

## RQ-21A Blackjack Unmanned Aircraft System (UAS)

### Executive Summary

- The Navy's Commander, Operational Test and Evaluation Force, with assistance from the Marine Corps Operational Test and Evaluation Activity, conducted the RQ-21A IOT&E between January and December 2014 in three phases at Twentynine Palms, California; Camp Lejeune, North Carolina; and aboard USS *Anchorage* (LPD 23). Total flight time accrued from all three test locations was 233.6 hours during 38 flights.
- DOT&E submitted an IOT&E report in June 2015 based on the demonstrated performance during IOT&E to inform the Services' Full-Rate Production (FRP) decision, which was originally planned for October 2015, now scheduled for September 2016. The Navy plans to conduct additional developmental testing and is investigating the conduct of a Verification of Correction of Deficiencies before the September 2016 FRP decision. DOT&E intends to provide an updated assessment prior to the FRP decision to further support that decision. In the IOT&E report, DOT&E concludes:
  - The RQ-21A testing was adequate and conducted in accordance with the DOT&E-approved test plan.
  - The RQ-21A is not operationally effective.
  - The RQ-21A is not operationally suitable.
  - The system has exploitable cybersecurity vulnerabilities.

### System

- Each system consists of five RQ-21A unmanned aircraft, surface components, and assorted government-provided equipment:
  - The surface components consist of two ground control stations, launch and recovery equipment, datalinks, multi-mission payloads, and support systems.
  - Government provided equipment includes vehicles and generators to transport and power ground components as well as intelligence workstations.
- The Marine Corps intends the RQ-21A system to have:
  - The reliability to support an operating tempo of 12 hours on station per day at a sustained rate for 30 days and the capability for one surge of 24 hours on-station coverage per day for a 10-day period during any 30-day cycle
  - An aircraft with 10 hours endurance, airspeed up to 80 nautical miles per hour, a service ceiling of 15,000 feet



density altitude, and an operating radius of 50 nautical miles

- An electro-optical sensor capable of providing the ground control station operator team sufficient visual resolution to support classification of a 1-meter linear sized object from 3,000 feet altitude above ground level and a sensor depression angle of 45 degrees, resulting in an assessment at a slant range of 4,242 feet
- An infrared sensor capable of classifying a 3-meter sized linear object from 3,000 feet above ground level and slant range of 4,242 feet
- An entire system transportable by CH-53E helicopter

### Mission

- Marine Corps commanders will use the RQ-21A Blackjack to provide units ashore with a dedicated battlefield Intelligence, Surveillance, and Reconnaissance (ISR) capability that will reduce their dependence on higher headquarters for ISR support.
- Detachments from Marine Corps Unmanned Aircraft System Squadrons will embark the requisite personnel and equipment aboard L-class ships and will be capable of conducting ship to shore operations.

### Major Contractor

Insitu, Inc. – Bingen, Washington

### Activity

- The Navy's Commander, Operational Test and Evaluation Force, with assistance from the Marine Corps Operational Test and Evaluation Activity, conducted the RQ-21A IOT&E

between January and December 2014 in three phases at Twentynine Palms, California; Camp Lejeune, North Carolina; and aboard USS *Anchorage* (LPD 23). Total

flight time accrued from all three test sites was 233.6 hours during 38 flights. The Navy and Marine Corps conducted the RQ-21A testing in accordance with the DOT&E-approved test plan.

- In May 2014, the Marine Corps deployed an Early Operational Capability RQ-21A system to support overseas combat operations. This deployed detachment consisted of up to eight aircraft, two launchers, and two recovery systems. Between May and September, the system flew approximately 121 flights for 995 flight hours. Data collected during the Early Operational Capability detachment's deployment overseas provided additional insights into system reliability.
- In June 2015, DOT&E submitted an IOT&E report based on the demonstrated performance during testing to inform the Services' FRP decision, which was originally planned for October 2015, now scheduled for September 2016. The Navy plans to conduct additional developmental testing and is investigating the conduct of a Verification of Correction of Deficiencies before the September 2016 FRP decision. DOT&E intends to provide an updated assessment prior to the FRP decision to further support that decision.

## Assessment

- The detachment equipped with RQ-21A is not effective in supporting the ground commander's mission because of an inability to have an unmanned aircraft arrive on station at the designated time and remain on station for the duration of the tasked period. During the IOT&E, the RQ-21A-equipped unit provided coverage during 68 percent of the tasked on-station hours (83.8 of 122.7 hours).
- The electro-optical/infrared sensor provides accurate target locations. While the Capabilities Production Document does not specify a threshold value for sensor point of interest accuracy, Marine Corps guidance indicates that 100 meter accuracy is sufficient to support tactical operations. RQ-21A provides a 90-percent circular error probable target location error of 43.8 meters. Such accuracy is sufficient to support targeting in a conventional linear battlefield, but does not support targeting in a dense urban environment that requires more accurate target locations.
- The RQ-21A sensor does not meet one of the two target classification Key Performance Parameters (KPPs) established in the Capabilities Production Document. The electro-optical sensor does not provide a 50 percent probability of correct classification for 1-meter linear objects (weapons or tools). The infrared sensor does meet the 50 percent threshold probability for correctly classifying 3-meter objects (vehicle chassis type) by demonstrating 100 percent correct classification.
- The communications relay payload limits the commanders' tactical flexibility and mission accomplishment. It is constrained to a single frequency in each of the two radios that are set before launch. Once airborne, operators cannot change frequencies. This limits the communications relay payload to supporting pre-planned relay missions on a single pair of pre-set frequencies.
- Aircraft endurance meets the 10-hour KPP. The longest IOT&E flight lasted 12.3 hours.
- The recessed, nose-mounted electro-optical/infrared payload requires circular orbits over the top of the target to maintain continuous coverage and positive target identification. The use of offset orbits results in the fuselage blocking the payload field of view for significant periods of time. These offset orbits resulted in auto-track break locks and loss of positive identification of high-value targets. There are orbit shapes that would allow RQ-21A operators to maintain continuous coverage of a target, but the current RQ-21A operating system limits operators to circular orbits.
- The RQ-21A is not operationally suitable. The RQ-21A demonstrated a Mean Flight Hour Between Abort for the System of 15.2 hours versus the 50-hour requirement. Because of aircraft reliability, overall system availability did not meet the 80 percent KPP threshold (demonstrated value equals 66.9 percent).
- The average time between overhaul of the propulsion modules was 48.9 hours, which does not meet the manufacturer's stated 100-hour capability.
- The RQ-21A Naval Air Training and Operations Standardization manual is missing important information regarding mission computer logic. This lack of information is especially critical during emergencies where operators are unaware of which conditions enable/disable various aspects of aircraft functionality. This lack of system operations information contributed to the loss of an aircraft during the first IOT&E flight.
- To support shipboard operations, the Navy permanently installed some RQ-21A ground components (antennae interface modules, datalink antennae) on selected ships. The ships' personnel, and not the RQ-21A detachment, own and maintain these components. During IOT&E, none of the ship's personnel received training on maintaining these installed components. The ship did not receive spare parts, maintenance manuals, or wiring diagrams with which to facilitate repairs.
- Field service representatives are required to conduct maintenance in accordance with the Naval Aviation Maintenance Program. Instead of using the established Naval Aviation Logistics Command Management Information System to track maintenance and flight information, the field service representatives used a program called Sapphire, which resulted in the accurate archiving of 15 of 136 unscheduled maintenance actions. Because of these inaccuracies, the Marine Corps will not be able to determine the true maintenance burden associated with RQ-21A operations.
- Extended logistics delay times and production quality control issues contributed to the system's poor reliability and availability. In six instances, aircraft spent time in a non-mission capable status while awaiting spare parts. Incorrectly assembled/configured components received from the manufacturer increase the maintenance time to repair or replace components, resulting in reduced mission availability.
- The system has exploitable cybersecurity vulnerabilities.

## Recommendations

- Status of Previous Recommendations. The Navy has made progress in the FY13 recommendation to accelerate annual operating hours in order to reach the projected 3,300 flight hours sooner than 2017, which would allow the Navy to identify and correct failure modes before committing to buy a significant number of systems. The remaining FY13 recommendation to conduct a comprehensive review of RQ-21A reliability versus requirements remains open.
- FY15 Recommendations. The Navy should:
  1. Improve the electro-optical sensor resolution to increase probability of correct classification for 1-meter sized targets.
  2. Increase the number of programmed aircraft loiter patterns to increase tactical flexibility and reduce fuselage obstruction of the payload.
  3. Fully integrate the communications relay payload into the aircraft architecture to allow for in-flight frequency changes and altering of other radio settings to increase tactical utility.
  4. Implement the cybersecurity recommendations listed in the classified annex to the IOT&E report to improve system security.
  5. Expand the systems description and flight characteristics section of the RQ-21A Naval Air Training and Operations Standardization manual to allow operators to safely react to system emergencies.
  6. Increase propulsion module service life and reliability to reduce maintainer workload, the number of spares required, and operating costs.
  7. Increase production quality control and implement thorough acceptance procedures for delivered systems and spare parts to reduce the number of faulty items received by fleet operators.
  8. Fully train and provide ship personnel with technical manuals, wiring diagrams, and spare parts related to RQ-21A shipboard components to increase RQ-21A full mission capability.
  9. Require field service representatives to utilize the Naval Aviation Logistics Command/Management Information System to track system maintenance to provide better maintenance burden data.
  10. Increase expenditures on spare parts to reduce administrative logistics delay times.
  11. Increase the number of spare parts in the pack-up kit to increase system availability.

# FY15 NAVY PROGRAMS