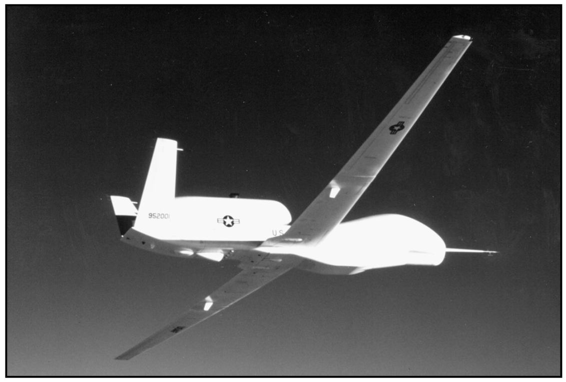
RQ-4A GLOBAL HAWK UNMANNED AERIAL VEHICLE (UAV) SYSTEMS



The Global Hawk Unmanned Aerial Vehicle (UAV) system is a theater commander's asset designed to satisfy broad area coverage and deep target surveillance and reconnaissance shortfalls. The Global Hawk air vehicle is to provide high-resolution Synthetic Aperture Radar (SAR) and Electro-Optical/Infrared (EO/IR) imagery at long range with long loiter times over target areas. A Signals Intelligence (SIGINT) capability is also being developed. Potential missions for the Global Hawk cover the spectrum of intelligence collection capabilities to support joint combatant forces in worldwide peace, crisis, and wartime operations.

The Global Hawk UAV system comprises an air vehicle component with air vehicles, sensor payloads, avionics, and data links; a ground segment with a launch and recovery element (LRE); a mission control element (MCE) with embedded ground communications equipment; a support element; and trained personnel.

The Global Hawk air vehicle is optimized for long range and endurance; it is to be capable of providing 24 hours on-station at a 1,200-nautical-mile range from the launch site. It has a wingspan of 116 feet and length of 44 feet and has a cruise speed of 350 knots. The maximum operating altitude is 65,000 feet mean sea level (MSL), although it is capable of providing imagery after the air vehicle has climbed above 56,000 feet above ground level (AGL). The integrated sensor suite consists of SAR, EO, and IR sensors. Either the EO or the IR sensors can operate simultaneously with the radar. Each of the sensors provides wide area search imagery and a high-resolution spot mode. The radar also has a ground moving target indicator (GMTI) mode; GMTI data are transmitted as a text product providing moving target location and radial velocity (this information is not displayed graphically). Both SAR and EO/IR imagery are processed onboard the aircraft and transmitted to the MCE as individual frames. The MCE can mosaic EO/IR frames into images prior to further dissemination.

Navigation is via inertial navigation with integrated Global Positioning System (GPS) updates. Global Hawk is intended to operate autonomously using a satellite data link (either Ku or UHF) for sending sensor data from the aircraft to the MCE. The common data link can also be used for direct down link of imagery when the UAV is operating within line-of-sight of users with compatible ground stations.

The ground segment consists of the MCE for mission planning, command and control, and image processing and dissemination; the LRE for controlling launch and recovery; and associated ground support equipment. (The LRE provides precision differential GPS corrections for navigational accuracy during takeoff and landings while precision coded GPS supplemented with an inertial navigation system is used during mission execution.) By having separable elements in the ground segment, the MCE and the LRE can operate in geographically separate locations, and the MCE can be deployed with the supported command's primary exploitation site. Both ground segments are contained in military shelters with external antennas for line of sight and satellite communications with the air vehicles.

BACKGROUND INFORMATION

The Global Hawk program began as part of the High Altitude Endurance (HAE) Advanced Concept Technology Demonstration (ACTD) that included both the Global Hawk and the Dark Star UAV programs. The ACTD began in 1995 under Defense Advanced Research Projects Agency (DARPA) management, and in October 1998, transitioned to the Air Force systems program office at Wright Patterson AFB. The Dark Star program was canceled in January 1999. At the conclusion of the ACTD, United States Joint Forces Command declared the Global Hawk had military utility and submitted a military utility assessment in September 2000 to support the transition from an ACTD to an acquisition program. Early operational assessments (EOAs) produced by AFOTEC and DOT&E found the system potentially effective and potentially suitable. Residual assets from the ACTD include four air vehicles, two MCEs, three LREs, two SAR payloads, and one integrated sensor suite (with EO/IR and SAR).

The Air Force has developed an acquisition strategy that is based on a spiral development process leading to Global Hawk air vehicles that satisfy the needs identified in the Military Utility Assessment and validated in the Operational Requirements Document. Desired capabilities were divided between two spirals, which are to be met by the Block 5 and Block 10 configurations, respectively. The Milestone II decision in March 2001 approved entry into engineering and manufacturing development (EMD) for Block 5 and the spiral development of Block 10 Global Hawk, as well as low rate initial production of six Block 5 air vehicles, two MCEs, and two LREs. Prior to that decision, DOT&E approved the TEMP, asking for an update within 120 days of contract award.

The spiral nature of the development creates a dynamic environment in which testing will occur. Components of the system will be continuously upgraded and, in some instances, replaced during EMD. The situation is exacerbated by participation in demonstrations that require the development of unique capabilities to support those efforts. This occurred for the Australian deployment discussed below; additionally, a United States Southern Command demonstration scheduled for early 2002 requires the development of an air-to-air moving target indicator capability, and a German demonstration planned for late 2002 requires the integration of a European Aeronautic Defence and Space electronic intelligence (ELINT) sensor.

A decision by the Deputy Secretary of Defense in late 2001 directed acceleration of the Global Hawk program. This acceleration, and, potentially, the participation of Global Hawk in Operation Enduring Freedom, will require readdressing the user's operational requirements, acquisition strategy, and test strategy.

TEST & EVALUATION ACTIVITY

Since the year-long demonstration and evaluation phase for the military utility assessment ended (June 2000), test activity has consisted of deferred testing objectives from the ACTD development, testing of Block II modifications to the ACTD aircraft, an Australian deployment and demonstration, and preparatory developmental testing associated with that effort. Deferred testing objectives from the ACTD include characterizing the performance of the EO/IR sensor and the GMTI mode of the radar. Block II modifications include the replacement of the primary aircraft navigator, environmental control system modifications, fuel balance system modifications, and replacement of the spoiler actuators. The Australian deployment required the development of specific capabilities including a backup communications capability to support the deployment flight from Edwards AFB to Australia, maritime radar modes, integration of an ELINT sensor, and work to interface the MCE with the Australian Ground Element. Developmental testing was done in the United States to verify correct operation of these new capabilities before the deployment.

During the Australian deployment (April – June 2001), Global Hawk flew six sorties in support of Tandem Thrust, a joint U.S.-Australian exercise. Five additional sorties were flown to characterize system performance for the Australian Defence Forces in a more controlled environment.

TEST & EVALUATION ASSESSMENT

In February 2001, DOT&E provided an EOA in support of the Milestone II decision. The EOA was based on the performance of the system during the June 1999 – June 2000 demonstration and evaluation period. The system was found potentially operationally effective and potentially operationally suitable. It was noted, however, that significant improvements were required in a number of areas.

Specifically, the system needed improvements in mission planning, imagery dissemination, scene accountability, system re-tasking, and communications bandwidth burden. The EOA noted significant unknowns in the area of effectiveness, including performance of the EO/IR sensor and GMTI mode of the radar. The EOA also noted the need for improvement in reliability in a stressing operational tempo as well as maturation of training plans, logistics infrastructure, and maintenance concept in order to provide an operationally suitable system. Development of a reliability growth management plan was recommended.

AFOTEC and the Australian Defence Science and Technology Organisation (DSTO) are developing a single summary report on the Australian Deployment to be released by the Australian Aerospace Defence Branch. A separate Operational Utility Evaluation (OUE) focusing on operational impacts and U.S. concerns was recently released by AFOTEC. DOT&E is reviewing these reports. Much of the raw data collected during the Australian Deployment are not yet available to DOT&E. Our assessment is preliminary and based on on-site observations by DOT&E representatives.

The primary focus of the Australian event was demonstrating Global Hawk's capabilities in the maritime/littoral surveillance role to satisfy Australian requirements. This was the reason for the development of the radar's maritime modes as well as incorporation of the Litton LR-100 ELINT sensor. There is currently no USAF requirement for either of these capabilities. The system was operated significantly differently from the envisioned USAF concept of operations. Also, because of the developmental nature of the system, significant contractor support was involved. Engineers and operators from Northrop Grumman, Raytheon, and L3COM were present in the MCE during all flights.

For the air vehicle, the Australian deployment represented the highest operational tempo attempted to date. The air vehicle flew fairly reliably; 13 of 14 planned sorties over 46 days were completed, totaling 287 flight hours. One sortie was aborted shortly after take-off when one of the new navigator systems reported a fault. The unit was found to be out of tolerance and was replaced.

However, because of concern regarding the navigator's fault reporting system, the following sortie was also canceled. A system engineer from the contractor's facility was flown to Australia to install a fix; this resulted in down time of about eight days. Another sortie was canceled due to a late engine start and high winds, but was completed the next day. The air vehicle also went into autonomous mode twice during the deployment when the MCE lost power. The air vehicle properly flew its autonomous profile while a backup generator was brought on-line.

The sensor system experienced numerous crashes and reboots during the deployment with each reboot requiring approximately 20 minutes. The crashes were likely influenced by the immaturity of the software with the recently added maritime modes as well as the unusual method of tasking where the Australian Ground Element was able to directly control the radar while the EO/IR scene collection was controlled from the MCE. Dissemination was also performed using non-standard methods including the Direct Dissemination Element and Australian dissemination channels.

Overall, the addition of experimental capabilities, presence of extensive contractor support and operation of the system, unique concept of operation employed, and use of non-system equipment in the deployment make it difficult to extract operational data relevant to the baseline configuration and USAF planned methods of employment.