para, last two sentences: Appears to recommend termination of the MMLSA and continued development of a three-mode receiver.

Page 10 Revised Deleted

Response: Restructuring the existing bi-mode contract vehicle seems the most efficient and cost effective way to pursue development of a multi-mode receiver.

14. Page 13, Conclusion: The FAA decided to terminate MLS Cat II/III procurements for fixed base operations. DoD has made the same decision, pending a firm decision by ICAO. It is prudent to continue with limited MLS programs (MMLS/ CMLSA) for tactical deployable requirements and to maintain flexibility for future PLS needs (multi-mode receiver). Change $65M to $43.1M.

Page 11 Revised

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Audit Team Members

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