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30 June 2011

AWR YMQ-18A20110630

MEMORANDUM FOR YMQ-18A Hummingbird Unmanned Aircraft System (b) (6), (b) (3) 10  
(b) (6), (b) (3) 10 USC 130b  
USSOCOM, 7701 Tampa Point Blvd, MacDill AFB, FL  
33621-5323.

SUBJECT: Airworthiness Release (AWR) for Operation of USSOCOM YMQ-18A Hummingbird Unmanned Aircraft System (UAS) in the C2 Configuration (AWR YMQ-18A20110630) (TN 98793).

1. Scope: This memorandum constitutes a Qualification Level 3 Airworthiness Release (AWR) for the YMQ-18A Hummingbird Unmanned Aircraft A013 for C2 Configuration test flights in accordance with reference D-10: Test Plan for Victorville flight Testing Pre-C2 (SATCOM included) AUS11D0666, Dated 16 May 2011, operating in Class D airspace of Southern California Logistic Airport, SCLA (VCV) and the transit corridor between VCV and R2515 under the Federal Aviation Administration (FAA) approved USSOCOM Certificate of Authorization (COA).
2. Validity: This AWR terminates on 31 May 2012 or upon change in configuration of the subject equipment, or upon issuance of a later AWR, whichever occurs first. This AWR is only valid for operation of aircraft tail numbers A013 in the C2 configuration as defined in reference D-9: Airworthiness Substantiation Document (ASD) for Country 2, AUS11D0665, Dated 16 May 2011.
3. Appendices: This memorandum and its appendices shall be carried in the logbook, controlling Ground Control Station (GCS), and aircraft historical record file.

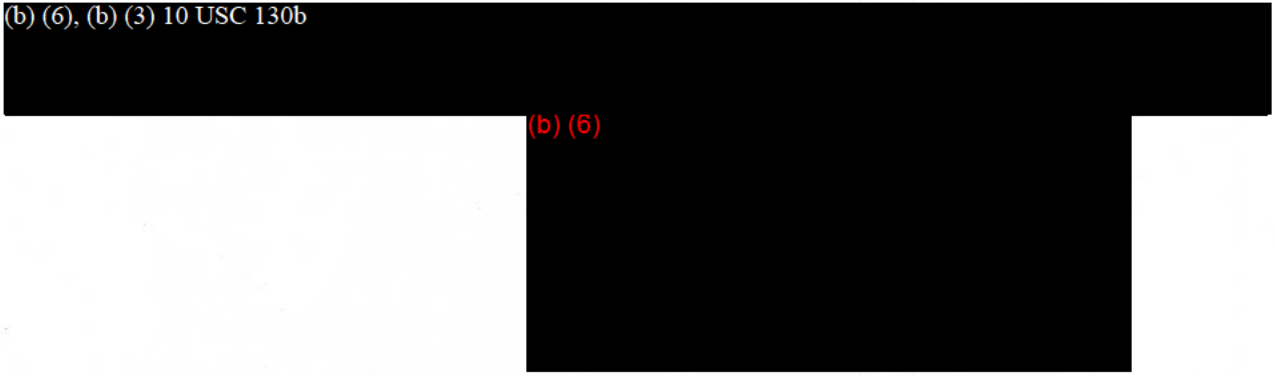
Appendix A - Restrictions and Operating Information  
Appendix B - Configuration and Installation Detail  
Appendix C - Inspections, Maintenance, and Logbook Instructions  
Appendix D - Reference List

4. The points of contact (POC) are (b) (6), (b) (3) 10 USC 130b  
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(b) (6)

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**Appendix A - Restrictions and Operating Information:**

**WARNING**

The YMQ-18A Hummingbird UAS with or without FORESTER/BLOS has not completed full airworthiness qualification. All flight operations shall be conducted in a manner to minimize exposure to manned aircraft, populated ground areas and cross roadways open to civil traffic at an angle between 45 to 90 degrees.

**WARNING**

Accidental operation of the YMQ-18A Hummingbird UAS with or without FORESTER/BLOS outside of active restricted airspace and/or the FAA approved COA shall be immediately reported to Air Traffic Control (ATC) / Range Control. The operator shall make immediate actions to correct the flight path and/or follow ATC/Range Control direction.

**WARNING**

The YMQ-18A Hummingbird UAS with or without FORESTER/BLOS has not undergone complete electromagnetic environmental effects (E3) testing. The aircraft may experience erroneous data reports, and/or loss of control of aircraft, and/or loss of control of payload. Operators shall avoid sources of electromagnetic fields such as but not limited to transmitters, power lines, and cell towers.

**WARNING**

The YMQ-18A UAS Ground Control Station (GCS) has not undergone Human-Machine Interface (HMI) evaluation. The performance, accuracy and efficiency of the GCS are unknown. The system should be used with extreme caution.

**WARNING**

The YMQ-18A Hummingbird UAS with or without FORESTER/BLOS does not have a sense and avoid system. Mid-air collision is a risk. All flight operations shall be conducted to ensure that minimum separation standards are maintained per approved COA.



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**WARNING**

In the event that the landing gear is not fully deployed or any other anomaly that would prevent a safe landing, the aircraft will be required to perform an emergency landing at a predetermined location. The area will be sanitized of personnel with an exclusion zone of 1200 feet radius from the planned touchdown coordinates.

**WARNING**

The PW-207D gas turbine engine in this installed configuration does not have over-speed protection. The remote engine kill switch box must be installed and operational for all engine-on ground runs.

**WARNING**

The overwrap strip on metal leading edge (MLE) main and tail rotor blade is a critical feature in the retention of the MLE. Each overwrap strip shall be visually and tap inspected for damage prior to each flight. If damage is found notify the POC in paragraph 4 of the cover memorandum.

**WARNING**

The SATCOM radome if installed, mounted above the main rotor hub has not undergone environmental or vibration testing. The radome structure and mounting surfaces shall be visually inspected for cracks and de-lamination prior to each flight.

**WARNING**

The right and left power distribution boxes are susceptible to failure due to fabrication method and non-military specification compliant capacitors. Only right and left power distribution boxes that have been upgraded with screened military specification capacitors and approved installation procedure are approved for installation on aircraft.

**WARNING**

AED shall be provided results of the 5 hour Production Acceptance Flight of aircraft A013 test prior to approval of follow-on flights. AED must be notified of any anomalies or corrections during the initial 5 hour flight test.



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**CAUTION**

The YMQ-18A Hummingbird UAS with or without FORESTER/BLOS has not been tested for the effects of lightning. Flight operations shall be restricted to no less than 25 nautical miles from lightning activity.

**CAUTION**

The YMQ-18A Hummingbird UAS with or without FORESTER/BLOS has not been qualified for the effects of icing. Flight operations are not authorized in known or forecast icing conditions. The aircraft will return to base if any icing is detected on the aircraft either by visual observation with onboard camera or by an ice detection system.

**CAUTION**

The YMQ-18A Hummingbird UAS with or without FORESTER/BLOS has not been qualified for the effects of precipitation. Flight operations shall be restricted from flight into or during measureable precipitation activity within the operational area. In the event of inadvertent flight into precipitation activity the aircraft shall make every attempt to exit and avoid the condition.

**CAUTION**

The YMQ-18A Hummingbird UAS with or without FORESTER/BLOS has not been qualified to MIL-STD-810G environmental temperature extremes to demonstrate structure and equipment function satisfactorily/safely. Therefore; the system may not operate or may cease operation when exposed to extreme temperatures, low pressure environments, and other non-standard climatic conditions. If conditions are entered that are outside of past experience, proceed with caution.

**CAUTION**

The YMQ-18A Hummingbird UAS with or without FORESTER/BLOS has not been qualified to MIL-STD-810G environmental temperature extremes. The aircraft shall not operate at altitudes or temperature conditions beyond which the backup batteries can safely provide power to the aircraft. The backup battery system shall be capable of providing adequate power to descend and land at an alternate ditching location.

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### **CAUTION**

The nickel erosion strip on the main and tail rotor blade leading edge is primarily for rain protection. The metal leading edges may not perform erosion protection well in sandy environments. Blades shall be inspected daily for erosion damage during operation in dust/sand environments. If erosion damage beyond 10% of original protective strip thickness the blade shall be removed.

### **CAUTION**

The YMQ-18A Hummingbird UAS with or without FORESTER/BLOS has not been qualified to MIL-STD-810G environmental effects for fuel jettisoning or qualified to meet FAR Part 29.1001 fuel jettisoning requirements. No off-loading fuel in-flight is permitted.

### **CAUTION**

The electrical power system; which includes the battery back-up, of the YMQ-18A has never been qualified or tested IAW MIL-STD-704. A failure of the electrical system could result in loss of communications between the aircraft and the GCS and loss of all flight control systems. The system should be used with extreme caution. Emergency procedures should be followed in the event of electrical power failure.

### **CAUTION**

Proper on-ground weather protection covers have not been developed for this aircraft. The aircraft cannot be left out in the rain. The exhaust duct should be covered when the aircraft is outside and there is potential of rain.

1. The aircraft operating instructions, procedures, and limitations shall be in accordance with references D-1.) YMQ-18A Unmanned Aerial System (UAS), A160T Operator's Checklist, D-2.) YMQ-18A Hummingbird Unmanned Aerial System (UAS) Ground Handling and Servicing Procedures, D-3.) Boeing A160 Ground Operating Procedures, D-4.) YMQ-18A Hummingbird Unmanned Aircraft System (UAS) Aircraft Pre-Flight Checklist, D-5.) YMQ-18A Hummingbird Unmanned Aircraft system (UAS), A160T Emergency Procedures, (as applicable) and this AWR. In the event of conflict between these documents, the information in this AWR shall prevail.
2. Flight of the YMQ-18A Hummingbird UAS is restricted to Visual Meteorological Conditions (VMC).



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3. Due to lack of SOF Explosive Atmosphere testing, the following precautions shall be observed in order to ensure safe flight:

### **WARNING**

The YMQ-18A Hummingbird UAS with or without FORESTER/BLOS has not undergone Explosive Atmosphere testing. A serious fire or explosion may result if the aircraft is powered while flammable vapors are present during ground or flight operations. The precautions in paragraph 3 of this appendix shall be observed in order to ensure safe operations.

a. The aircraft shall be un-powered and grounded IAW references D-1.) YMQ-18A Unmanned Aerial System (UAS), A160T Operator's Checklist, D-2.) YMQ-18A Hummingbird Unmanned Aerial System (UAS) Ground Handling and Servicing Procedures, D-3.) Boeing A160 Ground Operating Procedures, D-4.) YMQ-18A Hummingbird Unmanned Aircraft System (UAS) Aircraft Pre-Flight Checklist, D-5.) YMQ-18A Hummingbird Unmanned Aircraft system (UAS), A160T Emergency Procedures, (as applicable) and D-2 during refueling operations.

b. Ground operations of the aircraft shall be conducted at the greatest distance practical (no less than 50 feet) from all other aircraft and fuel depots.

c. If the aircraft is electrically powered during ground operations other than refueling, the crew shall assure that sufficient ventilation and airflow exists around the vehicle to prevent accumulation of hazardous/flammable vapors.

4. Because the specific temperatures for material allowable are unknown, the rotor blades must spin a minimum of 10 minutes prior to take off for composite blade and fuselage cooling when the ambient temperature is 100°F or above and exposed to direct sun light.

5. Because the specific temperatures for the material allowable are unknown, the YMQ-18A aircraft must not be left on the tarmac in direct sunlight for extended periods of time when the ambient temperature is 100°F or above. The aircraft should be sheltered or covered until ready for flight to avoid radiation heating.

6. Due to lack of static testing of the main rotor (MR) blade integration with the MR hub and the fact the fatigue values are by analysis/FEM; it is required that the RPM's do not exceed 400. If an exceedance does occur AED must be notified and concur with continued operations prior to next flight.

7. Use of data links is limited to approved frequencies for all ground and flight operations. Data link frequencies shall be de-conflicted through the local frequency manager/coordinator prior to conducting operations.



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8. An appropriate Lost Link Return Home Point shall be set such that the aircraft will not exit the approved operational airspace during lost link flight.
9. Flight over populated areas is prohibited.
10. In the event of loss of control, local ATC/Range Control and the chase aircraft/observers shall be notified immediately.
11. In the event of an engine failure or other catastrophic failure, local ATC/Range Control and chase aircraft/observer will be notified immediately and the aircraft shall be ditched over the appropriate Lost Link Return Home Point if possible. If not possible to make the Lost Link Return Home Point, every effort shall be made to visually inspect the probable impact area prior to committing to ditching location.
12. The flight path of the aircraft shall be within reach of pre-established ditching points where practicable.
13. During preflight someone other than the operator shall verify that the Lost Link Return Home Point is entered correctly.
14. Local ATC/Range Control shall be notified with a flight plan or flight strip prior to departure, to aid in airspace de-confliction.
15. Verified loss of any aircraft flight critical subsystem or Ground Control Station (GCS) or Mobile Ground Control Station (MGCS) flight critical sub-system shall require return to the appropriate Return Home Point.
16. All flight operations shall be conducted with a minimum of one controlling GCS or MGCS. For initial risk reduction flights either a full GCS monitoring will be used or if controlled from MGCS a parallel monitoring of all engineering parameters in EGCS will be required.
17. Airspace de-confliction outside of the restricted airspace shall be IAW the FAA COA.
18. Any procedural deficiencies or flight anomalies detected during operations shall be corrected, annotated, and reported to the POC listed in paragraph 4 of this AWR.
19. Antennae patterns and nulls have not been fully evaluated. The command and control link margin should be monitored closely until antenna performance has been validated and nulls are identified.

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20. Prior to first flight with the stated aircraft configuration, a comprehensive EMI/EMC check must be completed. Any unexplained EMI/EMC anomalies shall be resolved prior to first flight. Test results and corrective actions must be provided to POC list in paragraph 4 of this AWR prior to first flight.

21. Hand-off of aircraft control between primary launch GCS or MGCS to an alternate GCS or MGCS is not permitted in the VCV class D airspace or the transit corridor to R2515.

22. Aircraft flight monitoring of structural limits shall be IAW Reference D-6 with the following exceptions:

Max gross vehicle weight with payload is 5500 lbs.

Max acceleration in Z is 2 g.

Max decent rate of aircraft landing touchdown without FORESTER is 8 fps (480 fpm)

Max decent rate of aircraft landing touchdown with FORESTER is 6 fps (360 fpm)

Max forward flight speed is 100 knots based on TR hub.

2 Piece TR hub (PN UAA 35-723) max flap moment is 1702 in-lb

2 Piece TR hub (PN UAA 35-723) max lag moment is 1422 in-lb

1 Piece TR hub (PN 35-529) max flap moment is 1830 in-lb

1 Piece TR hub (PN 35-529) lag moment is 1530 in-lb

23. YMQ-18A A013 is not equipped with an Identification Friend or Foe (IFF) transponder. A013 is equipped with a commercial Bendix King KT-76A transponder. Aircraft without a military IFF transponder are not authorized to fly in airspace that require military modes.

24. Slung load cargo hook operation is not authorized.

25. The YMQ-18A Hummingbird UAS is restricted to a maximum flight altitude of 20,000 feet per PW-207D Engine Certification limit.

26. A personnel exclusion zone of 500 feet radius based on main rotor blade throw analysis is required.

27. Risk Reduction flights can only be performed by qualified LSO and RSO. Risk Reduction flights are not approved for pilots in training.

28. The TR hub must be replaced once the part has reached 132 flight hours. The removed parts must be marked as "Not Approved for Flight".

29. The L3 WESCAM MX-15HDi EO/IR payload is not authorized for activation or use of the active laser designator or laser illuminator. The unit is authorized for use of the laser rangefinder which is eye safe IAW Laser Safety for the L3 WESCAM MX-15HDi L0010 turret Pod (D-10).



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30. The maintenance required and engine life limits are based on the maximum continuous power (MCP) operation of the PW207D engine and shall be in accordance with the Pratt & Whitney (PW) Performance and Integration Manual. Any exceedence of the PW manuals shall be reported to AED POC list in paragraph 4 of this AWR memorandum.

31. Fuselage sealant material is restricted to AED approved materials (3M 8671 tape, De Soto Pr-1773 Class B NSN 8030011045396).

32. All fuselage seams and holes requiring sealant to prevent water penetration shall be visually inspected IAW installation and inspection procedures before and after all flights.

33. All aircraft shall follow the updated electrical power up procedure: Aircraft Maintenance Manual (AMM) Chapter 05-Aircraft General, BO-AMM-A160T-05, Dated 3 July 2011.

34. Commander's Corner:

The YMQ-18A Hummingbird Unmanned Aircraft System (UAS) has not completed full airworthiness qualification testing. Since this is a developmental aircraft in its initial stages of flight testing, every effort should be made to ensure an incremental approach is used and approved during envelope expansion. Strict adherence to the Operators Instructions, maintenance requirements and regimented test processes are required to reduce the risk of loss of aircraft, property damage and personnel injury.

The content of this AWR is based on information provided to AED in Appendix D, references 1-12, from technical interchange with the aircraft manufacturer, and physical inspection of the YMQ-18A aircraft. Many issues have been found and are addressed in AWIS 09-022 Rev 3 provided to USSOCOM (b) (6) on 11 February 2011. A risk acceptance memo has been signed and provided to AEV.



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#### **Appendix B - Configuration and Installation Detail:**

Configuration- This aircraft is not a production representative aircraft. The configuration of this aircraft is defined in reference D-9, Airworthiness Substantiation Document (ASD) for Country 2, AUS11D0665, Dated 16 May 2011 with a instrumented static mast, MR blade metal leading edge, and SATCOM radome mounted above the main rotor head , vibration survey instrumentation, LN-251 navigation integration and development aircraft health monitoring software. Under this AWR, A013 can operate with the single piece tail rotor (TR) hub with approved restrictions. Any deviations to this configuration shall be approved in writing by the Aviation Engineering Directorate (POC in cover memorandum paragraph 4) for this AWR to be valid.

The Boeing YMQ-18A is a four blade Unmanned Aircraft System (UAS) rotorcraft utilizing an organic two-speed drive system and a Pratt & Whitney PW207D turboshaft engine.

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**Appendix C - Inspections, Maintenance, and Logbook Instructions:**

1. In the event any operating limit, or limits established by this release are exceeded, in addition to the normal entry in flight log all limits that were exceeded shall be entered/noted and appropriate inspections shall be performed prior to next flight.

2. Aircraft Logbook Entries:

a. A copy of this AWR shall be inserted in the logbook and the following entry shall be noted: "Operate within limitations and restrictions specified in the enclosed airworthiness release dated 30 June 2011"

b. A weight and balance record (form DD365 recommended) shall be maintained and kept on file in each aircraft's log book and weight and balance book maintained by the operator.

c. If a hard landing event occurs, make the following entry: "Perform visual inspection of FOR and AFT bulk-head and landing gear as required by enclosed airworthiness release dated 30 June 2011."

d. Make the following entry: "Perform EMI/EMC check as required by the enclosed airworthiness release dated 30 June 2011." prior to first flight of each aircraft with this configuration.

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**Appendix D - Reference List:**

1. YMQ-18A Unmanned Aerial System (UAS), A160T Operator's Checklist, Document No. AUS 07D0404-E, Version 2.7, 18 February 2010.
  - 1.A. A160T Operators Check List for Country 1 deployment, AUS10D0528, Dated 29 July 2010.
2. YMQ-18A Hummingbird Unmanned Aerial System (UAS) Ground Handling and Servicing Procedures, TO MT-A160T-CL-2, Document No. AUS 07D0169, Change 0, 21 May 2008.
3. Boeing A160 Ground Operating Procedures; DCMA Palmdale GFR (b) (6), (b) (3) 10 USC 130b Signature Approval, August 2010.
  - 3A. Boeing A160 Flight Operations Procedure GFR approved 19 October 2010.
4. YMQ-18A Hummingbird Unmanned Aircraft System (UAS) Aircraft Pre-Flight Checklist, Document No. AUS07D406-A, Version 2.1, 19 December 2009.
5. YMQ-18A Hummingbird Unmanned Aircraft system (UAS), A160T Emergency Procedures, Document No. AUS09D0405-E, Version 2.6, 15 February 2010.
6. Structural Analysis Report Rev D, AUS07D0205, 9 April 2010.
7. YMQ-18A Hummingbird Unmanned Aerial System (UAS) Electronic Component Removal and Installation Procedures, TO MT-A160T-CL-3, Document No. AUS 07D0170, Change 0, 5 November 2007.
8. YMQ-18A Hummingbird Unmanned Aerial System (UAS) Mechanical Component Removal and Installation Procedures, TO MT-A160T-CL-4, Document No. AUS 07D0171, Change 0, 15 January 2008.
9. Airworthiness Substantiation Document (ASD) for Country 2, AUS11D0665, Dated 16 May 2011.
10. Test Plan for Victorville flight Testing Pre-C2 (SATCOM included) AUS11D0666, Dated 16 May 2011.
11. Laser Safety Summary for L3 WESCAM MX-15HDi L0010 Turret Pod, AFRL Brooks City, Memorandum for 645 AESG/SYS, 25 January 2010.
12. Software Configuration Control and Verification Document, AUS09D0413, Rev 3.2.21, 22 April 2011.