

F-22A – Raptor Advanced Tactical Fighter Aircraft



The Air Force is modernizing the F-22A with a series of capability releases delivered once every 12 – 18 months. In February 2025, DOT&E published a classified combined early fielding and LFT&E report on the F-22A Release 3 (R3) Operational Flight Program (OFP). The Air Force completed operational testing on the R4 OFP in FY25. DOT&E plans to publish a classified FOT&E report summarizing the results of R4 testing in the first half of FY26. The lack of instrumentation in the F-22A operational test aircraft to provide high-fidelity accurate mission-level results continues to restrict the Air Force's ability to accomplish adequate mission-level evaluations. A model of Sensor Enhancement (SeE) for the Joint Simulation Environment (JSE) will be important for adequate operational effectiveness testing, but development of the model is currently unfunded.

SYSTEM DESCRIPTION

The F-22A Raptor is a fifth-generation, air-superiority fighter aircraft that delivers low observability versus threat radars, high maneuverability, sustained supersonic speed, and advanced

integrated avionics. The Air Force is modernizing the F-22 hardware and software via the F-22 Raptor Agile Capability Release program. Capability releases take place every 12 – 18 months and are focused on sensor upgrades, data link upgrades, and survivability enhancements.

MISSION

Units equipped with the F-22A conduct offensive counter-air, defensive counter-air, and limited ground attack missions in high-threat environments, delivering air superiority to enable coalition air operations.

PROGRAM

The F-22A Raptor started as a major capability acquisition program, with the first production aircraft fielding in 2003. To modernize the fleet, the Air Force initiated hardware and software modernization efforts under the Middle Tier of Acquisition rapid prototyping pathway, eventually transitioning most of those efforts to traditional Acquisition Category programs. The R4 OFP is the current focus of F-22A FOT&E, and R5 software is in development. The Air Force intends to deliver SeE, which should significantly upgrade the capability of the F-22A, with R6.

The Tactical Link 16 and Tactical Mandates TEMP, approved by DOT&E in 2018, supported testing through the R2 Force Development Evaluation (FDE). DOT&E published a classified R2 FOT&E report in March 2024. DOT&E approved the R3 test plan and a combined R3/R4 TEMP in 4QFY23. DOT&E published a classified combined early fielding and LFT&E report on F-22A Capability R3 OFP in February 2025. DOT&E approved the R4 test plan in January 2025 and observed the R4 test events in February 2025. DOT&E will publish a classified FOT&E report on R4 testing in FY26.

The F-22 Program Office is writing an F-22 Overarching TEMP that contains test planning details for future capability releases up to R10 in FY26. The program office will provide shorter, more detailed TEMP annexes that outline and resource testing for specific capability releases on an annual cadence. The Air Force Operational Test and Evaluation Center is

writing an accreditation plan to use the JSE for SeE IOT&E testing.

» MAJOR CONTRACTOR

- Lockheed Martin Aeronautics Company – Fort Worth, Texas

TEST ADEQUACY

» OVERARCHING CHALLENGES

The lack of instrumentation, such as the Common Range Integrated Instrumentation System (CRIIS) and Open-Air Battle Shaping (OABS), in the F-22A operational test aircraft to provide high-fidelity accurate mission-level results continued to restrict the Air Force's ability to accomplish adequate mission-level evaluations in FY25. DOT&E required F-22A capability releases, starting with R1, to use high-fidelity, real-time kill removal instrumentation for accurate mission-level results during operational flight test events. This capability is also needed for the Air Force to use data collected during operational flight tests for verification, validation, and accreditation (VV&A) of the F-22A model in the JSE, which is required for SeE testing.

Technical challenges have prevented the Air Force from integrating a capability to provide high-fidelity, real-time kill removal for accurate mission-level results with the F-22A. Omissions in the F-22A OFP and delays integrating the requisite hardware to utilize OABS, the currently identified pathway for delivering the capability, have prevented the CRIIS/OABS solution from functioning. No F-22A operational test events to date have used

OABS or an equivalent capability, making effectiveness testing inadequate.

The Air Force needs to use the JSE to test capability upgrades that are part of the SeE program. The adequacy of future testing of the F-22A with the planned SeE capability is at risk, because delivery of the SeE model for the JSE is unfunded. Moreover, the required environment upgrades to the JSE baseline may not be delivered in time for the IOT&E of the F-22A model with SeE.

» R3 FOT&E

R3 FOT&E testing included FDE flight test events in FY24, suitability testing, a cyber vulnerability investigation (CVI) event, and a live fire evaluation of the low-drag fuel tanks, pylons, and sensor pod. FOT&E was adequate to determine operational suitability and survivability; however, FOT&E was not adequate to determine operational effectiveness, because the capability to provide high-fidelity, real-time kill removal for accurate mission-level results has not been integrated onto the aircraft. The Air Force also conducted R3 test events that included live employment of three AIM-120 Advanced Medium-Range Air-to Air Missiles (AMRAAM). This was the only portion of integrated testing that DOT&E observed.

» R4 FOT&E

R4 FOT&E testing in FY25 included an FDE flight test event, suitability testing, and a CVI event. DOT&E observed the FDE flight test event in February 2025. The aircraft used for the FDE were operationally representative, and all missions took place in accordance with the

DOT&E-approved test plan. DOT&E observed AIM-120 AMRAAM employment during Weapon System Evaluation Program integrated test events and the R4 CVI event in May 2025. The CVI took place at the Agile Integration Laboratory in St. Louis, Missouri. An on-aircraft cooperative vulnerability and penetration assessment planned for April 2025 was canceled because of scheduling conflicts.

PERFORMANCE

» EFFECTIVENESS

DOT&E did not assess R3 operational effectiveness because the capability to provide high-fidelity, real-time kill removal for accurate mission-level results has not been integrated onto the aircraft, resulting in testing being inadequate.

DOT&E will assess R4 operational effectiveness in a classified R4 FOT&E report in FY26.

» SUITABILITY

The R3 upgrade for the F-22A is not operationally suitable. While hardware reliability has improved relative to R2, the F-22A is still not maintainable without contractor support. Air Force maintainers rely on Lockheed Martin contractors to diagnose hardware failures. Additional details are discussed in the DOT&E classified R3 combined early fielding and LFT&E report published in February 2025.

DOT&E will assess R4 operational suitability in a classified R4 FOT&E report in FY26.

» SURVIVABILITY

The cyber survivability of the F-22A's Identification, Friend or Foe Transponder Mode 5 and Link 16 within the F-22A open system architecture, as well as the results from the LFT&E vulnerability assessment of the low-drag fuel tanks, pylons, and sensor pod, are discussed in the DOT&E classified R3 combined early fielding and LFT&E report published in February 2025.

DOT&E will assess R4 cyber survivability in a classified R4 FOT&E report in FY26.

activities to ensure data collection requirements in the JSE VV&A plan occur during open-air testing.

RECOMMENDATIONS

As recommended in the FY24 Annual Report, the Air Force should:

1. Conduct all future mission-level evaluations of the F-22A with the capability to provide high-fidelity, holistic mission evaluations of new capabilities in operationally representative environments. The data collected via such capabilities are critical for accomplishing the VV&A of the F-22A model in the JSE.
2. Fund and contract for the delivery of the SeE model in time to complete VV&A prior to its use in the JSE, which is required for F-22A SeE IOT&E.
3. Continue to prioritize integration of the required JSE environment upgrades necessary to accomplish adequate testing during F-22A SeE IOT&E.
4. Incorporate VV&A requirements for F-22A operations with SeE in the JSE into flight test