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



In January 2024, the Air Force completed IOT&E for the AN/ALQ-250(V)1 F-15 Eagle Passive Active Warning Survivability System (EPAWSS). In July 2024, DOT&E published a classified IOT&E report, which concluded that EPAWSS is operationally effective, operationally suitable, and cyber survivable in the environment in which it was tested, but performance is unknown in modern combat environments, where test capability is lacking. Test resource shortfalls common to all electromagnetic warfare assessments constrained the Air Force's ability to assess EPAWSS electromagnetic attack (EA) performance. The Air Force should continue to assess and improve EPAWSS effectiveness and suitability as part of F-15EX FOT&E, currently planned to begin in FY25.

SYSTEM DESCRIPTION

The AN/ALQ-250(V)1 EPAWSS is a self-protection system intended to enable F-15 aircrew to detect, identify, locate, deny, degrade, disrupt, and defeat air- and surface-to-air threats during operations within highly contested environments. 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 (i.e., 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. EPAWSS replaces three 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.

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. The Air Force plans to initially employ the F-15EX in an air superiority role. It will be flown by active duty and Air National Guard units to perform both offensive and defensive air-toair missions. EPAWSS provides the primary defensive suite to protect the F-15E and F-15EX during the conduct of these 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 ensure delivery of the capability as soon as possible. The Air Force Service Acquisition Executive approved the Milestone C DP 1 (i.e., production decision) in December 2020, authorizing the procurement of low-rate initial production hardware. DP 2 (i.e., installation decision) was approved in June 2022, which authorized the start of fleet aircraft modifications. The first operational F-15E modification began in May 2023.

In June 2022, DOT&E approved the EPAWSS TEMP. DOT&E approved the IOT&E flight test plan in March 2023, the ground test plan in July 2023, and the cyber-survivability test plan in November 2023. DOT&E observed the Air Force conducting IOT&E between July 2023 and January 2024. DOT&E published the classified IOT&E report in July 2024 to support the Air Force's full-rate production decision briefing in September 2024.

The Air Force intends to retrofit 99 F-15Es and equip all 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

During FY24, the Air Force completed the EPAWSS IOT&E. The Air Force conducted the test in accordance with the DOT&Eapproved TEMP, ground, flight, and cyber survivability test plans, with two DOT&E-approved waivers. DOT&E observed all operational testing.

In December 2023, the Air Force conducted operational ground testing of EPAWSS to collect data on the system's radar warning. A ground test conducted at the Integrated Demonstrations and Applications Laboratory (IDAL), Wright-Patterson AFB, Ohio. provided data for the evaluation of the radar warning performance in an operationally representative scenario. During IDAL testing, the Air Force's 36th Electronic Warfare Squadron programmed an operationally representative Mission Data File (MDF) that was evaluated in the operationally representative background radio frequency environment. Moreover, the Air Force conducted EA effectiveness testing during July 2023 at the Electronic Combat Simulation and Evaluation Laboratory, Point Mugu, Naval Base Ventura County, California, and collected data for the

evaluation against two closed-loop threat simulators.

From August 2023 to January 2024, the Air Force flew open-air flight test missions at the Eglin Gulf Test and Training Range, Florida, and the Nevada Test and Training Range, Nevada. DOT&E used data from flight testing to evaluate EPAWSS geolocation performance and overall mission success. However, the data were not adequate for assessing EA effectiveness because of shortfalls in open-air threat representation and failure to collect comparison data of effectiveness without EPAWSS. As part of offensive and defensive counter-air missions, various fourth- and fifth-generation Air Force and Navy aircraft acted as threat surrogates against the EPAWSS-equipped F-15s.

The Air Force assessed EPAWSS suitability through developmental and operational test events starting from the release of EPAWSS Flight Bundle 9.0 in January 2023. The Air Force collected data and assessed maintainability during a maintenance demonstration conducted in January 2024 with 366th Fighter Wing maintainers. Evaluators administered surveys and interviews after flight test missions and the maintenance demonstration to collect data from aircrew and maintainers for human-systems interaction assessments. The Air Force could not collect data on EPAWSS operational availability because logistics and supply chains were not operationally representative.

To evaluate the cyber survivability of EPAWSS, the Air Force conducted a cooperative vulnerability and penetration assessment (CVPA) and an adversarial assessment (AA). The Air Force's 48th Cyberspace Test Squadron conducted the CVPA and provided technical feedback during the AA. The CVPA was conducted in a hangar on a ground-powered F-15E with EPAWSS installed. The lack of observed cyber effects during the CVPA resulted in the AA being converted to an interview with operational aircrew and maintainers.

PERFORMANCE

» EFFECTIVENESS

EPAWSS is operationally effective under the conditions the open-air test ranges could produce during IOT&E. There are limitations to testing at DoD's open-air test ranges due to infrastructure deficiencies, such that the test environment was not operationally representative of a modern threat environment. In addition. demonstrated system performance of the radar warning, geolocation, and EA capabilities highlighted areas that require improvement. Test limitations constrained characterizing EA performance during flight testing. The limited EA effectiveness data showed system performance inconsistencies between ground and flight test events, but overall results from both types of tests indicate that EPAWSS EA is potentially effective.

» SUITABILITY

EPAWSS is operationally suitable and met most of its reliability and maintainability requirements during IOT&E. Although the performance of the built-in test (BIT) system has improved since the end of developmental testing, BIT false alarms still occurred in IOT&E sorties. Assessments of the suitability impacts of BIT false alarms and the performance of the Fully Automated Debrief System are available in the classified DOT&E test report published in July 2024. The report also includes classified recommendations to improve suitability. The MDF generator software used to assemble threat parameters into an MDF is hard to use and too slow to meet updated Air Force requirements. The 36th Electronic Warfare Squadron submitted 20 documented program deficiencies for the current version of the MDF generator.

» SURVIVABILITY

EPAWSS is survivable against cyber threats emulated during the IOT&E. The cyber test team was unable to generate significant adverse cyber effects on the installed EPAWSS system.

RECOMMENDATIONS

The Air Force should:

 Continue to improve EPAWSS as described in the classified IOT&E report, and test it as part of F-15EX FOT&E. These tests should include a comprehensive evaluation of EPAWSS EA effectiveness against modern threat simulators, along with collection of reference effectiveness data, without EPAWSS, for comparison.

- 2. Ensure that EPAWSS BIT and the Fully Automated Debrief System provide accurate and actionable information to aircrews and maintainers during F-15EX FOT&E.
- 3. Correct deficiencies with the MDF generator to provide more effective and efficient programming.