

F-15 Eagle Passive Active Warning and Survivability System (EPAWSS)



The Air Force continued to integrate software, firmware, and hardware fixes to improve the performance of the F-15 Eagle Passive Active Warning and Survivability System (EPAWSS) and address deficiencies discovered in ground and flight testing in preparation for the start of IOT&E. DOT&E approved the Air Force Operational Test and Evaluation Center (AFOTEC) IOT&E flight test plan in March 2023 and the hardware-in-the-loop test plans in July 2023. Operational testing began in July 2023 and is expected to complete in 2QFY24.

SYSTEM DESCRIPTION

The AN/ALQ-250(V)1 EPAWSS is a self-protection system intended to enable the F-15 aircrew to detect, identify, locate, deny, degrade, disrupt, and defeat air- and surface-to-air threats during operations within highly contested environments. EPAWSS replaces three functionally obsolete F-15 legacy Tactical Electronic Warfare System components: the AN/ALR-56C Radar Warning Receiver, the AN/ALQ-135 Internal Countermeasures Set, and the AN/ALE-45 Countermeasures Dispenser Set. The EPAWSS radar warning function scans the radio frequency environment and provides the aircrew with identification and location information of potential threat signals. When necessary, the system can respond with countermeasures (jamming or expendables) to defeat a threat radar or missile. EPAWSS integrates with the F-15 AN/APG-82(V)1 radar and Advanced Display Core Processor II mission computer.

MISSION

The Air Force employs the F-15E Strike Eagle as a dual-role fighter, designed to perform air-to-air and air-to-ground missions. EPAWSS provides the primary defensive suite to protect the F-15E during the conduct of both offensive and defensive missions.

The Air Force plans to employ the F-15EX in an air-to-air role, similar to the F-15C aircraft it will replace. It will be flown by active duty and Air National Guard units to perform both offensive and defensive air-to-air missions. EPAWSS provides the primary defensive suite to protect the F-15EX during counter-air missions.

PROGRAM

F-15 EPAWSS is an Acquisition Category IC program that tailored Milestone C into two decision points (DPs) to take long-lead hardware procurement off the critical path and deliver the capability as soon as possible. The Air Force Service Acquisition Executive approved the Milestone C DP 1 (Production Decision) in December 2020, authorizing the procurement of low-rate initial production aircraft retrofit kits and installation hardware; and DP 2 (Installation Decision) in June 2022, authorizing the start of fleet aircraft modifications. The first operational aircraft modification began in May 2023; the modified aircraft is due to return to the 48th Fighter Wing in 2QFY24.

Since last year's Annual Report, the Air Force revised its plan and now intends to retrofit 99 F-15Es and equip all 104 F-15EXs with EPAWSS as the aircraft are produced, with fielding due to start in FY24.

» MAJOR CONTRACTORS

- Boeing Defense, Space & Security – St. Louis, Missouri
- BAE Systems, Inc. – Nashua, New Hampshire

TEST ADEQUACY

DOT&E approved the AFOTEC IOT&E flight test plan in March 2023 and the hardware-in-the-loop test plans in July 2023. The Service is planning to submit the cyber test plan in 1QFY24.

During FY23, the Air Force completed a series of ground and flight test events as part of EPAWSS Integrated T&E. All testing was conducted in accordance with the DOT&E-approved Test and Evaluation Master Plan and test plans, and DOT&E observed all testing.

Developmental ground testing of an uninstalled system at the Integrated Demonstrations and Applications Laboratory (IDAL), Wright-Patterson AFB, Ohio, provided data to evaluate the radar warning function in the presence of a dense signal environment. The Air Force plans to conduct operationally oriented IDAL testing as part of the IOT&E in 1QFY24. The Air Force previously conducted developmental testing of the jamming effectiveness against a sample of required threats at the Electronic Combat Simulation and Evaluation Laboratory (ECSEL), Point Mugu, California,

and the Wright-Patterson Test Facility at Wright-Patterson AFB. This developmental testing was followed by operationally oriented ECSEL testing as part of IOT&E in July 2023.

The Air Force 96th Test Wing conducted flight testing of the incremental EPAWSS software releases, each integrating new capabilities with the hardware/firmware and correcting deficiencies; operational aircrews and maintainers participated in this testing. Developmental and operational testers also participated in the NORTHERN EDGE 23 multi-national exercise at the Joint Pacific-Alaska Range Complex in May to prepare for IOT&E. AFOTEC commenced IOT&E flight test missions at Nellis AFB, Nevada, in 4QFY23 and plans to complete the open-air missions in 1QFY24.

The Air Force conducted developmental cyber survivability assessments at Boeing's Electronic Systems Integration Laboratory. The Air Force plans to conduct on-aircraft operational cyber survivability testing during IOT&E. Specifically, the Service will conduct a cooperative vulnerability and penetration assessment in 1QFY24 followed by an adversarial assessment in 2QFY24.

Test resource constraints affecting all spectrum warfare systems (especially electromagnetic attack systems) significantly limit the breadth of DOT&E's assessment of EPAWSS effectiveness.

PERFORMANCE

» EFFECTIVENESS

During FY23, the Air Force continued to mature the software and hardware to address the deficiencies identified during developmental testing, prior to initiating IOT&E. DOT&E will continue to observe the IOT&E until testing concludes in 1QFY24 and will publish a classified report on its findings to support the full-rate production decision.

» SUITABILITY

Hardware failures during flight testing to date indicate the system potentially can meet its requirement for mean time between unscheduled maintenance. However, incidence of software-driven built-in test failure indications remains a concern. The rate of software anomalies requiring aircrew intervention is decreasing, but further improvement is still needed. The Air Force prioritized improvements to built-in-test capabilities prior to, and during, IOT&E execution. However, if those improvements do not rectify the inaccurate system status displayed in the cockpit, aircrews may lose confidence in EPAWSS and/or may be unaware of an actual failure. In addition, the inaccurate built-in test indications may drive unnecessary maintenance actions. These aircrew and maintainer problems may negatively affect the operations of F-15 units equipped with EPAWSS. DOT&E will continue to observe the IOT&E;

if these suitability problems remain unresolved, subsequent system improvements and an FOT&E might be required.

Air Force aircrews and maintainers are operating and supporting EPAWSS during the ongoing IOT&E using contractor-provided training, preliminary technical orders, and support equipment. Aircrews and maintainers will be surveyed through the end of the IOT&E to identify any areas of improvement. Additionally, AFOTEC plans to conduct an operationally oriented maintenance demonstration as part of the IOT&E.

» SURVIVABILITY

The Air Force completed planned developmental cyber survivability assessments, and the EPAWSS program improved the EPAWSS cyber posture by implementing and validating corrective actions based on the susceptibilities and vulnerabilities found during the developmental cyber assessments. AFOTEC plans to conduct the following on-aircraft operational cyber survivability testing during IOT&E: a cooperative vulnerability and penetration assessment in 1QFY24, followed by an adversarial assessment in 2QFY24.

RECOMMENDATION

The Air Force should:

1. As recommended in the FY22 Annual Report, implement built-in test indication improvements as part of the ongoing F-15 Continuous Development and Integration initiative.