

**Audit**



**Report**

OFFICE OF THE INSPECTOR GENERAL

**SHORT-TERM PRECISION LANDING CAPABILITIES  
FOR C-17 AIRCRAFT**

Report No. 98-070

February 11, 1998

**Department of Defense**

### **Additional Copies**

To obtain additional copies of this audit report, contact the Secondary Reports Distribution Unit of the Analysis, Planning, and Technical Support Directorate at (703) 604-8937 (DSN 664-8937) or FAX (703) 604-8932.

### **Suggestions for Future Audits**

To suggest ideas for or to request future audits, contact the Planning and Coordination Branch of the Analysis, Planning, and Technical Support Directorate at (703) 604-8908 (DSN 664-8908) or FAX (703) 604-8932. Ideas and requests can also be mailed to:

OAIG-AUD (ATTN: APTS Audit Suggestions)  
Inspector General, Department of Defense  
400 Army Navy Drive (Room 801)  
Arlington, Virginia 22202-2884

### **Defense Hotline**

To report fraud, waste, or abuse, contact the Defense Hotline by calling (800) 424-9098; by sending an electronic message to [Hotline@DODIG.OSD.MIL](mailto:Hotline@DODIG.OSD.MIL); or by writing to the Defense Hotline, The Pentagon, Washington, D. C. 20301-1900. The identity of each writer and caller is fully protected.

### **Acronyms**

AMC	Air Mobility Command
ASC	Aeronautical Systems Center
ASR/PAR	Airport Surveillance Radar and Precision Approach Radar
CMLSA	Commercial Microwave Landing System Avionics
CMNS	Combat Mission Need Statement
ESC	Electronic Systems Center
GPS	Global Positioning System
ILS	Instrument Landing System
JPALS	Joint Precision Approach and Landing System
MLS	Microwave Landing System
MMLS	Mobile Microwave Landing System
PLSR	Precision Landing System Receiver
TTLS	Tactical Transponder Landing System

February 11, 1998

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 Short-Term Precision Landing Capabilities for C- 17 Aircraft  
(Report No. 98-070)

We are providing this report for review and comment. Management comments to a draft of this report were considered in preparing the final report. This report is the first in a series resulting from our audit of the "Capabilities of DoD Air Traffic Control and Landing Systems to Support Deployments."

The Assistant Secretary of Defense (Command, Control, Communications, and Intelligence) and the Air Force provided comments. Based on management comments, we readdressed the recommendations to the Air Force and revised Recommendations 1 .b. and 2. We request the Air Force provide comments on Recommendations 1. and 2. by April 13, 1998.

Questions on the audit should be directed to Mr. Robert M. Murrell, Audit Program Director, at (703) 604-9210 (DSN 664-9210), e-mail: [rmurrell@dodig.osd.mil](mailto:rmurrell@dodig.osd.mil), or Mr. John M. Gregor, Audit Project Manager, at (703) 604-9353 (DSN 664-9353), e-mail: [jmgregor@dodig.osd.mil](mailto:jmgregor@dodig.osd.mil). See Appendix H for the report distribution. The audit team members are listed inside the back cover.



David K. Steensma  
Deputy Assistant Inspector General  
for Auditing

## Office of the Inspector General, DoD

Report No. 98-070.  
(Project No. 7RD-0008)

February 11, 1998

### Short-Term Precision Landing Capabilities for C-17 Aircraft

#### Executive Summary

**Introduction.** The Joint Precision Approach and Landing System (JPALS) Program was established to address landing system shortfalls documented in an Army, Navy, and Air Force joint mission need statement for precision approach landing capability. The joint mission need statement was approved by the Joint Requirements Oversight Council on August 29, 1995. The JPALS Program is a potential Acquisition Category ID program based on its potential application to more than 15,000 DoD aircraft and associated ground stations. The extent and estimated cost of the program are still being finalized.

In September 1996, the Commander, Air Mobility Command, prepared a draft combat mission need statement, which asserted an urgent need for an October 30, 1997, initial operational capability on a minimum core of transport aircraft and suggested use of microwave landing system technology to meet that need together with an airport surveillance radar and precision approach radar system. On October 16, 1996, the JPALS Near-Term, -Integrated Product Team recommended installing avionics, based on microwave landing system technology, on the aircraft cited in the combat mission need statement and purchasing the radar system to the JPALS Overarching Integrated Product Team. On October 28, 1996, the Under Secretary of Defense for Acquisition and Technology agreed to the JPALS Near-Term, Integrated Product Team recommendations. The Commander, Air Mobility Command, validated the combat mission need statement on November 14, 1996, and the Chief of Staff of the Air Force approved it on December 11, 1996. This report addresses the decisions made to install a developmental Precision Landing System Receiver (PLSR) avionics unit on C-17 aircraft. The estimated cost to meet the combat mission need statement ranged from \$54.6 million to \$118.1 million. The estimated cost to install the developmental avionics unit on C-17 aircraft ranged from \$41.6 million to \$105.1 million.

**Audit Objectives.** The overall audit objective was to evaluate the capabilities of DoD air traffic control and landing systems to support deployments. Specifically, we evaluated the rationale for the Air Force selection of a developmental PLSR in concert with the Mobile Microwave Landing System and an airport surveillance radar and precision approach radar system to meet the combat mission need statement requirement. We also reviewed applicable management controls. We will discuss Air Force plans to purchase an airport surveillance radar and precision approach radar system in a later report.

**Audit Results.** The short time frame allotted (from October 1996 to October 1997) for the development, acquisition, and testing of the PLSR avionics unit on C-17 aircraft for use with the existing Mobile Microwave Landing System ground station resulted in the Air Force not following DoD acquisition procedures. Decisions were made to use the PLSR without adequately documenting that:

- o the Air Force spent \$97.7 million for a Commercial Microwave Landing System Avionics unit installed on C-130 aircraft for use with the Mobile Microwave Landing System, but after 10 years, those systems have not worked in an operational deployment;

- o the life-cycle costs were not developed for the procurement of the PLSR;
- o the costs of potential alternatives were not developed and compared;
- o the JPALS Near-Term Integrated Product Team never finalized the results of its analyses;
- o the test plans for all PLSR capabilities were not fully developed and its installation was planned to occur on all C-17 aircraft before completion of all testing; and
- o the PLSR is a command unique, service unique system even though the objective of the JPALS Program is to develop one system for all Services.

As a result, the Air Force may commit to expend more than \$105.1 million on a high-risk acquisition strategy to procure and install PLSR avionics units on up to 120 C-17 aircraft. Further, the October 30, 1997, initial operational capability date was not met and testing of the avionics unit was stopped because of problems between the avionics unit and the C-17 aircraft. See Appendix A for details on the management control program.

**Summary of Recommendations.** We recommend reevaluation of the Air Force decision to install the PLSR on C-17 aircraft; to include limiting the acquisition and installation of the PLSR to one test aircraft, testing all PLSR capabilities, evaluating the costs and benefits of continuing the use of microwave landing system technology, and evaluating the costs and benefits of the PLSR and other competing alternatives under the ongoing DoD-wide JPALS Program. We also recommend instruction of program officials that when an expedited acquisition process is used, DoD acquisition policies and Federal Acquisition Regulation procedures must still be followed.

**Management Comments.** The Assistant Secretary of Defense (Command, Control, Communications, and Intelligence) neither concurred nor nonconcurred with the recommendations and requested we coordinate with the Air Force before issuing this report. The Air Force disagreed with recommendations to limit the acquisition and installation of the PLSR to one C-17 test aircraft and to prove the operational capability of and need for the PLSR by testing all PLSR capabilities. The Air Force agreed with recommendations to evaluate the costs and benefits of continuing microwave landing system technology, of the PLSR, and of other competing alternatives. The Air Force disagreed that program and contract officials needed reminders to comply with acquisition policies and procedures prescribed by regulations. See Part I for a summary of management comments and Part III for the complete texts of the management comments.

**Audit Response.** Based on management comments, we revised two recommendations and redirected recommendations to the Air Force. Air Force comments were responsive to the intent of the recommendations on testing and installing the PLSR on one aircraft and no additional comments are necessary. Air Force comments were partially responsive to recommendations to evaluate the costs and benefits of using microwave landing system technology, the PLSR, and other alternatives for precision landing. We request that the Air Force provide target dates for completion and documentation supporting those evaluations. Air Force comments did not adequately address recommendations to fully prove PLSR operational capability through testing and to provide guidance to program officials when using an expedited acquisition process. We revised those recommendations and request the Air Force provide additional comments by April 13, 1998.

# Table of Contents

---

<b>Executive Summary</b>	<b>i</b>
<b>Part I - Audit Results</b>	
Audit Background	2
Audit Objectives	4
Air Mobility Command Precision Approach Landing Capability	5
<b>Part II - Additional Information</b>	
Appendix A. Audit Process	
Scope	22
Methodology	22
Contacts During the Audit	23
Management Control Program	23
Appendix B. Summary of Prior Coverage	24
Appendix C. Glossary of Terms	26
Appendix D. Precision Landing System Receiver Program History	29
Appendix E. Sole-Source, Undefined Contractual Actions	32
Appendix F. Estimated Costs for Air Mobility Command Precision Landing Needs	35
Appendix G. Air Force Comments on the Draft Audit Report and Audit Response	37
Appendix H. Report Distribution	47
<b>Part III - Management Comments</b>	
Assistant Secretary of Defense (Command, Control, Communications, and Intelligence) Comments	50
Air Force Comments	51

## **Part I - Audit Results**

---

## Audit Background

This report is the first in a series resulting from our audit of the “Capabilities of DoD Air Traffic Control and Landing Systems to Support Deployments.” A glossary in Appendix C defines terms used in this report.

Joint Precision Approach Landing System. Existing precision approach landing systems have been in use for more than 40 years and suffer shortfalls that limit the ability of the unified commands to perform joint operations. The Joint Precision Approach and Landing System (JPALS) Program was established to satisfy the current operational needs of the Army, Navy, and Air Force joint mission need statement for precision approach landing capability. The Joint Requirements Oversight Council approved the joint mission need statement on August 29, 1995, and JPALS is a potential Acquisition Category ID program based on the potential for program application to more than 15,000 DoD aircraft, ships, and ground stations. The extent and estimated cost of the JPALS Program are still being finalized.

On May 28, 1996, the Principal Deputy Under Secretary of Defense for Acquisition and Technology signed an Acquisition Decision Memorandum for JPALS. The Acquisition Decision Memorandum designated the Air Force as lead Military Department and established Milestone 0 (Concept Exploration) criteria in support of a Defense Acquisition Board Milestone I (Program Definition and Risk Reduction) decision planned for September 30, 1997. To provide oversight, the Deputy Assistant Secretary of Defense (Command, Control, Communications, and Intelligence Acquisition) was appointed chairman for the JPALS Overarching Integrated Product Team.

Near-Term, Integrated Product Team. The Acquisition Decision Memorandum also established a JPALS Near-Term, Integrated Product Team to study areas of immediate need and to provide an assessment of a limited set of alternatives to meet directed user requirements for precision landing needs. Headquarters, Air Mobility Command (AMC), chaired the JPALS Near-Term, Integrated Product Team with representation from each Military Department.<sup>1</sup>

The JPALS Near-Term, Integrated Product Team was tasked to make recommendations to the Overarching Integrated Product Team on the following areas of immediate need:

---

<sup>1</sup>Co-integrated Product Team Leaders included representation from the Army Office of the Deputy Chief of Staff for Operations and Plans, Force Development Directorate, Aviation Division; the Navy Office of the Deputy Chief of Naval Operations for Resources, Warfare Requirements, and Assessment, Air Warfare Division; and the Air Force Flight Standards Agency.

- 
- o austere precision landing capability for C-17 aircraft;
  - o interoperability of Army and Navy aircraft with Air Force bases lacking precision approach radar; and
  - o shortfalls and obstacles to the full employment of the recently fielded Mobile Microwave Landing System (MMLS) supporting C-130 aircraft.

**Air Mobility Command Combat Mission Need Statement.** In early September 1996, AMC issued a draft Precision Approach Capability Combat Mission Need Statement (CMNS), which stated that a minimum core of transport aircraft (12 C-5 aircraft, 35 C-17 aircraft, and 12 C-141 aircraft) with the capability to use a rapidly deployable MMLS and a deployable airport surveillance radar and precision approach radar (ASR/PAR) system were required for a rapidly deployable precision approach capability. The CMNS also stated that an urgent need existed to obtain a precision approach initial operational capability by October 30, 1997, for the core transport aircraft.

**Decision Briefing of the JPALS Overarching Integrated Product Team.** The Commander, AMC, requested that the JPALS Near-Term, Integrated Product Team hasten its assessment of solutions for an austere precision landing capability for C-17 aircraft. As part of the Near-Term, Integrated Product Team, the Air Force Program Executive Officer for Airlift and Trainers convened a working group<sup>2</sup> on September 12, 1996, to analyze potential solutions to the AMC CMNS. On October 16, 1996, the Near-Term, Integrated Product Team made recommendations to the JPALS Overarching Integrated Product Team to:

- o modify 35 C-17 aircraft and 12 C-5 aircraft with a developmental Precision Landing System Receiver (PLSR) avionics unit,
- o modify 12 C-141 aircraft with a Commercial Microwave Landing System Avionics (CMLSA) receiver being installed on C-130 aircraft, and
- o purchase 2 ASR/PAR systems being developed commercially.

In making those recommendations, the JPALS Near-Term, Integrated Product Team envisioned use of the PLSR and CMLSA together with the MMLS. On November 14, 1996, the Commander, AMC, validated the CMNS and deleted

---

<sup>2</sup>The Air Mobility Contingency Precision Approach Capability Working Group was led by AMC and the Electronic Systems Center and included representatives from C-17, C-5, and C-141 system program offices; the Air Force Flight Standards Agency; the Global Positioning System Joint Program Office; the Joint Special Operations Command; the Air Force Scientific Advisory Board; and the Air Force Office of the Deputy Chief of Staff for Operations and Plans.

---

the requirement for the 12 C-5 aircraft and the 12 C-141 aircraft. The CMNS was approved by the Chief of Staff of the Air Force on December 11, 1996.

**Microwave Landing System.** In January 1983, the Air Force was designated the lead Military Department for DoD microwave landing system (MLS) development. The Air Force was tasked to submit an implementation plan, after coordinating with the other Military Departments, to the Office of the Secretary of Defense for MLS development. The international and domestic civilian plans to transition from the instrument landing system (ILS) to MLS as the international precision landing standard had a significant effect on the Air Force precision landing requirements and the Air Force selection of a precision landing system to support deployment needs. The Air Force developed and purchased 37 MMLS ground stations under a 1989 Electronic Systems Center contract at a cost of \$50 million to support Air Force C-130s (equipped with CMLSA) deploying to areas where precision approach and landing capabilities do not exist. The CMLSA was developed and produced under a 1987 Electronic Systems Center contract and is being installed under separate contracts for 550 planned C-130 aircraft. However, in June 1994, the Federal Aviation Administration decided to halt development of MLS technology and to pursue Global Positioning System (GPS) technology. As of April 1997, the Air Force has spent more than \$47.7 million on the development, purchase, and installation of the CMLSA.

**PLSR Capabilities and Planned Use.** The PLSR avionics unit is a multi-mode receiver that has been under development by the Electronic Systems Center since 1987. The PLSR is being designed to provide precision landing capability through ILS and MLS technologies and to include an upgrade capability to GPS technology. At airfields without precision landing capability, the Air Force plans to deploy the MMLS so that PLSR equipped C-17 aircraft can make precision approach landings using the MLS capability of the PLSR. See Appendix D for background on PLSR development.

## Audit Objectives

The overall audit objective was to evaluate the capabilities of DoD air traffic control and landing systems to support deployments. Specifically, we evaluated the rationale for the Air Force selection of a developmental PLSR unit (for use with the MMLS) and an ASR/PAR system to meet AMC needs. We also reviewed the effectiveness of the management control program as it applied to planning and acquiring products to meet user needs. See Appendix A for a discussion of the audit scope and methodology and the review of management controls. See Appendix B for a summary of a prior audit coverage. See Appendix E for a discussion of the Air Force contracting for the development, production, and installation of the PLSR on C-17 aircraft.

---

## **Air Mobility Command Precision Approach Landing Capability**

The short time frame allotted (from October 1996 to October 1997) for the development, acquisition, and testing of the PLSR avionics unit on C-17 aircraft for use with the existing Mobile Microwave Landing System ground station resulted in the Air Force not following DoD acquisition procedures. Decisions were made to use the PLSR without adequately documenting that:

- o the Air Force spent \$97.7 million for a Commercial Microwave Landing System Avionics unit installed on C-130 aircraft for use with the Mobile Microwave Landing System, but after 10 years, those systems have not worked in an operational deployment;

- o the life-cycle costs were not developed for the procurement of the PLSR;

- o the costs of potential alternatives were not developed and compared;

- o the JPALS Near-Term Integrated Product Team never finalize: the results of its analyses;

- o the test plans for all PLSR capabilities were not fully developed and its installation was planned to occur on all C-17 aircraft before completion of all testing; and

- o the PLSR is a command unique, service unique system even though the objective of the JPALS Program is to develop one system for all Services.

As a result, the Air Force may install a precision landing system capability that has not been operationally proven, has initiated procurement actions without knowing the full economic cost for the program, and may commit to spending more than \$105.1 million on the high-risk acquisition strategy to procure and install PLSR avionics units on up to 120 C- 17 aircraft before adequately testing and proving the full operational capability of the PLSR. Further, the October 30, 1997, initial operational capability date was not met and testing of the PLSR avionics unit was stopped because of problems between the avionics unit and the C- 17 aircraft.

## **Acquisition Planning Requirements**

**Acquisition Planning.** Acquisition planning is a process to ensure that an acquisition is coordinated and integrated through a comprehensive plan for fulfilling agency needs in a timely manner and at reasonable cost. Acquisition planning should begin as soon as a need is identified. Basic policy on developing acquisition strategies and managing acquisitions is in DoD Directive 5000.1, "Defense Acquisition," March 15, 1996; DoD Regulation 5000.2-R, "Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs," March 15, 1996; and in Federal Acquisition Regulation part 7, "Acquisition Planning."

**Acquisition Planning Policy.** DoD Directive 5000.1 states that the primary goal of the Defense acquisition system is to acquire, in a timely manner and at a fair and reasonable price, quality products that satisfy the needs of the operational user with measurable improvements to mission accomplishment. Federal Acquisition Regulation 7.102, "Policy," states that agencies should perform acquisition planning for all acquisitions to promote full and open competition and to ensure that needs are met in the most effective, economical, and timely manner.

## **Air Force Acquisition Planning**

Air Force program managers and contracting officials did not follow core acquisition management issues encompassed in DoD Directive 5000.1 and Federal Acquisition Regulation part 7 in developing acquisition plans to meet AMC precision landing capability needs. The acquisition plans for the PLSR avionics unit, based on the AMC CMNS, did not adequately document or identify:

- o the capability of MLS technology to support deployments;
- o the reasons for needing an initial operational capability as of October 30, 1997;
- o the operational test and evaluation plans needed to verify the operational capability of the PLSR avionics unit;
- o the full program costs; or
- o the alternative solutions considered and the reasons that the Air Force selected the PLSR avionics unit to meet the AMC precision landing capability needs.

## **Operational Capability of MLS Technology**

The Air Force plans to install PLSR avionics units on up to 120 C-17 aircraft, even though existing MLS landing system capabilities to be used by the PLSR have not been proven operationally capable of supporting precision landing needs during deployments. The Air Force was unable to use the MMLS ground stations and the CMLSA receivers during the deployment to Bosnia for precision landing needs.

**Operational Status of MLS Technology.** In response to the Federal Aviation Administration decision to pursue GPS technology for precision landing needs, the Army and the Navy deleted funding from MLS budgets, and neither plans to use MLS technology. The Air Force also deleted funding for its MLS program requirements based on recommendations made in Inspector General, DoD, Report No. 94-190, "Air Force Microwave Landing System," September 20, 1994 (see Appendix B). However, since 1983, the Air Force has continued with its efforts to field a deployable precision landing system capability based on the use of MLS technology. The Air Force efforts to field the MLS technology have resulted in the development and procurement of 37 MMLS ground stations, beginning in 1989, at a cost of \$50 million, and the development, procurement, and installation of CMLSA receivers, beginning in 1987, on 550 planned C-130 aircraft at a cost of more than \$47.7 million. However, after 10 years, the Air Force has not yet successfully demonstrated the operational feasibility of existing MLS capabilities to provide precision landing capability during an operational deployment.

**Attempts to Field MMLS and CMLSA.** In early 1996, during Operation Joint Endeavor, attempts to use the existing MLS capability were hindered by technical problems with both the MMLS and CMLSA and by procedural problems with flight and navigation manuals. Those problems resulted in procedural corrections for the use of MMLS ground stations and restrictions on the use of the CMLSA receiver because of installation problems on the C-130 aircraft. Also, production reliability and acceptance testing of the MMLS conducted from April through December 1996 identified technical deficiencies that resulted in modification retrofits for the MMLS. The Air Force has initiated action to fix the known problems, to include completing retrofits on the MMLS, verifying the proper installation of the CMLSA on C-130 aircraft, correcting software deficiencies with the CMLSA receiver, correcting flight manual errors on use of the CMLSA, and developing flight training programs for pilots on use of the CMLSA. The Air Force projected that all deficiencies would have been corrected by December 1997. However, additional follow-on test and evaluation is needed to assess the operational effectiveness and suitability of the MMLS and the C-130 aircraft equipped with the CMLSA and to prove the adequacy of corrective actions taken.

**Status of Follow-on Test and Evaluation.** Follow-on test and evaluation of the MMLS and the C-130 aircraft equipped with the CMLSA, to include electromagnetic compatibility and interference testing, was scheduled to begin in August 1996 and to be completed by June 1997. However, as of

## **Air Mobility Command Precision Approach Landing Capability**

---

December 1997, the Air Force had not developed a test plan. The Air Force Combat Air Delivery School does not recommend starting the testing until the operational problems with the MMLS and the CMLSA are corrected.

**Deployment Planning for the MMLS.** The AMC and the Air Force Special Operations Command have not developed an adequate concept of operations for deploying the MMLS. The AMC has drafted a concept of operations plan; however, that plan was still pending as of January 9, 1998. The Air Force Special Operations Command 22nd Special Tactics Squadron, McCord Air Force Base, was designated the Air Force Special Operations Command pilot unit for MMLS initial operating capability and for concept of operations validation by November 1, 1997. However, that plan was not final as of December 10, 1997. According to the Combat Air Delivery School, the current concept of operations, which the Air Combat Command prepared, lacks sufficient detail on MMLS employment in threat environments, wartime usage rates, enroute navigation, airfield survey procedures, flight check requirements, and the use of offset approach capability.

The lack of an adequate concept of operations plan for the MMLS contributed to the Air Force inability to effectively deploy the MMLS in the past and could adversely impact future efforts to use the MMLS in support of deployments.

**Operational Status of GPS Technology.** The Federal Aviation Administration is still developing GPS technology, and decisions on the use of GPS technology for precision landing capability are not expected until 1999 or later.

### **Initial Operational Capability Date**

The AMC and the Air Force Program Executive Officer for Airlift and Trainers could not provide a documented rationale, as required by DoD Directive 5000.1, regarding the need for an initial operational capability date of October 30, 1997: Federal Acquisition Regulation 7.104, "General Procedures," subparagraph (b) states that requirements and logistics personnel should avoid issuing requirements on an urgent basis or with unrealistic delivery or performance schedules because that approach generally restricts competition and increases prices. The October 30, 1997, date was based on the expected time needed to develop, install, and test a portion of the proposed MLS capability of the PLSR on C-17 aircraft and was not based on a documented or ongoing operational need. The AMC had no documented analysis of airlift requirements, to include the types, sizes, and quantities of material and personnel, to support a specific operational deployment scenario or the types of aircraft needed. Also, the AMC did not have an analysis of how often precision landings are needed because of poor weather or an analysis of the effects on operations from the inability to make a precision landing.

The initial operational capability date of October 30, 1997, was not based on ongoing operational needs. Because of the unrealistic initial operational

capability date, the Air Force did not design an adequate test plan, does not plan to fully test PLSR capabilities before installation on the C-17 aircraft, and did not thoroughly evaluate alternatives to meet precision landing needs before planning the acquisition of the PLSR.

## **Development, Production, and Testing of PLSR**

The Air Force modified existing contracts even though developmental and initial operational flight testing of the PLSR avionics units on C-17 aircraft had not been accomplished, as required by DoD Regulation 5000.2-R, to:

- o develop and produce 117 PLSR avionics units (9 units for testing, 94 units for production installation, and 14 units for spares);
- o install PLSR avionics units on 40 C- 17 aircraft (1 test aircraft and 39 retrofits); and
- o incorporate the PLSR avionics units into the C- 17 aircraft production line.

As of November 21, 1997, the Electronic Systems Center and the Aeronautical Systems Center had issued six undefinitized contractual actions, valued at \$42.9 million. The contractual actions are further discussed in Appendix E. The Air Force Program Executive Officer for Airlift and Trainers stated that the Air Force acquisition strategy was necessary to meet the initial operational capability date of October 30, 1997, and that PLSR avionics units may be installed on all the planned 120 C- 17 aircraft. However, current plans for installation of PLSR avionics units on the initial 35 C-17 aircraft are unknown because of testing delays. DoD Regulation 5000.2-R states that initial test and evaluation planning must provide for completion of initial operational test and evaluation before entering full-rate production.

**Developmental and Initial Operational Flight Testing.** The Air Force plans only limited testing of the proposed capabilities of the PLSR, to include the MLS capability to be used in deployments, before final decisions are made to install the PLSR on C-17 aircraft. The Air Force Operational Test and Evaluation Center issued “Air Mobility Contingency Precision Approach Capability (AMCPAC) Initial Operational Test and Evaluation Phase I & II Plan” on July 31, 1997. According to the test plan:

- o Phase I will support the initial fielding decision for the C-17 and will provide ILS (category 1 and 2), MLS collocated computed category 1 (MLS C), and Very High Frequency Omni Bearing Range with the C-17 in autopilot coupled and flight detector modes.
- o Phase II will add MLS split site modes, automatic (MLS A) and manual (MLS M) and C-17 raw deviations modes.
- o Phase III will add differential GPS capability, if it is funded.

The Air Force Operational Test and Evaluation Center test manager stated that the planned phase I testing of the PLSR will be done under the existing weather conditions on the day of testing and may not replicate the adverse conditions that could be expected during operational deployments. The test manager also stated that he would prefer to conduct all operational testing of existing PLSR capabilities, as provided for under phase I and phase II of the current initial operational test plan, so that the PLSR could be released without any flight restrictions on the use of the MLS-based capability of the PLSR. Instead, current Air Force plans call for a fielding decision based on an interim summary report on the results of the planned phase I testing.

**Test Status.** Combined developmental and phase I initial operational flight testing was scheduled for August 18 through September 29, 1997. PLSR installation on the C-17 aircraft was scheduled to begin October 7, 1997. The developmental testing began on August 18, 1997, but because of problems experienced during developmental testing, the PLSR was not certified ready for operational testing until November 10, 1997. The operational testing began on November 12, 1997, but was suspended as of November 20, 1997. Both the developmental and initial operational testing identified numerous problems with the PLSR and its integration into the C-17. Officials from the C-17 System Program Office were not sure when the current problems would be fixed or when operational testing would resume. The C-17 Systems Program Office officials stated that the PLSR would not be installed until after the current phase of operational testing was complete. The Director, Operational Test and Evaluation, is not involved in the planned testing.

**Test Plan.** The AMC requirements correlation matrix and the AMC CMNS do not describe the specific operational scenario (combat need) in which the PLSR equipped C-17 is expected to operate. Also, current plans do not ensure that the PLSR will be realistically tested under the types of adverse conditions that may be experienced during deployments. DoD Regulation 5000.2-R states that the primary purpose of operational test and evaluation is to determine whether systems are operationally effective and suitable for the intended use by representative users before production and deployment.

Appropriate testing is required to ensure system performance, operational effectiveness, and operational suitability for the desired military application. The Air Force problems with deploying the existing MMLS ground stations and CMLSA-equipped C-130 aircraft raises questions as to the viability of existing MLS capabilities in support of deployments and emphasizes the need for appropriate testing before additional costs are incurred on the PLSR. We believe realistic testing of the PLSR cannot be successfully accomplished until the operational problems of existing MLS capabilities are corrected and those corrections are verified by operational testing the MLS capabilities.

Under Aeronautical Systems Center contract F33657-95-D-2026, the Air Force is implementing its plan to develop, integrate, and flight test the PLSR avionics unit on one C-17 aircraft. The Air Force should fully prove the proposed capabilities of the PLSR through appropriate testing on that C-17 aircraft.

Testing should be based on specific operational scenarios and the results of testing of the PLSR should be used to assess other potential alternatives for a precision landing system. Further, final decisions to produce and install PLSR avionics units on additional C-17 aircraft or any other aircraft should be made only after testing is successfully completed.

## **Estimated Integration Costs and Program Affordability**

The Air Force did not document all program costs for precision landing capabilities before deciding to install PLSR avionics units on C-17 aircraft. The costs of continuing to attempt to field, operate, and maintain an MLS-technology-based system and the costs to develop, operate, and maintain a GPS-technology-based system were not fully documented and assessed. DoD Directive 5000.1 and DoD Regulation 5000.2-R state that the full costs of implementing proposed systems should be fully and clearly documented and identified to decision makers along with pertinent performance information so that informed decisions can be made on whether proposed systems offer sufficient military or economic benefit over existing systems. Also, the Defense Systems Affordability Council, chaired by the Under Secretary of Defense for Acquisition and Technology, emphasized the importance of identifying life-cycle support costs and ensuring the affordability of systems.

**Estimated Funding Requirements to Install PLSR.** In a January 6, 1997, reprogramming request to Congress, the Air Force stated that \$54.6 million was needed for a new-start modification in support of the AMC CMNS. At that time, the Air Force estimated that \$40.7 million was needed for the development, procurement, and installation of PLSR avionics units on 40 C-17 aircraft, \$13.0 million was needed to procure 4 ASR/PAR systems, and \$0.9 million was needed for flight-check equipment. However, in an April 15, 1997, response to the Inspector General, DoD, questions on integration of the PLSR into C-17 aircraft, the Air Force Program Executive Officer for Airlift and Trainers stated that the PLSR may be incorporated throughout the planned 120 C-17 aircraft fleet to maintain a single configuration. Based on available cost information obtained from the C-17 System Program Office, the potential costs to develop the differential GPS capability of the PLSR and to install PLSR avionics units on the 120 C-17 aircraft fleet would be \$105.1 million. Additional details on funding requirements to support the AMC CMNS and install PLSR avionics units on C-17 aircraft are in Appendix F.

## **Risk Management**

While the Air Force views the program to install PLSR avionics units on C-17 aircraft a low to moderate risk, the history of the deployable MLS program and the developmental status of the PLSR indicate otherwise. The Air Force Program Executive Officer for Airlift and Trainers stated that the availability of funds was a moderate risk to meeting the initial operational

Testing should be based on specific operational scenarios and the results of testing of the PLSR should be used to assess other potential alternatives for a precision landing system. Further, final decisions to produce and install PLSR avionics units on additional C-17 aircraft or any other aircraft should be made only after testing is successfully completed.

## **Estimated Integration Costs and Program Affordability**

The Air Force did not document all program costs for precision landing capabilities before deciding to install PLSR avionics units on C-17 aircraft. The costs of continuing to attempt to field, operate, and maintain an MLS-technology-based system and the costs to develop, operate, and maintain a GPS-technology-based system were not fully documented and assessed. DoD Directive 5000.1 and DoD Regulation 5000.2-R state that the full costs of implementing proposed systems should be fully and clearly documented and identified to decision makers along with pertinent performance information so that informed decisions can be made on whether proposed systems offer sufficient military or economic benefit over existing systems. Also, the Defense Systems Affordability Council, chaired by the Under Secretary of Defense for Acquisition and Technology, emphasized the importance of identifying life-cycle support costs and ensuring the affordability of systems.

**Estimated Funding Requirements to Install PLSR.** In a January 6, 1997, reprogramming request to Congress, the Air Force stated that \$54.6 million was needed for a new-start modification in support of the AMC CMNS. At that time, the Air Force estimated that \$40.7 million was needed for the development, procurement, and installation of PLSR avionics units on 40 C-17 aircraft, \$13.0 million was needed to procure 4 ASR/PAR systems, and \$0.9 million was needed for flight-check equipment. However, in an April 15, 1997, response to the Inspector General, DoD, questions on integration of the PLSR into C-17 aircraft, the Air Force Program Executive Officer for Airlift and Trainers stated that the PLSR may be incorporated throughout the planned 120 C-17 aircraft fleet to maintain a single configuration. Based on available cost information obtained from the C-17 System Program Office, the potential costs to develop the differential GPS capability of the PLSR and to install PLSR avionics units on the 120 C-17 aircraft fleet would be \$105.1 million. Additional details on funding requirements to support the AMC CMNS and install PLSR avionics units on C-17 aircraft are in Appendix F.

## **Risk Management**

While the Air Force views the program to install PLSR avionics units on C-17 aircraft a low to moderate risk, the history of the deployable MLS program and the developmental status of the PLSR indicate otherwise. The Air Force Program Executive Officer for Airlift and Trainers stated that the availability of funds was a moderate risk to meeting the initial operational

capability date of October 30, 1997, and that the development of the PLSR was a moderate risk that the Air Force would closely monitor to ensure that the schedule is maintained. The Air Force did not consider the status and operability of the MMLS a risk.

**Assessment of MLS Technology Risk.** During its assessment of alternatives, the JPALS Near-Term, Integrated Product Team stated that the MMLS was fielded and available for use, that it had been through developmental and initial operational test and evaluation, and that it could be deployed and set up by three people in 1 hour. However, the Air Force was unable to demonstrate the use of existing MLS capabilities for precision landing needs during the deployment to Bosnia, and the current status as to when the MMLS will be operationally deployable was not known.

**Acquisition Program Risk.** DoD Regulation 5000.2-R states that a risk management program should be established for each acquisition program to identify and control performance, cost, and schedule risks. We believe that the Air Force Program Executive Officer for Airlift and Trainers did not accurately identify all risk factors affecting the development, installation, and use of the PLSR on C-17 aircraft and that DoD level decision makers may not have been provided complete information relative to the AMC CMNS and the selected Air Force solution.

## Considering Alternative Solutions

The Air Force may not have identified less costly means of providing immediate precision landing capability for C-17 aircraft because it did not fully consider existing alternatives and promising, future alternatives. The AMC and the JPALS Near-Term, Integrated Product Team did not fully consider alternative solutions to meet the precision landing needs of C-17 aircraft or the costs of those alternatives. Also, the documented results of the JPALS Near-Term Integrated Product Team were not finalized and approved. DoD Directive 5000.1 and DoD Regulation 5000.2-R require DoD Components to document mission deficiencies in a mission need statement and to describe why nonmaterial alternatives are not adequate to meet a requirement. Nonmaterial alternatives include changes in doctrine, concepts of operations, tactics, strategy, organization, training, or revisions to current war plans. The DoD guidance also states that cost must be considered as an independent variable and requires acquisition managers to establish realistic cost objectives for all acquisition programs.

**Nonmaterial Alternatives.** The Air Force, the Army, and the Marine Corps have had existing equipment that can provide precision landing capability in adverse weather conditions. Therefore, AMC had no documented support for its assertions that existing nonmaterial alternatives could not meet the immediate need for precision landing capability on C-17 aircraft. Also, AMC planners were not fully aware of when or how precision landing capability support would

be provided during major regional conflicts and contingency operations. Existing war plans for major regional conflicts did not clearly identify requirements for precision landing capability.

**Air Force Landing Control Central.** The Air Force did not adequately consider use of the Air Force Landing Control Central (AN/TPN-19) to meet the AMC CMNS. The AMC CMNS stated that the AN/TPN-19 required 7 C-130 aircraft and 33 personnel for transport and initial setup. However, on September 24, 1996, the Air Force Program Executive Officer for Airlift and Trainers briefed the Commander, AMC, that the existing Air Force AN/TPN-19 (the precision approach radar portion only) could be deployed on 2 C-130 aircraft and be set up by 10 personnel and noted that the alternative would require a change in the current concept of operations. On October 21, 1996, the Commander, AMC, briefed the Assistant Secretary of the Air Force (Acquisition) on the AMC CMNS requirement and recommended pursuing the AN/TPN-19 (precision approach radar only) alternative, installing the PLSR on C-17 aircraft, and pursuing acquisition of an ASR/PAR. In a November 20, 1996, memorandum to the Chief, Mobility Training and Special Operations Requirements Division, Directorate of Operational Requirements, the Air Force Flight Standards Agency stated that the AMC CMNS misstated AN/TPN-19 airlift and personnel requirements. The Air Force Flight Standards Agency stated that the AN/TPN-19 (precision approach radar only) could be deployed and set up using 2 C-130 aircraft and 10 personnel, rather than 7 C-130 aircraft and 33 personnel.

Although the capabilities of the existing AN/TPN-19 (precision approach radar only) were known, AMC did not adequately document why that alternative alone could not meet immediate precision landing capability needs of the C-17 aircraft. The Air Combat Command recently revised the concept of operations plans to field the AN/TPN-19 (precision approach radar only) with a tactical air navigation system if required to support deployments. However, the AMC CMNS was never updated to reflect the AN/TPN-19 (PAR only) deployment capabilities.

**Army and Marine Corps Alternatives.** The AMC did not consider existing Army or Marine Corps precision approach radar systems for meeting immediate precision landing needs. The Army AN/TPN-18 Landing Control Central can be deployed using 1 C-130 aircraft and 7 personnel to set up. The Marine Corps AN/TPN-22 All Weather Landing Subsystem can be deployed using 2 C-130 aircraft and 7 personnel to set up. Both systems can provide precision approach landing capability in adverse weather.

We believe that existing precision landing systems in the Army, the Air Force, and the Marine Corps are capable of meeting the immediate precision landing capability needs of AMC and the C-17 aircraft. Further, the AMC CMNS requirement could be met through more effective coordination among the Military Departments and through better planning of operational requirements.

## Air Mobility Command Precision Approach Landing Capability

**Assessing Future Alternatives.** The JPALS Near-Term, Integrated Product Team assessed seven potential alternatives to meet the AMC CMNS:

- o Landing Control Central (AN/TPN- 19) ;
- o PLSR with the MMLS;
- o CMLSA with the MMLS:
- o Tactical Transponder Landing System (TTLS);
- o Local Area Differential Global Positioning System avionics and ground system;
- o Wide Area Global Positioning System Enhancement with GPS receiver capability; and
- o Optical Microwave Approach and Ranging (OMAR™) ground and avionics system.

Each alternative is fully described in Appendix C.

The JPALS Near-Term, Integrated Product Team did not consider life-cycle costs or apply cost-performance, trade-off analysis against the considered alternatives. Air Force officials stated that cost was secondary to the AMC CMNS need for an October 30, 1997, initial operational capability and, therefore, did not consider a cost analysis of the seven potential alternatives to meet the AMC CMNS. In October 1996, the JPALS Cost Performance Integrated Product Team emphasized the requirement for cost and trade-off analysis, but closed out the action in November 1996 with the explanation that “Only PLSR will be costed.” The effective application of cost and trade-off analysis could have shown the benefits of using existing Military Department radar systems or developmental systems to meet the immediate need for precision landing capability for C- 17 aircraft.

For example, one alternative, the Tactical Transponder Landing System (TTLS), was estimated to cost about \$500,000 per unit but was not pursued. In a February 20, 1997, memorandum to the Federal Aviation Administration, the Defense Advanced Research Projects Agency stated that the Commander, AMC, had asked the Defense Advanced Research Projects Agency to accelerate the TTLS Program and to complete its development by November 1997. In March 1997, the Federal Aviation Administration informed the Air Force Program Executive Officer for Airlift and Trainers that the TTLS is a viable precision landing alternative that can be developed as a military option for a transportable approach aid. The TTLS makes use of existing instrument landing system avionics used by most military and civilian aircraft today. The JPALS

Near-Term, Integrated Product Team excluded the TTLS from consideration to meet the AMC CMNS because it was not far enough along in development to meet the need for an October 30, 1997, initial operational capability.

**Documenting JPALS Near-Term Integrated Product Team Results.** The detailed support for the actions taken and recommendations made by the Near-Term Integrated Product Team are documented in the draft "Joint Precision Approach and Landing System (JPALS) Near-Term Working-Level Integrated Product Team (NT-WIPT) Assessment," prepared for the Office of the Deputy Assistant Secretary of Defense (Command, Control, Communications, and Intelligence Acquisition). We considered draft versions of that report, dated January 1997 and March 1997, in preparing the audit report. However, the Air Force Program Executive Officer for Airlift and Trainers never approved a final version of that report, and officials from the Office of the Program Executive Officer did not know when the report would be finalized.

## Conclusion

Air Force program managers plan to install PLSR avionics units on C-17 aircraft to provide a precision landing capability when used with existing MMLS ground stations, even though the Air Force has not demonstrated the operational viability of using existing MLS capabilities to support deployments.

**Initial Operational Capability.** The initial operational capability date of October 30, 1997, was unrealistic because no ongoing operational need mandates that date. Because of the initial operational capability date, the Air Force abbreviated the evaluation of alternatives that led to selecting the PLSR to meet AMC needs. Further, an adequate test plan was not designed by the Air Force because of the initial operational capability date and because of the lack of specific operational scenarios in the AMC CMNS.

**MLS Technology.** The use of MLS technology for precision landing in support of deployments was not operationally proven, and the full economic cost of continuing to use the technology is not known. Existing precision radar systems can provide precision landing capability. Also, less costly alternative systems may be available.

**GPS Technology.** In the long term, while GPS technology is expected to provide precision landing capability, the technology is still not fully developed, has not been proven reliable through adequate testing and evaluation, and the full cost of using GPS technology is not known.

**Potential Expenditures.** The Air Force plan to install PLSR avionics units on up to 120 C-17 aircraft before demonstrating the operational capability of the MLS and GPS technology could result in the unnecessary expenditure of more than \$105.1 million if the proposed capabilities of the PLSR cannot be effectively used during deployments.

The Air Force should limit the acquisition and installation of the PLSR avionics units to one C-17 test aircraft and adequately and realistically test PLSR capabilities before finalizing decisions on which precision landing system will be installed on the planned 120 C-17 aircraft fleet. Based on the results of such realistic testing, the costs and benefits of using the PLSR avionics units can be fully evaluated along with other competing alternatives to meet DoD-wide precision landing needs under the ongoing JPALS Program.

## Recommendations, Management Comments, and Audit Response

**Summary of Management Comments.** The Assistant Secretary of Defense (Command, Control, Communications, and Intelligence) stated that the Air Force draft response to the report contested that many discrepancies were in the draft audit report. The Assistant Secretary requested that the Inspector General, DoD, attempt to reconcile the disagreements with the Air Force prior to issuing the final report. Based on that request, we obtained additional information from the Air Force. The full text of the Assistant Secretary's comments is in Part III. The Air Force management comments on the recommendations are summarized below. Appendix G summarizes the Air Force comments on the overall draft report. Based on the management comments, we readdressed the recommendations from the Assistant Secretary of Defense (Command, Control, Communications, and Intelligence) to the Air Force and we revised Recommendations 1. b. and 2.

**1. We recommend that the Assistant Secretary of the Air Force for Acquisition reevaluate the decision to install the Precision Landing System Receiver avionics units on C-17 aircraft. The reevaluation should include:**

**a. Limiting the acquisition and installation of the Precision Landing System Receiver to one C-17 test aircraft.**

**Air Force Comments.** The Principal Deputy Assistant Secretary of the Air Force (Acquisition and Management) did not agree with the recommendation. The Air Force stated that a well-planned, event driven schedule was laid out for the Air Mobility Contingency Precision Approach Capability<sup>3</sup> program and that arbitrarily limiting acquisition and installation to a single aircraft makes no sense. The program is based on a validated mission need and is following prescribed acquisition procedures. The PLSR will not be

---

<sup>3</sup>The Air Mobility Contingency Precision Approach Capability program was established to identify solutions to the AMC CMNS. The solutions involved actions to develop and install the PLSR on C-17 aircraft for use with the MMLS ground receiver, which are discussed in this report. The Air Force actions to acquire the Ground Control Approach-2000 radar system are the subject of an on-going audit.

installed on C-17 aircraft until after a fielding decision, supported by the results of developmental and operational testing. The results of the phase I initial operational test and evaluation, which will verify no loss of existing capability and the addition of deployed MMLS capability, will be the basis of the decision to install the PLSR. The complete text of the Air Force comments is in Part III.

**Audit Response.** Testing the PLSR and the MMLS on a single aircraft makes sense. Following the issuance of the draft audit report, the Air Force implemented a plan to develop, integrate, and flight test the PLSR avionics unit on a single C-17 aircraft. That action satisfies the intent of the recommendation and additional comments are not required.

**b. Proving the operational capability and feasibility of the Precision Landing System Receiver to provide precision landing capability in support of deployments through phase II of the test schedules before installing the Precision Landing System Receiver on the C-17 fleet.**

**Air Force Comments.** The Principal Deputy Assistant Secretary of the Air Force (Acquisition and Management) did not agree with the draft report recommendation. The Air Force stated that appropriate testing was planned and that the PLSR will not be installed on C-17 aircraft until adequate testing has successfully occurred.

**Audit Response.** Based on Air Force comments and additional audit work, we updated the report to show the current status of testing. We also revised the recommendation. The Air Force Operational Test and Evaluation Center is conducting the initial operational testing. The initial operational test plan calls for three phases of testing. The phase I operational testing started on November 12, 1997. That testing was suspended on November 20, 1997, because of scheduled maintenance of the C-17 test aircraft and additional technical problems with the integration of the PLSR on the C-17. As of January 6, 1998, C-17 System Program Office officials were not sure when the operational testing would resume. Also, the Air Force has not yet determined phase II and phase III test schedules.

The Air Force plans to acquire and install PLSR avionics units on 39 C-17 aircraft through retro-fit actions based on the completion of phase I testing but not phase II testing and based on an Air Force Operational Test and Evaluation Center prepared interim summary report on the results of the phase I testing, which covers only a portion of the designed capabilities of the PLSR. The Air Force Operational Test and Evaluation Center stated that those actions were necessary to support the AMC CMNS timeline. The Air Force Operational Test and Evaluation Center test manager stated that the planned phase I testing of the PLSR will be done under the weather conditions on the day of testing and may not replicate the adverse conditions that could be reasonably expected during operational deployments. The test manager also stated that he would prefer to conduct all operational testing of existing PLSR capabilities as provided for under phase I and phase II of the current initial operational test plan, so that the PLSR could be released without any flight restrictions on the use of the MLS-based capability of the PLSR. We believe

the test manager's suggestion to be a more cost-effective and operationally sound approach to the testing of the PLSR. The current Air Force plans may result in the fielding of the PLSR with flight restrictions that will limit the operational utility of the PLSR on C- 17 aircraft.

We request that the Air Force provide comments on the revised recommendation.

**c. Evaluating the costs and benefits of continuing the use of microwave landing system technology to provide precision landing capability in support of deployments.**

**Air Force Comments.** The Principal Deputy Assistant Secretary of the Air Force (Acquisition and Management) agreed with the recommendation. The Air Force stated that the JPALS Program and the Electronic Systems Center will stay current on the continuing use of MLS technology and that the Air Force will ensure that the JPALS Program conducts an appropriate costs and benefits analysis.

**Audit Response.** The Air Force comments are responsive to the intent of the recommendation to evaluate the costs and benefits of continuing to use microwave landing system technology in support of deployments.

We request that the Air Force provide us a target date for completion of the analysis and provide us with the documentation on the analysis of the costs and benefits of continuing to use MLS technology.

**d. Evaluating the costs and benefits of the Precision Landing System Receiver and other alternatives against established mission requirements under the ongoing DoD-wide Joint Precision Approach and Landing System Program.**

**Air Force Comments.** The Principal Deputy Assistant Secretary of the Air Force (Acquisition and Management) agreed with the recommendation. The Air Force stated that the cost and benefits of the PLSR will be evaluated as part of the JPALS analysis of alternatives cost trade-off analysis, along with other potential material alternatives.

**Audit Response.** The Air Force comments are responsive to the intent of the recommendation to evaluate the costs and benefits associated with the PLSR.

We request that the Air Force provide us a target date for completion of the analysis and provide us with the documentation on the analysis of the costs and benefits of the PLSR and other material alternatives.

**2. We recommend that the Assistant Secretary of the Air Force for Acquisition provide guidance that the use of Air Force Instruction 63-114, "Rapid Response Process," does not relieve program officials from properly documenting operational requirements, preparing cost analyses of alternatives, finalizing Integrated Product Team reports, and planning acquisitions as required by DoD Directive 5000.1, "Defense Acquisition," March 15, 1996, and by Federal Acquisition Regulation Part 7, "Acquisition Planning."**

**Air Force Comments.** The Principal Deputy Assistant Secretary of the Air Force (Acquisition and Management) disagreed with the draft report recommendation and stated that periodic reminders can help maintain awareness of acquisition procedures. However, special instructions were not warranted at this time. The Air Force stated that the Air Mobility Contingency Precision Approach Capability program was based on a validated and approved mission need; acquisition plans followed Air Force Instruction 63-1 14, "Rapid Response Process," May 5, 1994; and the JPALS Overarching Integrated Product Team approved the acquisition strategies with which the Under Secretary of Defense for Acquisition and Technology concurred.

**Audit Response.** The Air Force did not adequately document and consider existing nonmaterial solutions to the claimed immediate need for precision landing capability on C-17 aircraft before validating the AMC CMNS. In addition, the Air Force never clearly specified the operational requirements and capabilities that required immediate support.

The initial operational capability date of October 30, 1997, restricted Air Force evaluations of potential alternative solutions to the AMC CMNS. Also, there were no life-cycle cost analyses of alternatives. As of January 6, 1998, as a result of problems experienced during the limited (phase I) developmental and initial operational testing scheduled for the PLSR, C-17 System Program Office officials do not know when testing will be completed.

We recognized that the JPALS Overarching Integrated Product Team approved acquisition strategies with which the Under Secretary of Defense for Acquisition and Technology concurred. However, those acquisition strategies were composed of briefing charts and point papers. Also, the JPALS Overarching Integrated Product Team never issued a signed final report and decisions were based on two draft reports.

The proper acquisition planning procedures to follow are those mandated by DoD Directive 5000.1. Air Force Instruction 63-1 14 specifically states that the Rapid Response Process does not replace normal acquisition procedures, but rather speeds up the process to satisfy wartime needs.

We request that the Air Force provide comments on the revised recommendation.

## **Part II - Additional Information**

---

## **Appendix A. Audit Process**

### **Scope**

To accomplish the audit objective, we evaluated the Air Force selection of alternatives to satisfy the Air Mobility Command CMNS for deployable precision landing systems. Components of the selected systems we reviewed included :

- o the Precision Landing System Receiver (PLSR),
- o the Commercial Microwave Landing System Avionics,
- o the Mobile Microwave Landing System, and
- o the Airport Surveillance Radar and Precision Approach Radar.

### **Methodology**

We conducted this program audit from October 1996 through June 1997 in accordance with auditing standards issued by the Comptroller General of the United States, as implemented by the Inspector General, DoD. We obtained and examined documents related to precision landing systems for the period December 1981 through April 1997. We analyzed the operational status of the Mobile Microwave Landing System and of the Commercial Microwave Landing System Avionics, which was developed, produced, and is being installed at a cost of \$97.7 million. We examined the program history of the development of the PLSR (previously called Military Microwave Landing System Avionics) since 1983 and examined contracts and requests for proposal, dated from January 1993 to February 1997, that had been prepared for the development, purchase, and installation of the PLSR on C-17 aircraft. Through February 1997, the Air Force has expended about \$101 million for the development and initial production of the PLSR. Additionally, we examined plans to purchase four Airport Surveillance Radar and Precision Approach Radar valued at \$13 million. No computer-processed data were used during the audit.

## Contacts During the Audit

We visited or contacted individuals or organizations within the DoD, the Federal Aviation Administration, the GEC-Marconi Electronics Systems Corporation, and the Advanced Navigation and Positioning Corporation. Further details are available upon request.

## Management Control Program

DoD Directive 5010.38, "Management Control (MC) Program," August 26, 1996, 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 controls.

**Scope of Review of the Management Control Program.** We reviewed the adequacy of Air Force management controls over acquisition planning for the Precision Landing System Receiver. Specifically, we reviewed management controls over the Air Mobility Command's validation of the operational need and acquisition planning efforts by the Air Force Program Executive Office for Airlift and Trainers, the Air Force Aeronautical Systems Center, and the Air Force Electronic Systems Center. We also reviewed management's self-evaluation of those controls.

**Adequacy of Management Controls.** We identified material weaknesses as defined by DoD Directive 5010.38 for the Air Force. DoD policies and procedures require program and contracting officials to properly plan acquisitions so that users obtain quality products that provide measurable improvement to mission accomplishment, in a timely manner and at a fair and reasonable price. However, the Air Force did not follow DoD policies and procedures to ensure that realistic operational needs and capabilities were established and validated, test plans were developed, full program and life-cycle costs were identified, and competing alternatives were properly considered before modifying existing contracts to produce and install PLSR avionics units on C-17 aircraft. Recommendations 1. and 2., if implemented, will help to correct the weaknesses. Potential monetary benefits could be realized as a result of implementing Recommendation 1. However, we could not determine the amount because it will depend on subsequent actions taken by the Air Force. A copy of this final report will be provided to the senior official in charge of management controls for the Air Force.

**Adequacy of Management's Self-Evaluation.** Air Force officials identified acquisition planning and contract support as assessable units; however, the Air Force assigned a low level of risk to those assessable units and did no further testing. Therefore, the Air Force did not identify the material weaknesses identified by the audit. The Air Force officials should have assigned a higher level of risk and tested the areas.

---

## Appendix B. Summary of Prior Coverage

**Inspector General, DoD, Report No. 97-204, “Undefinitized Contractual Actions,” August 15, 1997.** The report states that the Military Departments did not always comply with the statutory provisions for the use of undefinitized contractual actions. Undefinitized contractual actions were not adequately justified, were not definitized in a timely manner, and the reasonableness of negotiated profit rates was not documented. As a result, the DoD contractual position in the award and negotiation process was weakened and contractors received profits that were not commensurate with the risk undertaken. The report recommended that the Service Acquisition Executives issue guidance to their contracting organizations requiring:

- o justification documents to provide specific details on the procurement requirement, the procurement planning performed, and the adverse effect if the procurement is delayed;

- o contracting officers to meet milestones for definitizing undefinitized contract actions; and

- o contracting organizations to establish performance goals for definitizing undefinitized contractual actions and tracking compliance with statutory and regulatory requirements.

The Service Acquisition Executives generally concurred with the recommendations.

**Inspector General, DoD, Report No. 94-190, “Air Force Microwave Landing System,” September 20, 1994.** The report states that 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. As a result, the Air Force continued the Microwave Landing System program and began the development, purchase, and installation of Microwave Landing System hardware on C-130 aircraft. Further, the report states that the Air Force had not finalized analyses to determine and validate the number of Mobile Microwave Landing System ground stations needed to support the Air Force tactical precision landing requirements. We recommended that the Assistant Secretary of Defense (Command, Control, Communications, and Intelligence) determine the DoD precision landing requirements and select the best precision landing technologies to satisfy the DoD precision landing requirements. We also recommended that the Assistant Secretary of the Air Force (Acquisition) procure only 11 additional Commercial Microwave Landing System Avionics kits (thus reducing the number of kits to be procured by 238) for the remaining

**C-130** aircraft, determine the number of Mobile Microwave Landing Systems needed to support the Air Force tactical precision landing requirements, and develop a fielding plan.

The Air Force reduced the Microwave Landing System program requirements as of September 1994. The report identified potential monetary benefits of \$27.8 million that would result from the Air Force reduction of program requirements.

---

## Appendix C. Glossary of Terms

**Air Force Landing Control Central (AN/TPN-19).** The AN/TPN-19 is the primary Air Force deployable air traffic control and landing system in use today. It is composed of an AN/TPN-24 (ASR), an AN/TPN-25 (PAR), and the OK-235 and OK-236, which make up the Operations Control Center. The AN/TPN-19 is a complete ground control approach facility. The ASR and PAR are used by air traffic controllers to identify and locate arriving and departing aircraft and to provide final approach guidance. The AN/TPN-19 is capable of identifying aircraft with secondary radar out to 200 nautical miles, providing primary radar coverage out to 60 nautical miles (with ASR), and providing precision approach radar coverage for both azimuth and elevation from 20 nautical miles to touchdown (with PAR). The Air Force has 10 AN/TPN-19 systems in inventory.

**Airport Surveillance Radar (ASR).** The ASR provides air traffic control operations with information on approaching and departing aircraft up to 60 nautical miles from an airdrome runway. Air traffic controllers can use ASR to maintain separation of aircraft and provide for terminal airspace traffic management.

**Air Traffic Control and Landing Systems (ATCALS).** ATCALS are DoD facilities, personnel, and equipment (fixed, mobile, and seaborne) with associated avionics to provide safe, orderly, and expeditious aircraft movements worldwide.

**Commercial Microwave Landing System Avionics (CMLSA).** The CMLSA is a microwave landing system that provides precision landing capability when used with microwave landing system ground equipment. The CMLSA is based on a Canadian Marconi Company CMA-2000 Microlander system, which was modified to meet Air Force requirements. The CMLSA is installed on about 438 C-130 aircraft out of a total, planned installation of 550 C-130 aircraft.

**Instrument Landing System (ILS).** ILS has been the primary fixed-base, worldwide precision landing system in use for about 40 years at civilian and military airports. The ILS ground station transmits electronic information to avionics receivers in the aircraft cockpit. The pilot uses this information from the cockpit instruments to keep the aircraft on the proper approach glidepath and aligned to the runway.

**Global Positioning System (GPS).** The GPS is a constellation of U.S. Navigation System satellites that use timing and ranging data to provide three-dimensional position and velocity information to users. Currently, the

GPS system does not provide the accuracy, integrity, and availability for use as a precision landing system. Plans call for GPS to be augmented with a precision ground reference station, such as the Local Area Differential GPS or Wide Area GPS Enhancement or other system.

**Joint Precision Approach and Landing System (JPALS) Program.** The JPALS Program was established to satisfy the needs of the joint mission need statement for the Army, the Navy, and the Air Force, for Precision Approach Landing Capability. The primary objective of the JPALS Program is to define the future aircraft precision approach and landing control system architecture for DoD. The Air Force was designated lead Military Department for the JPALS Program. The Air Force Program Executive Officer for Airlift and Trainers is the executive agent for JPALS efforts responsible for coordinating and facilitating execution of a streamlined acquisition process.

**Local Area Differential GPS.** Local Area Differential GPS avionics and ground system will be composed of new GPS or modified avionics integrated with a data link to receive differential corrections and integrity information from a militarized ground system. Local Area Differential GPS uses a GPS receiver at a surveyed location, compares the electronically derived GPS position to the surveyed position, and broadcasts the difference in position (that is, error) to suitably equipped aircraft. Local Area Differential GPS is dependent on the development of aircraft GPS receivers and a militarized and transportable ground station.

**Microwave Landing System (MLS).** MLS is a follow-on precision landing system to the instrument landing system. In the early 1980s, the Federal Aviation Administration demonstrated that the microwave landing system could replace the ILS. However, in June 1994, the Federal Aviation Administration decided to halt further development of the microwave landing system in favor of the GPS and its potential to provide precision landings.

**Mobile Microwave Landing System (MMLS).** MMLS is an all-weather, lightweight, transportable ground-based precision landing system designed for rapid deployment. The MMLS is transportable by one C-130 aircraft and can be set up by three people.

**Optical Microwave Approach and Ranging (OMAR™).** OMAR™ uses a ground unit with microwave optical technology to present a high-frequency guidance signal to the aircraft, somewhat resembling an ILS. OMAR™ began as a developmental system for the automatic landing of unpiloted aerial vehicles under a small business incentive contract with the Army. A fully qualified and flight-tested system requires avionics development, platform integration, flight testing, and preproduction engineering.

**Precision Approach Radar (PAR).** PAR is used by air traffic control operations to guide aircraft on final approach for landing during poor visibility and adverse weather. The air traffic controller communicates with the pilot, normally within a range of 10 to 20 nautical miles, giving instructions as needed to keep the aircraft on the proper approach glidepath and aligned to the runway.

**Precision Landing System Receiver (PLSR).** PLSR (formerly called the Military Microwave Landing System Avionics receiver) is being developed by GEC-Marconi Electronics Systems Corporation under contract with the Air Force Electronic Systems Center. PLSR is designed to receive both microwave landing system and frequency modulated, protected ILS transmissions with growth potential to a GPS precision approach capability. This growth capability is contingent upon the augmentation of the GPS with a precision ground reference station, completion and loading of a new version of PLSR software, interface with a GPS antenna, and modification of the applicable aircraft mission computer. The PLSR is also being designed to be compliant with international standards for frequency modulation interference.

**Tactical Transponder Landing System.** The Tactical Transponder Landing System (TTLS) is a precision ground system that uses the existing aircraft ILS avionics and identification friend or foe transponder to provide guidance to the aircraft. With the TTLS, the base station receives and processes the aircraft's transponder signal and generates ILS localizer and glide slope signals for the aircraft instrumentation. The TTLS is being developed by the Advanced Navigation and Positioning Corporation under a cooperative agreement sponsored by the Defense Advanced Research Projects Agency. The TTLS is transportable by one C-130 aircraft and can be set up by three people.

**Wide Area GPS Enhancement.** Wide Area GPS Enhancement is an accuracy enhancement to the GPS. Wide Area GPS Enhancement requires modifications to current GPS receiver sets and integration with an onboard database management system. Wide Area GPS Enhancement consists of three phases. The first phase modifies spare bits in the satellite broadcast message to encode corrections for authorized users and has been completed. The second phase will increase the number of monitor stations in ground equipment to incorporate state-of-the-art signal processing. The third phase will facilitate more navigation uploads. The availability of the full-up Wide Area GPS Enhancement system is projected beyond the year 2000.

## Appendix C. Glossary of Terms

---

**Precision Approach Radar (PAR).** PAR is used by air traffic control operations to guide aircraft on final approach for landing during poor visibility and adverse weather. The air traffic controller communicates with the pilot, normally within a range of 10 to 20 nautical miles, giving instructions as needed to keep the aircraft on the proper approach glidepath and aligned to the runway.

**Precision Landing System Receiver (PLSR).** PLSR (formerly called the Military Microwave Landing System Avionics receiver) is being developed by GEC-Marconi Electronics Systems Corporation under contract with the Air Force Electronic Systems Center. PLSR is designed to receive both microwave landing system and frequency modulated, protected ILS transmissions with growth potential to a GPS precision approach capability. This growth capability is contingent upon the augmentation of the GPS with a precision ground reference station, completion and loading of a new version of PLSR software, interface with a GPS antenna, and modification of the applicable aircraft mission computer. The PLSR is also being designed to be compliant with international standards for frequency modulation interference.

**Tactical Transponder Landing System.** The Tactical Transponder Landing System (TTLS) is a precision ground system that uses the existing aircraft ILS avionics and identification friend or foe transponder to provide guidance to the aircraft. With the TTLS, the base station receives and processes the aircraft's transponder signal and generates ILS localizer and glide slope signals for the aircraft instrumentation. The TTLS is being developed by the Advanced Navigation and Positioning Corporation under a cooperative agreement sponsored by the Defense Advanced Research Projects Agency. The TTLS is transportable by one C-130 aircraft and can be set up by three people.

**Wide Area GPS Enhancement.** Wide Area GPS Enhancement is an accuracy enhancement to the GPS. Wide Area GPS Enhancement requires modifications to current GPS receiver sets and integration with an onboard database management system. Wide Area GPS Enhancement consists of three phases. The first phase modifies spare bits in the satellite broadcast message to encode corrections for authorized users and has been completed. The second phase will increase the number of monitor stations in ground equipment to incorporate state-of-the-art signal processing. The third phase will facilitate more navigation uploads. The availability of the full-up Wide Area GPS Enhancement system is projected beyond the year 2000.

---

## **Appendix D. Precision Landing System Receiver Program History**

In 1983, the Air Force was designated lead Military Department for DoD MLS procurement. The Air Force was to define, develop, and procure MLS avionics for all DoD aircraft that were not identified to receive the Navy-developed multi-mode receiver.

In June 1987, the ESC awarded five contracts for concept development of the Military Microwave Landing System Avionics receiver at a cost of about \$0.5 million each. The contracts were completed in October 1988, and each contractor demonstrated a functional model of a two-band MLS/ILS receiver and provided custom chip descriptions, producibility reports, and reliability predictions for their proposed designs.

In December 1989, the ESC awarded three contracts for a 30-month Military Microwave Landing System Avionics Engineering and Manufacturing Development Phase I effort. Each contractor delivered test units to the Government, and those units were tested from March through August 1992. The results of the test were to be provided as Government-furnished information during the Engineering and Manufacturing Development Phase II effort.

In June 1993, the ESC awarded a contract to GEC-Marconi Electronics Systems Corporation for the Engineering and Manufacturing Development Phase II effort. The contractor was to develop an avionics receiver, the Military Microwave Landing System Avionics receiver, capable of receiving and processing signals from ILS and MLS ground stations to execute precision landings to Category I (200-foot decision height and one-half mile visibility), Category II (100-foot decision height and one-quarter mile visibility), and Category III (50 foot decision height and zero visibility) minima. The award was for \$13.3 million and provided for 30 Military Microwave Landing System Avionics receivers, training, and technical data. The contract also included options to purchase up to 2,200 Military Microwave Landing System Avionics units.

In June 1994, the Federal Aviation Administration decided to halt further development of the MLS for Category II and III precision approach landings and canceled two contracts for that development. The Federal Aviation Administration indicated that the GPS could already handle nonprecision approach landings and had great potential to provide precision approach landings. Further, according to the Federal Aviation Administration, “continuing the MLS development program is not an economically sound strategy, since all indications are that we will never need to deploy Category II and III systems in any significant numbers.”

## Appendix D. Precision Landing System Receiver Program History

---

In March 1995, the ESC entered into a Cooperative Research and Development Agreement with GEC-Marconi Electronics Systems Corporation to demonstrate the feasibility of incorporating a differential GPS capability into the two-band (ILS/MLS) Military Microwave Landing System Avionics receiver while maintaining performance and physical requirements. The agreement was initiated because the Military Microwave Landing System Avionics receiver being procured from GEC-Marconi Electronics Systems Corporation could not maintain civil operability with the 1994 Federal Aviation Administration decision to halt MLS development in favor of a GPS-based landing system technology. Under the agreement, the Air Force provided a prototype Military Microwave Landing System Avionics receiver, test aircraft, and ground facilities. GEC-Marconi Electronics Systems Corporation provided integration and flight test support. A test program was conducted from September 21, 1995, through November 6, 1995, using a Sikorsky S-76 helicopter and a C-135C "Speckled Trout" aircraft. A September 6, 1996, final report on the results of the test program, prepared for the ESC by ARINC, Incorporated, concluded that a three-band (ILS/MLS/differential GPS) receiver, the PLSR, was feasible.

In October 1995, the ESC issued a partial stop-work order to stop work on all efforts for the Military Microwave Landing System Avionics receiver, except for bench testing and procedure, testing radio frequency modules, and debugging the receiver processor unit. The stop-work order was issued because using commands were no longer interested in the two-band (ILS/MLS) system, and the ESC was considering developing a three-band (ILS/MLS/differential GPS) landing system. This partial stop-work was extended three times through July 1996.

On May 7, 1996, the House Committee on National Security, noted in the "National Defense Authorization Act for Fiscal Year 1997" (House Report 104-563) that the Air Force had expended about \$50<sup>1</sup> million to develop an all-weather, worldwide landing capability for military aircraft, but the Air Force budget did not contain any funding for procurement of the PLSR. The committee recommended \$5 million to complete development of the program and requested that the Secretary of the Air Force assess the cost and operational effectiveness for procurement of the PLSR and provide a report on the results of this assessment to the congressional defense committees by February 1, 1997. The Air Force response was submitted to Congress on February 28, 1997. The response is discussed later in this appendix.

On July 16, 1996, GEC-Marconi Electronics Systems Corporation submitted a Class I Engineering Change Proposal to the ESC. The Engineering Change Proposal was approved by the ESC on July 18, 1996, and was issued to

---

<sup>1</sup>Through February 1997, the Electronic Systems Center has expended about \$10 1 million for the development and production of the PLSR (previously called Military Microwave Landing System Avionics receiver).

## **Appendix D. Precision Landing System Receiver Program History**

---

incorporate a differential GPS capability into the Military Microwave Landing System Avionics receiver at a cost of \$2.7 million. The program name changed from Military Microwave Landing System Avionics to the PLSR.

In September 1996, AMC prepared a draft Precision Approach Capability CMNS. The CMNS was validated by the Commander, AMC, on November 14, 1996, and was approved by the Chief of Staff of the Air Force on December 11, 1996.

On December **23**, 1996, the ESC issued a modification to accelerate the PLSR schedule and to modify production options to incorporate changes for increased functionality and to meet the initial operational capability date of October 30, 1997, established by the CMNS. Through February **26**, 1997, options were exercised by the ESC to procure 117 PLSR production units and by the Aeronautical Systems Center to install PLSR on 35 C-17 aircraft.

On January 6, 1997, in **letters<sup>2</sup>** to Congress, the Air Force Deputy Assistant Secretary for Budget stated that the Air Force intends to initiate a new start modification for the C-17 in support of the AMC CMNS. The Air Force stated that the total estimated cost over the Five Year Defense Plan was \$54.6 million for research, development, and procurement of a ground based radar, avionics, and aircraft modifications starting in fiscal year 1997. The estimate provided for the development, production, and installation of PLSR avionics units on 40 C-17 aircraft (\$40.7 million); flight check equipment (\$0.9 million); and procurement of 4 ASR/PAR systems (\$13 million).

On February **28**, 1997, in response to the May 17, 1996, congressional request, the Air Force stated that the PLSR was being evaluated under the JPALS Program analysis of alternatives and would be completed in September 1997. The Air Force stated that it would provide the requested information when it forwarded the results of the JPALS analysis of precision landing needs to the congressional defense committees.

---

\*Letters sent to Chairmen and Ranking Minority Members of the Senate subcommittee on Defense, Committee on Appropriations, and of the House Subcommittee on National Security, Committee on Appropriations.

---

## Appendix E. Sole-Source, Undefined Contractual Actions

The ESC and the Aeronautical Systems Center (ASC) use of sole-source, undefined contractual actions to accelerate the development, production, and installation of the PLSR on C-17 aircraft was not justified because the Air Force did not properly document and support the AMC CMNS requirement for precision landing capability on a minimum of 35 C-17 aircraft by October 30, 1997.

**Regulatory Guidance.** United States Code, title 10, section 2326, (10 U.S.C. 2326), “Undefined Contractual Actions: Restrictions,” states that:

The head of an agency may not enter into a UCA [undefined contractual action] unless the request to the head of the agency for authorization of the UCA[undefined contractual action] includes a description of the anticipated effect on requirements of the military department concerned if a delay is incurred for purposes of determining terms, specifications, and price before performance is begun under the contract action.

Federal Acquisition Regulation 6.303, “Justifications, ” states that technical and requirements personnel are responsible for providing and certifying as accurate and complete the necessary data to support recommendations for other than full and open competition. Federal Acquisition Regulation 6.303 further states that contracting officers shall not commence negotiations for sole-source contracts until the contracting officers justify the use of a sole-source contract in writing and certify to the accuracy and completeness of the justification.

Defense Federal Acquisition Regulation Supplement 217.74, “Undefined Contract Actions, ” subparagraph 2 17.7403, “Policy, ” states that undefined contractual actions shall be used only when contracting officials cannot negotiate definitive contracts in time to meet the Government’s requirements. Defense Federal Acquisition Regulation Supplement 2 17.7404- 1 also requires that the contracting officer request for Undefined Contractual Action approval include a full explanation of the need to begin contract performance before contract definitization.

## Appendix E. Sole-Source, Undefined Contractual Actions

---

**Sole-Source, Undefined Contractual Actions.** ESC and ASC issued six sole-source, undefined contractual actions, valued at \$42.9 million. The three undefined contractual actions issued by ESC against contract F19828-93-C-0116 with GEC-Marconi Electronics Systems Corporation follow.

- o Modification PO0017, with a negotiated value \$2.0 million, was issued on December 23, 1996, to accelerate the development and contractor testing of the PLSR.

- o Modification PO0018, with a negotiated value of \$4.6 million, was issued on December 30, 1996, to procure 9 PLSR test units, 16 PLSR production units, and 14 PLSR spare units and for engineering services and related travel. Also, the modification updated the unit costs for existing contract options to procure up to 2,200 PLSR units over 3 production years. The maximum option quantities and cost per unit for each production year are: production year 1 - 600 units at \$69,500; production year 2 - 800 units at \$56,973; and production year 3 - 800 units at \$56,427.

- o Modification PO0021, with a negotiated value of \$5.4 million, was issued on February 2, 1997, to procure 78 PLSR production units.

ASC issued three undefined contractual actions against ongoing contracts with McDonnell Douglas Aircraft as follows.

- o Delivery order 0018 (contract F33657-95-D-2026), with a negotiated value of \$16.5 million, was issued on November 26, 1996, to develop, integrate, and flight test the PLSR on the C-17.

- o Modification PO0046 (contract F33657-95-C-2027), with a negotiated value of \$12.4 million, was issued on February 18, 1997, to plan, procure, and accumulate parts for installation of the PLSR, for field support, and for the retrofit of 39 C-17 aircraft with the PLSR.

- o Modification PO0023 (contract F33657-96-C-2059), valued at \$2.0 million, was issued on February 3, 1997, to incorporate installation of the PLSR into the C-17 production line. The modification was still unnegotiated as of December 10, 1997.

**Justifications for ESC and ASC Sole-Source, Undefined Contractual Actions.** ESC prepared two justification documents and ASC prepared three justification documents for the undefined contractual actions. Justification documents must include supporting rationale and must describe operational and program effects. The ESC and ASC justifications stated that the contract

## Appendix E. Sole-Source, Undefined Contractual Actions

---

actions were necessary to meet the October 30, 1997, initial operational capability established by the AMC CMNS. ESC described operational and program effects as follows:

The Air Force's ability to provide credible power projection stands in jeopardy due to the operational limitations of current deployable precision approach systems. Currently the world's premier airlift aircraft (i.e. the C-17) does not have the capability to land at austere airfield[s] in inclement weather. This deficiency severely limits the United States' ability to conduct contingency, humanitarian and peacekeeping missions around the globe.

The operational and program effects for two (Delivery order 0018 and modification PO0046) of the ASC contractual actions were:

The C-17 will not have the capability to perform Category I (200', 1/2 mile) approaches into austere airfields equipped with mobile microwave landing systems and thus not meet AMC's C-MNS.

The operational and program effect for ASC modification PO0023 was:

To maintain a single aircraft configuration with the same aircraft capabilities, the program will install the capability at the earliest production incorporation point. There is significant cost savings by installing the capability during the production phase versus using retrofit actions. Without the UCA, capability would be further delayed to the future fleet.

The justification statements made by ESC and ASC were based on statements in the AMC CMNS. However, the CMNS was neither properly validated nor supported by reliable documented analysis or acquisition plans.

**Potential Effect of Sole-Source, Undefined Contractual Actions Contracting.** Contracting officials did not fully comply with regulatory guidance concerning sole-source, undefined contractual actions. Consequently, a potential exists for increased prices for goods and services. Further, the use of undefined contractual actions may weaken the DoD position in negotiating and definitizing the final contract price. Although we considered the use of those sole-source actions inappropriate, we did not make any recommendations because Inspector General, DoD, Report No. 97-204, "Undefined Contractual Actions," August 15, 1997 (see Appendix B), addresses those concerns.

---

## Appendix F. Estimated Costs for Air Mobility Command Precision Landing Needs

The Air Force may spend \$105.1 million (\$118.1 million less \$13 million for planned ASR/PAR procurement) for PLSR avionics units on C-17 aircraft.

The table shows initial estimated funding requirements presented to the Overarching Integrated Product Team on October 16, 1996; estimated funding requirements submitted to Congress on January 6, 1997, to implement the AMC CMNS solution, to include the planned acquisition of four ASR/PAR systems; and potential estimated funding requirements to utilize the GPS upgrade capability of the PLSR and to outfit the planned 120 C-17 aircraft fleet with PLSR avionics units.

### Estimated Funding Requirements for AMC Precision Landing Needs

Dollars in Millions

Item	Initial	Congress	Potential
Aircraft integration	\$39.1 <sup>1</sup>	\$40.7 <sup>2</sup>	\$45.6 <sup>3</sup>
MMLS deployability	0.5	0.9	0.9
Planned ASR/PAR procurement		13.0	13.0
Developmental flight test			0.1
Developmental and initial operational (C-17) flight test			1.6
Trainer updates			0.7
Develop, test, and integrate differential GPS			38.0 <sup>4</sup>
Outfit remaining C-17 fleet			18.2 <sup>5</sup>
<b>Total</b>	<b>\$39.6</b>	<b>\$54.6</b>	<b>\$118.1</b>

---

<sup>1</sup>Estimated cost to outfit 35 C-17 aircraft and 12 C-5 aircraft with PLSR avionics units, 12 C-141 aircraft with CMLSA receivers, and \$2.0 million for operation and maintenance. On November 14, 1996, the Commander, AMC, deleted the requirement for the 12 C-5 aircraft and the 12 C-141 aircraft.

<sup>2</sup>Estimated costs to develop, produce, and install PLSR avionics units on 40 C-17 aircraft.

## Appendix F. Estimated Costs for Air Mobility Command Precision Landing Needs

<sup>3</sup>Estimated cost to develop, test, and procure 117 PLSR avionics units (based on three ESC undefinitized contractual actions for \$12.0 million); to develop, integrate, flight test, retrofit PLSR avionics units on 40 C-17 aircraft, and to integrate PLSR installation into the C-17 production line (based on three ASC undefinitized contractual actions for \$30.9 million). The estimate also includes an ESC fixed price modification for \$2.7 million to incorporate differential GPS capability into the PLSR.

<sup>4</sup>Additional costs that the C-17 System Program Office estimated to develop, test, and integrate the differential GPS capability of the PLSR avionics units on C-17 aircraft. The estimated costs are based on a periodic update, "C-17 Precision Landing System Receiver (PLSR) MOD [modification] Status Air Mobility Contingency Precision Approach Capability (AMCPAC), " March 3, 1997, signed by the Program Director for the C-17 System Program Office.

<sup>5</sup>Additional estimated costs to procure 144 PLSR avionics units and to install PLSR avionics units on 80 C-17 aircraft based on C-17 System Program Office cost data.

---

# Appendix G. Air Force Comments on the Draft Audit Report and Audit Response

## Introduction

This appendix summarizes Air Force comments on the audit background and finding. Air Force comments are included in their entirety in Part III of this report. The Air Force also provided additional documents in its response to the draft audit report. Those documents were considered in preparing the final audit report. Those documents are too voluminous to include in their entirety in the final audit report but are available on request.

**Air Force Comments.** The Air Force stated the audit background paragraph “Decision Briefing of the JPALS Overarching Integrated Product Team” was inaccurate. The Commander, AMC, did not direct the JPALS Near-Term, Integrated Product Team to hasten its efforts, and the Air Force Program Executive Officer for Airlift and Trainers convened a “Tiger Team” that was separate from the JPALS Near-Term, Integrated Product Team but with many of the same members to meet AMC requirements. The Overarching Integrated Product Team approved the acquisition strategy, as did the Commander, AMC. The Under Secretary of Defense for Acquisition and Technology concurred with the recommendations on October 28, 1996, and concurred with the DoD JPALS Overarching Integrated Product Team report on January 13, 1997. The recommended number of ASR/PAR systems to purchase was raised from two to four.

**Audit Response.** We disagree that the paragraph is inaccurate. The October 16, 1996, briefing, “Joint Precision Approach and Landing System (JPALS) Overarching IPT [Integrated Product Team] (OIPT) [on] Air Mobility Command (AMC) Contingency Precision Approach, ” stated that in “Early Sep [September] 96 [1996] CINCTRANSCOM [Commander in Chief, U.S. Transportation Command] requested accelerated assessment: ...” by the JPALS Near-Term, Integrated Product Team. The “Tiger Team” is identified in the report as a part of the JPALS Near-Term, Integrated Product Team Working Group. The intent of the paragraph was to describe the principal recommendations made by the JPALS Near-Term, Integrated Product Team and actions leading to those October 16, 1996, recommendations. In preparing the report, we recognized that the Overarching Integrated Product Team approved the recommended acquisition strategy, which encompassed the principal JPALS Near-Term, Integrated Product Team recommendations and that the Under

## Appendix G. Air Force Comments on the Draft Audit Report and Audit Response

Secretary of Defense for Acquisition and Technology concurred with those recommendations. We also recognized that the recommendation to purchase two ASR/PAR systems was later raised to four systems.

We also recognize that the Under Secretary of Defense for Acquisition and Technology concurred with recommendations made by the DoD JPALS Overarching Integrated Product Team on October 28, 1996, and January 13, 1997. Those recommendations were addressed in two memorandums dated October 28, 1996, and January 7, 1997, from the Deputy Assistant Secretary of Defense (Command, Control, Communications, and Intelligence Acquisition) (who is the Chairman, JPALS Overarching Integrated Product Team). Both memorandums were addressed to the Under Secretary of Defense for Acquisition and Technology and the Principal Deputy Under Secretary of Defense (Acquisition and Technology), and the subject of both memorandums was “Joint Precision Approach and Landing System (JPALS) Overarching Integrated Product Team (OIPT) Report.” However, those memorandums provided only summary information on overall JPALS initiatives, to include JPALS Near-Term, Integrated Product Team actions and recommendations on the immediate need for precision landing capability for C-17 aircraft and problems related to the full employment of the MMLS. The immediate AMC need for precision landing capability was not adequately supported, and the extent of problems associated with the full employment of the MMLS was not fully and accurately identified before the JPALS Near-Term, Integrated Product Team recommendations to accelerate development and install the PLSR on C-17 aircraft. We believe that senior-level DoD officials may not have been provided complete information before the Air Force recommended its solution to meet the AMC CMNS.

Further, even though the January 7, 1997, memorandum stated, “The Near-Term IPT [Integrated Product Team] has completed all of its tasks,” documentation of those tasks and actions to implement Near-Term Integrated Product Team recommendations has not been finalized and approved. We revised the report to show the status of the JPALS Near-Term Integrated Product Team results.

**Air Force Comments.** The Air Force stated that the draft report understated the potential use of MLS technology because the draft report mentioned only intentions of Great Britain and the Netherlands to field MLS technology, and the Air Force recommended that the report should state that the United States, Italy, the United Kingdom, Denmark, and Belgium plan to implement MLS technology. The Air Force also stated that Belgium, Canada, Denmark, Spain, the Netherlands, Turkey, the United Kingdom, and the United States identified the potential need for a multi-mode landing system receiver avionics or the MLS. The Air Force further stated that the International Civil Aviation

## Appendix G. Air Force Comments on the Draft Audit Report and Audit Response

Organization recommended use of multi-mode landing system receiver avionics and that the Airlines Electronic Engineering Committee is developing specifications for a multi-mode landing system.

**Audit Response.** We agree with the Air Force comments and revised the report.

**Air Force Comments.** The Air Force stated that the report incompletely and inaccurately described the planned use and capabilities of the PLSR. The Air Force stated that the report did not acknowledge the operational impact of the added frequency modulation protection being incorporated in the PLSR design, that the concept of a multi-mode landing system receiver was a key recommendation of the International Civil Aviation Organization and that the PLSR is being designed as a multi-mode receiver. Further, the report did not acknowledge that the PLSR will be compatible with Federal Aviation Administration and International Civil Aviation Organization standards for precision landing using ILS, MLS, or GPS.

**Audit Response.** We disagree that the report is inaccurate. We recognize that the requirement for frequency modulation protection and the work of the International Civil Aviation Organization and the Airlines Electronic Engineering Committee concerning multi-mode receivers are important considerations, and we believe that those considerations should be thoroughly documented and evaluated under the ongoing JPALS program. However, the requirement for frequency modulation protection was not critical to the alleged AMC CMNS need for immediate precision landing capability for C-17 aircraft.

**Air Force Comments.** The Air Force disagreed with the statement, “Air Force program managers plan to install PLSR avionics units on C-17 aircraft to provide precision landing capability when used with existing MMLS ground stations, even though the Air Force has not demonstrated the operational viability of using existing MLS capabilities to support deployments.” The Air Force stated that it has shown the operational use of the existing MMLS ground station and that AMC was working to correct deficiencies noted to date. Also, the Air Force followed acquisition procedures based on Air Force Instruction 63-1 14.

**Audit Response.** The Air Force was unsuccessful in its initial attempts to deploy the MMLS to Bosnia during the early stages of Operation Joint Endeavor and, further, the Air Force has not successfully demonstrated the operational feasibility of existing MLS capabilities to provide precision landing capability during an operational deployment. An ESC program official informed us that an MMLS was deployed to Bosnia in 1997 but was later shut down because of the costs involved in maintaining and operating the system and that the Air Force could not land C-130 aircraft because of continuing problems with the CMLSA receivers installed on the C-130 aircraft. The MMLS and the

## Appendix G. Air Force Comments on the Draft Audit Report and Audit Response

CMLSA-equipped C-130 aircraft still cannot be used to support deployments. The ESC program official also stated that the United States Air Force Europe was concerned about the costs of having to train, operate, and maintain the MMLS and precision approach radar systems to support deployment requirements. Moreover, neither AMC nor the Air Force could provide evidence that the MMLS can be deployed on 12-hours notice, be set up by three personnel, and be operational as desired by AMC to support deployments. We recognize that AMC is working toward correcting problems identified with the use of MLS technology to support deployments; however, the corrections are still ongoing and the feasibility of deploying as a first-in capability is still unproven. The Air Force Rapid Response Process covered under Air Force Instruction 63-1 14 does not waive any of the requirements of DoD Directive 5000.1 or the Federal Acquisition Regulation.

**Air Force Comments.** The Air Force disagreed with comments on the operational capability of MLS technology. The Air Force stated that the report was misleading because it did not state that the Air Force was correcting the MMLS and CMLSA problems that occurred during Operation Joint Endeavor.

**Audit Response.** The report states that the Air Force initiated actions to correct known deficiencies with the MMLS and the CMLSA. However, initiating those actions does not make the MMLS and CMLSA operationally deployable. Further, additional follow-on test and evaluation will be needed, but the Air Force has yet to develop the test plan to assess those corrective actions.

**Air Force Comments.** The Air Force stated that the report was inaccurate because it did not address Air Force funding reductions for MLS programs after the Federal Aviation Administration halted development of MLS technology in 1994. Also, the Air Force stated that it continued its effort involving MLS technology to capitalize on MMLS and CMLSA sunk costs and to take advantage of the improved tactical capability that those systems provided.

**Audit Response.** We revised the report to show that the Air Force reduced funding for MLS programs as a result of Inspector General, DoD, Report No. 94-190, "Air Force Microwave Landing System," September 20, 1994. While the Air Force may have decided to take advantage of sunk costs in its MLS program, the Air Force has not provided any analysis that proves the cost-effectiveness of those decisions. Also, the full costs of correcting deficiencies with the existing MMLS and CMLSA-equipped C-130 aircraft, of adding MLS capability to C-17 aircraft, and of making those systems a viable operational capability are unknown.

**Air Force Comments.** The Air Force disagreed that plans to correct deficiencies with the MMLS and CMLSA were not finalized and stated that formal actions to correct those deficiencies are ongoing and projected to be completed by December 1997.

## Appendix G. Air Force Comments on the Draft Audit Report and Audit Response

**Audit Response.** Based on the Air Force response and additional information AMC provided, we revised the report to reflect that the Air Force expects all deficiencies to be corrected by December 1997.

**Air Force Comments.** The Air Force stated that the electromagnetic compatibility and interference problems are unique to CMLSA-equipped C-130 aircraft and are not relevant to the C-17 modification. The Air Force also stated that follow-on test and evaluation will be conducted after all CMLSA deficiencies have been corrected and the system has been operationally used for a period of time.

**Audit Response.** The intent of the paragraph “Status of Follow-on Test and Evaluation” was to document the status of follow-on test and evaluation of the MMLS and CMLSA-equipped C-130 aircraft. The Air Force had not provided information to show whether electromagnetic compatibility and interference problems associated with the C-130 aircraft are relevant to the C-17 modification. We believe it prudent to consider those problems in conducting electromagnetic compatibility and interference testing on the C- 17 modification.

**Air Force Comments.** The Air Force stated that the Combat Air Delivery School comments are based on a concept of operations that the Air Combat Command prepared and do not relate to current information. Further, the Air Force stated that the Air Force Special Operations Command expected to finalize a new concept of operations by October 31, 1997, and that a new Air Mobility Command concept of operations would be approved by September 1997.

**Audit Response.** We clarified the report to show that the Combat Air Delivery School comments applied to the Air Combat Command prepared concept of operations. However, we believe those comments are still applicable because the Air Force Special Operations Command and the Air Mobility Command had not finalized and approved a new concept of operations for deployment as of January 9, 1998. We updated the report to reflect the current status of the concept of operations for the MMLS.

**Air Force Comments.** The Air Force stated that rationale for the initial operational capability date of October 30, 1997, was because the date was deemed the soonest achievable given the technology and the acquisition realities. The date was selected on October 16, 1997. The Air Force stated that the rationale was documented in the AMC CMNS and that the CMNS was prepared in accordance with Air Force Instruction 63-1 14, “Rapid Response Process, ” May 5, 1994. The Air Force did not have an analysis of how often precision landings are needed to support deployments because knowing where or how often crises or contingencies will develop is impossible. The Air Mobility

## Appendix G. Air Force Comments on the Draft Audit Report and Audit Response

Command cannot restrict the ability of the National Command Authority to respond quickly in a crisis because of a lack of precision landing capability.

**Audit Response.** Although the AMC CMNS stated that AMC required an initial operational capability of October 30, 1997, neither AMC nor the Air Force could provide any additional support for that date. As described in Air Force Instruction 63-1 14, the Rapid Response Process was established “to accelerate the fielding of critical systems to meet theater-specific wartime needs. The Rapid Response Process does not replace normal acquisition procedures; but rather speeds up the process of fielding systems to satisfy wartime needs.” When used properly, the Rapid Response Process can be a useful administrative process for quickly providing critical wartime supplies. The Air Force did not comply with provisions of normal acquisition procedures mandated by DoD Directive 5000.1 and the Federal Acquisition Regulation. Also, the Air Force response stated that the initial operational capability date was based on the time needed to develop and install the PLSR on the C-17 aircraft and not on a critical wartime operational requirement.

The AMC CMNS and other documentation that the Air Force provided did not identify that the Army AN/TPN-18 Landing Control Central was deployed to Bosnia on one C-130 aircraft during the initial stages of Operation Joint Endeavor or that the AN/TPN-18 provided precision landing support to Army aircraft and AMC cargo aircraft including the first precision landing of a C- 17 aircraft in a tactical location. Also, the U.S. Transportation Command and the Air Force could not provide documentation that National Command Authority mandates cannot be met with existing Military Department precision landing capability. Knowledge of the specific operational scenarios that existing precision landing capabilities can not meet would have been useful to decision makers.

**Air Force Comments.** The Air Force disagreed that AMC did not describe the specific operational scenario (combat need) in which the PLSR-equipped C-17 aircraft is expected to operate. The Air Force stated that the C-17 aircraft supports the global air mobility mission and that AMC assumes that the C-17 aircraft will be employed to support that mission.

**Audit Response.** We agree that precision landing capability is necessary for the C-17 aircraft and other aircraft in support of world-wide military operations, and we understand that those needs are being addressed under the ongoing JPALS Program. That important DoD capability should be fully documented and alternatives thoroughly evaluated under the JPALS Program.

**Air Force Comments.** The Air Force stated that the Hierarchy of Material Alternatives defined in DoD Directive 5000.1 states that “the use or modification of systems or equipment that the Department already owns is more

## Appendix G. Air Force Comments on the Draft Audit Report and Audit Response

cost-effective than acquiring new material, ” and that modifying the existing PLSR program for use with the already deployed MMLS complies with that guidance. ·

**Audit Response.** The Air Force reference to DoD Directive 5000.1, section 2, “Acquiring Quality Products,” subparagraph b, “Hierarchy of Material Alternatives,” is misleading. The referenced subparagraph states, “In response to operational requirements, priority consideration shall always be given to the most cost-effective solution over the system’s life-cycle. Generally, use or modification of systems or equipment that the Department already owns is more cost-effective than acquiring new material. ” The Air Force never determined the life-cycle costs for the development or installation of the PLSR on the C-17 or any other aircraft. The developmental nature of the PLSR and the extent of deficiencies with the existing MMLS and CMLSA systems should warrant documentation and evaluation of all costs before decisions on the continued use of MLS technology and for comparison and analysis of alternative solutions.

**Air Force Comments.** The Air Force stated that the CMNS direction called for installing PLSR avionics units on a minimum of 35 aircraft and that the installation was extended to 48 aircraft based on production-line considerations. The Air Force stated that the C-17 Requirements and Planning Council approved the action which is covered under requirements from the C-17 Integrated Weapon System Management Program Management Directive, March 18, 1996, requirements regarding maintenance of a single aircraft configuration.

**Audit Response.** We agree that a single aircraft configuration should be maintained to the maximum extent possible.

**Air Force Comments.** The Air Force did not agree that it did not know all program costs for precision landing capabilities before deciding to install PLSR avionics units on C-17 aircraft. The Air Force stated that the report is misleading when considered in the context of the AMC CMNS. The differential GPS budget estimate was for a potential, future requirement and is not part of the current program to install MLS and ILS operational capability on the C-17. Contract actions have been definitized and proposals received, the C-17 program office does not track operation and support costs for new projects at the project level, and the life-cycle cost of the C-17 system is updated every 2 years.

**Audit Response.** The report fully considered the AMC CMNS and the Air Force actions to implement solutions to the CMNS. We agree with the Air Force statement that it did not include the full program cost for PLSR capabilities and did not perform life-cycle cost analysis for the development and installation of the PLSR on C-17 aircraft. We used estimated costs cited in a periodic update on “C-17 Precision Landing System Receiver

## Appendix G. Air Force Comments on the Draft Audit Report and Audit Response

(PLSR) MOD [modification] Status Air Mobility Contingency Precision Approach Capability (AMCPAC), ” March 3, 1997, signed by the Program Director for the C-17 System Program Office. The Air Force should determine full life-cycle program costs for the PLSR. We updated the report to reflect current cost information that the Air Force provided after the draft report was issued.

**Air Force Comments.** The Air Force stated that the draft report estimated value of \$109.8 million for the additional costs to develop differential GPS capability of the PLSR and to install PLSR avionics units on the 120 C-17 aircraft fleet was inaccurate.

**Audit Response.** We based the \$109.8 million cost on cost information that the Air Force provided. We revised those costs to \$105.1 million based on information that the Air Force provided after issuance of the draft audit report. Those costs do not reflect the estimated life-cycle costs for the development and installation of the PLSR for the C-17 aircraft. Further, those costs do not reflect the funds spent and still required to correct problems with the existing MMLS and CMLSA systems.

**Air Force Comments.** The Air Force disagreed with the report statement, “The Air Force did not consider the status and operability of the MMLS a risk.” The Air Force stated that it recognized the PLSR development risk associated with the ILS and MLS bands.

**Audit Response.** The report addresses the risks associated with the MMLS ground station, not the risks associated with the MLS band on the PLSR avionics unit.

**Air Force Comments.** The Air Force disagreed that the JPALS Near-Term, Integrated Product Team did not adequately consider the risks associated with deployment of MMLS or identify all risk factors affecting the development, installation, and use of PLSR on C-17 aircraft. The Air Force stated that MMLS deployment capability has been demonstrated, that three people can set it up in 1 hour, that operational capability at a deployed location has been demonstrated, and that the AMC concept of operations for contingency precision approach capability provides theater commanders the option for waiving portions of the flight inspection requirements.

**Audit Response.** The Air Force comments imply that merely placing the MMLS on the ground demonstrates operational deployment capability. The Air Force did not provide evidence that it made precision landings using the MMLS during an operational deployment or that the MMLS can actually provide the “first-in” capability that AMC desired. The Air Force is still working to correct problems with CMLSA-equipped C-130 aircraft, which are the only Air Force aircraft outfitted to use MLS technology. The Air Force

## Appendix G. Air Force Comments on the Draft Audit Report and Audit Response

Operational Test and Evaluation Center test manager could not confirm that the PLSR will be tested against the MMLS in a realistic operational deployment scenario. We maintain that the Air Force did not accurately consider all risk factors affecting the development, installation, and use of the PLSR on C-17 aircraft.

**Air Force Comments.** The Air Force disagreed that it did not fully consider existing precision landing alternatives to meet the immediate precision landing needs of C-17 aircraft. The Air Force stated that the lack of nonmaterial solutions to meet the immediate AMC need for precision landing was documented in the Joint Precision Approach and Landing Capability Mission Need Statement. The Air Force also stated that the Army, the Air Force, and the Marine Corps systems do not meet the AMC requirement for a “quick response” rapidly deployable precision approach capability as demonstrated in Bosnia.

**Audit Response.** The Joint Mission Need Statement addresses long-range precision landing needs that are being evaluated DoD-wide under the ongoing JPALS Program. The Joint Mission Need Statement did not address or adequately support the AMC immediate and short-term needs. The Air Force response did not address that the Army AN/TPN-18 Landing Control Central provided precision landing capability for AMC cargo aircraft during the early stages of Operation Joint Endeavor.

**Air Force Comments.** The Air Force stated that current Army, Air Force, and Marine Corps deployable air traffic control and landing systems can technically supply AMC with a precision approach capability. However, the Air Force stated that other existing radar systems did not provide airport surveillance capability; took too much airlift, personnel, and time to set up; and were old, maintenance-intensive, and unreliable. The Air Force stated that AMC required its own organic precision landing capability to support initial contingency operations and that AMC will be able to deploy both an MMLS and a full airport surveillance and precision approach radar system on two C-130 aircraft.

**Audit Response.** The Air Force documents did not explain why other organizations could not meet the AMC requirements for “first-in” capability, and support its need for airport surveillance radar capability. We were also not provided documents that show that two C-130 aircraft could deploy an MMLS and an airport surveillance and precision approach radar system. The Air Force-selected, command-unique solution to meet the AMC CMNS will perpetuate existing DoD-wide problems associated with maintaining numerous dissimilar radar systems for similar precision landing needs. The Joint Mission Need Statement for Precision Approach and Landing Capability, currently being addressed under the JPALS Program, states that the maintenance and use of dissimilar radar systems by the Services has increased costs and has hindered joint military operations. Service-wide requirements for precision landing

## Appendix G. Air Force Comments on the Draft Audit Report and Audit Response

capability should be thoroughly defined and cost-performance trade-off analysis should be performed before acquiring replacement systems for existing precision landing systems. We understand that the reevaluation of the costs and benefits of the PLSR and other alternatives against established mission requirements under the ongoing JPALS Program will include the performance of trade-off analysis.

**Air Force Comments.** The Air Force stated that performance tradeoffs were considered related to requirements for performance, safety, deployability, and schedule for the AMC CMNS. The Air Force stated that solutions rated outside AMC requirements were considered to be of no benefit, regardless of cost. The Air Force also stated that the TTLS system shows promise and is still being considered under the JPALS Program but did not meet the AMC CMNS requirements.

**Audit Response.** DoD Directive 5000.1 states that fiscal constraint is a reality that all participants in the Defense acquisition process must recognize and that cost must be viewed as an independent variable. We believe that effective cost and trade-off analysis should have examined existing military systems and planned developmental systems, including the TTLS .

**Air Force Comment.** The Air Force disagreed that the installation of the PLSR may inhibit the future insertion of commercial, off-the-shelf GPS. The Air Force stated that the military GPS service is not commercially available because of security considerations and that the PLSR is a modular design providing growth capability. The Air Force stated the Federal Aviation Administration is committed to replacing the existing ILS-based systems with augmented GPS-based systems and has committed considerable resources to the development of GPS technology.

**Audit Response.** Based on management comments, we revised the report.

---

## **Appendix H. Report Distribution**

### **Office of the Secretary of Defense**

Under Secretary of Defense for Acquisition and Technology  
Deputy Under Secretary of Defense (Acquisition Reform)  
Director, Defense Logistics Studies Information Exchange  
Under Secretary of Defense (Comptroller)  
Deputy Chief Financial Officer  
Deputy Comptroller (Program/Budget)  
Assistant Secretary of Defense (Command, Control, Communications, and Intelligence)  
Assistant Secretary of Defense (Public Affairs)

### **Department of the Army**

Assistant Secretary of the Army (Financial Management and Comptroller)  
Auditor General, Department of the Army

### **Department of the Navy**

Assistant Secretary of the Navy (Financial Management and Comptroller)  
Auditor General, Department of the Navy  
Superintendent, Naval Postgraduate School

### **Department of the Air Force**

Assistant Secretary of the Air Force (Acquisition)  
Air Force Program Executive Officer for Airlift and Trainers  
Assistant Secretary of the Air Force (Financial Management and Comptroller)  
Commander, Air Combat Command  
Commander, Air Mobility Command  
Commanding Officer, Air Education and Training Command

## **Appendix H. Report Distribution**

---

### **Department of the Air Force (cont'd)**

Commander, Air Force Materiel Command  
    Commanding Officer, Aeronautical Systems Center  
    Commanding Officer, Electronic Systems Center  
Commander, Air Force Special Operations Command  
Auditor General, Department of the Air Force

### **Other Defense Organizations**

Director, Defense Contract Audit Agency  
Director, Defense Logistics Agency  
Director, National Security Agency  
    Inspector General, National Security Agency  
Inspector General, Defense Intelligence Agency

### **Non-Defense Federal Organizations and Individuals**

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

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 National Security, Committee on Appropriations  
House Committee on Government Reform and Oversight  
House Subcommittee on Government Management, Information, and Technology,  
    Committee on Government Reform and Oversight  
House Subcommittee on National Security, International Affairs, and Criminal Justice,  
    Committee on Government Reform and Oversight  
House Committee on National Security

## **Part III - Management Comments**

# Assistant Secretary of Defense (Command, Control, Communications, and Intelligence) C o m m e n t s



COMMAND CONTROL  
COMMUNICATIONS, AND  
INTELLIGENCE

ASSISTANT SECRETARY OF DEFENSE  
6000 DEFENSE PENTAGON  
WASHINGTON, DC 20301-6000

August 19, 1997



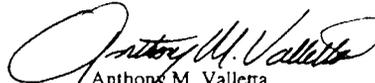
MEMORANDUM FOR INSPECTOR GENERAL

SUBJECT: Comments on Audit **Report** on Short-Term Precision Landing Capabilities  
for C-17 Aircraft (Project No. 7RD-008)

The C3I Systems Overarching Integrated Product Team (OIPT) approved the strategy for the near-term effort for a mobility **airlift** contingency **precision** approach capability and the delegation to the Air Force PEO for Airlift and Trainers as the Milestone Decision Authority. The USD(A&T) concurred. While I am committed to success of this near-term effort, the Air Force is entrusted to identify the need and pursue the acquisition in accordance with the statutes and regulations required for an acquisition of this category.

The Air Force that there are many discrepancies in the draft audit report. I recommend that, before this report is finalized, an attempt be made to reconcile the discrepancies with the Air Force.

Therefore, until the final audit is published, preferably with some of the discrepancies reconciled, the C3I Systems OIPT will continue to review the near-term effort with the Joint Precision Approach and Landing System (JPALS). If there is a lack of appropriate oversight or implementation of acquisition procedures, the OIPT will direct the necessary actions.

  
Anthony M. Valleria  
(Acting)



# Air Force Comments



OFFICE OF THE ASSISTANT SECRETARY

DEPARTMENT OF THE AIR FORCE  
WASHINGTON DC

25 AUG 1997

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

FROM SAF/AQ  
1060 Air Force Pentagon  
Washington DC 20330-1060

SUBJECT Audit Report on Short-Term Precision Landing Capabilities for C-17 Aircraft  
(Project No 7RD-0008)

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

The Air Force does not concur with the recommendation of "limiting the acquisition and installation of the PLSR to one C-17 test aircraft"

The Air Force does not concur with the recommendation of Increased testing as suggested under the specific recommendation of "proving the operational capability and feasibility of the PLSR to provide precision landing capability in support of deployments through appropriate testing"

The Air Force concurs with the recommendation of "evaluating the costs and benefits of continuing the use of microwave landing technology to provide precision landing capability in support of deployment". Based on the fact that the US, Italy, UK, Denmark, and Belgium are planned users of microwave landing technology, it is important for the DoD to stay current on the costs and benefits of microwave landing technology. The Air Force believes the JPALS program and the GATO/MC2 System Program Office at the Electronic Systems Center is the right place to stay current on continuing use of MLS technology. The Air Force will ensure the Joint Precision Approach and Landing System (JPALS) program conducts appropriate cost and benefit analysis.

The Air Force also concurs with the recommendation of "evaluating the costs and benefits of the PLSR and other alternatives against established mission requirements under the ongoing DOD-wide JPALS program". The cost and benefits of the PLSR will be evaluated as part of the JPALS Phase 0 Analysis of Alternatives cost trade-off analysis.

## Air Force Comments

---

Finally, the Air Force does not concur with the recommendation of having the “Assistant Secretary of the Air Force for Acquisition instruct program and contract officials to properly document operational requirements and to plan acquisitions as required ”

The rationale for Air Force nonconcurrency with three of the recommendations discussed above are too numerous to discuss in this memo. For that reason, I have attached the Air Force's Response Summary and Detailed Response, which contain the complete Air Force response. I request that the Air Force's response be included in your final report.

Should you have any questions about this memo or its attachments please do not hesitate to contact me.



**DARLEEN A. DRUYUN**  
Principal Deputy Assistant Secretary  
(Acquisition & Management)

Arch  
Air Force DoD/IG Report Response

TABLE OF CONTENTS

DoD/IG Audit Report Response on Short-Term Precision Landing	1	*
Joint Precision Approach and Landing System (JPALS) Near Term Integrated Product team (NT-IPT)	2	
JPALS A D M	3	
AMCPAC Decision Briefing to AMC/CC	4	
AMCPAC Follow-up Briefing to AMC/CC	5	
AMC/CC Global Reach Ltr to General Ronald R Fogleman, Chief of Staff	6	
C-MNS Message	...7	
JPALS/OIPT Report	8	
AFI 63-114 - Rapid Response Process	9	
PMD 0020 for C-17 IWSM Program	10	
Information Points of Contact	11	

\* Omitted for length. Copies available upon request.



**Air Force Response  
to  
DoD/IG Audit Report on Short-Term Precision Landing Capabilities for C-17  
Aircraft (Project No. 7RD-0008)**

**PART I - BACKGROUND**

**1. Introduction**

The Audit Report on Short-Term Precision Landing Capabilities for C-17 Aircraft (Project No. 7RD-0008) misunderstands facts related to the program and offers faulty conclusions

**2. Methodology**

The DoD/IG draft report response is broken into three parts. background, response summary and the detailed response.

The DoD/IG report itself focuses on acquisition planning, microwave landing system technology, initial operational capability date, testing and alternative systems. The Response Summary (RS) and the Detailed Response (DR) follows the same format and structure as the DoD/IG report

Air Force review of the DoD/IG report was conducted with in-depth analysis by a team of engineers, program managers, contracting representatives and senior officials from across the Air Force, including Air Force Materiel Command, Air Mobility Command, Air Force Operational Test and Evaluation Center, and Air Force Flight Standards Agency

### **PART II - RESPONSE SUMMARY (RS)**

The RS contains summary analysis of the DoD/IG report, response to the DoD/IG report recommendations, conclusions and executive summary

#### **1. Summary Analysis of DoD/IG Report**

The following general analysis reviews five key areas of the DoD/IG report. These areas are particularly important as they form the basis of the report's recommendations. This section provides a top-level assessment of the validity of the report assertions.

##### **Acquisition Planning**

The heart of the DoD/IG report on acquisition planning are assertions that the Air Force did not follow prescribed DoD acquisition procedures. These assertions are not true. As the rest of this response will show, the Air Force, through existing contracts, acquisition plans, the AMC Combat Mission Needs Statement (C-MNS) and AFI 63-1 14, *Rapid Response Process (RRP)*, followed procedures in carrying out the Air Mobility Contingency Precision Approach Capability (AMCPAC) program.

##### **Microwave Landing System (MLS) Technology**

The key assertion in this section revolved around conjecture of Air Force reliance on an immature, unneeded and unproven technology. These conjectures are false. The following response shows that MLS technology is in use or being planned for employment in four European countries and the United States. At the same time it is nearly operationally capable within the Air Force inventory.

##### **Initial Operating Capability (IOC) Date**

This section of the report and, in some ways, the entire DoD/IG report hinges on the assertion of no documented rationale for the 30 Oct 97 IOC. The assertion is false. Air Force Instruction 63-114, Rapid Response Process and 1 O-60 I, Mission Needs and Operational Requirements Guidance and Procedures, provide the methods and process for utilizing Combat Mission Need Statement and the subsequent accelerated fielding of critical systems to meet HQ USAF major commands (MAICOM) and warfighting commanders in chief (CINCLANTFLT) On 11 Dec 96, the Chief of Staff of the Air Force approved the AMC/CC-validated C-MNS which contained a required IOC, in accordance with the Rapid Response Process. Suggesting there was no documented rationale for the required IOC is erroneous. The assertion ignores an essential basis of Air Force contingency response acquisition procedures.

**Testing**

The **DoD/IG** report concludes that abbreviated test planning and testing were being conducted on **the** AMCPAC system. This is false. Developmental testing will meet the purpose and scope of *I, Developmental Test* **and Evaluation**, and will demonstrate full PLSR functionality. Readiness for operational testing will be certified by the C-17 SPO. AFOTEC will conduct appropriate operational testing. Phase I of **AFOTEC's** testing concludes with a fielding decision. Phase I testing includes 287 approaches, allocated to **110 MLS** and **177 ILS/VOR** approaches. Precision tracking data and pilot rating data will be collected for all 287 approaches. Additionally, **50 to 100** current C-17 approaches will be performed for the purpose of baselining pilot rating. As this response shows, the **DoD/IG** report came to an inaccurate conclusion largely due to a lack of research and communication with those planning and conducting AMCPAC testing.

**Alternate Systems**

The **DoD/IG** asserts the Air Force failed to adequately consider alternate systems. However, evaluating alternative systems was a core activity of an Air Force Tiger Team convened and chartered to address AMC precision approach capability shortfalls. The Tiger Team conducted the initial evaluation leading to the **AMC/CC** selection of the MMLS and PLSR paired with the C-17 to perform contingency landing operations. The evaluation criteria and results were simple and discrete and passed Air Force, OSD and FAA scrutiny, before obtaining **OSD(A&T)** concurrence for the AMCPAC program.

**2. Response to Recommendations for Corrective Action (page 16)**

I .a. "Limiting the acquisition and installation **of the** PLSR to one C-17 test aircraft."

Nonconcur. A well planned, event driven schedule is laid out for the AMCPAC program and arbitrarily limiting acquisition and installation to a single aircraft makes no sense. The AMCPAC program is based on a validated mission need and is following prescribed acquisition procedures. PLSR installation on C-17s will not occur until after the fielding decision, which will be supported by developmental and operational testing. The results of the Phase **IIOT&E** test will be the basis of the decision to install the PLSR. Phase **I** AFOTEC testing includes 287 approaches, allocated to 110 MLS and 177 **ILS/VOR** approaches. Precision tracking data and pilot rating data will be collected for all 287 approaches. Additionally, **50 to 100** current C-17 approaches will be performed for the purpose of baselining pilot rating.

I .b. "Proving the operational capability and feasibility of the PLSR to provide precision landing capability in support of deployments through appropriate testing."

Redirected

Revised and  
redirected

**Final Report  
Reference**

Nonconcur. Appropriate testing is planned and no corrective action is required. The AMCPAC program is premised on program planning which dictates the PLSR will not be installed on C- 17s until adequate testing has been accomplished. Installation will not occur until **after** PLSR contractor qualification testing, integration testing conducted by the C- 17 contractor, flight testing conducted by FAA personnel collaborating in an Air Force evaluation. and operational flight testing conducted by AFOTEC

**Redirected**

**1.c.** "Evaluating the costs and benefits of continuing the use of microwave landing technology to provide precision landing capability in support of deployments."

Concur. Based on fact the **US**, Italy, UK. Denmark and Belgium are planned users of microwave landing technology, it is important for the **DoD** to stay current on the costs and **benefits** of microwave landing **technology**. The Air Force believes the JPALS program and the **GATO/MC2** System Program Office at the Electronic Systems Center is the right place to stay current on continuing use of MLS technology.

**Redirected**

**1.d.** "Evaluating the costs and benefits of the PLSR and other alternatives against established mission requirements under the ongoing **DoD-wide** JPALS program."

Concur. The cost and benefits of the PLSR will be evaluated as part of the JPALS Phase 0 Analysis of Alternatives cost trade-off analysis. along with other potential materiel alternatives.

**Revised**

2. "Assistant Secretary of the Air Force for Acquisition instruct program and contract **officials** to properly document operational requirements and to plan acquisitions as required. . ."

Nonconcur. Even though periodic reminders from senior acquisition officials can help program officials maintain awareness of acquisition procedures, special instructions are not warranted at this time. Program documentation reflects that AMCPAC requirements were based on a validated mission need and were approved by the Chief of Staff of the Air Force. Additionally, all acquisition planning followed Air Force Instruction **63- 114**, acquisition strategies were approved by the JPALS **DoDOIPT** and was concurred in by **USD(A&T)**.

3. Response to Conclusions (page 15)

First paragraph:

"**IOC** of October 30. 1997 was unrealistic"

Nonconcur.

This is not an accurate statement. **AMC/CC** validated a Combat Mission Need Statement (C-MNS), which was approved by the Chief of Staff of the Air Force on

11 Dec 96, calling for an IOC of 30 Oct 97. The C-MNS was validated and approved in accordance with the Rapid Response Process (RRP) AFI 10-601 (dated 31 May 94), para 3.3, states the RRP, as described in AFI 63-114 (dated 4 May 94), is used to satisfy deficiencies that arise during combat or crisis operations (e.g. JOINT ENDEAVOR) or when the MAJCOM/CC believes accelerated peacetime acquisition procedures are necessary, based on immediacy of need and availability of offset funding. Operation JOINT ENDEAVOR highlighted a shortfall in which AMC was unable to operate effectively at Tuzla Airfield, Bosnia for almost two weeks due to a lack of precision approach capability. In actual hostilities, this lack of capability translates into potential lives lost. CINCTRANS, fulfilling his responsibility as a supporting CINC, determined that AMC required the capability ASAP to support its rapid mobility mission in the event weather is a limiting factor.

The 31 Oct 97 date was deemed to be the soonest achievable given technology and acquisition realities. The operational need was clearly and unequivocally documented in the C-MNS.

*"As demonstrated in Bosnia during operation JOINT ENDEAVOR, the airlift (~130 loads), personnel (33 personnel, 48-72 hours required to set up for operation), and flight inspection requirements of the current PAR induced an operationally unacceptable delay in initiating immediate airlift operations in areas of chronically poor weather."*

NOTE: The stated C-MNS airlift and personnel resources are for deployment of a complete Radar Approach Control (RAPCON). Airlift and personnel resources for deployment of a standalone PAR are addressed in responses to the first, second, and third paragraphs on page 13 of the DoDIG Audit Report.

Regarding the requirement to include types, sizes, and quantities, AMC must be able to provide capability to warfighting CINCs to move an initial insertion force that includes all air transportable equipment and personnel. Equipment can range from outsize (M-1, Bradley, Patriot Battery, and helicopter) to palletized and bulk supplies. As for an analysis of how often precision landings are needed, it is impossible to know where or how often crises or contingencies will develop. AMC cannot restrict the ability of the National Command Authority to respond quickly in a crisis due to a lack of this capability.

"the Air Force abbreviated the proposed testing of the PLSR on the C-17"

Nonconcur

This is not an accurate statement. PLSR testing on the C-17 is not abbreviated. Developmental testing is being conducted within the scope and intent of AFI 99-101 *Developmental Test and Evaluation* (1 Nov 96), and will demonstrate full PLSR.

Final Report  
Reference

**functionality.** All testing recommended by AFOTEC will be conducted. Phase I of **AFOTEC's** testing concludes with a fielding decision. Phase I testing includes 287 approaches, allocated to **110 MLS** and **177 ILS/VOR** approaches. Precision tracking data and pilot rating data will be collected for all 287 approaches. Additionally, SO to 100 current C-17 approaches will be performed for the purpose of baselining pilot rating.

Second paragraph:

"MLS technology for precision landing in support of deployments has not been operationally proven"

Nonconcur

This is not an accurate statement. MMLS ground segment (the mobile ground transmitter) technology was demonstrated in a tactical scenario during **IOT&E** and in Tuzla **Airfield**, Bosnia and Ramstein, Germany. MLS is a proven technology which is supported by **ICAO-approved** Standards and Recommended Procedures (**SARPS**) and FAA-approved flight inspection and terminal instrument procedures (**TERPS**).

Third paragraph:

"Installation of the PLSR at this time may also inhibit the future insertion of less costly commercial, off-the-shelf components, if and when GPS technology is proved effective for precision landing capabilities."

Nonconcur.

This is not an accurate statement. It is inaccurate to say that the installation of PLSR will inhibit insertion of commercially available off-the-shelf GPS in the future. First, the **full** military GPS service (Precision Positioning Service (PPS) or P/Y-code) is not available to the commercial sector due to the use of crypto-variable keys to provide secure accuracy to authorized users—there are no COTS products that can make full use of P/Y code. Second, the PLSR was designed to be modular and provide growth capability in processing and interfaces. The intent is to make the box adaptable to both **software** (reloadable over the MIL-STD-I 553 data bus) or hardware upgrades that may be available in the future.

The FAA has committed considerable resources and reorganized its operational structure to support development of an augmented GPS precision landing system which may be fielded as early as **1998**. The FAA is committed to replace most of the existing **ILS** based operations with augmented GPS operations. The GPS capability installed in the PLSR is the most advanced in the **DoD** inventory and is likely more capable than any GPS receiver commercially available. This is exemplified by its embedded Receiver Autonomous Integrity Monitoring (**RAIM**), Wide Area Augmentation System (WAAS)

Deleted

compatibility. local area differential GPS functionality. all in view satellite monitoring  
100% spare memory growth and spare processing speed to meet future evolving  
requirements

The FAA is committed to GPS technology. The FAA, other US agencies  
(including DoD), and other nations are conducting extensive testing of this technology.  
While it is true that GPS is not fully developed for all precision landing applications,  
special purpose systems do exist for Special Category I (SCAT-I) landings. This is the  
type of Local Area Differential GPS ground station envisioned for initial use with the  
PLSR (I-2 years). Finally, the FAA has plans for fielding the Wide Area Augmentation  
System within the next 2 years, making PLSR potentially interoperable with the civil  
community.

Fourth paragraph

"The Air Force plan to install PLSR avionics units on up to 120 C-17 aircraft before  
demonstrating the operational capability of the MLS and GPS technology could result in  
the unnecessary expenditure of more than \$109.8 million if the proposed capabilities of the  
PLSR cannot be effectively used during deployments.

Nonconcur

The statement is misleading. As senior Air Force and DoD officials were informed  
prior to issuing direction to proceed, AMCPAC is a moderate risk program. As such,  
there are substantial technical, schedule and cost challenges to the program. However, as  
previously demonstrated, the AMCPAC program plan does not call for installation of  
PLSR units until after a favorable fielding decision has been made. A fielding decision can  
only be made based on planned, adequate testing.

C-MNS direction was for a minimum of 35 aircraft which logically was extended  
to 48 aircraft to coincide with the C-17 aircraft production line break point for the end of  
modification block 9. This action was approved by senior Air Force officers who chaired  
the C-17 Requirements and Planning Council (R&PC) for the primary reason of  
maintaining a single aircraft configuration. In fact, under the 18 Mar 96, C-17 Integrated  
Weapon System Management (IWSM) PMD and C-17 R&PC procedures, the Air Force  
would have needed extraordinary justification to not continue the PLSR configuration in  
aircraft 36 - 48. Due to long-lead material requirements, a Undefinitized Contact Action  
(UCA) was issued to maintain possible single aircraft configuration production schedule.  
The C-17 PLSR LJCA will be definitized concurrent with the fielding decision milestone,  
which is a function of successful Phase I testing.

The "\$109.8 million" cost figure is misleading as it includes unapproved growth  
features, outdated cost estimates, and non-AMCPAC activities not in the approved  
program.

Revised to  
\$105.1  
million

Revised to  
\$105.1  
million

# Air Force Comments

Final Report  
Reference

Fifth paragraph

"We believe that the Air Force should limit the acquisition and installation of the PLSR avionics units to one C-17 test aircraft"

Nonconcur.

This statement ignores the basic origin of the required and directed AMCPAC program. The requirement for AMCPAC is the validated and approved C-MNS of 11 Dec 96

#### 4. Response to Executive Summary

Audit Results (page ii)

"As a result, the Air Force may install a precision landing system technology that has not been operationally proven, has initiated procurement without knowing the full economic cost for the program, and may spend more than \$109.8 million on a high-risk acquisition strategy to procure and install developmental avionics units on up to 120 C-17 aircraft before adequately testing and proving the full operational capability of the developmental avionics unit"

Nonconcur

This statement is not accurate. The Air Force will not install and operate the PLSR system until a favorable fielding decision has occurred. The fielding decision will be based on a detailed acquisition and test program. Additionally, the Air Force has determined the acquisition cost of the program. Even though the Air Force has embarked on a moderate risk program to meet the challenge of the AMC C-MNS, C-17s will not be modified and equipped with PLSR until adequate testing and operational suitability have been demonstrated.

C-MNS direction was for a minimum of 35 aircraft which logically was extended to 48 aircraft to coincide with the C-17 aircraft production line break point for the end of modification block 9. This action was approved by senior Air Force officers who chaired the C-17 Requirements and Planning Council (R&PC) for the primary reason of maintaining a single aircraft configuration. In fact, under the 18 Mar 96, C-17 Integrated Weapon System Management (IWSM) PMD and C-17 R&PC procedures, the Air Force would have needed extraordinary justification to not continue the PLSR configuration in aircraft 36 - 48. Due to long-lead material requirements, a Undefinitized Contract Action (UCA) was issued to maintain possible single aircraft configuration production schedule. The C-17 PLSR UCA will be definitized concurrent with the fielding decision milestone, which is a function of successful Phase I testing.

Revised to  
\$105.1  
million

Summary of Recommendations (page ii)

“We recommend that the Deputy Assistant Secretary of Defense (Command. Control. Communications and Intelligence Acquisition) reevaluate Air Force decisions on short-term precision landing capability for the C-17 aircraft, to include limiting the acquisition and installation of the Precision Landing System Receiver to one test aircraft, proving the operational capability of and need for the Precision Landing System Receiver through appropriate testing against established requirements, evaluate the costs and benefits of continuing the use of microwave landing system technology to provide precision landing capability in support of deployments; and evaluate the cost and benefits of the Precision Landing System Receiver and other competing alternatives against established mission requirements under the ongoing DoD-wide Joint Precision Approach and Landing System Program. We also recommend that the Assistant Secretary of the Air Force for Acquisition instruct program and contract officials to comply with policies and procedures for acquisition planning prescribed by DoD regulation and the Federal Acquisition Regulation.”

Nonconcur.

As this response has summarized and will show in greater detail, the scope of PLSR acquisition and installation is an event based program containing proper safeguards for successful program execution. There is some merit in MLS and PLSR cost and benefit analysis, and the Air Force has plans to conduct such analysis. Therefore, recommending this analysis is redundant.

“We also recommend that the Assistant Secretary of the Air Force for Acquisition instruct program and contract officials to comply with policies and procedures for acquisition planning prescribed by DoD regulation and the FAR.”

Nonconcur.

Even though periodic reminders from senior acquisition officials can help program officials maintain awareness of acquisition procedures, special instructions are not warranted at this time. Program documentation reflects that AMCPAC requirements were based on a validated mission need from AMC/CC and were approved by the Chief of Staff of the Air Force. Additionally, all acquisition plans followed Air Force Instruction 63-114, acquisition strategies were approved by the OIPT and were concurred with by USD(A&T).

Revised and  
redirected

Revised

Final Report  
Reference

PART III - DETAILED RESPONSE (DR)

The DR follows the DoD/IG report, page by page. Following the page numbers are report paragraph and sentence locations, which precede the response comments to the DoD/IG report.

Page 2

Revised

(1) Second paragraph. Change to the third sentence as follows to add reference to Navy shipboard requirement. "The joint mission need statement was approved by the Joint Requirements Oversight Council on August 29, 1995 and is a potential acquisition category ID program based on the potential for program application to more than 15,000 DoD aircraft, ships, and ground stations."

Revised

(2) Third paragraph. Change to second sentence to reflect current terminology for Phase 0 and Phase 1. "The Acquisition Decision Memorandum designated the Air Force as lead Military Department and established Milestone 0 (Phase 0 Concept Exploration) criteria in support of a Defense Acquisition Board Milestone 1 (Program Definition and Risk Reduction)."

Revised

(3) Fourth paragraph, last sub-bullet (on page 3). Change to reflect exact wording from the ADM and NT-IPT Report. "Exploitation of Mobile Microwave Landing System." This is consistent with the two preceding sub-bullets. It is also more consistent with Joint Precision Approach and Landing System (JPALS) Program's Near-Term (NT) IPT tasking which was to "examine any shortfalls or obstacles to the full employment of the recently fielded MMLS supporting C-130 tactical airlift."

Page 3

(5) Second paragraph. This paragraph is not accurate. HQ AMC/CC did not direct the Near Term IPT to hasten its efforts. He identified an immediate operational deficiency, and requested a solution be developed to correct the deficiency. In order to comply with the requirement, AFPEO/AT convened an AMCPAC Tiger Team (12 Sep 96) to develop a strategy and assess potential technologies to meet AMC's requirement. The Tiger Team was not the JPALS Near Term IPT, although many of the members were the same. The Tiger Team developed a strategy, suggested alternatives and out-briefed the JPALS Overarching IPT (OIPT) on 16 Oct 96 in order to obtain high level review. The OIPT approved the AMCPAC acquisition strategy. As the Tiger Team recommendations were being coordinated, HQ AMC/DO staff requested the number of off-the-shell PAR/ASR systems be raised from 2 to 4 to support training and deployment requirements. A decision briefing was provided to HQ AMC/CC, who approved the Tiger Team's recommended solution set. AMC/CC directed his staff to prepare a C-MNS, once it was validated, the Rapid Response Process as outlined in AFI 63-114 was initiated.

USD(A&T) concurred with the Tiger Team's recommended solution on 28 Oct 96 and further concurred with the OIPT report on 13 Jan 97.

Page 4

(6) First paragraph: This paragraph is not accurate. The potential use of MLS technology is understated. Replace last sentence with "US, Italy, UK, Denmark and Belgium plan on implementing MLS." Additionally, to be more complete, the report should reflect the Chairman's Report for the 13 Jun 97 Air Group V Meeting in which Belgium, Canada, Denmark, Spain, the Netherlands, Turkey, the UK, and the US either identified the potential need for multi-mode landing system receiver avionics or the microwave landing system.

Sentence  
deleted

It should be noted in the DoDIG report that the International Civil Aviation Organization (ICAO), which establishes international policy for navigation/precision landing, has recommended the use of a multi-mode landing system avionics. Additionally, the Airlines Electronic Engineering Committee (AEEC) is actively developing specifications for a multi-mode landing system for both digital and analog based aircraft which will serve as the standard for commercial air carrier operations.

(7) Second paragraph: This paragraph is incomplete and inaccurate. Below are three corrections.

Add to beginning of paragraph: "It is critical to note the planned use of a multi-mode landing system receiver by the civil community. Also, it is important to acknowledge the operational impact of the added FM frequency protection provisions incorporated in the PLSR design.

Revised

Second sentence: Replace with, "the PLSR is being designed to provide precision landing capability through ILS, MLS, and GPS technology-the concept of a multi-mode landing receiver (i.e., ILS/MLS/GPS) was a key recommendation from the International Civil Aviation Organization (ICAO) in 1995 and is consistent with the ongoing AEEC development of two multi-mode landing receiver specifications."

Third sentence, insert the following after third sentence: "The PLSR will be compatible with US and international civil standards for precision landing and is designed to be fully compliant with FAA/ICAO standards for precision landing via either ILS, MLS, or GPS. It should be noted that the PLSR contains the only known ILS in the DoD inventory which is fully compliant to international standards for FM frequency interference. This will allow equipped aircraft uninterrupted passage in UK controlled airspace by complying with a 1994 UK CAA Air Worthiness Notice which otherwise restricts aircraft, without FM frequency protection provisions, from entering controlled UK airspace in 1998"

Page 5

**Final Report  
Reference**

**Revised**

First paragraph, first sentence: This sentence is not accurate. The Air Force has shown operational use of the existing **MMLS** ground station. Air Mobility Command is actively working to correct deficiencies noted to date. **AMC** plans to have the problems solved by year's end. Additionally, the PLSR will be fully tested before any C-17 aircraft is retrofitted and made operational. The acquisition procedures followed in this effort were based on the Rapid Response Process outlined in AFI 63-114.

Page 6

First paragraph: This paragraph is not accurate. **FY98-03** Defense Planning Guidance, Section 1A para 3 (p 6), Roles of U.S. Military Power, states "finally, to meet all of these requirements successfully, U.S. forces must be capable of responding quickly and operating effectively. That is, they must be ready to fight.. " Operation JOINT ENDEAVOR highlighted a shortfall in which **AMC** was unable to operate effectively at Tuzla Airtfield, Bosnia for almost two weeks due to a lack of precision approach capability. In actual hostilities, this lack of capability translates into potential lives lost. CINTRANS, fulfilling his responsibility as supporting **CINC**, determined that AMC required the capability ASAP to support its rapid mobility mission in the event weather is a limiting factor.

**AFI O-60 I** (dated 31 May 94), 3.3, states the Rapid Response Process (RRP) as described in **AFI 63-114** (dated 4 May 94), is used to satisfy deficiencies that arise during combat or crisis operations (i.e. JOINT ENDEAVOR) or when the **MAJCOM/CC believes accelerated peacetime acquisition procedures are necessary, based on immediacy of need and availability of offset funding.** Although AFI 63-114 Rapid Response Process criteria states that normally the capability is fielded within 60 days, **AMC/CC** recognized, due to its complexity, this modification could not be completed in such a short time. HQ AMC, HQ ESC, **AFPEO/AT**, and the C-17 SPO agreed that a 12 month schedule was achievable. **AMC/CC** therefore directed the 30 Oct 97 date for initial operating capability.

Further, program and contracting officials did follow acquisition management directives. The PLSR acquisition plan clearly substantiates that proper acquisition planning was conducted and that policy directives, contained in **DoD Directive 5000 I** and Federal Acquisition Regulation Part 7, were satisfied. The inference that FAR 7.102 was not followed is not accurate. The PLSR acquisition plan authorizes the purchase of 2,200 PLSR avionics to be procured for the purpose of being installed on both cargo and fighter aircraft. It was based on **full** and open competition following two prior acquisition phases consisting of a fly-off competition among three different contractors and another **down-**selection of multiple brassboard designs. Additionally, the Hierarchy of Material Alternatives defined in **DoD 5000.1** states the use or modification of systems or equipment that the Department already owns is more cost-effective than acquiring new material. Modifying the existing PLSR program coupled with the use of the already deployed **MMLS** complies with the above guidance.

Additionally, HQ AFOTEC has developed an operational test plan, which answers the following critical operational issues (COIs) for the PLSR:

1. Is the AN/ARN-155 PLSR an effective substitute for the current capabilities of the AN/ARN 147 VIM receiver on the C-17?
2. Does the AN/ARN-155 PLSR provide effective precision microwave landing guidance to contingency airfields using co-located MMLS ground stations (Phase I)?
3. Does the AN/ARN-155 PLSR provide effective precision microwave landing guidance to other airfields using fixed base or split site mobile MLS ground stations (Phase II)?
4. Does the AN/ARN-155 PLSR provide effective precision differential global positioning system landing guidance (Phase III)?
5. Is the AN/ARN-155 PLSR suitable for the C-17 mission?

COIs 1, 2, and 5 will be answered in Phase 1, which will support the fielding decision of the PLSR. COIs 3 and 4 represent additional capabilities and will be answered at a future date, if funded. The test plan is being prepared from the C-MNS, RCM and draft operational concept. It reflects how AMC operates the C-17, using MCI 11-217, C-17 Operations; AFI I-206, General and AFI 11-217, Instrument Flight Procedures. The test will have realistic scenarios in which line aircrews of various experience levels will fly precision approaches in the C-17, using the PLSR.

Finally, a new, stand-alone acquisition plan is not required based on the AMC C-MNS. Existing PLSR and C-17 contracts and other acquisition documentation were sufficient to satisfy AMC C-MNS requirements, when taken together with the previously mentioned documents required under RRP. Specifically, it is important to recognize the existence of the PLSR program before AMCPAC and that all necessary acquisition authority was granted in 1983 to purchase up to 2,200 systems for the intent of being installed on cargo/fighter aircraft. Basic C-17 acquisition planning documents were also in place prior to AMCPAC.

Second paragraph: This paragraph is misleading. The Air Force is correcting MMLS and CMLSA problems that occurred during Operation JOINT ENDEAVOR. Flight inspection procedures, TERPS, and frequency allocations are already in place. Additional personnel have been trained on the system, and as it is used more, their familiarity and proficiency will improve.

Page 7

First paragraph: This paragraph is not accurate. Until June 94, MLS was a viable joint FAA/DoD program. The FAA decided to halt development of MLS technology and to pursue GPS at that time. As a result of this decision, the Army and Navy deleted MLS funds from their budgets. In this time frame, the Air Force also deleted funding for the Fixed Base MLS and reduced funding for the Military MLS Avionics. However, since the operational requirement was still valid and production contracts had already been awarded

# Air Force Comments

Final Report  
Reference

for MMLS and CMLSA equipment. the Air Force elected to **capitalize** on the MMLS/CMLSA sunk costs and take advantage of the improved tactical capability provided by MMLS and the CMLSA being installed on the C-130 fleet Note The complete Air Force rationale for continuing with the MMLS, CMLSA, and multi-mode receiver development was provided in a 15 Jul 94 OSD/C3I Memorandum, to the Director, Readiness and Operational Support Subj Quick-Reaction Audit Report on the Air Force Microwave landing System (Project No

Revised

Second paragraph, second sentence. This sentence is not accurate The retrofit modifications to the MMLS were not the result of deficiencies discovered during Operation JOINT ENDEAVOR Instead, they were the result of the Production Reliability and Acceptance Testing, and were not a factor in whether or not the equipment could be deployed There are no outstanding deficiencies which will prevent deployment of the MMLS

Revised

Second paragraph, last sentence This sentence is not accurate. It is true that there are CMLSA deficiencies which need to be corrected However, formal action to correct all these deficiencies is on-going and is projected to be complete by Dec 97 The Electronic Systems Center and Air Mobility Command (AMC) are aggressively addressing these issues A meeting of all stakeholders occurred in Apr 97 at Little Rock AFB and OPRs have been assigned to all action items and are being tracked monthly at AMC Additionally, the CMLSA receiver only involves the C-130 aircraft and does not impact the C-17

Third paragraph. This paragraph is not accurate. The EMI/EMC problems listed are unique to the C-130 CMLSA and are not relevant to the C-17 modification or MMLS FOT&E has not been completed on the MMLS due to its lack of operational utilization (caused by lack of aircraft with compatible avionics) Follow-on test and evaluation (FOT&E) will be conducted after all CMLSA deficiencies have been corrected; however, FOT&E is not a pacing factor for MMLS/CMLSA operational use DT&E was conducted by the contractor (Textron) in 1992-3 and OT&E was conducted by AFOTEC and ACC in 1994-5

HQ ACC submitted a FOT&E request to the Air Force Combat Air Delivery School (CADS) on 3 Aug 96 CADS determined that FOT&E should not be conducted until the C-130 issues restricting MLS use are corrected and the system as a whole is operationally utilized for a period of time, and therefore have not prepared a test plan AMC, in conjunction with the C-130 SPO and HQ ESC, is actively working the C-130 issues and plans to have the problems solved by 30 Nov 97

The referenced EMI/EMC testing applies only to the C-130 CMLSA system There are 4 C- defensive systems (ALE-40, AAR-47, ALR-69, and AI Q-131) that have not been EMI/EMC tested with the CMLSA operating, WR-ALC/LBRE engineers have verified through engineering analysis that the ALE-40, AAR-47, and the

ALR-69 will not affect MLS operation on the C-130. The ALQ-13 1 will be handled via a procedural change to the C-130 flight operations manual.

It is important to reiterate that the PLSR will be fully tested before any C-17 aircraft is retrofitted. ESC is conducting an independent test of the PLSR at the FAA Tech Center to verify "subsystem" operation prior to installing it on the C-17 for flight test. The Boeing Company will conduct dedicated DT&E (to verify system operation) and AFOTEC will conduct IOT&E.

Fourth paragraph: This paragraph is not accurate. The comments made by the Combat Delivery School were based on a CONOPS written by HQ ACC approximately two years ago and do not relate to current information. HQ AMC and HQ AFSOC have been developing a detailed concept of operations for deployment and use of the MMLS to support contingency mobility operations since this effort began. AFSOC has agreed to be the primary supplier/deployer of MMLS capability for AMC. They expect to finalize the CONOPS and training syllabus, and have operator checklists in place NLT 31 Oct 97. This will give Special Tactics Teams the ability to deploy the MMLS in support of contingency airlift operations. AMC's concept of operations is on track to be approved by Sep 97

Page 8

Second paragraph: This paragraph is not accurate. AFI IO-601 (dated 31 May 94), para 3.3, states the Rapid Response Process (RRP) as described in (dated 4 May 94), is used to satisfy deficiencies that arise during combat or crisis operations (e.g. JOINT ENDEAVOR) or when the MAJCOM/CC believes accelerated peacetime acquisition procedures are necessary, based on immediacy of need and availability of offset funding. Operation JOINT ENDEAVOR highlighted a shortfall in which AMC was unable to operate effectively at Tuzla Airfield, Bosnia for almost two weeks due to a lack of precision approach capability. In actual hostilities, this lack of capability translates into potential lives lost. CINTRANS, fulfilling his responsibility as a supporting CMC, determined that AMC required the capability ASAP to support its rapid mobility mission in the event weather is a limiting factor.

The 31 Oct 97 date was deemed to be the soonest achievable given technology and acquisition realities. The operational need was clearly and unequivocally documented in the C-MNS.

*During Bosnia during operation JOINT ENDEAVOR, the airlift (7 C-130 loads), personnel (33 personnel) 48-72 hours required to set up for of the current PAR induced an operationally unacceptable delay in initiating immediate airlift operations in areas of chronically poor weather."*

Page 8  
Revised

## Air Force Comments

---

NOTE The stated C-MNS airlift and personnel resources are for deployment of a complete Radar Approach Control (RAPCON) Airlift and personnel resources for deployment of a standalone PAR are addressed in responses to the first, second, and third paragraphs on page 13 of the DoDIG Audit Report

Regarding the requirement to include types, sizes, and quantities, AMC must be able to provide capability to to move an initial Insertion force that includes all air transportable equipment and personnel Equipment can range from outsize (M-I Bradley, Patriot Battery, and helicopter) to palletized and bulk supplies As for an analysis of how often precision landings are needed, it is impossible to know where or how often crises or contingencies will develop AMC cannot restrict the ability of the National Command Authority to respond quickly in a crisis due to a lack of this capability

Third paragraph This sentence is not accurate The C-MNS is a documented user requirement in accordance with 14, *Rapid Response Process (RRP)*. "The RRP starts when HQ USAF, major commands (MAJCOM), and warfighting Commanders In Chief (CINC) issue an urgent, time-sensitive Combat Mission Need Statement (C-MNS)"

The Air Force intends to fully test (developmentally and operationally) the planned released PLSR capability for MLS Cat I, co-located and other requirements as listed in the C-MNS RCM Phase I section. The Air Force is executing an extensive developmental ground test program The parallel (non-C-17) PLSR ESC flight test at the FAA Technical Center will demonstrate PLSR specification compliance in flight, to include operations with split site mobile and fixed base MLS ground stations The C-17 weapon system phased flight test program consisting of Phase I one week - Dedicated Development Test (DT), two weeks - combined DT and Operational Test (OT) and three weeks - Dedicated OT Phase I Operational Testing will verify the minimum capability required to operate the C-17 airfields and replace the existing VOR/ILS/Marker Beacon Receiver Phase II will add additional MLS capability that will have been demonstrated by ESC Phase III will add DGPS capability if funded in the future The phased approach was adopted to insure thorough system testing, while meeting the validated AMC combat need

Because of the initial operational capability date, the Air Force has adopted a phased flight test program to initially provide a tactical landing capability to support operations to Category I minima, with the potential for a second phased designed to provide an European civil interoperability capability to Category II minima, and finally assess the likelihood of FAA civil interoperability by evaluating the GPS functionality

Page 9

Second paragraph. This paragraph is misleading Phase I testing will be complete and AFOTEC will provide an interim summary report to support the fielding decision, prior to commencing PLSR installation on the C-17 fleet

Third paragraph: This paragraph is not accurate. HQ AFOTEC has developed an operational test plan, which answers the following critical operational issues (COIs) for the PLSR:

1. Is the AN/ARN-155 PLSR an effective substitute for the current capabilities of the AN/ARN 147 VIM receiver on the C-17?
2. Does the AN/ARN-155 PLSR provide effective precision microwave landing guidance to contingency airfields using co-located MMLS ground stations (Phase I)?
3. Does the AN/ARN-155 PLSR provide effective precision microwave landing guidance to other airfields using fixed base or split site mobile MLS ground stations (Phase II)?
4. Does the AN/ARN-155 PLSR provide effective precision differential global positioning system landing guidance (Phase III)?
5. Is the AN/ARN-155 PLSR suitable for the C-17 mission?

COIs 1, 2, and 5 will be answered in Phase 1, which will support the fielding decision of the PLSR. COIs 3 and 4 represent additional capabilities and will be answered at a future date, if funded. The test plan is being prepared from the C-MNS, RCM and draft operational concept. It reflects how AMC operates the C-17, using MCI 11-217, C-17 Operations: AFI 11-206, General Flight Rules; and AFI 11-217, Instrument Flight Procedures. The test will have realistic scenarios in which line aircrews of various experience levels will fly precision approaches in the C-17, using the PLSR.

Additionally, per the PMD memo of 28 Jan 97, HQ AFOTEC is to conduct IOT&E as required. AMCPAC is an ACAT III effort and is not on the OSD/DOT&E oversight list. OSD/DOT&E is not required to be involved in the test program. Phase 1 testing will be complete by 29 Sep 1997 and AFOTEC will provide an interim summary report by 9 Oct 97 to support the fielding decision, prior to commencing installation on the C-17 fleet. PLSR installation on the aircraft is scheduled to start 22 Oct 97 and not 7 Oct 97. AFOTEC tests to the user's requirements and has developed a test plan based on the needs that AMC has stated in the AMCPAC Requirements Correlation Matrix (RCM). Those requirements have been broken into phases to facilitate rapid fielding and testing of the system. AFOTEC is conducting appropriate testing to established levels of confidence on the requirements. The flight test program has been closely coordinated between all parties with multiple Test Plan Working Group (TPWG) and weekly test teleconferences with representatives from the prime C-17 contractor (MTA), AFFTC, ESC, C-17 SPO, AFOTEC, and AMC. Minutes of these meetings were taken, action items were assigned and tracked to closure. A test responsibility matrix was developed and coordinated with all agencies involved, including the Air National Guard, which is responsible for set up and operation/maintenance of the three Mobile Microwave Landing Systems (MMLS) located at separate test locations. The Operational Templates (33 each) documented in AF Manual 63-119, Certification of System Readiness for Dedicated Operational Test and Evaluation, were coordinated and tailored for the AMCPAC flight test program and used as a guide to ensure readiness for dedicated IOT&E. Additionally, a draft Joint Reliability and Maintainability Evaluation Team (JRMET) and Test Data Scoring Board (TDSB)

Final Report  
Reference

charter was established. The mission and membership of the JRMET is defined in AFI 99-102, *Operational Test and Evaluation*, as "Assists in collecting, analyzing, and categorizing reliability and maintainability (R&M) data during DT&E and IOT&E. The JRMET is chaired by a member of the SPO and includes representatives from the supporting and operating commands, test organization, the operational test agency, and when appropriate, contractor personnel as technical advisors." Finally, an Initial Operational Test & Evaluation Plan will guide the operational testing for the AMCPAC. AFOTEC has been involved in the AMCPAC program.

While the final test report may not be completed prior to 22 Oct 97, the program office will have the interim summary report, as permitted by AFI 99-102 to support the PLSR fielding decision prior to C-17 installation. Phase I of AFOTEC's testing concludes with a fielding decision. During Phase I AFOTEC testing includes 287 approaches, allocated to 110 MLS and 177 ILS/VOR approaches. Precision tracking data and pilot rating data will be collected for all 287 approaches. Additionally, 50 to 100 current C-17 approaches will be performed for the purpose of baselining pilot rating.

Page 10

First paragraph, first sentence: This sentence is not accurate. The C-17 supports the global air mobility mission and the C-MNS and RCM make the assumption that the C-17 will be employed to support that mission. To realistically test the AMCPAC installation, the OT plan incorporates procedures from the MCI 11-217, draft AMCPAC operations concept, and general flight rules to develop realistic scenarios for test.

Second paragraph, second sentence: This sentence is misleading. It overstates the implications of MLS fielding on the C-130 fleet as related to the C-17. The CMLSA deficiencies which prevented employment of the CMLSA equipped C-130 aircraft with the MMLS in Tuzla Airfield, Bosnia are being corrected. After all deficiencies are corrected, a CMLSA/MMLS FOT&E will be conducted. Additionally, AFOTEC will conduct an IOT&E that tests to AMC requirements prior to the fielding decision for the PLSR on the C-17.

Third paragraph, first and second sentences: The concepts described in these sentences are being carried out under the current AMCPAC program. AFOTEC is conducting IOT&E as directed by the 28 Jan 97 PMD to support a properly validated C-MNS using the AFI 63-114 process. Testing will be to the user's needs as defined in the RCM approved by AMC/XP. Results will be available and reported through an interim summary report prior to the fielding decision.

Third sentence: This sentence is not accurate. The AMCPAC C-MNS is a requirements document validated and approved through appropriate Air Force channels in accordance with AFI 63-114.

Revised

Revised

Fourth paragraph: This paragraph is misleading when considered in context of the C-MNS. Based on the RRP timelines, adequate consideration of cost was given. When a comparison is made installing 40 C-17s (production break point) with PLSR between the current cost estimate (\$38.3M) and the Congressional inputs (\$40.7), the estimates are very close. The Congressional input was required due to a program new start (i.e. not on the P-3As) using 3010 BP1 I funding. The full production incorporation cost was not submitted to Congress, as it used 3010 BP10 funding for C- 17 product improvements, which did not require Congressional notification. This is an appropriate management decision given the Air Force's commitment to maintaining, to the maximum extent practical, a single C- 17 aircraft configuration. The Differential GPS (DGPS) budgeting estimate was for a potential, future requirement and is not part of the current program to install MLS/ILS operational capability on the C-17.

Since the initial cost data collection by the DOD/IG, the C-17 integration and development Undefined Contract Action (UCA) has been definitized; MTA has submitted a firm proposal for the retrofit and production incorporation with updated outyear production estimates; and Aircrew Training System has been defined. Additionally, the initial program cost estimate included a value of \$2.25M for PLSR Operation and Support (O&S) cost which was inadvertently not relayed to the DOD IG. The C-17 program office manages the C-17 as a system and does not track O&S cost of new projects at the project level. The life cycle cost of the C- 17 system is updated every two years.

Page 11

First paragraph: This paragraph is not accurate. The DOD/IG value of \$109.8 is wrong. The \$40.7 M estimate was for PLSR MLS capability on 40 aircraft (production modification break point) and is consistent with the AF current estimate of \$38.3M for 40 aircraft. The DOD/IG includes a \$38M budgetary estimate for DGPS and \$18. IM for outfitting the remaining fleet which was not part 40 aircraft estimate.

Revised to  
\$105.1  
million

Current Cost Estimate (\$M):

	Current	Congress	Comment
Integration (1 A/C)	18.2		Note 1
Retrofit (39 A/C)	16.8		Note 2
Trainer Updates	.7		
DT&E/IOT&E	1.6		
Flight Test			
Initial Spares	1.0		
Sub Total	38.3	40.7	
Production (80 A/C)	16.7		Note 3
Total	55.0		Note 4

Note 1: Integration Cost

## Air Force Comments

### Final Report Reference

<b>C-17 Develop/Integrate</b>	<b>13.6</b>
<b>ESC Development Cost</b>	<b>3.9</b>
<b>ESC (9 PLSRs) Lab/Flight Test</b>	<b>.7</b>
<b>Total</b>	<b>18.2</b>

Note 2: **Retrofit** Cost 39 A/C

MTA Group <b>A/Installs/F. S.</b>	11.3
ESC (78 <b>PLSRs</b> )	5.5
Total	16.8

Note 3: Production Cost 80 A/C

MTA Lot 9 (8 Non-Ret)	2.0
MTA <b>Outyear</b> (72 A/C)	5.1
ESC ( <b>160</b> PLSRs)	11.2
ESC PLSR (Non-Recurring)	2.0
<b>VIM* Credit</b>	<b>-3.6</b>
Total	16.7

Note 4:

\***VIM** = Very High Frequency Omni Bearing Range (VOR) Instrumented Landing System (**ILS**) Marker (**M**) Beacon

(VIM credit: PLSR replaces the **VIM**. SPO will not buy **VIMs (\$3.6M)** for P-49+ for a total of 72 **aircraft** at a **shipset** cost of 550,000, assuming more than 35 are modified.)

Page 11

Second paragraph, last sentence: This sentence is not accurate. The Air Force recognized the PLSR development risk associated with the **ILS** and **MLS** bands. The Air **Force** exercised prudent management mitigating that risk. The C-17 production incorporation design will accept either the PLSR or the VIM (LRU that PLSR replaces). In the event the PLSR development lags, there would be no impact to the C-17 production line. For the retrofit C-17s, if the PLSR development lags, the retrofit would be deferred until units are available. Additionally, an operational aircraft (P-12) was made available for dedicated support of the **DT&E**, combined **DT&E/IOT&E**, and dedicated **IOT&E** testing to mitigate overall C-17 test schedule risk.

Page 12

Third paragraph, first and second sentence: These sentences are not accurate. **MMLS** deployment capability has been demonstrated. Once at its deployed location, the **MMLS** can be setup in the collocated configuration by three people in one hour. **MMLS**

operation at a deployed location has been demonstrated. The limitations which initially prevented its use in Bosnia (i.e. a FAA collocated flight inspection capability and TERPS) have been resolved. Additionally, the MMLS capability to provide a ground check of the MMLS signal in space using a portable MLS receiver supports the Theater Commander's options for waiving various portions of the flight inspection requirement as contained in the Air Mobility Command Concept of Operations for Contingency Precision Approach Capability. This is a feature no other current precision approach and landing system offers.

Page 12

First paragraph: This paragraph is not accurate. Acquisition program risk was an integrated evaluation element of all evaluation criteria considered by the Tiger Team. Additionally, the AMCPAC program risk assessment and monitoring is integral to ongoing program execution.

Second paragraph: This paragraph is not accurate. At the time the Tiger Team met, JPALS IIPT was conducting a review of potential systems to meet the JPALS requirements (in response to JPALS Request For Information). As a result of this review, the Tiger Team was able to provide an overall assessment, including cost performance and schedule, of possible alternatives to meet the C-MNS requirement. The lack of non-material solutions to meet this requirement was already documented in the Joint Precision Approach and Landing Capability MNS (USAF 002-94).

*"Nonmateriel Alternatives. Changes to doctrine, tactics, training, or organization will not correct the deficiency of the current Department of Defense precision landing systems. There are no known nonmateriel alternatives to this requirement."*

The costs associated with this program were outlined, reviewed and approved by appropriate Air Force and OSD officials prior to program approval.

Third paragraph, second sentence: This sentence is not accurate. Existing Air Force, Army, and Marine systems will indeed provide PAR capability to precision minimums. However, current systems do not meet AMC's requirement for a "quick response, rapidly deployable precision approach capability." The deficiencies associated with the current DoD precision landing systems are documented in the Joint MNS for Precision Approach and Landing Capability (USAF 002-94).

*The USAF Air Traffic Management Strategic Plan, dated Jul 96 states*

*"With the exception of the deployable A7 CALS described were fielded before the 1980s. Due to their age and dated technology, the deployable ATC equipment suites will soon be unable to support Global Reach and Theater (TBM) strategies. They further require*

*excessive airlift resources to deploy, do not interface with digital C4 architectures, and cannot be integrated into regional terminal and enroute ATC system architectures."*

Deliberate OPLANS are written for operations into major airfields capable of large throughput. Part of this requirement is 24 hour operations, necessitating a need for precision approach capability to limit effects of adverse weather/night operations. AMC requires its aircrews to fly precision approaches to the maximum extent possible during night and/or IMC conditions. On the other hand, real world, short notice contingency operations are not necessarily flown into major airfields. Operation JOINT ENDEAVOR highlighted a shortfall--aircraft were unable to land at Tuzla Airfield, Bosnia for almost two weeks due solely to lack of precision approach capability.

Page 13

First paragraph- This paragraph is not accurate. AMC did adequately consider the use of the AN/TPN-19 to meet the C-MNS requirements. Current Air Force, Army, and Marine Corps deployable ATCALS can technically supply AMC with a precision approach capability. However, the issues surrounding rapid deployability and other organization's ability to support AMC's timeline led to AMC/CC's requirement for an organic precision approach capability supporting initial contingency operations start-up. The AN/TPN-25 (precision approach radar only piece of the AN/TPN-19) does require 2 C-130's to deploy, however this does not include the prime mover capability required to unload from aircraft and setup. In addition, it does not supply the airport surveillance capability required to perform air traffic sequencing separation to allow increased airlift throughput. In the same two C-130s, AMC will be able to deploy both the MMLS as well as a full ASR/PAR capability. Airlift assets are valuable commodities and the less required to support the air traffic control infrastructure set-up the more that's available to directly support the warfighting CINC.

Second paragraph: This paragraph is not accurate. AMC/CC tasked his staff to provide viable solutions and options for a first-in capability. To complete the assessment, a set of criteria were developed to compare existing and new systems. The core criteria were as follows: (1) capable of providing CAT I precision guidance, (2) deployable on one C-130 (3) capable of being set up and operating within six hours by 2 people.

According to AMC/SCMM, the TPN-25 (AN/TPN-19 (PAR only)) requires 36 hours to set up, 10 maintenance personnel to operate, and would require extensive upgrade to meet the Air Force standard mission ready rate of 98%. The USAF Air Traffic Management Strategic Plan states "the TPN-25 PAR is frequently unavailable for use." These inadequacies were the primary reasons it was not selected as a viable solution.

Third paragraph. This paragraph is not accurate. None of the referenced alternate systems met C-MNS requirements. AMC did consider the use of [redacted] to meet the C-MNS requirements. Although the current Air Force, Army, and Marine Corps

deployable ATCALs can technically supply AMC with a precision approach capability. the issues surrounding rapid deployability to support initial start-up operations during contingency operations were seen as insurmountable. The AN/TPN-25 (precision approach radar only piece of the AN/TPN-19) does require 2 C-130's to deploy, however, this does not include the prime mover capability required to unload from aircraft and setup. In addition it does not supply the airborn surveillance capability required to perform air traffic sequencing and separation to allow increased airlift flow. The Army TPN-18 was considered and was found to be a 1960 vintage radar with severe reliability problems. Given the history of the TPN-18 it was not recommended as a solution. The Army AN/TPN-18 and the Marine Corps AN/TPN-22 provide capabilities comparable to the AN/TPN-19, but were not considered to be the most viable solutions for the same reasons that the AN/TPN-19 precision approach radar (PAR) was not considered to be the most viable alternative. As documented in the C-MNS, there were several key AMC contingency requirements, making deployment terms (12 hours) and transfer of resources key aspects of any solution to the C-MNS requirement. The Marine MATCALs is a newer system than other systems discussed above. However, according to available information, it is maintenance intensive and not recommended for first-in capability. Additionally, this and the Army system are still subject to contingency deployability constraints not applicable to organic AMC assets.

Page 14

First paragraph. Change bullet 6 to "WAGE with GPS aircraft receiver capability to process WAGE and perform Receiver Autonomous Integrity Monitoring (RAIM)/Fault Detection and Exclusion (FDE)." Rationale: a key element is that for safety reasons the receivers must be upgraded to provide integrity to the pilot. Also, change bullet 7 to "OMAR ground and avionics system" as both are required.

Second paragraph. This paragraph is not accurate. Performance tradeoffs were accomplished. The four major requirements areas in the Tiger Team Assessment were Performance, Safety, Deployability, and Schedule. The performance requirement was already the least stringent for precision landing (Category 1) and was therefore not traded off. It was not considered appropriate to tradeoff Safety as AMC requires an equivalent level of safety as called for by FAA and ICAO standards. The Deployability and Schedule thresholds were varied to determine sensitivity. Doubling the deployment requirement or adding 50% (6 months) to the schedule requirement produced no "knee in the curve." If the solution did not fall within AMC requirements, the system was determined to be of no benefit over existing systems, regardless of cost.

Third paragraph. This paragraph is incomplete. The TTLS system provides promise and is still being studied under the JPALS program. However, it has significant deficiencies in its ability to meet near term AMC requirements. Specifically, the TTLS is deficient (RED) in the areas of Deployability and Schedule. Its System Specification calls for a setup time of 24 hours which is 4 times the AMC requirement. From a schedule standpoint, the TTLS is a developmental system that has challenging hurdles to overcome to meet

Revised

Final Report  
Reference

rigorous deployed environment requirements, Analysis and testing of reliability and environmental compliance are ongoing. Engineering schedule estimates add additional development time to those provided directly from the TTLS vendor. Analogous experience by program managers and system engineers with the MMLS and other similar systems, shows that design updates are inevitably required after development and operational testing. The nature of the updates usually relates to ground based systems deployment capability and operator interface. Estimates of availability were 9-12 months beyond the AMC need date. In addition, the TTLS suffers from limited performance capabilities. Specifically, the system can only service one aircraft at a time on final approach which would not meet the majority of AMC deployment scenarios The TTLS vendor, ANPC, informally proposed a 12- 18 month development program with attendant R&D cost (approximately \$3.5M) to incorporate growth features. ESC plans to recommend an operational evaluation of TTLS to AMC to determine utility and suitability to meet future requirements. ESC is also continuing to monitor the TTLS development and test program and review contract documentation as it becomes available.

Conclusion (page 15)

First paragraph:

“IOC of October was unrealistic”

Nonconcur.

This is not accurate. AMC/CC validated Combat Mission Need Statement which was approved by the Chief of Staff of the Air Force on 11 Dec 96, called for an IOC of 30 Oct 97.

“the Air Force abbreviated the proposed testing of the PLSR on the C-1 7”

Nonconcur.

This is not an accurate statement. PLSR testing on the C-17 is not abbreviated. Developmental testing is being conducted in accordance with AFI99-101 and will demonstrate full PLSR functionality. All testing recommended by AFOTEC will be conducted.

Second paragraph:

“MLS technology for precision landing in support of deployments has not been operationally proven”

Nonconcur.

Revised

This is not an accurate statement. **MMLS** technology in a tactical scenario was demonstrated during **IOT&E** and at Tuzla Airfield, Bosnia and Ramstein, Germany. **MLS** is a proven technology which is supported by ICAO approved Standards and Recommended Procedures (**SARPS**) and FAA approved flight inspection and terminal instrument procedures (TERPS). Additionally, in the future, deployment of the **TPN-19** and other equivalent radars in conjunction with the **MMLS** will be coordinated to provide to provide a more robust and flexible capability.

Third paragraph:

“Installation of the PLSR at this time may also inhibit the future insertion of less costly commercial, off-the-shelf components. if and when GPS technology is proved effective for precision landing capabilities.”

Nonconcur

**This is not an accurate statement.** The installation of PLSR will not inhibit insertion of commercially available off-the-shelf GPS. First, the military GPS service (Precision Positioning Service (PPS) or **P/Y-code**) is not a commercial industry due to the use of **crypto-variable** keys to provide secure accuracy to authorized users-there are no COTS products in this area. Second, the PLSR was designed to be modular and provide growth capability in processing and interfaces. The intent is to make the box adaptable to both software (reloadable over the MIL-STD-I 553 data bus) or hardware upgrades that may be required in the **future**.

The FAA has committed considerable resources and reorganized its operational structure to support development of an augmented GPS precision landing system which may be **fielded** as early as **1998**. The FAA is committed to replace most of the existing **ILS** based operations with augmented GPS operations. The GPS capability installed in the PLSR is the most advanced in the **DoD** inventory and is likely more capable than any GPS receiver commercially available. This is exemplified by its embedded Receiver Autonomous Integrity Monitoring (**RAIM**), Wide Area Augmentation System (WAAS) compatibility, local area differential GPS functionality, all in view satellite monitoring, 100% spare memory growth and spare processing speed to meet future evolving requirements.

The FAA is committed to GPS technology. The FAA other federal agencies (including **DoD**), and other nations are conducting extensive testing of this technology. While it is true that GPS is not **fully** developed for all precision landing applications, special purpose systems do exist for Special Category I (SCAT-I) landings. This is the type of Local Area Differential GPS ground station envisioned for initial use with the PLSR (**1-2** years). In addition, the FAA has plans to field the Wide Area Augmentation System within the next 2 years which the PLSR will be potentially civil interoperable. These capabilities will be available in the near term.

# Air Force Comments

---

Final Report  
Reference

Revised to  
\$105.1  
million

Page 16

Redirected

Revised and  
redirected  
Page 17

Fourth paragraph:

"The Air Force plan to install PLSR avionics units on up to 120 C- 17 aircraft before demonstrating the operational capability of the MLS and GPS technology could result in the unnecessary expenditure of more than \$109.8 million if the proposed capabilities of the PLSR cannot be effectively used during deployments."

Nonconcur.

The statement is misleading. As senior Air Force and DoD officials were informed prior to issuing direction to proceed, AMCPAC is a moderate risk program. As such, there are substantial technical, schedule and cost challenges to the program. However, as previously discussed, the AMCPAC program plan does not call for installation of PLSR units until after a favorable fielding decision has been made; a fielding decision will only be made based on planned, adequate testing. Finally, there is no Air Force documentation that can substantiate the "5109.8 million" figure

Fifth paragraph:

"We believe that the Air Force should limit the acquisition and installation of the PLSR avionics units to one C-1 7 test aircraft"

Nonconcur.

This statement ignores the facts related to the AMCPAC program. The requirements base of AMCPAC is found in the validated and approved C-MNS of 11 Dec 96.

Response to Recommendations for Corrective Action (page 16)

1.a. "Limiting the acquisition and installation of the PLSR to one C-17 test aircraft."

Nonconcur. The AMCPAC program is based on a validated mission need and is following prescribed acquisition guidelines. PLSR installation on the C-1 7 fleet will not occur until after the fielding decision, which will be supported by developmental and operational testing. The results of the Phase IIOT&E, which will verify no loss of existing capability and the addition of deployed MMLS capability, will be the basis of the decision to install the PLSR.

1.b. "Proving the operational capability and feasibility of the PLSR to provide precision landing capability in support of deployments through appropriate testing."

Nonconcur. The AMCPAC program is premised on program planning which dictates the PLSR will not be installed on the C-17 fleet until adequate testing has been accomplished

Installation will not occur until after PLSR contractor qualification testing, integration testing conducted by the C- 17 contractor. flight testing conducted by FAA personnel collaborating in an Air Force evaluation, and flight testing conducted by AFOTEC have successfully occurred.

I.c. "Evaluating the costs and benefits of continuing the use of microwave landing technology to provided precision landing capability in support of deployments."

Redirected  
Page 18

Concur. Based on fact the US, Italy, UK, Denmark and Belgium are planned users of microwave landing technology, it is important for the DoD to stay current on the costs and benefits of microwave landing technology. The Air Force believes the JPALS program and the GATO/MC2 System Program Office at the Electronic Systems Center is the right place to accomplish this.

I.d. "Evaluating the costs and benefits of the PLSR and other alternatives against established mission requirements under the ongoing DoD-wide JPALS program."

Redirected  
Page 18

Concur. The cost and benefits of the PLSR will be evaluated as part of the JPALS Phase 0 Analysis of Alternatives cost trade-off analysis along with other potential materiel alternatives.

2. "Assistant Secretary of the Air Force for Acquisition instruct program and contract officials to properly document operational requirements and to plan acquisitions as required.. ."

Revised  
Page 19

Nonconcur. Even though periodic reminders from senior acquisition officials can help program officials maintain awareness of acquisition procedures, special instructions are not warranted at this time. Program documentation reflects that AMCPAC requirements were based on a validated mission need from AMC/CC and were approved by the Chief of Staff of the Air Force. Additionally, all acquisition plans followed Air Force Instruction 63-114 and were concurred with by USD(A&T).

Page 19

Page 23

Third paragraph: This paragraph is not accurate. Operational needs were validated by the C-MNS in accordance with the RRP.

Fourth paragraph: This paragraph is not accurate. The Air Force's self-evaluation was and is adequate. The Air Force continually monitors the AMCPAC program through a variety of means to assure adequacy of management controls. This directive requires management controls which provide reasonable assurance programs are operating as intended and to evaluate for adequacy of the controls. This is being done on the AMCPAC program.

**Air Force Comments**

Final Report  
Reference

Page 29

Page 24

Revised  
Appendix D

Appendix C - Precision Landing System Receiver Program History This appendix contains an error The PLSR is capable of complete Category II functionality with the capability of Category 111 accuracy

Page 32

Page 27

First sentence This sentence is not accurate The C-MNS is a valid, documented user requirement Reference AFI 63-1 14

Page 33

Page 28

Revised

ESC prepared two UCAs for AMCPAC The first UCA approval was dated 19 Dec 96 and used for modification PO0017 which accelerated the development of the system The second one dated 19 Feb 97 supported the procurement of production units under P00018 and PO0021 of the existing contract Both of these documents along with the associated modifications were provided to the DOD/IG The statements supporting the acquisition actions were based on validated and approved C-MNS in accordance with 14 The PLSR system previously had an approved acquisition plan on file

The AMC C-MNS was validated and supported The following is documentation of the contractual actions taken by the C-1 7 SPO.

Revised  
\*  
\*

Delivery Order 0018 UCA (Contract F33657-95-D-2026) was detinitized on 25 Mar 97 for S 16 5. Attachment 1 An additional \$2 9 million of timely but non-AMCPAC software modifctatton is included in this price. Attachments 2 The AMCPAC portion of the \$16 5 million is \$13 6 million

Revised

Modification PO0046 (Contract F33657-95-C-2027) The DOD/IG value of \$3 7 million includes both AMCPAC and non-AMCPAC efforts AMCPAC items are CLIN 0028 items for a value of \$3 2 million The remaining \$ 5 million, CLIN 0026, is not an AMCPAC item. For contractual convenience, the efforts were grouped contractually on the same contract modification

Additionally, the firm proposal is now in. Attachment 3. and we estimate final prices at or below the firm proposal:

	Title	NTE	Proposal
028AA	AMCPAC Group A Hardware	\$2 9M	\$2 3M
028AB	35 A/C Installs (option to WA)	\$9 7M	\$8 1M
028AC	Field Support Sustaining	\$ 3M	\$ 2M
028AD	FY98 Installs 4 A/C (New option)	Est \$1 7	<u>\$ 7M</u>
		39 A/C Total \$1 1 3M	

\* Omitted for length. Copies available upon request.

Page 29

Sixth paragraph, **first** sentence. This sentence is not accurate. The C-MNS is a valid, documented user requirement. Reference AFI 63-114. The C-MNS was properly staffed and approved/validated by the Chief of Staff of the Air Force on 11 Dec 96.

**Seventh** paragraph, **first** sentence. This sentence is not accurate. The C-MNS is a valid, documented user requirement. Reference AFI 63-114. The use of UCAs was necessary to support the requirement. Additionally, any integration work on the C-17 would be accomplished by the Boeing Company as sole source. They maintain the drawing package as the aircraft is still in production. They are the only qualified vendor to perform avionics integration efforts on the aircraft. The PLSR effort already had an existing contract vehicle.

Page 30

**First** paragraph. This paragraph is not accurate. As this report has pointed out there is no Air Force documentation that supports a \$109.8 million program estimate.

Page 34

Page 35

Revised to  
\$105.1  
million

## **Audit Team Members**

The report was prepared by the Readiness and Operational Support Directorate,  
Office of the Assistant Inspector General for Auditing, DoD.

Thomas F. Gimble  
Robert M. Murrell  
John M. Gregor  
Len R. Wilkinson  
Gary L. Queen  
Yoon S. Sim  
Michael S. Henry  
Nancy C. Cipolla  
Noelle G. Blank