

KC-46A Pegasus



The Air Force has collected all achievable IOT&E aerial refueling (AR) and secondary mission data on the current configuration of KC-46A until the program updates the Wing Aerial Refueling Pods (WARPs), refueling boom, and Remote Vision System (RVS). Testing completed in FY23 included centerline drogue AR of the CV-22 and the remaining KC-10 refueling the KC-46A test events. The Air Force continues to work with Boeing to develop critical upgrades to the refueling boom and RVS, with IOT&E expected to be completed on those systems in FY24 and FY25, respectively. WARP testing was delayed by identified Federal Aviation Administration (FAA) certification non-compliance items, which are expected to be resolved no later than 1QFY24, forging a pathway for IOT&E testing continuation in FY24.

SYSTEM DESCRIPTION

The KC-46A tanker aircraft is a modified Boeing 767-200ER commercial airframe with military and technological upgrades. KC-46A upgrades include a fly-by-wire refueling boom, centerline and WARP hose-drogue baskets, a dual-remote Air Refueling Operator Station enabled by an exterior RVS, additional fuel tanks in the body, a boom refueling receiver receptacle above the cockpit, a Boeing 787 digital cockpit update, Large Aircraft Infrared Countermeasures, a modified ALR-69A radar warning receiver, and Tactical Situational Awareness System that integrates input from the Radio Frequency Self Defense System (RFSDS). The KC-46A cargo bay is designed to accommodate palletized cargo, aeromedical evacuation equipment, and roll-on command, control, and communications gateway payloads.

MISSION

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

- Perform AR in support of six primary missions of nuclear operations support, global strike support, air bridge support, aircraft deployment support, theater support, and special operations support.
- Accomplish the secondary missions of airlift, aeromedical evacuation, emergency AR, air sampling, and support of combat search and rescue.

PROGRAM

The KC-46A Pegasus is an Acquisition Category IC program intended to be the first increment of 179 replacement tankers for the fleet of more than 400 KC-135 and KC-10 tankers. DOT&E approved the Milestone C Test and Evaluation Master Plan update in 2016 and the IOT&E test plan in April 2019. In a May 2020 memorandum, DOT&E communicated to the Assistant Secretary of the Air Force for Acquisition, Technology, and Logistics that DOT&E will not submit an IOT&E report on KC-46A until operational testing of a production-representative RVS is complete. The Air Force expects a corrected RVS (version 2.0) to be ready for operational testing in mid-FY25. Air Mobility Command (AMC) completed the interim capability releases process and concludes that the KC-46A is ready for worldwide use. In September 2022, AMC approved the KC-46A as a deployable asset, capable of performing operations as tasked by the U.S. Transportation Command.

» MAJOR CONTRACTOR

- Boeing Commercial Airplanes in conjunction with Boeing Defense, Space & Security – Seattle, Washington

TEST ADEQUACY

KC-46A testing in FY23 included centerline drogue refueling of the CV-22 and finishing the

remaining KC-10 refueling of the KC-46A test events. The Air Force Operational Test and Evaluation Center (AFOTEC) concluded all the achievable IOT&E data collection for AR and secondary missions utilizing the current KC-46A configuration. AFOTEC has collected 82 percent of the planned IOT&E flight test data but cannot complete IOT&E until the program achieves certification of the WARP system and implements the final boom and RVS upgrades. AFOTEC published a classified annex to its seventh periodic report in June 2023, which summarized the findings of the RFSDS integrated testing in FY22. The Air Force also completed electromagnetic pulse testing of the KC-46A in FY23.

KC-46A IOT&E has been ongoing since May 2019. AFOTEC has continued to collect data, in accordance with the DOT&E-approved test plan, to support assessments for sortie generation, AR, airlift, aeromedical evacuation, survivability through threat avoidance, and sustained operations under adversarial cyberattack conditions. DOT&E has been periodically observing and continually monitoring all IOT&E testing.

In November 2022, a KC-46A crew from the 157th Air Refueling Wing set an Air Mobility Command endurance record with a 36-hour refueling mission over the Pacific initiated from Pease Air National Guard Base, New Hampshire. In addition to ongoing receiver qualification and IOT&E, Air Mobility Command tasked the KC-46A to participate in

several exercises in FY23, such as MOBILITY GUARDIAN in July 2023. In FY23, the KC-46A Joint Reliability and Maintainability Evaluation Team completed adjudication of all maintenance records over the contract-required 50,000 fleet flight hours.

AFOTEC began a third and final phase of cooperative cyber survivability testing in September 2023 and plans to complete the cooperative vulnerability and penetration assessment by December 2023 with a second adversarial assessment phase in FY24. Flight testing of the new boom actuator is expected to begin in late FY24, and flight testing of the new RVS will follow in FY25. Previous IOT&E of the WARP system, scheduled for April 2023, was suspended pending resolution of FAA certification issues. An Agreement In Principle (AIP) was signed between the Air Force and Boeing in August 2023. The AIP enables a continuation of Lot 2 WARP deliveries, provides conditional DD250 transfer from the contractor to the Air Force, and documents a commitment to resolve burdensome maintenance tasks. The FAA certification criteria for thin skin (bird strike/lightning) protection still needs to be addressed with resolution expected by 1QFY24. If resolved, IOT&E could resume in FY24 for WARP testing. Assuming RVS 2.0 upgrades are completed in mid-FY25, IOT&E will resume and DOT&E expects to complete its assessment and issue an IOT&E report post data collection and analysis.

PERFORMANCE

» EFFECTIVENESS

The KC-46A continues to operate under the interim capability releases to support most mission requirements; however, restrictions persist on boom refueling due to RVS and boom deficiencies. Problems with the RVS also degrade the effectiveness of boom AR under certain lighting conditions. Furthermore, a problem with the boom telescope actuator control can cause excess loads during receiver contact, making it difficult for some receivers to maintain contact position, and/or lead to contacts outside of the receptacle. This has prevented boom AR of the A-10 until the boom actuator redesign is complete, but the excess boom loads are noticeable even with large aircraft such as the C-17. These shortfalls in RVS and the boom represent three of the remaining six open Category 1 deficiencies the program office is tracking. The remaining Category 1 deficiencies involve leaks in the fuel manifold system, cracks and leaks in the refueling receptacle drain line, and cracks in the auxiliary power unit drain mast. Two previous Category 1 deficiencies were downgraded to a Category 2 status. The program office will continue to address the downgraded Category 1 deficiencies despite their new status. The first downgraded deficiency addresses Flight Management System (FMS) instabilities. A software release was provided in April 2023 and the

system was monitored to ensure known instabilities are fixed. The FMS deficiency status will be reviewed again in September 2023 and is expected to be closed if no further instabilities present. The second Category 1 deficiency that was downgraded to Category 2 documents unexpected failures during pressure testing of the boom telescope tube assembly. This deficiency is completing the final investigation steps prior to documenting a timeline for future resolution. As of August 2023, the program office was actively addressing six open Category 1 deficiencies.

The WARP system was not able to enter IOT&E or be released for operational employment, because it failed several compliance criteria for FAA supplemental-type certification. Developmental testing occurred on an experimental airworthiness approval for prototype hardware, but production hardware did not meet certification requirements such as cowling bird strike, lightning tolerance, and wiring corrosion protection. The program is addressing these shortfalls and is expecting the WARP system to be ready for operational test at the end of 1QFY24.

As reported in the FY22 Annual Report, cargo operations are still severely limited by a lack of technical data and procedures that are available to legacy aircraft to support safe cargo operations. Cargo deficiencies were segregated into 15 specific cargo loading projects managed by a Cargo Loading Tiger

Team. Consistent with DOT&E's recommendation in the FY22 Annual Report, the Air Force continues to address the cargo-related deficiencies to improve cargo-carrying operations. At the end of FY23, 6 of the 15 projects were completed with the remaining in projects in work. The program office is working with Boeing to develop an improved KC-46A cargo operations manual expected for delivery by 3QFY24.

» **SUITABILITY**

The program office is attempting to address suitability problems, but operational availability (≥ 80 percent threshold) and mission capable rate (≥ 90 percent threshold) remained steady at well below their threshold requirements throughout FY23. A notable factor adversely affecting availability metrics is the time-based maintenance driven by underlying commercial 767 requirements, along with commercial parts supply chain delays that contribute to a significant portion of the aircraft down-time. The program office is working with Boeing, the Defense Logistics Agency, and the Air Force Sustainment Center to develop Air Force-specific maintenance schedules and improve supply logistics.

Problems with the Automatic Performance Tool (APT) for calculating aircraft weight and balance contributed to delays and cancellations of operational KC-46A mission taskings. Furthermore, the technical publications for KC-46A that are composed of substantial baseline

commercial 767 information do not allow Air Force personnel to employ common approaches to deal with weight and balance discrepancies with the APT.

» **SURVIVABILITY**

AFOTEC published a classified report in June 2023 detailing the integrated test of the RFSDS and does not plan any further testing of the current system during IOT&E. DOT&E is awaiting the final test data for analysis, but preliminary findings show that the program should continue to work on software updates to the RFSDS to improve the aircrew interface and the clarity of information presented to support threat avoidance capabilities. Active and passive system electromagnetic pulse testing in FY21 indicated that the KC-46A has basic survivability in a nuclear environment. The program conducted electromagnetic pulse direct electric current testing in FY23 to determine the extent of that survivability; DOT&E is awaiting the test data for analysis and will include the results of that analysis in the KC-46A IOT&E report.

RECOMMENDATIONS

The Air Force should:

1. Resolve the remaining six Category 1 deficiencies.
2. Address problems with the WARP design to obtain the FAA airworthiness certification needed for completion of IOT&E and operational fielding.

3. Develop KC-46A-unique sortie generation and maintenance schedules to improve mission reliability and aircraft availability over what current civilian technical data and certifications allow.
4. Complete development, with Boeing, of an improved KC-46A cargo operations manual.