

## MQ-9 Reaper Unmanned Aircraft System (UAS)

### Executive Summary

- The Air Force has successfully integrated the MQ-9 Unmanned Aircraft System (UAS) into ongoing combat operations since the completion of IOT&E and transition to Acquisition Category 1D status in 2009. The program has accelerated production and incorporated ever-increasing combat capability to meet current and evolving combat mission needs. Similarly, the MQ-9 UAS has demonstrated a unique capacity to meet the challenges of urgent combat operational needs through the rapid incorporation of emergent sensor and systems technologies outside of the MQ-9 baseline program of record.
- The MQ-9 continues to be effective in executing combat missions with the fielded Block 1 remotely-piloted aircraft (RPA) using both program of record capabilities and emergent systems technologies dictated by evolving operational needs.
- Responding to urgent operational needs and incorporating associated emerging technologies has affected the program's ability to meet MQ-9 program of record requirements within a predictable development timeline and stable test and fielding schedule in FY11.
- The Air Force deferred the planned FY11 Milestone C decision for the Block 5 RPA due to immature system integration. Accelerated Block 1 RPA production and incorporation of emergent capabilities outside of the acquisition program of record have dominated MQ-9 priorities and have resulted in systemic challenges in prioritizing and maturing software Operational Flight Programs (OFFPs) to meet development and fielding timelines for the Increment One program of record.
- The Air Force path to satisfying the MQ-9 UAS Increment One requirements evolved in FY11. Resolution of outstanding requirements and shortfalls identified in previous MQ-9 IOT&E will be addressed through an FOT&E of the final Increment One UAS configuration consisting of the Block 5 RPA, the Block 30 Ground Control Station (GCS), and RPA OFP 904.6. Planned FY13 FOT&E has slipped to FY14 due to ongoing developmental challenges and associated programmatic schedule impacts.
- Ongoing developmental challenges precluded operational testing and subsequent fielding of baseline program enhanced capabilities to operational MQ-9 units in FY11 (OFP 904.0, OFP 904.2, and Joint Direct Attack Munition (JDAM)).
- Findings from an Air Force operational assessment (OA) of the Increment One system (Block 5 RPA, Block 30 GCS) indicated incremental progress towards achieving effectiveness requirements in support of future FOT&E. However, progress towards achieving system suitability requirements was not evident during the OA.
- The MQ-9 program continues to lack an approved Test and Evaluation Master Plan (TEMP) to support ongoing



developmental and operational testing. Additionally, the MQ-9 UAS lacks realistic and achievable system Mean Time Between Critical Failure (MTBCF) reliability requirements and a growth path to achieve such requirements.

### 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 system includes GCS for launch/recovery and mission control of sensors and weapons.
- 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 MQ-9 is commanded through its GCS 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 (CPD) 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.
- The Block 5 RPA is designed 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 2-person aircrew to operate all onboard systems. The Block 5 RPA will be formally tested in FOT&E in 2014.

# AIR FORCE PROGRAMS

## Mission

- The combatant commander uses 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

## Activity

- MQ-9 Block 1 RPA OFP software and Block 5 RPA hardware developmental testing was ongoing throughout FY11. OFP software suites 904.0, 904.2, and 904.4 are intended to provide incremental enhancements to fielded Block 1 RPAs and to mature capabilities to be incorporated into OFP 904.6. The final MQ-9 Increment One UAS configuration will include the Block 5 RPA, Block 30 GCS, and OFP 904.6. The Air Force plans to retrofit Block 1 RPAs to a Block 5 hardware configuration upon completion of Increment One FOT&E anticipated in FY14.
- The Air Force Air Combat Command (ACC) began a Force Development Evaluation (FDE) to support limited MQ-9 fielding of the GBU-38, 500-pound JDAM in November 2009. Software anomalies discovered during the FDE resulted in JDAM testing being placed in a pause status pending resolution of MQ-9 OFP fuzing and weapons envelope discrepancies in 2010. MQ-9 JDAM FDE testing remained on hold throughout FY11 and is not likely to resume until CY12.
- Planned FY11 ACC FDE testing of MQ-9 Block 1 OFPs 904.0 and 904.2 did not occur. Software maturity challenges and continued developmental delays resulted in the program's decision not to attempt to field OFP 904.0. Similarly, ongoing software challenges have pushed OFP 904.2 FDE to CY12.
- The Air Force Operational Test and Evaluation Center (AFOTEC) completed an OA of MQ-9 Block 5 RPA capabilities in support of a planned June 2011 Block 5 Milestone C acquisition decision. Testing was conducted in accordance with a DOT&E-approved OA plan. Though incremental progress towards achieving some outstanding MQ-9 Increment One requirements was noted, system maturity and integration were not sufficient to support the June Milestone, which has been deferred pending demonstration of system maturity until possibly as late as FY13.
- DOT&E approved the existing MQ-9 TEMP in October 2007 to support IOT&E of the MQ-9 UAS with the Block 1 RPA. Since the MQ-9 UAS was designated an Acquisition Category 1D program in December 2009, no TEMP update has been submitted to OSD for consideration and approval. Ongoing, post-IOT&E MQ-9 developmental and operational testing continues to be conducted outside of the construct of an applicable DOT&E approved TEMP.

## Assessment

- Upon completion of the Increment One Block 1 UAS IOT&E in 2009, DOT&E assessed the MQ-9 UAS was effective in the Killer mission role and suitable. IOT&E did not assess the MQ-9 UAS Hunter mission role primarily due to immature systems development and integration of the Lynx synthetic aperture radar (SAR). Without the Lynx SAR, the MQ-9 remains unable to execute all weather Hunter-Killer operations. The SAR is the only MQ-9 system capable of providing the MQ-9 UAS with the capability to find, fix, track, and engage targets through the weather. Additionally, the Air Force deferred 14 MQ-9 CPD threshold capabilities from IOT&E for assessment in future OT&E. Since 2009, the approach to satisfying the outstanding CPD requirements has evolved, and the Air Force intends to fulfill the Increment One CPD requirements with a final UAS configuration consisting of a Block 5 RPA, Block 30 GCS, and OFP 904.6. The Block 5 RPA includes major hardware modifications to the baseline Block 1 aircraft compelling the Air Force to pursue a separate Milestone C decision for this new aircraft configuration within the Increment One UAS program of record. MQ-9 production is currently at full-rate levels with authorization to produce 48 Block 1 RPAs annually until such time as a Block 5 Milestone C decision is made. The Air Force intends to retrofit all Block 1 RPAs to a Block 5 configuration upon completion of Block 5 development and testing. Formal operational testing of the final MQ-9 Increment One UAS (Block 5 RPA, Block 30 GCS, OFP 904.6) is required and will be conducted as an AFOTEC-led FOT&E to fully assess the Increment One effectiveness, suitability, mission capabilities, and satisfaction of CPD key performance parameters.
- Accelerated RPA production and responding to emergent capability insertion requests outside of the acquisition program of record (e.g. Urgent Operational Need Statements) continue to dominate Air Force MQ-9 program priorities. Consequently, the program faces systemic challenges in prioritizing and maturing software OFPs to meet development and fielding timelines for the Increment One program of record. During FY11, projected FOT&E for the final Increment One configuration UAS (Block 5 RPA, Block 30 GCS, OFP 904.6) slipped from FY13 to FY14, and the desired June 2011 Block 5 RPA Milestone C decision was deferred

due to the program's inability to demonstrate sufficient system integration maturity in the FY11 development schedule. Until the program is able to better prioritize and control maturation and development of the Increment One program of record capabilities, future delays in operational testing and fielding of associated capabilities will continue to occur.

- Insufficient progress in resolving MQ-9 UAS program of record developmental challenges in hardware and software development precluded the fielding of planned program of record combat capabilities to operational MQ-9 units (OFP 904.0, OFP 904.2, and JDAM).
- Findings from the AFOTEC OA of the Increment One Block 5 RPA indicated incremental progress towards achieving RPA system effectiveness requirements in support of future FOT&E; however, progress towards achieving system suitability requirements was not evident during the OA. Block 5 RPA maturity did not enable assessment of all Block 5 hardware systems integrated into a single aircraft. Limited systems attributes were assessed as configured in multiple RPAs modified with elements of Block 5 hardware, and GCSs modified with elements of Block 30 GCS hardware and interface capabilities.
  - The MQ-9 demonstrated the ability to utilize the Lynx SAR to locate and designate fixed targets with sufficient accuracy to successfully employ JDAM weapons in developmental testing. However, Lynx SAR capabilities were not mature enough to support using the system's ground moving target indicator capabilities to track moving surface targets.
  - The Block 5 heavy weight landing gear system, high capacity starter/generator, and, the BRU-71 bomb rack demonstrated progress towards meeting system requirements. However, dual ARC-210 radios, encrypted datalinks, the redesigned avionics bay, and digital electronic engine control system had not been incorporated into the test aircraft for assessment.
  - Progress towards satisfying Increment One suitability requirements was not evident during the OA period. The program continues to lack: finalized technical orders to maintain the MQ-9 system; consolidated and comprehensive documentation of maintenance records; and a reliability growth plan and formal process to track and adjudicate suitability shortfalls during system developmental and operational testing.
  - A subsequent OA, to include Block 5 RPA flight test, will be required to inform the FY13 Block 5 RPA Milestone C decision.
- In 2009, DOT&E assessed that the MQ-9 CPD threshold MTBCF requirements of 500 hours (RPA and GCS) evaluated during IOT&E were unachievable and that the Air Force should re-evaluate the requirements. To date, the program continues to lack achievable MTBCF requirements and a reliability growth path to support such requirements.

- Developmental testing made incremental progress in resolving deficiencies discovered during the 2009 MQ-9 JDAM FDE testing; however, OFP software deficiencies remain and the system has yet to demonstrate readiness for resumed operational testing.
- As was the case in FY10, information assurance (IA) vulnerabilities and deficiencies are not well characterized because the system has only completed limited IA testing. The system continues to operate under an extended Interim Authority to Operate, pending full system IA testing.
- The Air Force has yet to submit a TEMP for OSD approval to support the ongoing developmental and operational T&E activities associated with the MQ-9 Increment One program of record. The previously approved 2007 TEMP was adequate to support the MQ-9 IOT&E in 2008; however, there is no TEMP supporting current T&E. The lack of an approved TEMP hampers DOT&E's ability to accurately assess the adequacy of ongoing operational T&E efforts and evaluate program progress towards satisfying Increment One Capability Production Document (CPD) requirements.

## Recommendations

- Status of Previous Recommendations. The Air Force is attempting to address previous DOT&E recommendations, though accelerated production and incorporation of non-program of record emergent capabilities priorities continue to hinder the program's ability to make substantial progress towards satisfying the MQ-9 UAS Increment One program of record requirements.
- FY11 Recommendations. The Air Force should:
  1. Resolve the MQ-9 GBU-38 JDAM integration deficiencies and complete the 2009 JDAM operational testing that has been in a pause status since 2010.
  2. Revisit the MQ-9 CPD MTBCF threshold requirements and establish achievable, testable requirements and a reliability growth path to achieve such requirements.
  3. Conduct a subsequent formal operational assessment of the MQ-9 UAS to support and inform an FY12/13 Block 5 RPA Milestone C decision.
  4. Complete IA testing to support full accreditation of the MQ-9 system.
  5. Complete development of Increment One UAS hardware and software to support FOT&E of the Increment One system to assess operational effectiveness, suitability, and mission capability of the final Increment One UAS configuration (Block 5 RPA, Block 30 GCS, and OFP 904.6).
  6. Conduct an OA, including Block 5 RPA flight test, to inform the FY13 Block 5 RPA Milestone C decision.
  7. Complete and submit a TEMP for OSD approval addressing ongoing MQ-9 Increment One UAS developmental and operational T&E.

## AIR FORCE PROGRAMS