

MQ-9 Reaper Armed Unmanned Aircraft System (UAS)

Executive Summary

- The MQ-9 Program of Record continues to face challenges with evolving content, prioritizing and maturing system software, and developing and delivering technical order data to meet development and fielding timelines for the MQ-9 Increment One Program of Record. The Air Force will complete MQ-9 remotely-piloted aircraft (RPA) production under Low-Rate Initial Production; there will be no Full-Rate Production decision.
- The Air Force completed a Force Development Evaluation (FDE) of the Block 1 RPA configured with Operational Flight Program (OFP) 904.2 in December 2013. This increment of operational testing assessed improvements to optical and infrared sensor target location accuracy; established a baseline measurement of radar target location accuracy and ground-moving target indicator detection capability; and evaluated system user interface improvements.
- Block 5 RPA developmental testing revealed aircraft overheating problems that precluded the completion of operationally representative hot-weather ground testing. At the end of FY14, the Air Force was pursuing corrective actions to include system redesign and additional developmental testing in FY15 in order to meet Air Force global operating environment requirements.
- The final configuration of the MQ-9 Increment One Unmanned Aircraft System (UAS) continued to evolve in FY14. The Air Force proposed further changes and enhancements to the MQ-9 UAS. These changes entail additional hardware, software, and enhanced capabilities beyond those addressed in the current MQ-9 Test and Evaluation Master Plan (TEMP). Changes to the Increment One UAS will be supported by a new MQ-9 acquisition strategy and new developmental and operational test and evaluation construct. A new TEMP is required to articulate the developmental and operational test construct and scope of resources necessary to support the testing of the MQ-9 UAS content proposed under the new Air Force acquisition strategy.

System

- The MQ-9 Reaper UAS is a remotely-piloted, armed, air vehicle that uses optical, infrared, and radar sensors to locate, identify, target, and attack ground targets.
 - The MQ-9 RPA is a medium-sized aircraft that has an operating ceiling up to 50,000 feet, an internal sensor payload of 800 pounds, an external payload of 3,000 pounds, and an endurance of approximately 14 hours.
 - The Ground Control Station (GCS) commands the MQ-9 RPA for launch, recovery, and mission control of sensors



and weapons. C-band line-of-sight datalinks are used for RPA launch and recovery operations, and Ku-band satellite links are used for RPA mission control.

- The MQ-9 RPA carries AGM-114, HELLFIRE II anti-armor precision laser-guided missiles and GBU-12, 500-pound laser guided bombs.
- The Air Force is using an evolutionary acquisition approach for meeting Increment One Capability Production Document requirements, with Block 1 and Block 5 RPAs and Block 15 and Block 30 GCSs.
- The Air Force is currently fielding the Block 1 RPA and the Block 15 GCS.
- The Air Force designed the Block 5 RPA to incorporate improved main landing gear, an upgraded electrical system with more power, an additional ARC-210 radio, encrypted datalinks, a redesigned avionics bay and digital electronic engine control system, the BRU-71 bomb rack, high-definition video, and upgraded software to allow the two-person aircrew to operate all onboard systems.

Mission

- Combatant Commanders use the MQ-9 onboard sensors and weapons to conduct armed reconnaissance and pre-planned strikes. Units equipped with MQ-9s can find, fix, track, target, engage, and assess critical emerging targets (both moving and stationary).
- MQ-9 units can also conduct aerial intelligence gathering, reconnaissance, surveillance, and target acquisition for other airborne platforms.

Major Contractor

General Atomics Aeronautical Systems Inc. – San Diego, California

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Activity

- The Air Force conducted all MQ-9 testing in accordance with the DOT&E-approved TEMP and test plan.
 - Air Combat Command completed an FDE of the Block 1 RPA configured with OFP 904.2 in December 2013. This increment of operational testing assessed improvements to optical and infrared sensor target location accuracy; established a baseline measurement of radar target location accuracy and ground moving target indicator (GMTI) detection capability; and evaluated system user interface improvements.
 - In June and July of 2014, the Air Force conducted MQ-9 Block 5 RPA developmental testing to include an Integrated System Evaluation of hot-weather capabilities. Block 5 RPA design shortfalls resulted in aircraft overheating on the ground that precluded the Air Force from successfully completing this testing.
 - In July 2014, the Air Force 92d Information Operations Squadron and the Air Force Operational Test and Evaluation Center (AFOTEC) conducted a cybersecurity Cooperative Vulnerability Assessment of the Block 5 RPA and Block 30 GCS to support the planned FY15 FOT&E.
 - Late in FY14, Air Combat Command began a Tactics Investigation to explore the potential for limited envelope employment of GBU-38 500-pound Joint Direct Attack Munition (JDAM) weapons from Block 1 RPAs configured with OFP 904.2. AFOTEC will fully test JDAM capabilities during planned FY15 FOT&E of the MQ-9 Block 5 RPA and Block 30 GCS configured with OFP 904.6.
 - The final configuration of the MQ-9 Increment One UAS continued to evolve throughout FY14. As of the end of FY14, the Air Force indicated it intends to incorporate an improved Multi-Spectral Targeting System-B (MTS-B) electro-optical/infrared sensor, additional weapons, avionics hardware, and further system software revisions into the Increment One Program of Record capabilities.
 - At the end of FY14, the MQ-9 System Program Office was exploring new acquisition strategy approaches to react to changing content desired by the Air Force and to deliver desired capabilities to the users.
- AGM-114 HELLFIRE missiles and GBU-12 500-pound, laser-guided bombs.
 - The Lynx synthetic aperture radar (SAR) targeting accuracy supports target designation and employment of AGM-114 missiles and GBU-12 laser-guided bombs. Lynx SAR testing results further demonstrated system target location accuracies sufficient to support JDAM employment. However, JDAM testing was not accomplished as part of the OFP 904.2 FDE due to JDAM launch acceptability region software deficiencies. The Air Force intends to correct JDAM launch acceptability region shortfalls in future MQ-9 OFP 904.6.
 - The Lynx SAR GMTI demonstrated the ability to detect ground-moving targets; however, cross-cueing capability from the Lynx SAR to the MTS-B was poor.
 - Neither the RPA nor GCS met the Air Force Mean Time Between Critical Failure or Mean Repair Time threshold requirements during the FDE period. However, 16 of 16 RPA failures and 17 of 20 GCS failures were hardware failures not related to the OFP upgrade. The only software anomalies observed were confined to the GCS where two system software resets and one software reload occurred.
- Developmental testing of the MQ-9 Block 5 RPA revealed system deficiencies that precluded the successful completion of planned FY14 hot weather testing. Testers were unable to execute planned sorties in an operationally representative hot-weather environment due to the Block 5 RPA system overheating during ground operations prior to take-off.
 - Based on the performance shortfalls encountered, the Air Force is considering redesigned hardware, additional ground equipment, OFP software changes, and technical order changes to resolve the overheating problems.
 - However, at the end of FY14, a final solution had not been identified and additional developmental testing remained to be accomplished. The Air Force expects to resolve this problem prior to the start of planned FY15 FOT&E.
 - Preliminary observations of Air Combat Command's Tactics Investigation exploring limited envelope operational employment of GBU-38 JDAMs indicate that although weapons can be employed from MQ-9 Block 1 RPAs configured with OFP 904.2, current displayed launch acceptability region shortfalls do not yet meet Air Force operational needs. JDAM employment remains to be fully evaluated during the FY15 FOT&E in conjunction with OFP 904.6 testing.
 - The DOT&E-approved TEMP identifies OT&E requirements for the currently-defined final configuration of the MQ-9 Increment One UAS. Should the configuration change from that identified in the TEMP (Block 5 RPA, Block 30 GCS, and OFP 904.6), an updated TEMP will be required to address new Increment One UAS configurations, content, and associated T&E efforts. Regardless of any potential changes, DOT&E will evaluate the Block 5 RPA, Block 30 GCS, and OFP 904.6 in conjunction with the planned AFOTEC FOT&E in FY15.

Assessment

- The MQ-9 program continues to face systemic challenges in prioritizing and maturing software OFPs and developing technical order data to meet development and fielding timelines for the MQ-9 Increment One Program of Record. The Air Force has elected not to conduct a Full-Rate Production decision for the Block 5 RPA, and the MQ-9 system will complete delivery of all planned RPAs under Low-Rate Initial Production. FOT&E of the Increment One UAS configuration, originally planned for 2013, is projected to begin in late FY15.
- DOT&E assesses that results of the MQ-9 904.2 software upgrade FDE demonstrate:
 - The MTS-B electro-optical/infrared targeting accuracy is improved compared to that of the legacy OFP configuration, and supports employment of legacy

Recommendations

- **Status of Previous Recommendations.** In FY14, the Air Force made progress towards satisfying previous years' recommendations to complete the development of the Increment One UAS hardware and software cybersecurity vulnerability testing.
- **FY14 Recommendations.** The Air Force should:
 1. Complete the development of the Increment One UAS hardware and software to support FOT&E of the Increment One system.
 2. Improve the Lynx SAR GMTI cross-cueing capability to enable effective hunter/killer operations against moving targets.
 3. Resolve the Block 5 RPA hot-weather operating shortfalls prior to the start of AFOTEC's planned FOT&E in FY15.
 4. Complete the development of the GBU-38 JDAM capability for MQ-9 and fully test it during AFOTEC's FOT&E in FY15.
 5. Update the MQ-9 Increment One UAS TEMP to accurately reflect the content being pursued under the evolving program of record.

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