

KC-46A

Executive Summary

- DOT&E approved the post-Milestone B Test and Evaluation Master Plan (TEMP) in January 2013. The TEMP approval memorandum identified planned test program shortfalls that require resolution prior to the Milestone C TEMP approval.
- Readiness for the scheduled start of IOT&E continues to be high-risk with a 12-month delay expected. It is unlikely that Boeing and the Air Force will develop a schedule that delivers 18 different certified receiving aircraft, as described in the Milestone B TEMP, prior to the start of familiarization training for the IOT&E.
- The program has made advances in collecting and analyzing live fire test data needed to address the KC-46A vulnerability to threat-induced dry bay fires, threat-induced wing structural failures, and flight deck armor effectiveness.

System

- The KC-46A aerial refueling aircraft is the first increment of replacement tankers (179) for the Air Force's fleet of KC-135 tankers (more than 400).
- The KC-46A design uses a modified Boeing 767-200ER commercial airframe with numerous military and technological upgrades, such as the fly-by-wire refueling boom, the remote air refueling operator's station, additional fuel tanks in the body, and defensive systems.
- The KC-46A is intended to provide boom (pictured) and probe-drogue refueling capabilities. The Air Force intends to equip the KC-46A with an air-refueling receptacle so that it can also receive fuel from other tankers, including legacy aircraft.
- The KC-46A is designed to have significant palletized cargo and aeromedical capacities; chemical, biological, radiological, nuclear survivability; and the ability to host communications gateway payloads.
- Survivability enhancement features are incorporated into the KC-46A design.
 - Susceptibility is reduced with an Aircraft Survivability Equipment suite consisting of Large Aircraft Infrared



Countermeasures, the ALR-69A Radar Warning Receiver (RWR), and a Tactical Situational Awareness System. The suite is intended to compile threat information from the RWR and other on- and off-board sources and prompt the crew with an automatic re-routing suggestion in the event of a threat.

- Vulnerability is reduced through the addition of fuel tank inerting and integral armor to provide some protection to the crew and critical systems.

Mission

Commanders will use units equipped with the KC-46A to:

- Perform air refueling to accomplish six primary missions to include nuclear operations support, global strike support, air bridge support, aircraft deployment, theater support, and special operations support. Secondary missions will include airlift, aeromedical evacuation, emergency aerial refueling, air sampling, and support of combat search and rescue.
- Operate in day/night and adverse weather conditions over vast distances to support U.S., joint, allied, and coalition forces.
- Operate in a non-permissive environment.

Major Contractor

The Boeing Company, Commercial Aircraft in conjunction with Defense, Space & Security – Seattle, Washington

Activity

- The KC-46A Integrated Test Team met quarterly from April 2011 through June 2014. The September 2014 meeting was postponed pending resolution of design and contractual issues.
- DOT&E approved the post-Milestone B TEMP in January 2013, with caveats.
- DOT&E approved the Air Force Operational Test and Evaluation Center's plan for a KC-46A operational assessment to support the Milestone C decision.
- Developmental, operational, and Federal Aviation Administration test planning is in progress. The contractor's preliminary Stage 4 (final build) test plans were submitted to the Air Force. More than 90 percent of the plans were accepted.
- Initial flight of the first Engineering and Manufacturing Development (EMD) aircraft is more than five months late, primarily due to electrical wiring design complexity. The

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KC-46A has approximately 60 percent more wiring than Boeing's commercial 767-200 aircraft.

- Test venues for the ALR-69A RWR and the AAQ-24 Large Aircraft Infrared Countermeasures system have been agreed to by all parties. Detailed test planning for each venue remains to be completed.
- The Air Force planned and executed three major live fire test series: (1) Center Wing Dry Bay Fire Vulnerability, (2) Wing Hydrodynamic Ram Evaluation, and (3) Armor Effectiveness.
- Boeing is preparing draft detailed test plans for Electromagnetic Pulse (EMP) testing based on the contract-specified design margin of 6 decibels (dB), which provides a higher-risk hardening approach.

Assessment

- DOT&E identified shortfalls in the planned test program that require resolution prior to Milestone C TEMP approval. The TEMP requires increased detail in a number of areas. The Air Force is addressing shortfalls in the planned test program.
 - Mitigation is needed for the impact of concurrent activities and planned flying hours for the EMD program that place a high demand on limited aircraft and simulator resources.
 - The operational test aircrew and maintenance personnel must have time to attain their training requirements and establish proficiency in operationally representative conditions before the start of IOT&E.
 - The technical order verification process must be completed before the start of IOT&E.
 - Sufficient calendar time must be allotted for correction of discrepancies and/or deficiencies discovered during developmental testing prior to the planned start of operational testing.
- The Air Force is continuing to analyze existing schedule risks and potential mitigations. DOT&E analysis of Boeing schedules with regard to aerial-refueling certifications, aircraft and support equipment technical orders, and operator/maintainer training indicates that operational testing will likely slip at least 12 months. It is unlikely that Boeing and the Air Force will develop a schedule that delivers 18 different certified receiving aircraft, as described in the Milestone B TEMP, prior to the start of training for the IOT&E. Also, until all detailed test plans (known as Stage 4 test plans) are approved, DOT&E will not have sufficient insight to determine if there are adequate mitigations to reduce the schedule risks prior to the start of IOT&E.
- The test team is working a cybersecurity strategy to be consistent with DOT&E guidance; however, specific details to execute an adequate test are not yet defined.
- The first flight of the initial KC-46A aircraft scheduled for January 2015 is now planned for April 2015. This delay will alter the planned certification schedule of Phase I receiving aircraft and may delay the August 2015 Milestone C decision.
- Analysis of the wing-leading edge, wing-trailing edge, and live fire test data for the center wing dry bay fire confirmed the vulnerability of the KC-46A to dry bay fires. Subsequent

analysis will follow completion of the Fuselage Dry Bay Fire Vulnerability and Wing Dry Bay Fire Sustainment test series in FY15 to determine if sufficient data were obtained to quantify the most significant dry bay fire ignition and sustainment factors affecting overall KC-46A survivability.

- Live fire test data identified the KC-46 threat-induced structural limitations as a function of several engagement conditions. Post-test data analysis is ongoing to: (1) improve modeling and simulation accuracy, (2) assess flight load-carrying capability for engagement conditions beyond the test design space, and (3) assess structural failure limits as a function of dynamic loads.
- Preliminary analysis of the KC-46 armor performance demonstrated the expected armor effectiveness against a specification threat with 80 percent confidence. Test data were also collected to assess the performance of the installed armor against the specification threat and two other operationally representative threats. Evaluation of the effects of these data on the overall crew protection assessment is ongoing and will address a range of engagement conditions.
- The KC-46 EMP design margin was based on Military Standard (MIL-STD)-2169. After the fixed-price contract was awarded, a new MIL-STD-3023 was released that called for tanker aircraft to meet a 20 dB EMP design margin versus a 6 dB EMP design margin. The actual KC-46 EMP design margin should be determined.
- The TEMP and other test documents do not address detailed Information Assurance (IA) protect, detect, react, and restore requirements. The program has begun to address these shortfalls by planning additional testing and crew IA training through the IA Working Group.

Recommendations

- Status of Previous Recommendations. The Air Force addressed one of the FY12 recommendations to incorporate realistic assumptions in test plans; however, additional work is still needed. The Air Force still needs to address the remaining FY12 and FY13 recommendations to:
 1. Submit a TEMP with a realistic schedule mitigating the above mentioned shortfalls.
 2. Provide an approach to correct the ALR-69A RWR shortfalls prior to integration on the KC-46A.
 3. Plan to begin IOT&E at least 12 months later than the current TEMP indicates to allow for completion of developmental test and initial training.
 4. Provide a comprehensive aerial-refueling certification plan for the KC-46A including all EMD Phase 1 and 2 receivers.
 5. Plan testing against realistic cybersecurity threats to identify vulnerabilities for correction. In addition, plan follow-on penetration testing to assess IA performance in terms of protect, detect, react, and restore functions.
- FY14 Recommendation.
 1. The Air Force should conduct EMP testing to assess the actual EMP design margin of the KC-46.