

Global Hawk High-Altitude Long-Endurance Unmanned Aerial System (RQ-4)

Executive Summary

- In January 2011, USD(AT&L) re-structured the RQ-4 Global Hawk program into four sub-programs and directed that formal operational requirements, acquisition strategies, and test strategies be developed for each. In April 2011, the Air Force declared a critical Nunn-McCurdy cost breach for the overall Global Hawk program. Following an OSD program review, USD(AT&L) completed Nunn-McCurdy congressional re-certification requirements in June 2011. The Air Force is now executing separate RQ-4 Global Hawk Block 10/20, Block 30, and Block 40 sub-programs, and planning a future Global Hawk Ground Segment Re-Architecture (GSRA) sub-program.

Block 10/20

- The Air Force removed all RQ-4A Global Hawk Block 10 systems from operational service in 2011.
- In response to a U.S. Central Command (USCENTCOM) Joint Urgent Operational Need (JUON) request, the Air Force integrated the Battlefield Airborne Communications Node (BACN) payload onto two of the six production RQ-4B Global Hawk Block 20 air vehicles to provide an around-the-clock BACN theater communications relay capability. Based on operational test results and data from the first six months of USCENTCOM operations, DOT&E concluded that the BACN payload effectively supports theater communication relay operations. However, the two BACN RQ-4B Global Hawk Block 20 air vehicles (designated EQ-4B) cannot provide the requested around-the-clock theater communications relay coverage due to ground control station design limitations and existing Global Hawk air vehicle reliability and availability shortfalls. As a result, the Air Force received congressional direction to modify additional Global Hawk Block 20 air vehicles with the BACN payload to support the requested around-the-clock USCENTCOM operations.

Block 30

- The Air Force conducted RQ-4B Global Hawk Block 30 IOT&E from October 2010 through January 2011. DOT&E concluded the system was not operationally effective for conducting near-continuous, persistent intelligence, surveillance, and reconnaissance (ISR) operations. The Enhanced Imagery Sensor Suite (EISS) provided electro-optical, infrared, and synthetic aperture radar (SAR) imagery that met or exceeded most operational requirements. The Airborne Signals Intelligence Payload (ASIP) provided a limited operational utility, but did not consistently deliver actionable signal intelligence products to operational users, due to technical performance deficiencies and immature training, tactics, techniques,



- and procedures. The system was not operationally suitable due to low air vehicle reliability, incomplete maintenance technical data, inadequate maintenance training, and ineffective integrated diagnostic systems. When operating at near-continuous operational tempos, the system provided less than half the required 55 percent Effective-Time-On-Station (ETOS) coverage over a 30-day period. The system did not meet joint interoperability certification and information assurance requirements.
- Following IOT&E, the Air Force revised critical spare part requirements and implemented a comprehensive reliability improvement program to reduce critical system component failures and address anticipated component obsolescence deficiencies. These efforts are gradually improving system reliability and availability. Each USCENTCOM, U.S. Pacific Command (USPACOM), and U.S. European Command (USEUCOM) Global Hawk Combat Air Patrol (CAP), consisting of three aircraft, can generate sufficient sorties to support a steady-state operational tempo of approximately three missions per week. These missions vary in duration depending on theater requirements and operational priorities. Updated modeling and simulation results, which incorporate recent field operating data and revised spare part requirements, project that Global Hawk Block 30 CAP ETOS during near-continuous operational tempos should improve from 27 percent during IOT&E to approximately 45 percent as initial spare parts become available. This indicates that the program is meeting reliability growth goals and progressing toward the minimum 55 percent ETOS operational requirement for

single vehicle control operations. The Air Force requested FY12 funding for initial spare parts procurement with deliveries continuing through FY15.

- In June 2011, the Air Force proposed and implemented a revised RQ-4B Global Hawk Block 30 follow-on test schedule to support incremental delivery of Block 30 improvements, leading to a comprehensive RQ-4B Global Hawk Block 30 FOT&E in late FY12. Operational testing for the first incremental system capability upgrade began in July 2011. However, in August 2011, the Air Force halted operational testing due to a serious air vehicle command and control software deficiency. Test schedule delays have also occurred due to flight test resource constraints, and emerging additional test requirements associated with engine, fuel system, and diminishing manufacturing source upgrades. As a result, the Block 30 FOT&E originally planned for late FY12 is unlikely to occur until at least mid-FY13.

Block 40

- In December 2010, the Air Force completed the final phase of Multi-Platform Radar Technology Insertion Program (MP-RTIP) sensor risk reduction testing on the Scaled Composites Model 281 Proteus test bed aircraft. SAR ground mapping and Ground Moving Target Indicator (GMTI) operating modes met nearly all system performance specifications with improved sensor stability during concurrent SAR/GMTI. Based on these results, the Air Force plans to integrate the MP-RTIP SAR, GMTI, and concurrent SAR/GMTI operating modes on the RQ-4B Global Hawk Block 40 system.
- The Air Force successfully completed RQ-4B Global Hawk Block 40 air vehicle flight-envelope expansion testing in June 2011. MP-RTIP sensor integration flight tests on the Global Hawk Block 40 air vehicle began in July 2011.

System

- The RQ-4 Global Hawk is a remotely-piloted, high-altitude, long-endurance airborne intelligence, surveillance, and reconnaissance system that includes the Global Hawk unmanned air vehicle, various intelligence and communications relay mission payloads, and supporting command and control ground stations.
- The RQ-4A Global Hawk Block 10 system is a limited production version of the original Global Hawk Advanced Concept Technology Demonstration system.

- The RQ-4B Global Hawk Block 20 system is equipped with either the EISS imagery intelligence payload or the BACN theater communications relay payload. The EISS sensor includes infrared, optical, and synthetic aperture radar sensors for collecting still imagery intelligence on ground targets. The BACN payload provides communications connectivity between geographically separated operational units.
- The RQ-4B Global Hawk Block 30 system is equipped with a multi-intelligence payload that includes both the EISS imagery intelligence payload and the ASIP electronic signal collection sensor.
- The RQ-4B Global Hawk Block 40 system is equipped with the MP-RTIP synthetic aperture radar payload designed to simultaneously collect imagery intelligence on stationary ground targets and track ground moving targets.

Mission

- The theater Air Operations Center tasks Air Force RQ-4 Global Hawk reconnaissance units to provide high-altitude, long-endurance intelligence collection capabilities or theater communications relay capabilities to supported commanders.
- Operators collect imagery and signals data in order to support ground units and to identify intelligence essential elements of information for theater commanders. Units equipped with RQ-4B Global Hawk use line-of-sight and beyond line-of-sight satellite datalinks to control the Global Hawk system and transmit collected intelligence data.
- Distributed intelligence processing, exploitation, and dissemination systems receive intelligence data directly from the air vehicle or from the Global Hawk ground station via intelligence data transmission systems.
- Ground-based intelligence analysts exploit collected imagery and signals information to provide intelligence products in support of theater operations.
- Global Hawk can also provide imagery intelligence directly to forward-based personnel through direct line-of-sight datalink systems.

Major Contractor

Northrop Grumman Aerospace Systems, Strike and Surveillance Systems Division – San Diego, California

Activity

All Blocks

- In January 2011, USD(AT&L) re-structured the RQ-4 Global Hawk program into four sub-programs and directed that formal operational requirements, acquisition strategies, and test strategies be developed for each. The Air Force is now executing separate RQ-4 Global Hawk Block 10/20, Block 30, and Block 40 sub-programs and planning a future

Global Hawk Ground Segment Re-Architecture (GSRA) sub-program.

- In April 2011, the Air Force declared a critical Nunn-McCurdy cost breach for the overall Global Hawk program. Following an OSD program review, USD(AT&L) completed Nunn-McCurdy congressional re-certification requirements in June 2011. The June 2011 USD(AT&L)

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Acquisition Decision Memorandum established future program acquisition and development milestones for each Global Hawk sub-program based on proposed Air Force acquisition and test program schedules.

- All RQ-4 Global Hawk operational testing was accomplished in accordance with DOT&E-approved test plans.

Block 10/20

- The Air Force removed all RQ-4A Global Hawk Block 10 systems from operational service in 2011. RQ-4B Global Hawk Block 20 systems continue to support test and training activities at Edwards AFB, California, and Beale AFB, California.
- In response to a USCENTCOM JUON request, the Air Force integrated the BACN payload onto two of the six production RQ-4B Global Hawk Block 20 air vehicles to provide a theater communications relay capability. The Air Force Operational Test and Evaluation Center (AFOTEC) completed a BACN EQ-4B Global Hawk Block 20 Operational Utility Evaluation (OUE) in September 2010. In November 2010, the Air Force fielded these two systems to the USCENTCOM area of operations.

Block 30

- The Air Force conducted RQ-4B Global Hawk Block 30 IOT&E from October 2010 through January 2011. DOT&E published the RQ-4B Global Hawk Block 30 beyond low-rate initial production report in May 2011. USD(AT&L) deferred the planned June 2011 RQ-4B Global Hawk Block 30 full-rate production decision due to program budget uncertainties.
- In early 2011, the Air Force deployed RQ-4B Global Hawk Block 30 systems to three forward operating locations in the USCENTCOM, USPACOM, and USEUCOM operating areas. The Air Force declared RQ-4B Global Hawk Block 30 initial operational capability in August 2011 for imagery intelligence operations, but deferred signals intelligence initial operational capability until early 2012 pending delivery of production ASIP sensors.
- In late 2010, the Air Force initiated a multi-year RQ-4B Global Hawk Block 30 follow-on development program to correct identified system deficiencies, address known component obsolescence problems, and deliver previously deferred operational capabilities. In June 2011, the Air Force proposed and implemented a revised follow-on test schedule to support incremental delivery of Block 30 improvements, leading to a comprehensive RQ-4B Global Hawk Block 30 FOT&E in late FY12. Operational testing for the first incremental system capability upgrade began in July 2011. However, in August 2011, the Air Force halted operational testing due to a serious air vehicle command and control software deficiency.

Block 40

- In December 2010, the Air Force completed early developmental testing of the RQ-4B Global Hawk Block 40 MP-RTIP sensor on the Scaled Composites

Model 281 Proteus test bed aircraft. This testing focused on improving radar technical performance and improving system stability during concurrent use of the SAR ground mapping and GMTI operating modes.

- USD(AT&L) deferred the planned June 2011 RQ-4B Global Hawk Block 40 Milestone C decision due to program budget uncertainties. In addition, the Air Force proposed significant changes in RQ-4B Global Hawk Block 40 operational capability requirements, including removal of Battle Management Command and Control (BMC2) capabilities as a system threshold requirement. Completion of final RQ-4B Global Hawk Block 40 acquisition and test strategies is on hold pending resolution of budget problems and Joint Staff approval of a revised RQ-4B Global Hawk Block 40 Capabilities Production Document (CPD). In the interim, the Air Force proposed and implemented a revised RQ-4B Global Hawk Block 40 development and test schedule leading to a projected IOT&E and initial fielding in late FY13. This test program does not include development of BMC2 capabilities.
- The Air Force completed Global Hawk Block 40 air vehicle flight envelope expansion testing in June 2011. MP-RTIP sensor integration flight test on the Global Hawk Block 40 air vehicle began in July 2011.

Ground Segment Re-Architecture (GSRA)

- The Air Force began development of initial operational requirements in preparation for possible initiation of the RQ-4B Global Hawk GSRA sub-program in late FY12.

Assessment

Block 10/ 20

- In July 2011, DOT&E published an operational assessment of the BACN RQ-4B Global Hawk Block 20 JUON system. Based on operational test results and data from the first 6 months of USCENTCOM operations, DOT&E concluded that the BACN payload effectively supports theater communication relay operations. However, the two fielded BACN EQ-4B Global Hawk Block 20 air vehicles initially provided only 36 percent of the requested around-the-clock on-station coverage due to air vehicle availability shortfalls and ground control station design limitations.
- Since initial fielding, BACN EQ-4B Global Hawk Block 20 air vehicle availability and ETOS performance has improved as the Air Force has implemented initiatives to increase system reliability. For example, the Air Force fielded an improved interim electrical generator and continued efforts to field a new, re-designed generator system. The Air Force is also developing improved repair methods for aircraft structural components and longer-term structural design changes are under review. Improved inertial navigation units will replace existing units by attrition. In the interim, mission-essential equipment rules have been relaxed to allow flight operations to continue using redundant navigation systems when inertial navigation unit failures occur. A redesigned fuel nozzle

was recently qualified for the Global Hawk engine and retrofits are underway. These efforts, combined with initiatives to improve spare parts availability, increased air vehicle availability rates. As a result, two BACN EQ-4B Global Hawk Block 20 systems can now provide approximately 50 percent of the required around-the-clock on-station coverage. Despite system reliability and availability improvements, augmentation by other BACN-equipped aircraft, such as the Bombardier Global Express BD-700 aircraft or additional BACN EQ-4B Global Hawk Block 20 systems, is required to provide the requested USCENTCOM around-the-clock theater communications relay capability. The Air Force received congressional direction to modify additional Global Hawk Block 20 air vehicles with the BACN payload to support USCENTCOM operations.

Block 30

- In May 2011, DOT&E published the RQ-4B Global Hawk Block 30 Beyond Low-Rate Initial Production Report based on test results from the RQ-4B Global Hawk Block 30 IOT&E conducted from October 2010 through January 2011. DOT&E concluded that the system demonstrated the capability to provide about 40 percent of requested ISR coverage when used at low operational tempos (two to three sorties per week using three air vehicles). When operating at near-continuous operational tempos, the system provided less than half the required 55 percent ETOS coverage over a 30-day period. As a result, the system was not operationally effective for conducting near-continuous, persistent ISR operations. During IOT&E, the EISS provided electro-optical, infrared, and SAR imagery that met or exceeded most operational requirements and provided actionable imagery intelligence products to operational users. The ASIP provided a limited operational utility to detect, identify, and locate some threat radars and to detect some communication signals, but did not consistently deliver actionable signal intelligence products to operational users due to technical performance deficiencies and immature training, tactics, techniques, and procedures. During IOT&E, the RQ-4B Global Hawk Block 30 was not operationally suitable due to low air vehicle reliability, incomplete maintenance technical data, inadequate training, and ineffective integrated diagnostic systems. The system did not meet joint interoperability certification and information assurance requirements.
- Following IOT&E, the Air Force revised critical spare parts requirements and implemented a comprehensive reliability improvement program to reduce critical system component failures and address anticipated component obsolescence. The program also implemented plans to improve maintenance training, technical orders, and other system maintainability problems. These efforts are gradually improving system reliability, availability, and maintainability. Each USCENTCOM, USPACOM, and

USEUCOM Global Hawk CAP, consisting of three aircraft, can generate sufficient sorties to support a steady-state operational tempo of approximately three missions per week. These missions vary in duration depending on theater requirements and operational priorities. Updated modeling and simulation results, incorporating field operating data collected through August 2011 and revised spare part requirements, project that Global Hawk Block 30 ETOS performance at near-continuous operational tempos should improve from 27 percent during IOT&E, to approximately 45 percent, as initial spare parts are delivered. This indicates that the program is meeting reliability growth goals and progressing toward the minimum 55 percent ETOS operational requirement for single vehicle control operations. The Air Force requested FY12 funding for initial spare parts procurement with deliveries continuing through FY15. AFOTEC will conduct a complete re-evaluation of RQ-4B Global Hawk Block 30 operational suitability during FOT&E.

- In November 2011, the Air Force developed an initial ASIP performance improvement plan to address signal detection, signal geo-location, operator training, tactics, and technical documentation deficiencies observed during IOT&E. AFOTEC will conduct a complete re-evaluation of RQ-4B Global Hawk Block 30 signals intelligence capabilities during FOT&E.
- Since IOT&E, the Air Force has implemented corrective action plans for some interoperability and information assurance deficiencies. AFOTEC and the Joint Interoperability Test Command will re-evaluate compliance with required interoperability and information assurance standards during FOT&E.
- Operational testing for the next incremental Global Hawk Block 30 capability upgrade began in July 2011. In August 2011, the Air Force halted operational testing due to a serious air vehicle command and control software deficiency. The RQ-4B Global Hawk Block 30 developmental test program previously identified this deficiency, but underestimated its impact during operational missions.
- RQ-4B Global Hawk Block 30 test schedule is high risk due to recently identified software deficiencies, flight test resource constraints, and additional test requirements associated with engine, fuel system, and diminishing manufacturing source upgrades. As a result, the Block 30 FOT&E originally planned for late FY12 is unlikely to occur before mid-FY13.

Block 40

- The MP-RTIP sensor showed improved performance during the final phase of MP-RTIP risk reduction and developmental testing on the Scaled Composites Model 281 Proteus test bed aircraft. The SAR ground mapping and GMTI operating modes met nearly all system performance specifications. Sensor stability during concurrent

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SAR/GMTI operations also improved. Based on these results, the Air Force plans to integrate the SAR, GMTI, and concurrent SAR/GMTI operating modes on the RQ-4B Global Hawk Block 40 system. The Air Force deferred further development of other potential radar operating modes, such as High Range Resolution, Airborne Moving Target Indicator, and Maritime Moving Target Indicator indefinitely.

- The Air Force completed RQ-4B Global Hawk Block 40 air vehicle envelope expansion flight tests and began MP-RTIP sensor integration testing in July 2011. Based on lessons learned from Global Hawk Block 30 testing, the Air Force appropriately increased planned interoperability testing to ensure successful integration with supporting intelligence tasking and data processing, exploitation, and dissemination systems.
- Although the RQ-4B Global Hawk Block 40 and MP-RTIP development programs made significant technical progress in late 2010 and 2011, the current program test schedule is very high risk due to a combination of test resource constraints and the low priority of the Block 40 test program relative to Block 30 flight test activities. FY11 test funding reductions reduced Global Hawk flight test capacity at Edwards AFB, California, by up to 30 percent. In addition, Global Hawk Block 40 testing is subordinate to all other ongoing Global Hawk test efforts, such as the Global Hawk Block 30 follow-on test program. Based on Global Hawk test schedule delays experienced since June 2011, RQ-4B Global Hawk Block 40 IOT&E may be delayed up to one year beyond the previously planned FY13 target date.
- The Air Force will deliver the majority of RQ-4B Global Hawk Block 40 systems to Grand Forks AFB, North Dakota, prior to the currently planned IOT&E and operational fielding dates. As a result, the Air Force is considering an option to field these aircraft for early operational employment. However, current program test plans and schedules do not include activities necessary to support early operational fielding.

Recommendations

- Status of Previous Recommendations. The Air Force resolved previous recommendations to develop a Global Hawk reliability improvement plan and improve system interoperability testing. The Air Force also made progress on previous DOT&E recommendations to revise Global Hawk Block 30 and Block 40 operational requirements and identify specific Block 40 end-to-end operational architectures and interoperability requirements.
- FY11 Recommendations. The Air Force should:
 1. Complete development of final RQ-4B Global Hawk Block 30 and Block 40 operational requirements to provide clear expectations and priorities for development and test of operational capabilities.
 2. Complete development of RQ-4B Global Hawk Block 30 and Block 40 test strategies and ensure that adequate test resources are provided to support the wide range of planned Global Hawk T&E activities needed to meet proposed Nunn-McCurdy re-certification baseline schedules, or alternatively, revise schedule baselines to reflect delays that will inevitably result if current T&E resources are not increased.
 3. Provide definitive direction to the Global Hawk program regarding possible RQ-4B Global Hawk Block 40 early operational fielding options as soon as possible to ensure timely development of supporting program test plans and schedules, if required.
 4. Continue implementation of the OSD-approved Global Hawk Reliability and Maintainability Plan to improve the operational suitability of all Global Hawk variants.
 5. Continue implementation of the Air Force ASIP performance improvement plan to address signal detection, signal geo-location, operator training, and technical documentation deficiencies observed during RQ-4B Global Hawk Block 30 IOT&E.
 6. Develop a comprehensive plan to address critical interoperability and information assurance deficiencies observed during RQ-4B Global Hawk Block 30 IOT&E.

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