

# F-22A – Raptor Advanced Tactical Fighter Aircraft



In March 2024, DOT&E published a classified FOT&E report on the F-22A Release 2 (R2) Operational Flight Program (OFP) discussed in the FY23 Annual Report. In FY24, the F-22A program completed Force Development Evaluation (FDE) on the R3 OFP, their third annual capability release. DOT&E will publish a classified report on the R3 FDE in 2QFY25. Operational testing of the next capability release, R4, will begin in 1QFY25. During R3 testing, the Federal Aviation Administration (FAA) restricted Link 16 transmission, an ongoing issue that has impeded both testing and utilization of a combat capability already installed in the aircraft. Moreover, the lack of Open-Air Battle Shaping (OABS) instrumentation in the F-22A operational test aircraft continues to restrict the ability to accomplish adequate mission-level evaluations.

## 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 F-22 capability release program adds to the F-22A's already significant combat capability via increments that were originally planned for release annually, but have been extended to 18-month durations.

## 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. Since 2019, the Air Force has been implementing hardware and software modernization efforts as capability releases. The Tactical Link 16 and Tactical Mandates TEMP, approved by DOT&E in 2018, supported testing through the R2 FDE. DOT&E published a classified FOT&E report on the R2 testing in March 2024 and expects to publish a classified FDE report on the R3 testing in 2QFY25.

DOT&E approved the R3 test plan and a combined R3/R4 TEMP in 4QFY23. The R3/R4 TEMP provides a capstone test strategy and test concept for these two capability releases. DOT&E expects incremental updates to the TEMP every two capability releases, beginning with R5, planned for FY25. Planning for the next F-22A capability release, R4, is complete and operational testing will begin in 1QFY25.

### » MAJOR CONTRACTOR

- Lockheed Martin Aeronautics Company – Fort Worth, Texas

## TEST ADEQUACY

Prior to executing the operational testing portion of the DOT&E-approved F-22 R3 OFP FDE Test Plan, the Air Force recommended the OFP for Combat Air Force fielding. The Air Force decision was based on OFP maturity during integrated testing (IT) and on validation of deficiencies identified prior to fielding. R3 IT also included live employment of three AIM-120 Advanced Medium-Range Air-to-Air Missiles. This was the only portion of IT that was observed by DOT&E. Furthermore, the required OABS capability was not available during the R3 IT events.

The OABS limitation, which was also a limitation during testing of R1 and R2 OFPs, stemmed from omissions in the F-22A OFP and delays integrating the Common Range Integrated Instrumentation System (CRIIS) hardware into the

F-22A. CRIIS is the current flight test instrumentation capability needed for OABS in the F-22A. OABS enables high-fidelity, real-time, kill removal for accurate mission-level results and the collection of critical data that will be used during verification, validation, and accreditation (VV&A) of the F-22A in the Joint Simulation Environment (JSE).

A longstanding Link 16 test limitation, which stems from FAA restrictions on Link 16 transmissions, continues to challenge testing. A more thorough evaluation of the Link 16 capability in the F-22A is being coordinated with the FAA through a recent memorandum of agreement.

The adequacy of future F-22A testing with the planned Sensor Enhancement (SeE) capability is at risk because delivery of the required SeE model in time for testing of the F-22A with SeE in the JSE is not funded. Nor is the required SeE on contract or planned for being on contract. Moreover, delivery of required environment upgrades to the JSE is currently at risk of being late for testing of the required F-22A release with SeE.

The F-22 program executed an updated analysis to determine the vulnerability of new low-drag external fuel tanks, pylons, and sensor pods. DOT&E did not require an updated alternative live fire test program, deeming an updated analysis to be sufficient, assuming no significant new vulnerabilities or data gaps are discovered in this update.

## PERFORMANCE

### » EFFECTIVENESS

An evaluation of the operational effectiveness of the R2 F-22A can be found in the classified FOT&E report published in March 2024.

Since the operational test phase of the R3 FDE Test Plan was not executed, DOT&E did not evaluate the mission-level operational effectiveness of the R3 F-22A. Analysis of the results from live weapons testing of the R3 F-22A with the AIM-120 will be discussed in the classified FDE report to be published in 2QFY25.

### » SUITABILITY

An evaluation of the operational suitability of the R2 F-22A can be found in the classified FOT&E report published in March 2024.

An evaluation of the operational suitability of the R3 F-22A will be in the classified FDE report to be published in 2QFY25.

One suitability issue that remains from R1 and R2 testing is the significant delay in receiving an avionics component from the vendor, which is critical to enabling F-22A Link 16 capabilities.

### » SURVIVABILITY

An evaluation of the cyber survivability of the R2 F-22A can be found in the classified FOT&E report published in March 2024.

Analysis of 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, will be discussed in the classified FDE report to be published in 2QFY25.

## RECOMMENDATIONS

The DoD should:

1. As recommended in the FY23 Annual Report, solidify a plan that allows routine accomplishment of Link 16 testing that demonstrates operational effectiveness and cyber survivability, while accommodating FAA protocols, restrictions, and test-specific operating procedures.

The Air Force should:

1. As recommended in the FY23 Annual Report, conduct all future mission-level evaluations of the F-22A with OABS to enable high-fidelity, holistic mission evaluations with new capabilities in operationally representative environments. The data collected by the OABS system capability is critical in accomplishment of VV&A of the F-22A in the JSE.
2. Fund and contract for the delivery of the SeE model in time to complete VV&A prior to 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 activities to ensure data collection requirements in the JSE VV&A plan occur during open-air testing.
5. As recommended in the FY23 Annual Report, prioritize addressing the delays to the delivery of Link 16 avionics components as soon as possible.