

QF-16 Full-Scale Aerial Target (FSAT)

Executive Summary

- The Air Force conducted 99 QF-16 developmental and operational test sorties in FY13 and 14, completing IOT&E in September 2014. DOT&E's QF-16 IOT&E report submitted in January 2015 stated that the QF-16 is operationally effective and will provide a high-fidelity representation of fourth-generation air superiority threats for U.S. weapon systems testing and tactics, techniques, and procedures development. Additionally, the QF-16 is operationally suitable, and under the 53rd Weapons Evaluation Group Concept of Employment that provides a primary and spare target for each mission, the QF-16 achieved 98.3 percent mission supportability. Although there are deficiencies that prevent the QF-16 from meeting its Mission Supportability and Mean Time Between Failure (MTBF) requirements, they do not have significant operational impact. The program is not required to meet the MTBF requirement until the QF-16 reaches Full Operational Capability.
- The Air Force should accomplish cybersecurity testing in accordance with the DOT&E cybersecurity policy memorandum, dated August 1, 2014.
- The Air Force should ensure procurement funding provides at least 25 Full-Scale Aerial Target (FSAT) targets per year beginning in FY16 to meet Service-coordinated aerial target requirements, in compliance with Resource Management Decision 700.
- The Air Force should provide plans for Phase II of the Air Superiority Target program to address shortfalls in testing against fifth-generation airborne threats.

System

- The QF-16 is the latest FSAT designed to test and evaluate U.S. weapon systems and assist in developing tactics, techniques, and procedures to counter fighter-size airborne threats. The DOD is replacing the current FSAT, the QF-4, due to its increasing dissimilarity from current and projected air-superiority threats, declining supportability, and depletion of suitable F-4 airframes.
- The QF-16 system is composed of regenerated F-16 Block 15, 25, and 30 aircraft equipped with Drone-Peculiar Equipment to enable remote command and control, missile trajectory



- scoring, and safe flight termination. Like the QF-4, the QF-16 is capable of manned and Not Under Live Local Operator flight operations. It will operate from Tyndall AFB, Florida, using the Gulf Range Drone Control System, and Holloman AFB, New Mexico, using the White Sands Integrated Target System located at White Sands Missile Range, New Mexico.
- The QF-16 retains F-16 flight performance characteristics and payload capabilities including supersonic, after-burning engines, high-G maneuvering, complex electronic attack, and expendable countermeasures.

Mission

The DOD uses FSATs to:

- Provide threat-representative presentations for developmental and operational test and evaluation for U.S. weapon systems, as mandated by Title 10 U.S. Code, Section 2366
- Continuously evaluate fielded air-to-air missile capabilities while providing live missile training for combat air crews through Air Force and Navy Weapon Systems Evaluation Programs

Major Contractor

The Boeing Company – St. Louis, Missouri

Activity

- In January 2015, DOT&E submitted an IOT&E report on the QF-16 FSAT.
- On September 5, 2014, QF-16 completed its last IOT&E flight. In total, QF-16 flew 99 developmental and operational test sorties, 19 of which were integrated test, and 4 dedicated

operational test sorties (2 manned and 2 Not Under Live Local Operator). The Air Force conducted the IOT&E in accordance with the DOT&E-approved test plan dated May 31, 2013.

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Assessment

- As detailed in the IOT&E report, DOT&E found that the QF-16 is operationally effective and will provide a high-fidelity representation of fourth-generation air superiority threats for U.S. weapon systems testing and tactics, techniques, and procedures development.
 - The QF-16 demonstrated the full Mission Performance Key Performance Parameter (KPP) profile with the Target Control Systems at Tyndall AFB, Florida, and White Sands Mission Range, New Mexico. The Mission Performance KPP profile included ground operations, launch and climb out, flight maneuvers, post-shot procedures, and recovery.
 - The QF-16 successfully demonstrated the ability to carry, operate, and monitor all KPP-required mission pods used for countermeasures and electronic attack, including the Tactical Electronic Attack Missions System, ALQ-167, ALQ-188, ALE-56, and ALE-40. The QF-16 flew with AIM-9 sized pods and a centerline fuel tank, and successfully employed both internal and external expendables.
 - The QF-16 successfully demonstrated the Flight Termination System and Vector Scoring System (VSS), which provides miss distance between a missile and the QF-16.
- As reported in the IOT&E report, DOT&E found that the QF-16 is operationally suitable. Although there are deficiencies that prevent the QF-16 from meeting its Mission Supportability and MTBF requirements, they do not have significant operational impact.
 - Under the 53rd Weapons Evaluation Group Concept of Employment that provides a primary and a spare target for each mission, the QF-16 achieved 98.3 percent mission supportability.
 - Calculations from test data measure MTBF to be 31.1 hours with 80 percent confidence bounds of 23.74 hours and 41.21, short of the 45-hour Full Operational Capacity requirement. About half (12 of 25) of QF-16 drone-peculiar equipment failures were related to the VSS.
 - The drone-unique Mean Time to Repair is 28.4 ±17.2 minutes, well within the requirement of less than 90 minutes for events within the 90th percentile. Training and technical orders are adequate for both maintainers and operators.
- Initially, DOT&E exempted QF-16 from a cybersecurity Cooperative Vulnerability Penetration Assessment and Adversarial Assessment because the system had no direct connection to the internet and had a Flight Termination System independent of the control system. However, DOT&E published refined cybersecurity testing guidance for acquisition programs in August 2014. The Air Force Life Cycle Management Center, with the support of the Air Force Operational Test and Evaluation Center, is in the process of test planning to comply with DOT&E's additional cybersecurity testing requirements. The QF-16 program currently lacks funding for additional cybersecurity testing.
- The Air Force did not require QF-16 to represent fifth-generation airborne threat systems (including radio frequency low-observability characteristics, internally-carried advanced electronic attack, and low probability of intercept sensors). DOT&E continues to emphasize existing aerial targets, including the QF-16, are insufficient for adequate operational testing of U.S. weapon systems.
 - In the Air Superiority Target Phase I Analysis of Alternatives Final Report (March 15, 2007), the Air Force recommended further study to produce user consensus on critical characteristics of future aerial targets and to determine capabilities and shortfalls in existing test resources.
 - Multiple stakeholders within Congress, OSD, the Air Force, and the Navy, support the requirement for a fifth generation FSAT.
- In late June, Boeing performed sample inspections on a QF-16 at Cecil Field, Florida, and discovered workmanship deficiencies with wire splices, termination, and routing. As a result of these findings, they broadened the inspection population to the first three production aircraft already delivered to Tyndall AFB, Florida, and found similar problems. Corrective actions are ongoing and Air Combat Command is expected to declare Initial Operational Capability in FY16.

Recommendations

- Status of Previous Recommendations. The Air Force still needs to address the following outstanding recommendations:
 1. Complete radar cross section measurements for QF-16 to ensure current and future U.S. weapon systems programs have precise, reliable data on system performance against measured, low-observable target presentations. Of note, the program is on pace to complete all of the necessary measurements by February 2017.
 2. Ensure QF-16 procurement funding continues to comply with Resource Memorandum Decision 700-mandated levels of 25 aircraft per year beginning in FY16, in order to meet Service-coordinated and approved test and training resource requirements.
 3. Complete the user requirements and current capabilities studies and provide plans for Phase II of the Air Superiority Target program to address test and evaluation shortfalls for U.S. weapon systems with respect to threat-representative, fifth-generation FSATs.
- FY15 Recommendations. The Air Force should:
 1. Accomplish cybersecurity testing in accordance with the DOT&E cybersecurity policy memorandum, dated August 1, 2014.
 2. Continue to monitor VSS reliability to ensure the corrections that were implemented in low-rate initial production Lot 1 aircraft will support compliance with the QF-16's MTBF requirement.