

C-5 Avionics Modernization Program (AMP) and Reliability Enhancement and Re-engining Program (RERP)

Executive Summary

- The C-5 Reliability Enhancement and Re-engining Program (RERP) will likely improve overall effectiveness of the modernized aircraft, but mission capability improvements require further assessment.
- C-5 Avionics Modernization Program (AMP) software upgrades address some of the deficiencies identified in previous operational testing, and may improve situational awareness and integrated diagnostic functionality.
- An adequately funded C-5 enterprise-wide Acquisition Strategy, fleet integration roadmap, and modernization Test and Evaluation Master Plan (TEMP) are needed to clearly define the planned and programmed modernization effort.
- Ballistic testing on a production-representative C-5 RERP pylon demonstrated that threat impacts to fuel and hydraulic lines can produce sustained fires.

System

- The C-5 is the largest four-engine, military transport aircraft in the United States. The C-5 has 36 pallet positions and can carry a maximum payload of 270,000 pounds. The typical crew size is seven.
- The AMP incorporates a mission computer, a glass cockpit with digital avionics (including autopilot and auto-throttles), and state-of-the-art communications, navigation, and surveillance components for air traffic management functionality.
- The RERP provides reliability enhancements, plus new commercial engines, nacelles, thrust reversers, and pylons.



Mission

- Units equipped with the C-5 perform strategic airlift, emergency aero-medical evacuation, transport of brigade-size forces in conjunction with other aircraft, and delivery of outsize or oversize cargo (cargo that does not fit on a standard pallet) to the warfighter.
- Units equipped with the C-5 execute missions at night, in adverse weather conditions, and in civil-controlled air traffic environments around the world. As the C-5 receives in-flight aerial refueling, the units are capable of completing extended-range missions.

Prime Contractor

- Lockheed Martin

Activity

- USD(AT&L) restructured, recertified to Congress, and designated RERP as an Acquisition Category 1D program in February 2008, following a Nunn-McCurdy breach in late FY07. The scaled-down program now includes 49 RERP production aircraft: 47 B models and two C models. Including the three test aircraft, there will be a total of 52 RERP aircraft.
- The RERP Milestone C Acquisition Decision Memorandum (ADM) allowed the restructured program to enter low-rate initial production (LRIP). The first LRIP lot will be for one aircraft, delivered in late FY10 after operational testing finishes.
- The Integrated Test Team is in the process of updating the TEMP. The Milestone C ADM required an update to the C-5

TEMP for all planned RERP activity by June 2008 and an additional update that would address all C-5 fleet-wide updates by the December 2008 Integrated Program Review (IPR).

- The Air Force Operational Test and Evaluation Center (AFOTEC) completed its report on a second operational assessment on RERP in December 2007, in time to support the Milestone C decision in March 2008. AFOTEC determined that the RERP was progressing to enhance overall C-5 effectiveness; however, results from data assessing mission capability rates were inconclusive.
- AFOTEC began a third operational assessment in June 2008, in accordance with the DOT&E-approved plan. Results from the OA-3 will support the December 2008 IPR.

AIR FORCE PROGRAMS

- RERP developmental testing on the three designated test aircraft (two B model and one A model) continued through FY08, nearing completion of the four-year developmental test effort. The test team flew over 400 flights and 1,100 hours during the developmental period through August 2008, which included a four-day outside the continental United States (OCONUS) Integrated System Evaluation (ISE). A second ISE mission is planned for December 2008, over the Pacific, encompassing 11 missions in 8 days, outside of OCONUS.
- The C-5 Program Offices are pursuing parallel efforts to upgrade software and hardware for both the RERP and the AMP aircraft.
- The C-5 AMP BCC07 upgrade completed developmental testing on one operational AMP-modified C-5B aircraft at Travis AFB, California. Developmental testing included both ground and flight test activity, involving over 80 flight hours and an OCONUS ISE. AFOTEC will conduct follow-on operational testing starting in early FY09, to support AMC's fielding decision for BCC07 in early 2009. The next upgrade to the AMP aircraft, BCC03, has just begun.
- C-5 RERP production version 3.3, completed developmental flight test in September 2008. Upgrade version 3.4 is in the works and the Air Force is planning to incorporate prior to the start of operational testing.
- Ballistic testing conducted on a production-representative pylon for the C-5 RERP pylon showed that threat impacts onto hydraulic and fuel lines could cause sustained fires for all threats tested.
- C-5 RERP will likely improve overall mission effectiveness of the modified fleet; however, the extent to which it will meet the mission capability rate requires further assessment.
- C-5 AMP BCC07 addresses deficiencies found during IOT&E in 2006 and will likely improve aircrew situational awareness and integrated diagnostic functionality.
- The C-5 modernization strategy, C-5 Fleet Integrated Roadmap, and TEMP are in progress. The Air Force needs to adequately fund deficiency correction and sustainment.
- The new pylon design separates the flammable fluids from potential ignition sources to reduce the possibility of a safety-related fire. However, this design does not offer protection from ballistic threats and the pylon has no effective fire suppression system.

Recommendations

- Status of Previous Recommendations: The Air Force has made satisfactory progress on all but one of the previous recommendations.
- FY08 Recommendations.
 1. The program should consider modifying the current engine nacelle fire suppression system to provide expanded fire suppression into the pylon.
 2. The C-5 enterprise should address remaining deficiencies identified during AMP IOT&E in upcoming AMP BCC software builds and RERP follow-on development.
 3. The Air Force should apply lessons learned from the AMP IOT&E, e.g., ensuring technical orders are fully validated and verified prior to the start of RERP IOT&E.
 4. The Air Force should develop and deliver an adequate fleet integration roadmap that addresses all modernization efforts and configuration management of the entire C-5 fleet. The roadmap should be updated annually.

Assessment

- Although restructured, the C-5 RERP will not have a production aircraft for IOT&E until 4QFY09. AFOTEC will use the three SDD aircraft, from the developmental testing period and reconfigured as production-representative for the IOT&E, to support the full-rate production decision.