UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION - FEDERAL AVIATION ADMINISTRATION

SPECIAL AIRWORTHINESS CERTIFICATE

A	CATEGORY/DESIGNATION	Experimental (Unmanned Aircraft)	
	PURPOSE	Research & Development, Crew Training or Market Survey	
B	MANU-FACTURER NAME	N/A	
	ADDRESS	N/A	
C	FLIGHT FROM	See attached operating limitations	
	TO	See item D, reverse side of this certificate	
D	N- 605RN		SERIAL NO. 005
	BUILDER RAYTHEON CO.		MODEL COBRA
E	DATE OF ISSUANCE February 23, 2007		EXPIRY February 23, 2008
	OPERATING LIMITATIONS DATED 02/23/07		ARE PART OF THIS CERTIFICATE
	SIGNATURE OF FAA REPRESENTATIVE Judith Baty		DESIGNATION OR OFFICE NO. Phoenix MIDO ANM-108P

Any alteration, reproduction or misuse of this certificate may be punishable by a fine not exceeding $1,000 or imprisonment not exceeding 3 years, or both. THIS CERTIFICATE MUST BE DISPLAYED IN THE AIRCRAFT IN ACCORDANCE WITH APPLICABLE TITLE 14, CODE OF FEDERAL REGULATIONS (CFR).

FAA Form 8130-7 (07/04) *SEE REVERSE SIDE* *NSN: 0052-00-693-4000*

A	This airworthiness certificate is issued under the authority of Public Law 104-6, 49 United States Code (USC) 44704 and Title 14 Code of Federal Regulations (CFR).
B	The airworthiness certificate authorizes the manufacturer named on the reverse side to conduct production fight tests, and only production flight tests, of aircraft registered in his name. No person may conduct production flight tests under this certificate: (1) Carrying persons or property for compensation or hire: and/or (2) Carrying persons not essential to the purpose of the flight.
C	This airworthiness certificate authorizes the flight specified on the reverse side for the purpose shown in Block A.
D	This airworthiness certificate certifies that as of the date of issuance, the aircraft to which issued has been inspected and found to meet the requirements of the applicable CFR. The aircraft does not meet the requirements of the applicable comprehensive and detailed airworthiness code as provided by Annex 8 to the Convention On International Civil Aviation. No person may operate the aircraft described on the reverse side: (1) except in accordance with the applicable CFR and in accordance with conditions and limitations which may be prescribed by the Administrator as part of this certificate; (2) over any foreign country without the special permission of that country.
E	Unless sooner surrendered, suspended, or revoked, this airworthiness certificate is effective for the duration and under the conditions prescribed in 14 CFR, Part 21, Section 21.181 or 21.217.

FAA FORM 8130-6, APPLICATION FOR U.S. AIRWORTHINESS CERTIFICATE

Form Approved O.M.B. No. 2120-0018
09/30/2007

U.S. Department of Transportation
Federal Aviation Administration

APPLICATION FOR U.S. AIRWORTHINESS CERTIFICATE

INSTRUCTIONS - Print or type. Do not write in shaded areas; these are for FAA use only. Submit original only to an authorized FAA Representative. If additional space is required, use attachment. For special flight permits complete Sections II, VI and VII as applicable.

I. AIRCRAFT DESIGNATION

1. REGISTRATION MARK	2. AIRCRAFT BUILDER'S NAME (Make)	3. AIRCRAFT MODEL DESIGNATION	4. YR. MFR.	FAA CODING
N605RN	Raytheon	Cobra	2007	061001A
5. AIRCRAFT SERIAL NO.	**6. ENGINE BUILDER'S NAME (Make)**	**7. ENGINE MODEL DESIGNATION**		20500
005	Desert Aircraft	DA-150		
8. NUMBER OF ENGINES	**9. PROPELLER BUILDER'S NAME (Make)**	**10. PROPELLER MODEL DESIGNATION**	**11. AIRCRAFT IS (Check if applicable)**	
1	Mezjlick	30 x 12	☐ IMPORT	

II. CERTIFICATION REQUESTED

APPLICATION IS HEREBY MADE FOR: *(Check applicable items)*

- A 1 ☐ STANDARD AIRWORTHINESS CERTIFICATE *(Indicate Category)* ☐ NORMAL ☐ UTILITY ☐ ACROBATIC ☐ TRANSPORT ☐ COMMUTER ☐ BALLOON ☐ OTHER
- B ☑ SPECIAL AIRWORTHINESS CERTIFICATE *(Check appropriate items)*
  - 7 ☐ PRIMARY
  - 9 ☐ LIGHT-SPORT *(Indicate Class)* ☐ AIRPLANE ☐ POWER-PARACHUTE ☐ WEIGHT-SHIFT-CONTROL ☐ GLIDER ☐ LIGHTER THAN AIR
  - 2 ☐ LIMITED
  - 5 ☐ PROVISIONAL *(Indicate Class)*: 1 ☐ CLASS I; 2 ☐ CLASS II
  - 3 ☐ RESTRICTED *(Indicate operation(s) to be conducted)*: 1 ☐ AGRICULTURE AND PEST CONTROL; 2 ☐ AERIAL SURVEY; 3 ☐ AERIAL ADVERTISING; 4 ☐ FOREST *(Wildlife Conservation)*; 5 ☐ PATROLLING; 6 ☐ WEATHER CONTROL; 0 ☐ OTHER *(Specify)*
  - 4 ☑ EXPERIMENTAL *(Indicate operation(s) to be conducted)*: 1 ☑ RESEARCH AND DEVELOPMENT; 2 ☐ AMATEUR BUILT; 3 ☐ EXHIBITION; 4 ☐ AIR RACING; 5 ☑ CREW TRAINING; 6 ☑ MARKET SURVEY; 0 ☐ TO SHOW COMPLIANCE WITH THE CFR; 7 ☐ OPERATING *(Primary Category)* KIT BUILT AIRCRAFT
  - 8 ☐ OPERATING LIGHT-SPORT: 8A ☐ Existing Aircraft without an airworthiness certificate & do not meet § 103.1; 8B ☐ Operating Light-Sport Kit-Built; 8C ☐ Operating light-sport previously issued special light-sport category airworthiness certificate under § 21.190
  - 8 ☐ SPECIAL FLIGHT PERMIT *(Indicate operation(s) to be conducted, then complete Section VI or VII as applicable on reverse side)*: 1 ☐ FERRY FLIGHT FOR REPAIRS, ALTERATIONS, MAINTENANCE, OR STORAGE; 2 ☐ EVACUATION FROM AREA OF IMPENDING DANGER; 3 ☐ OPERATION IN EXCESS OF MAXIMUM CERTIFICATED TAKE-OFF WEIGHT; 4 ☐ DELIVERING OR EXPORTING; 5 ☐ PRODUCTION FLIGHT TESTING; 6 ☐ CUSTOMER DEMONSTRATION FLIGHTS
- C 6 ☐ MULTIPLE AIRWORTHINESS CERTIFICATE *(check ABOVE "Restricted Operation" and "Standard" or "Limited" as applicable)*

III. OWNER'S CERTIFICATION

A. REGISTERED OWNER *(As shown on certificate of aircraft registration)* — IF DEALER, CHECK HERE →

NAME	ADDRESS
Raytheon Co	PO Box 11337 Tucson, AZ 85734-1337

B. AIRCRAFT CERTIFICATION BASIS *(Check applicable blocks and complete items as indicated)*

AIRCRAFT SPECIFICATION OR TYPE CERTIFICATE DATA SHEET *(Give No. and Revision No.)*	AIRWORTHINESS DIRECTIVES *(Check if all applicable AD's are complied with and give the number of the last AD SUPPLEMENT available in the biweekly series as of the date of application)*
NA	☑ AD Bi-Weekly # 2007-03
AIRCRAFT LISTING *(Give page number(s))*	**SUPPLEMENTAL TYPE CERTIFICATE** *(List number of each STC incorporated)*
NA	NA

C. AIRCRAFT OPERATION AND MAINTENANCE RECORDS

CHECK IF RECORDS IN COMPLIANCE WITH 14 CFR Section 91.417	TOTAL AIRFRAME HOURS	3 EXPERIMENTAL ONLY *(Enter hours flown since last certificate issued or renewed)*
☐	0	0

D. CERTIFICATION - I hereby certify that I am the registered owner (or his agent) of the aircraft described above, that the aircraft is registered with the Federal Aviation Administration in accordance with Title 49 of the United States Code 44101 et seq. and applicable Federal Aviation Regulations, and that the aircraft has been inspected and is airworthy and eligible for the airworthiness certificate requested.

DATE OF APPLICATION	NAME AND TITLE *(Print or type)*	SIGNATURE
022307	Donald L. Newman, Director, Unmanned Systems	Donald L. Newman

IV. INSPECTION AGENCY VERIFICATION

A. THE AIRCRAFT DESCRIBED ABOVE HAS BEEN INSPECTED AND FOUND AIRWORTHY BY: *(Complete the section only if 14 CFR part 21.183(d) applies.)*

- 2 ☐ 14 CFR part 121 CERTIFICATE HOLDER *(Give Certificate No.)*
- 3 ☐ CERTIFICATED MECHANIC *(Give Certificate No.)*
- 6 ☐ CERTIFICATED REPAIR STATION *(Give Certificate No.)*
- 5 ☐ AIRCRAFT MANUFACTURER *(Give name or firm)*

DATE	TITLE	SIGNATURE

V. FAA REPRESENTATIVE CERTIFICATION

(Check ALL applicable block items A and B)

A. I find that the aircraft described in Section I or VII meets requirements for
- ☐ THE CERTIFICATE REQUESTED
- 4 ☐ AMENDMENT OR MODIFICATION OF CURRENT AIRWORTHINESS CERTIFICATE

B. Inspection for a special permit under Section VII was conducted by:
- ☒ FAA INSPECTOR
- ☐ FAA DESIGNEE
- ☐ CERTIFICATE HOLDER UNDER
- ☐ 14 CFR part 65
- ☐ 14 CFR part 121 OR 135
- ☐ 14 CFR part 145

DATE	DISTRICT OFFICE	4 DESIGNEE'S SIGNATURE AND NO.	1 FAA INSPECTOR'S SIGNATURE
2/23/07	NM50		

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION - FEDERAL AVIATION ADMINISTRATION

SPECIAL AIRWORTHINESS CERTIFICATE

A	CATEGORY/DESIGNATION	Experimental (Unmanned Aircraft)		
	PURPOSE	Research & Development, Crew Training or Market Survey		
B	MANU-FACTURER	NAME	N/A	
		ADDRESS	N/A	
C	FLIGHT	FROM	See attached operating limitations	
		TO	See item D, reverse side of this certificate	
D	N- 605RN			SERIAL NO. 005
	BUILDER	RAYTHEON CO		MODEL COBRA
E	DATE OF ISSUANCE	February 23, 2007		EXPIRY February 23, 2008
	OPERATING LIMITATIONS DATED	02/23/07		ARE PART OF THIS CERTIFICATE
	SIGNATURE OF FAA REPRESENTATIVE	Judith Baty		DESIGNATION OR OFFICE NO. Phoenix MIDO ANM-108P

Any alteration, reproduction or misuse of this certificate may be punishable by a fine not exceeding $1,000 or imprisonment not exceeding 3 years, or both. THIS CERTIFICATE MUST BE DISPLAYED IN THE AIRCRAFT IN ACCORDANCE WITH APPLICABLE TITLE 14, CODE OF FEDERAL REGULATIONS (CFR).

FAA Form 8130-7 (07/04) SEE REVERSE SIDE NSN: 0052-00-693-4000

A	This airworthiness certificate is issued under the authority of Public Law 104-6, 49 United States Code (USC) 44704 and Title 14 Code of Federal Regulations (CFR).
B	The airworthiness certificate authorizes the manufacturer named on the reverse side to conduct production fight tests, and only production flight tests, of aircraft registered in his name. No person may conduct production flight tests under this certificate: (1) Carrying persons or property for compensation or hire: and/or (2) Carrying persons not essential to the purpose of the flight.
C	This airworthiness certificate authorizes the flight specified on the reverse side for the purpose shown in Block A.
D	This airworthiness certificate certifies that as of the date of issuance, the aircraft to which issued has been inspected and found to meet the requirements of the applicable CFR. The aircraft does not meet the requirements of the applicable comprehensive and detailed airworthiness code as provided by Annex 8 to the Convention On International Civil Aviation. No person may operate the aircraft described on the reverse side: (1) except in accordance with the applicable CFR and in accordance with conditions and limitations which may be prescribed by the Administrator as part of this certificate; (2) over any foreign country without the special permission of that country.
E	Unless sooner surrendered, suspended, or revoked, this airworthiness certificate is effective for the duration and under the conditions prescribed in 14 CFR, Part 21, Section 21.181 or 21.217.

VI. PRODUCTION FLIGHT TESTING

A. MANUFACTURER

NAME	ADDRESS

B. PRODUCTION BASIS *(Check applicable item)*

- [ ] PRODUCTION CERTIFICATE *(Give production certificate number)* ⟶
- [ ] TYPE CERTIFICATE ONLY
- [ ] APPROVED PRODUCTION INSPECTION SYSTEM

C. GIVE QUANTITY OF CERTIFICATES REQUIRED FOR OPERATING NEEDS

DATE OF APPLICATION	NAME AND TITLE *(Print or Type)*	SIGNATURE

VII. SPECIAL FLIGHT PERMIT PURPOSES OTHER THAN PRODUCTION FLIGHT TEST

A. DESCRIPTION OF AIRCRAFT

REGISTERED OWNER	ADDRESS

BUILDER *(Make)*	MODEL

SERIAL NUMBER	REGISTRATION MARK

B. DESCRIPTION OF FLIGHT — CUSTOMER DEMONSTRATION FLIGHTS ☐ *(Check if applicable)*

FROM	TO

VIA	DEPARTURE DATE	DURATION

C. CREW REQUIRED TO OPERATE THE AIRCRAFT AND ITS EQUIPMENT

- [ ] PILOT
- [ ] CO-PILOT
- [ ] FLIGHT ENGINEER
- [ ] OTHER *(Specify)*

D. THE AIRCRAFT DOES NOT MEET THE APPLICABLE AIRWORTHINESS REQUIREMENTS AS FOLLOWS:

E. THE FOLLOWING RESTRICTIONS ARE CONSIDERED NECESSARY FOR SAFE OPERATION: *(Use attachment if necessary)*

F. CERTIFICATION – I hereby certify that I am the registered owner (or his agent) of the aircraft described above; that the aircraft is registered with the Federal Aviation Administration in accordance with Title 49 of the United States Code 44101 et seq. and applicable Federal Aviation Regulations; and that the aircraft has been inspected and is safe for the flight described.

DATE	NAME AND TITLE *(Print or Type)*	SIGNATURE

VIII. AIRWORTHINESS DOCUMENTATION (FAA/DESIGNEE use only)

X	A. Operating Limitations and Markings in Compliance with 14 CFR Section 91.9, as applicable.	N/A	G. Statement of Conformity, FAA Form 8130-9 *(Attach when required)*
X	B. Current Operating Limitations Attached	N/A	H. Foreign Airworthiness Certification for Import Aircraft *(Attach when required)*
X	C. Data, Drawings, Photographs, etc. *(Attach when required)*	N/A	I. Previous Airworthiness Certificate Issued in Accordance with 14 CFR Section _____ CAR _____ (Original Attached)
X	D. Current Weight and Balance information Available in Aircraft		
N/A	E. Major Repair and Alteration, FAA Form 337 *(Attach when required)*	X	J. Current Airworthiness Certificate Issued in Accordance with 14 CFR Section 21.191 (A)(C)(F) *(Copy Attached)*
X	F. This inspection Recorded in Aircraft Records	N/A	K. Light-Sport Aircraft Statement of Compliance, FAA Form 8130-15 *(Attach when required)*

U.S. Department
of Transportation
**Federal Aviation
Administration**

Phoenix Manufacturing Inspection District Office
13951 N. Scottsdale Rd. #123
Scottsdale, AZ 85254

EXPERIMENTAL - OPERATING LIMITATIONS
RESEARCH AND DEVELOPMENT, and/or CREW TRAINING.

REGISTERED OWNER NAME: RAYTHEON MISSILE SYSTEMS **REGISTERED OWNER ADDRESS:** PO BOX 11337 TUCSON, AZ 85734-1337 **AIRCRAFT DESCRIPTION:** FIXED WING **AIRCRAFT REGISTRATION:** N605RN	**AIRCRAFT BUILDER:** RAYTHEON MISSILE SYSTEMS **YEAR MANUFACTURED:** 2007 **AIRCRAFT SERIAL NUMBER:** 005 **AIRCRAFT MODEL DESIGNATION:** COBRA **ENGINE MODEL:** DESERT AIRCRAFT DA-150

The following conditions and limitations apply to all Raytheon Missile Systems, Cobra Unmanned Aircraft System flight operations, while operating in the National Airspace System (NAS). These conditions and limitations must be accessible to the pilot in command at all times.

1. GENERAL:

a. For the purposes of this **Special Airworthiness Certificate and Operating Limitations**, the Cobra Unmanned Aircraft System (UAS), owned and operated by Raytheon, is considered to be an integrated system that is composed of the Cobra aircraft, S/N 005, unmanned aircraft (UA) pilot(s), UA control station(s) (fixed or mobile), telemetry, navigation and communications equipment to include ground and airborne equipment that is used for control of the Cobra UA. The ground equipment used for communication with the chase aircraft and Air Traffic Control during UAS operations is considered part of the UAS.

b. Unless otherwise specified in this document, the UA Pilot-in-Command (PIC) and Raytheon shall comply with all applicable sections and parts of 14 CFR including, but not limited to, parts 61 and 91.

c. No person may operate this UA for other than the purpose of Research and Development, Market Survey and/or Crew Training, to accomplish the flight operations outlined in Raytheon Program Letter dated February 21, 2007 which describes compliance with § 21.193(d), and has been made available to the pilot in command of the UA. In addition, this UA must be operated in accordance with applicable air traffic and general operating rules of part 91, and all additional limitations herein prescribed under the provisions of § 91.319(e).

d. The UA PIC must determine that the UA is in a condition for safe operation and in a configuration appropriate for the purpose of the intended flight.

e. No person may operate this UA to carry property for compensation or hire.

f. This UA must be marked with its U.S. Registration number in accordance with 14 CFR part 45 or exemption thereto.

g. This UA must display the word "EXPERIMENTAL" in accordance with § 45.23(b) or exemption thereto.

h. Prior to conducting initial Cobra flight operations, Raytheon must forward a copy of the Cobra Program Letter, Special Airworthiness Certificate, and Operating Limitations to:

1) Debra Trindle FAA Air Traffic Representative, Luke and Davis-Monthan Air Force Base, AZ, (623) 856-9596, FAX: (623) 856-8339, email, debra.trindle@luke.af.mil.

2) Roger Trevino, Airspace Specialist, FAA Central Enroute Service Area, Operations Branch, AJO-2C2, roger.trevino@faa.gov, FAX: 817-222-5547.

i. Section 47.45 requires that the FAA Aircraft Registry must be notified within 30 days of any change in the aircraft registrant's address. Such notification is to be made by submitting AC Form 8050-1 to AFS-750 in Oklahoma City, Oklahoma.

2. PROGRAM LETTER: The Raytheon Program Letter, dated February 21, 2007, shall be used as a basis for the determination of the operating limitations prescribed in this document. All flight operations must be conducted in accordance with the provisions of this document.

3. AUTHORIZED FLIGHT OPERATIONS AREA:

a. The base of operations for the UA shall be:

Unmanned Vehicles International, Inc
2595 North Sagebrush Road, Whetstone, AZ
±4 Miles east of State Route 90 on State Route 82, west of
Mile Post 56, ½ mile north. on Sagebrush Road
T20S, R20E, Sec. 3

This is the address of the Cochise County Western Region Landfill. UVI is accessed through the landfill property.

b. The flight operations area authorized for the UA is depicted graphically below. This area shall be referred to as the "Primary Containment Area." It is recognized that Raytheon may be permitted to operate within Special Use Airspace (SUA) per authorization of the using agency. Under these circumstances, should the UA venture beyond the boundaries of the SUA (e.g., spill out), Raytheon is responsible for notifying the FAA of the breach.

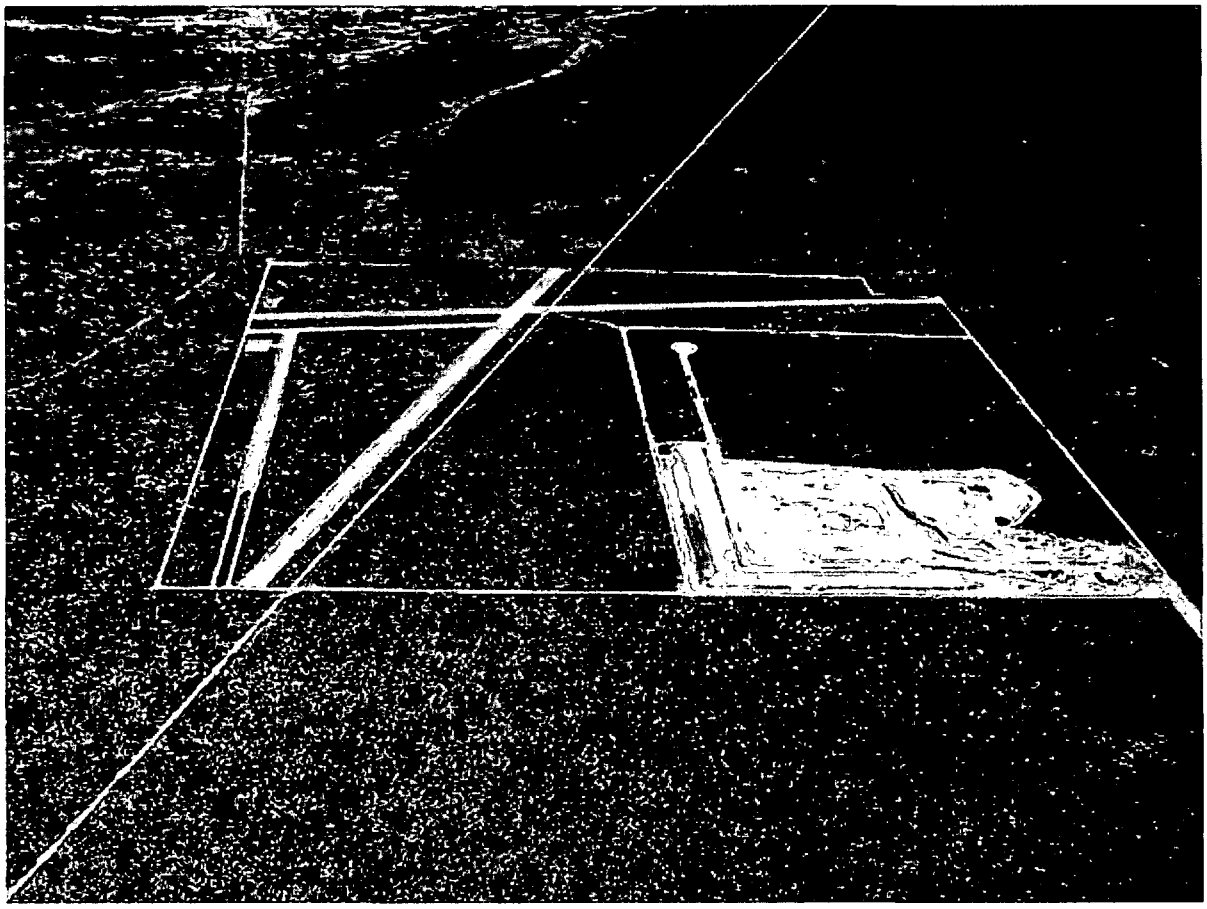


Figure 1. UVI UAS airfield looking north, located next to the Cochise County landfill.

Phoenix Sectional

FHU 004/08.5, 4225' Elevation

N 31° 43' 30", W 110° 17' 47"

The UVI site is shown in Figure 2 and was specifically located to have easy access to the R-2303 restricted airspace. Not having regular access to the restricted airspace, Raytheon will operate below the 8000' MSL lower limit of R-2303B to remain outside of restricted airspace unless prior coordination has been obtained. The pattern altitude is 600' AGL, and beyond 1 mile Raytheon would operate at 2000' AGL and below, normally remaining between 1500' – 2000' AGL. As a civil user not on a DoD contract, Raytheon does not have priority access to the R-2303 airspace. Through UVI Inc, Raytheon has coordinated with the Libby Field Airspace Manager, El Paso Gas

(pipeline patrol) and the Border Patrol, and has directly coordinated with Prescott Flight Service Station for NOTAMs. The Four Pillars (AZ21) airfield indicated in red on the map shown in Figure 2 is currently abandoned.

The UVI site is located on state property and is operated on a state lease for the purpose of operating UAS. The State has approved the lease to UVI, Inc., for UAS operations only. From Highway 82 to the south to I-10 on the north, the land is nearly uninhabited. The only ground traffic in the Primary Containment Area is along Highway 80 from Tombstone to Benson. The Raytheon local operating area is a 1 mile radius from UAS control station located on the UVI site. The aircraft are kept north of Highway 82 and east of Highway 90. When UAS flight operations exceed 1 NM from the ground observer, a chase plane will be used.

In Figure 2, the larger area outlined with a hashed black line is the proposed Raytheon UAS operations area. This would be used for developmental testing and demonstration from the surface to 2000' AGL (6000' MSL average). All of Raytheon's UAS flight operations will be within radio line of sight of the Ground Control Station. Victor Airway 66 crosses the Primary Containment Area and has a Minimum Reception Altitude (MRA) of 9500' MSL (4500' AGL). VR 259 from points D to E, and VR 260 from points D to E, also cross this area, and Raytheon will contact Flight Service to see if they are active prior to crossing.

The chase plane and UAS will have active transponders when within the lateral limits of the VR routes. The class E airspace overlaying the Primary Containment Area is used for instrument approaches into Libby Army Airfield (KFHU). The TOMBS intersection is the missed approach holding point at 9500' MSL, and the minimum vectoring altitude is 6500' MSL for IFR traffic. Ninety Percent of the proposed operating area is uninhabited state land. The cutouts at the corners of the Primary Containment Area are designed to keep Raytheon UAS away from the small communities of Whetstone to the SW, St. David to the north, and Tombstone to the SE. The eastern border is the edge of the Tombstone MOA. State highway 90 borders the western edge, state highway 82 the southern edge. The only trafficable road inside the Primary Containment Area is state highway 80, a two lane blacktop between Benson and Tombstone. The San Pedro river valley traverses the area south to north, and is a designated wildlife area. All flight operations over the wildlife area will be 2000' AGL.

d. The boundary of the Primary Containment Area is defined by the following coordinates:

1) N 31° 44' 00.00" W 110° 20' 30.00"
2) N 31° 52' 00.00" W 110° 20' 00.00"
3) N 31° 52' 00.00" W 110° 11' 00.00"
4) N 31° 56' 30.00" W 110° 11' 00.00"
5) N 31° 58' 10.00" W 110° 03' 00.00"
6) N 31° 50' 30.00" W 110° 03' 00.00"
7) N 31° 50' 30.00" W 110° 00' 00.00"
8) N 31° 45' 00.00" W 110° 00' 00.00"
9) N 31° 45' 00.00" W 110° 11' 00.00"
10) N 31° 43' 14.00" W 110° 14' 00.00"
11) N 31° 42' 00.00" W 110° 19' 30.00"
12) N 31° 44' 00.00" W 110° 19' 30.00"

13) Return to 1

Figure 2: Primary Containment Area (WAC Depiction)

e. The UA PIC shall ensure that all UA flight operations remain within the lateral and vertical boundaries of the Primary Containment Area. Furthermore, the UA PIC shall take into account all factors that may affect the capability of remaining within the Primary Containment Area. This includes, but is not limited to, considerations for wind, gross weight, and glide distances.

f. Any flight operation that transgresses the lateral or vertical boundaries of the Primary Containment Area shall be immediately concluded, and Air Traffic Control notified of the flight status. Raytheon shall, at the conclusion of the flight, immediately notify the Unmanned Aircraft

Program Manager AIR-160, of any flight operation that transgresses the lateral or vertical boundaries of the Primary Containment Area. The point of contact is Mr. Doug Davis. Mr. Davis can be reached at 202-385-4636 or email kenneth.d.davis@faa.gov.

g. Further flight operations shall not be conducted until the incident is reviewed by AIR-160, and authorization to resume operations is received.

4. UA PILOTS and OBSERVERS:

a. All flight operations shall have a designated UA Pilot-In-Command (PIC). Any additional UA pilot(s) assigned to a crew station during UA flight operations shall be considered a Supplemental UA Pilot. The UA PIC shall have responsibility over each flight conducted and be held accountable for the UA flight operation.

b. The UA PIC is responsible for the safety of the UA as well as persons and property along the UA flight path. This includes, but is not limited to, collision avoidance and the safety of persons and property in the air and on the ground. The UA PIC shall avoid densely populated areas (§ 91.319) and exercise increased vigilance when operating within or in the vicinity of published airway boundaries.

c. The UA PIC shall hold, at a minimum, an FAA Private Pilot certificate, with either an Airplane or Rotorcraft category, Single or Multiengine class ratings, or military equivalent, and have it in his/her possession.

d. The Supplemental Pilot need not be a certificated pilot, but must have successfully completed a recognized Private Pilot ground school or successfully completed the private pilot written test within 90 days of the date of these limitations.

e. The UA PIC shall have operational override capability over any Supplemental Pilot, regardless of position.

f. The UA PIC shall maintain currency in manned aircraft in accordance with § 61.57.

g. The UA PIC shall have a Flight Review in manned aircraft every 24 calendar months in accordance with § 61.56.

h. All UA Pilots shall maintain currency in unmanned aircraft in accordance with Cobra Unmanned Aircraft Systems Training Plan, dated 9/18/06.

i. All UA pilots shall have a Flight Review in unmanned aircraft every 24 calendar months in accordance with Raytheon company procedures.

j. All flight operations conducted in the Primary Containment Area shall have an Observer to perform traffic avoidance and visual observation to fulfill the "see and avoid" requirement of § 91.113.

k. All Observers shall:

1) Hold at a minimum, an FAA Private Pilot certificate or military equivalent (an Observer does not require currency as a pilot); or,

2) In lieu of a Pilot certificate, have successfully completed specific Observer training acceptable to the FAA.

l. All UA Pilots and Observers shall have successfully completed applicable Cobra Unmanned Aircraft Systems Training Plan, dated 9/18/06.

m. The UA PIC and Observer(s) must have in their possession a valid third class (or higher) airman medical certificate that has been issued under 14 CFR part 67.

n. UA Pilots and Observers shall perform crew duties for only one UA at a time. When the Observer is located in a chase aircraft, the Observer's duties shall be dedicated to the task of observation only. Concurrent duty as pilot is not authorized.

o. All Observers must be thoroughly trained, familiar with, and possess, operational experience with the equipment being utilized for observation and detection of other aircraft for collision avoidance purposes as outlined in the Raytheon Program Letter.

p. Observer Responsibilities: The task of the Observer is to provide the UA pilot(s) with instructions to maneuver the UA clear of any potential collision with other traffic. Observer duties require continuous visual contact with the UA at all times in such a manner as to be able to discern UA attitude and trajectory in relation to conflicting traffic. To satisfy these requirements:

1) At no time shall the Observer permit the UA to operate beyond line-of-sight necessary to ensure that maneuvering information can be reliably determined.

2) At no time shall Observers conduct their duties more than one (1) nautical mile laterally or 3000 feet vertically from the UA. The small size of this particular UA may not allow for adequate observation at the 1 mile limit. It should be understood that this limit is the maximum range allowed and that a practical distance may be something less, with the determination of such at the discretion of the applicant. Therefore, until an onsite validation of observer distance is conducted by the FAA, it will remain the responsibility of the applicant to insure the safety of flight and adequate visual range coverage to mitigate any potential collisions.

3) Observers must maintain continuous visual contact with the UA.

4) Observers may be positioned in a chase aircraft. When a chase aircraft is utilized, it must maintain a reasonable proximity, and shall position itself relative to the UA in such a manner as to reduce the hazard of collision in accordance with § 91.111.

5. COMMUNICATIONS:

a. Raytheon shall contact Air Traffic Control prior to flight operations. Raytheon shall squawk transponder code 1200 unless otherwise directed by local Air Traffic Control.

b. Appropriate Air Traffic frequencies shall be monitored during flight operations.

c. All UAS crew positions must maintain two-way communications with each other during all operations. If unable to maintain two-way communication, the UA will be expeditiously returned to its base of operations while remaining within the Primary Containment Area, and conclude the flight operation.

d. Spectrum used for operation and control of the UA must be approved by the Federal Communications Commission or other appropriate government oversight agency prior to operations being conducted.

6. FLIGHT CONDITIONS:

a. All flight operations must be conducted during daylight hours in visual meteorological conditions (VMC), including cloud clearance minimums as specified in § 91.155. Flight operation in instrument meteorological conditions (IMC) is not permitted.

b. The UA is prohibited from aerobatic flight, that is, an intentional maneuver involving an abrupt change in the UA's attitude, an abnormal acceleration, or other flight action not necessary for normal flight (§ 91.303).

c. Flight operations must not involve carrying hazardous material or the dropping of any objects or external stores.

d. The UA and chase aircraft shall be equipped with operable strobe/anti-collision lights and shall be illuminated during operations.

e. The UA must be equipped with, and operate, an approved Mode C altitude encoding transponder during all flight operations.

f. The chase aircraft transponder must be on standby while performing chase operation flight with the UA. In the event of UA transponder failure, the chase aircraft will operate the transponder in Mode C.

g. In the event of transponder failure on either the UA or the chase aircraft, the UA must conclude all flight operations and expeditiously return to its base of operations within the prescribed limitations of this authorization.

h. Raytheon must request the issuance of a Notice to Airman (NOTAM) through the Prescott Automated Flight Service Station at least twenty-four 24 hours prior to flight operation.

7. FLIGHT TERMINATION & LOST LINK PROCEDURES:

a. In accordance with Raytheon Program Letter, dated February 21, 2007, flight termination must be initiated at any point that safe operation of the UA cannot be maintained.

b. In the event of lost link, the UA must provide a means of automatic recovery that ensures airborne operations are predictable and that the UA remains within the Primary Containment

Area. The chase aircraft/Observer will be immediately notified of the lost link condition and the expected UA response.

8. MAINTENANCE:

a. The Cobra UAS must not be operated unless it is inspected and maintained in accordance with the Cobra UAS Inspection Program, dated 09/27/2006, or later FAA-approved revision. Maintenance must be recorded in the UAS maintenance records.

b. No person may operate this UAS unless within the preceding 12 calendar months it has had a condition inspection performed in accordance with, FAA-approved, Cobra UAS Inspection Program, dated 9/27/06, and was found to be in a condition for safe operation. This inspection will be recorded in the UAS maintenance records.

c. Only those individuals authorized by Raytheon Missile Systems, and acceptable to the FAA, may perform inspections required by these operating limitations.

d. Inspections of the UAS must be recorded in the UAS maintenance records showing the following, or a similarly worded, statement: "I certify that this UAS has been inspected on [insert date] in accordance with the scope and detail of the Cobra UAS Inspection Program, dated 9/27/06, and was found to be in a condition for safe operation." The entry will include the UAS's total time-in-service, and the name and signature of the person performing the inspection and the date the inspection was performed.

e. UAS instruments and equipment installed must be inspected and maintained in accordance with the requirements of the Cobra UAS Inspection Program, dated 9/27/06. Any maintenance or inspection of this equipment must be recorded in the UAS maintenance records.

f. No person may operate this UAS unless the altimeter system and transponder have been tested within the preceding 24 calendar months in accordance with 14 CFR § 91.411 and § 91.413 respectively. These inspections will be recorded in the UAS maintenance records.

9. EQUIPAGE:

a. The UAS shall be equipped with an operable Mode-C transponder.

b. The Cobra Ground Control Station will be equipped with two-way communications equipment allowing for communications between the UA pilot, chase aircraft, and Air Traffic Control.

10. REVISIONS and OTHER PROVISIONS:

a. The Experimental Certificate, the Raytheon Missile Systems FAA-accepted Program Letter, and Operating Limitations cannot be reissued, renewed, or revised without application being made to the Phoenix Manufacturing Inspection District Office (MIDO), and coordinated with the Production and Airworthiness Division, AIR-200. AIR-200 will be responsible for

headquarters internal coordination with the Aircraft Certification Service, Flight Standards Service, Air Traffic, Office of Chief Council, and Office of Rulemaking.

b. No Certificate of Waiver or Authorization may be issued in association with this Experimental Certificate unless coordinated with the Phoenix MIDO and the Production and Airworthiness Division, AIR-200.

c. All revisions to Cobra UAS Inspection Program, must be reviewed and approved by the Scottsdale Flight Standards District Office (FSDO). The FSDO can be reached at telephone number is 480-419-0111.

Judith A. Baty
Aviation Safety Inspector
Phoenix Manufacturing Inspection District Office
13951 N. Scottsdale Rd. #123
Scottsdale, AZ 85254

Date: February 23, 2007

The Special Airworthiness Certificate and accompanying Operating Limitations expire on February 23, 2008.

I certify that I have read and understand the operating limitations, and conditions, that are a part of the Special Airworthiness Certificate; FAA Form 8130-7 issued on February 23, 2007, for the purpose of Research and Development and/or Crew Training.

This Special Airworthiness Certificate is issued for the Raytheon Missile Systems, UA model "Cobra," serial number 005, registration number N605RN.

Applicant:

Date: February 23, 2007

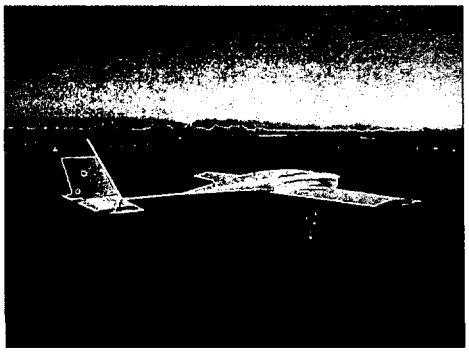
FOR

Name: Donald L. Newman

Title: Director, Unmanned Systems

Company: Raytheon Missile Systems

Raytheon



UNMANNED SYSTEMS

Program Letter (N605RN) for Unmanned Aircraft Systems, Experimental Airworthiness Certificate

REV –

Document ID: UNM-01-RR99816

Date: 21 Feb 2007

Raytheon Company
P.O. Box 11337
Tucson, AZ 85734-1337

Raytheon

Raytheon

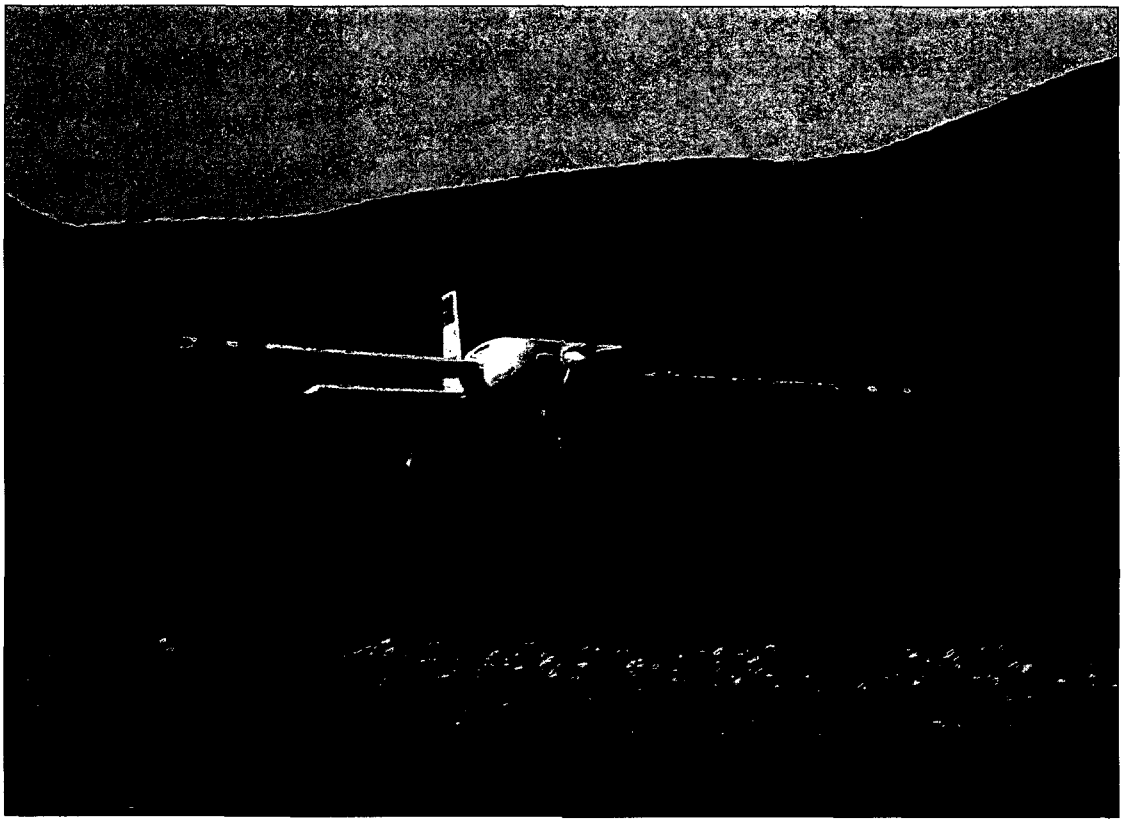
Program Letter (N605RN) for Unmanned Aircraft Systems, Experimental Airworthiness Certificate

Cobra UAS

Document ID: **UNM-01-RR99816**

Rev -

02/21/2007



Revision History

Revision No.	Description of Change	Date	Revised By
Rev -	Original Document	02/21/07	

Table of Contents

Aircraft Specifications 1
1. Define the experimental purpose(s) under which the aircraft is to be operated (14 CFR § 21.191) 2
2. Describe the purpose/scope of the experimental program for each 14 CFR § 21.191 experimental purpose sought (14 CFR § 21.193(b)(d)) 2
3. Define the area(s) in which the experimental flights will be conducted 3
4. Aircraft Configuration 7
5. Inspection And Maintenance (14 CFR 91.7) 12
6. Pilot Qualification (14 CFR §§ 61.3, 61.5) 13
7. Aircraft Marking (14 CFR § 45) 15
8. ATC Transponder and Altitude Reporting System Equipment and Use (14 CFR § 91.215) 16
9. Method for See and Avoid (14 CFR § 91.113a) 16
10. Safety Risk Management 17
11. System Configuration 17
12. System Safety – Flight Termination and Lost Link 17
13. Command and Control 19
14. Control Stations 21
15. Control Frequencies 21
Appendix A - Cobra Drawings and Photographs 23
Appendix B - Cloud Cap Piccolo II Users Guide 27
Appendix C - Raytheon UAS Flight Manual 28
Appendix D - Cobra Weight and Balance 28
Appendix E - Minimum Equipment List 30
Appendix F - System Configuration Diagram 34
Appendix G - FAA UAS Safety Checklist 37
Appendix H – Acronym List 38

Table of Figures

Figure: 1 Cobra UAS 2
Figure: 2 UVI Airfield 3
Figure: 3 Proposed Ops Area 6
Figure: 4 Cobra 3 View Drawing 8
Figure: 5 MVCS CUCS 11
Figure: 6 Piccolo Autopilot Limits 19

Aircraft Specifications

Registered Owner Name:
Raytheon Company

Registered Owner Address:
Raytheon Missile Systems
Bldg M09, M/S 5
P.O. Box 11337
Tucson, AZ 85734-1337

Aircraft Description:
The aircraft is an unmanned, composite, mid-wing monoplane with standard tail surfaces and a tractor engine. The vertical and horizontal stabilizers are attached to a composite tail boom. The control surfaces consist of full span flaperons, elevator and rudder. The landing gear is tricycle type with a steerable nosewheel, and the main landing gear is equipped with pneumatic brakes. The engine is a 16 hp, air-cooled, 2-cycle, 2 cylinder, opposed, and carbureted powerplant with an electronic ignition system, using gasoline with a 100:1 2-cycle oil mix. Primary electrical power comes from a 500 watt generator with a 180 watt regulator. A Lithium Polymer rechargeable battery provides backup electrical power for 1 hour in the case of main power source failure.
As a prototype airframe, Raytheon expects that there will be slight design changes based on the data collected from the initial test flights.

Aircraft Registration:
This will be an Experimental Aircraft Registration.
Unless otherwise specified in the certificate, the aircraft will be marked on the aft fuselage surface using the N12345 format. 3" lettering will be used due to the small size of the aircraft. The word "Experimental" will be displayed on the fuselage over the wing in ½" letters.

Aircraft Builder:
Raytheon Missile Systems

Year Manufactured:
2006

Aircraft Serial Number:
Serial Number 005
(Update serial number for each application)

Aircraft Registration Number:
N605RN

Aircraft Model Designation:
Cobra

Engine Model:
Desert Aircraft DA-150
http://www.desertaircraft.com/engines_detail.php?Page=DA-150

Fuel:
87-91 Octane Gasoline
OR
100 Octane Aviation Fuel

Oil:
Saber™ Professional Synthetic 100:1 Pre-Mix 2-Cycle Oil (ATP)
http://www.amsoil.com/storefront/atp.aspx

Propeller Model:
Bolly Products 30x12
http://www.bollyprops.com
OR
Menz 30 x 12
OR
Mejzlik 30 x 12
http://mejzlikmodellbau.inshop.cz

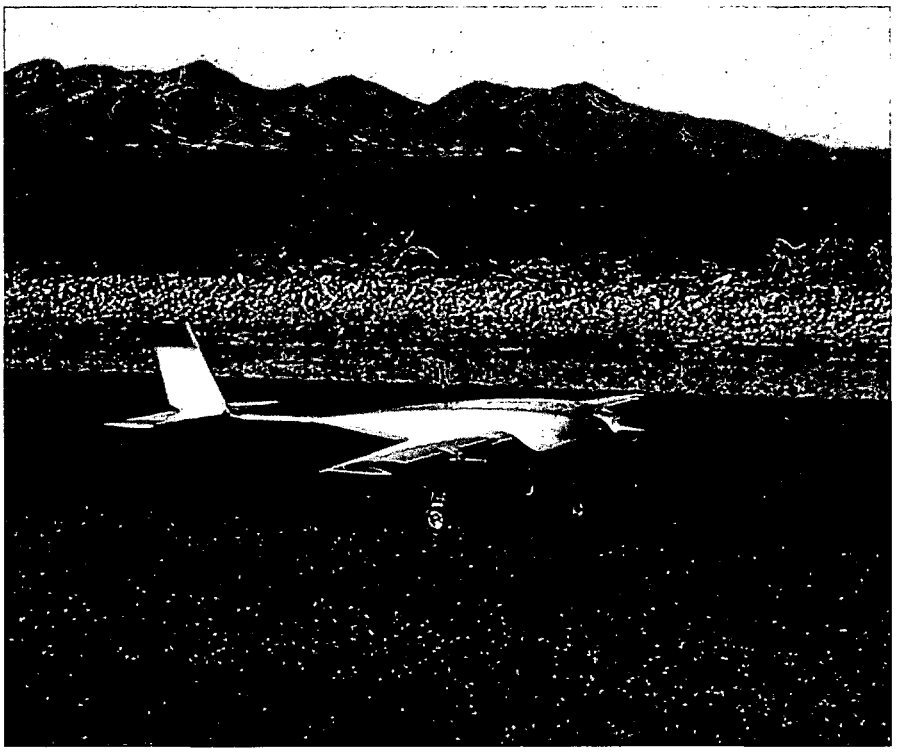


Figure: 1 Cobra UAS

1. **Define the experimental purpose(s) under which the aircraft is to be operated (14 CFR § 21.191)**

   Research and development. Testing new unmanned aircraft design concepts, avionics and ground equipment, Command and Control Systems, installations, operating techniques, and new uses for unmanned aircraft.

   Crew training. Training of the Raytheon Company flight crews.

   Market surveys. Use of UAS for purposes of conducting market surveys, sales demonstrations, and customer crew training only as provided in §21.195.

2. **Describe the purpose/scope of the experimental program for each 14 CFR § 21.191 experimental purpose sought (14 CFR § 21.193(b)(d))**

   Research and development – This unmanned aircraft will be used as a test bed for data links, sensors, processors, autopilots, "sense and avoid" and other electronics/avionics as required to meet the Raytheon Company business goals.

   Crew training – Flights will be conducted by qualified Raytheon UAS pilots. Aircraft checkout and regular proficiency training will be conducted to meet the Raytheon Company flight testing requirements. Upon customer request, flight training of a customer pilot will occur.

   A training program will be submitted as a separate document.

Market surveys – This aircraft will be used to demonstrate the concepts, electronics and avionics listed above to various public customers. The demonstration of the Cobra UAS will only be conducted at the site approved under the experimental airworthiness certificate.

3. Define the area(s) in which the experimental flights will be conducted

- Describe the areas over which the flights are to be conducted and address of base operation (14 CFR § 21.193(d)(3)).

  Raytheon leases a new facility built specifically by Unmanned Vehicles International (UVI) Inc. (http://www.uviinc.com/) to operate UAS near Sierra Vista, AZ.

  Unmanned Vehicles International, Inc
  633 Wilcox Drive
  Sierra Vista, Arizona 85635
  520-458-4212

  Raytheon has been using this facility for local UAS operations since April 2005, and has accumulated 50 hours from 57 flights using the Manta, Silver Fox, and Cobra UAS.

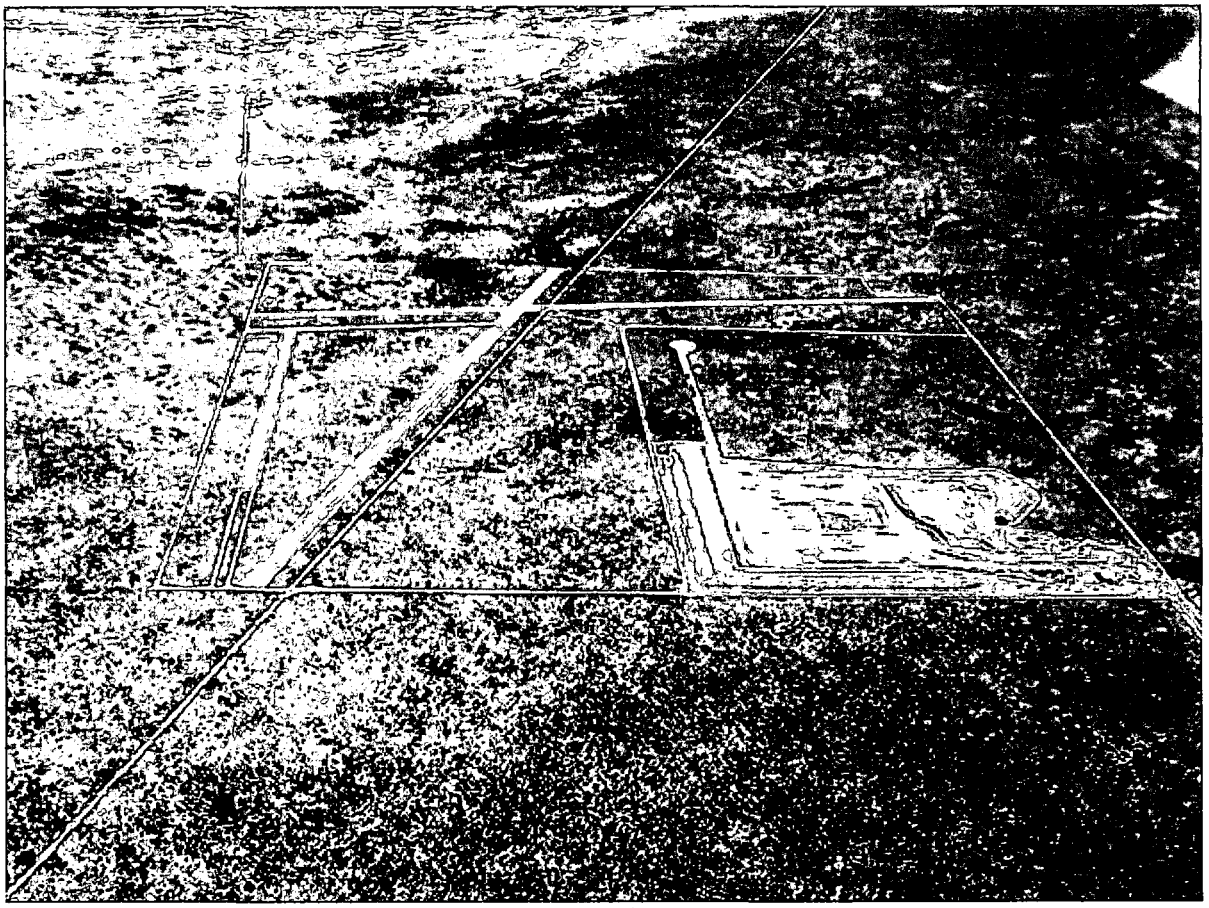


Figure: 2 UVI Airfield

UVI UAS airfield looking north, located next to the Cochise County landfill.

Phoenix Sectional

FHU 004/08.5, 4225' Elevation

N 31° 43' 30", W 110° 17' 47"

The UVI site is shown in Figure 2 and was specifically located to have easy access to the R-2303 restricted airspace. Not having regular access to the restricted airspace, Raytheon will operate below the 8000' MSL lower limit of R-2303B to remain outside of restricted airspace unless prior coordination has been obtained. The pattern altitude is 600' AGL, and beyond 1 mile Raytheon would operate at 2000' AGL and below, normally remaining between 1500' – 2000' AGL. As a civil user not on a DoD contract, Raytheon does not have priority access to the R-2303 airspace. Through UVI Inc, Raytheon has coordinated with the Libby Field Airspace Manager, El Paso Gas (pipeline patrol) and the Border Patrol, and has directly coordinated with Prescott Flight Service Station for NOTAMs. NOTAMs will be filed if directed by the FAA.

The Four Pillars (AZ21) airfield indicated in red on the map shown in Figure 3 is currently abandoned.

The UVI site is located on state property and is operated on a state lease for the purpose of operating UAS. The State has approved the lease to UVI Inc for UAS operations only. From Highway 82 to the south to I-10 on the north, the land is nearly uninhabited. The only ground traffic in the proposed operating area is along Highway 80 from Tombstone to Benson.

The Raytheon local operating area is a 1 mile radius from UVI and the aircraft are kept north of Highway 82 and east of Highway 90. When flight operations will remain within 1 NM and the EP/Observer will be able to maintain visual contact, and a chase plane will not be used.

In Figure 3, the larger area outlined with a hashed black line is the proposed Raytheon UAS operations area. This would be used for developmental testing and demonstration from the surface to 2000' AGL (6000' MSL average). All of Raytheon's UAS flight operations will be within radio line of sight of the Ground Control Station. Victor Airway 66 crosses the proposed operating area and has a Minimum Reception Altitude (MRA) of 9500' MSL (4500' AGL). VR 259 from points D to E, and VR 260 from points D to E, also cross this area, and Raytheon will contact Flight Service to see if they are active prior to crossing. For flights beyond visual range of the EP, a chase plane will be used. The chase plane and UAS will have active transponders when within the lateral limits of the VR routes.

The class E airspace overlaying the proposed operating area is used for instrument approaches into Libby Army Airfield (KFHU). The TOMBS intersection is the missed approach holding point at 9500' MSL, and the minimum vectoring altitude is 6500' MSL for IFR traffic.

Ninety Percent of the proposed operating area is uninhabited state land. The cutouts at the corners of the proposed op area are designed to keep Raytheon UAS away from the

small communities of Whetstone to the SW, St David to the north, and Tombstone to the SE. The eastern border is the edge of the Tombstone MOA. State highway 90 borders the western edge, state highway 82 the southern edge. The only trafficable road inside the op area is state highway 80, a two lane blacktop between Benson and Tombstone. The San Pedro river valley traverses the area south to north, and is a designated wildlife area. All flight operations over the wildlife area will be 2000' AGL.

- Identify all proposed flight areas using latitude and longitude on aeronautical maps.

  The following grid coordinates define the Raytheon Op Area:

  1. N 31° 44' 00.00" W 110° 20' 30.00"
  2. N 31° 52' 00.00" W 110° 20' 00.00"
  3. N 31° 52' 00.00" W 110° 11' 00.00"
  4. N 31° 56' 30.00" W 110° 11' 00.00"
  5. N 31° 58' 10.00" W 110° 03' 00.00"
  6. N 31° 50' 30.00" W 110° 03' 00.00"
  7. N 31° 50' 30.00" W 110° 00' 00.00"
  8. N 31° 45' 00.00" W 110° 00' 00.00"
  9. N 31° 45' 00.00" W 110° 11' 00.00"
  10. N 31° 43' 14.00" W 110° 14' 00.00"
  11. N 31° 42' 00.00" W 110° 19' 30.00"
  12. N 31° 44' 00.00" W 110° 19' 30.00"
  13. Return to 1

- Will flight-testing include payload testing?

  Yes. Various Electro Optic, passive and RF sensors will be tested. Frequency management will be coordinated with the FAA, FCC Western Region and Fort Huachuca frequency managers.

- What considerations need to be taken with regard to Payloads?

  Considerations include size, weight, power requirements, EMI/RFI, drag, data communications and additional crew.

  Size and weight of the payload will affect the aircraft weight and balance and maximum gross weight. The power draw on the onboard electrical system and backup batteries must also be considered. EMI/RFI might affect the aircraft as well as the payload. If the payload is external or has external components such as antennae, the drag increase must be evaluated. If the payload requires additional data communications, the effect on the available bandwidth and data priority as compared to command and control data will be evaluated. The addition of a payload will affect the workload of the crew depending on its complexity. The workload will be evaluated and an additional crew member added if required to operate the sensor. The addition of flight crewmembers or additional training will be considered when required for new payload operations.

- Will the aircraft perform any aerobatic maneuvers?

  No

- Flight Conditions (e.g., VFR, IFR, VMC, etc.)

  Day VFR only. All testing, training and demonstration will be conducted in Day VFR conditions.

4. Aircraft Configuration

- **Attach three-view drawings or three-view dimensioned photographs of the aircraft (14 CFR § 21.193(b) (4)).** (Appendix A)

Figure: 3 Proposed Ops Area

- Include information on airspeed, altitude, number of flight hours, number of flights and program duration for each test flight area.

  Airspeed: 35-100 KIAS

  Altitude: 2000 AGL and below

  Winds: 20 KTS headwind, 8 KTS crosswind

  Flight Hours: 300 flight hours per year

  2-3 flight days per week during the workweek. Weekend flying will occur only once per quarter.

  Duration: 1 year for this application, with renewal anticipated annually.

- What class of airspace will be used?

  FAA Class E and G.

- Will minimum fuel requirements of 14 CFR § 91.151 be met?

  Yes, a fuel reserve minimum of 30 minutes for day flying will be maintained.

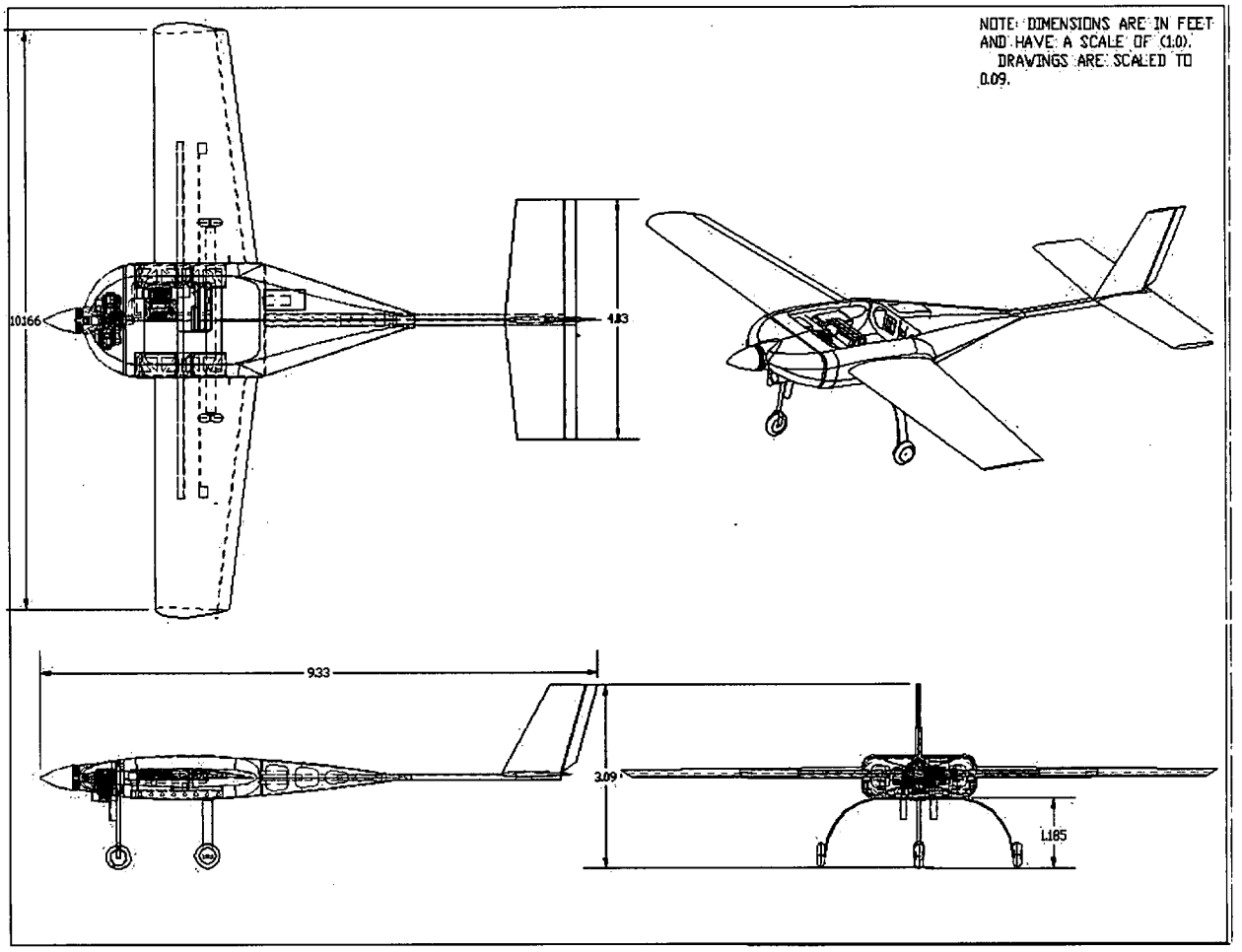


Figure: 4 Cobra 3 View Drawing

- Describe Unmanned Aircraft System configuration including ground control station.
  - Cobra UAS
    - Cloud Cap Piccolo II Autopilot (http://www.uavautopilots.com/)

      See Appendix B – Piccolo Systems Users Guide

      The Piccolo II is a MEMS based autopilot that allows for manual, stability augmentation, and autonomous control of the UAS. The air data system, GPS, and Microhard datalink are built into a compact, low weight, avionics package. A Honeywell magnetometer provides magnetic heading information to the autopilot.
    - Transponder

      Microair 2000, mode 3a/c with air data provided by an altitude encoder or the Piccolo II flight control system.

      The transponder will be required for all flights.

- Lights

  A white strobe light will be attached to the upper fuselage as an anti-collision light for all flights.

- Video Transmitter

  An independent COTS ¼ to 2 watt video transmitter at 2.4 GHz will be used for transmission of the video signal.

- Power

  Primary electrical power comes from a 500 watt generator with a 180 watt regulator. A Lithium Polymer rechargeable battery provides backup electrical power for 1 hour in the case of main power source failure. The battery is charged in flight.
  The system voltage is indicated to the pilot as well as a visual and audio alert if the high or low voltage range is exceeded. While on Generator power (14.8 volts) the voltage is green. If the generator fails, the battery (15.8 volts) comes online and the alert sounds. Once the battery is below 14.8 volts the alert will stop until the low voltage value is exceeded.

o Datalink

- Microhard MHX UHF Datalink

  The Piccolo autopilot has an integrated MHX-910 frequency hopping radio from Microhard Systems Inc. The MHX radio is a 900MHz ISM band radio with good receive sensitivity and a maximum 1 Watt output power. The wireless link formed between radios extends from all the aircraft to the ground station. Traditional wireless links were made of a single frequency, and multiple networks could be constructed by using multiple frequencies. With a frequency hopping radio the concept of networks defined by frequencies is replaced with networks defined by hopping patterns. Hence it is possible to have a network of radios using one hopping pattern while another network of nearby radios uses a separate hopping pattern. In each case a single ground station coordinates the communications for each network.

  The Microhard radio has a 25 NM range and is used as the Primary control link when installed alone or as the secondary link and flight termination system if a developmental datalink is installed.

- Raytheon MicroLight UHF Datalink

  The MicroLight radio is based on the Raytheon Enhanced Position Location Reporting System (EPLRS) technology. This is a software programmable digital datalink operating from 420-450 MHz. This radio is networkable, allowing the radio to act as a node in a network. This radio has a 100 NM range. The range is variable with the selected mode of operation.

The MicroLight UHF Datalink is developmental and can be used for C2 and low rate video. This radio will be evaluated for Joint Tactical Radio System (JTRS) waveforms, and its usability within a net-centric UAS.

- Other developmental datalinks (See Proprietary Payload Addendum)

  For all datalink testing, the original MicroHard link provided with the Piccolo II autopilot will be maintained as a secondary safety backup and flight termination system.

- Ground Control Station
  - Raytheon Multi-Vehicle Control System (MVCS)

    The MVCS is a derivative of the US Navy Tactical Control System and can be used to control different types of UAS as long as a STANAG compliant Vehicle Specific Module (VSM) has been created for that aircraft. STANAG 4586 is a NATO standard for interoperability between diverse UAS. The MVCS is networkable allowing multiple pilot consoles to be connected together and to share data. MVCS is also designed to be hosted on the Digital Common Ground Station (DCGS) developed by the US Air Force.

    - STANAG 4586 Vehicle Specific Module (VSM)

      The VSM is the interface or translator between the aircraft and the ground control station. It is software, and can be hosted on an airborne processor in the aircraft or the computer connected to the Ground Control Station. The VSM used by the Cobra is the same as that used on the Manta and Silver Fox UAS. The VSM interface for these aircraft was created to communicate with the Piccolo autopilot.

    - STANAG 4586 Common UAV Control Station (CUCS)

      The CUCS is the operator interface to the system controls. It provides the displays of information to the internal pilot (Figure 5). The displays are configurable and can be considered a virtual Multi-Function Display (MFD). The displays include the Primary Flight Display (PFD), a moving map or situational awareness display, Warnings and Cautions, and various data displays for the aircraft telemetry. This system allows satellite imagery to be used as a moving map display. When more than one UAS telemetry stream is detected on the network, all UAS positions are shown on the map with an ID and altitude tag.

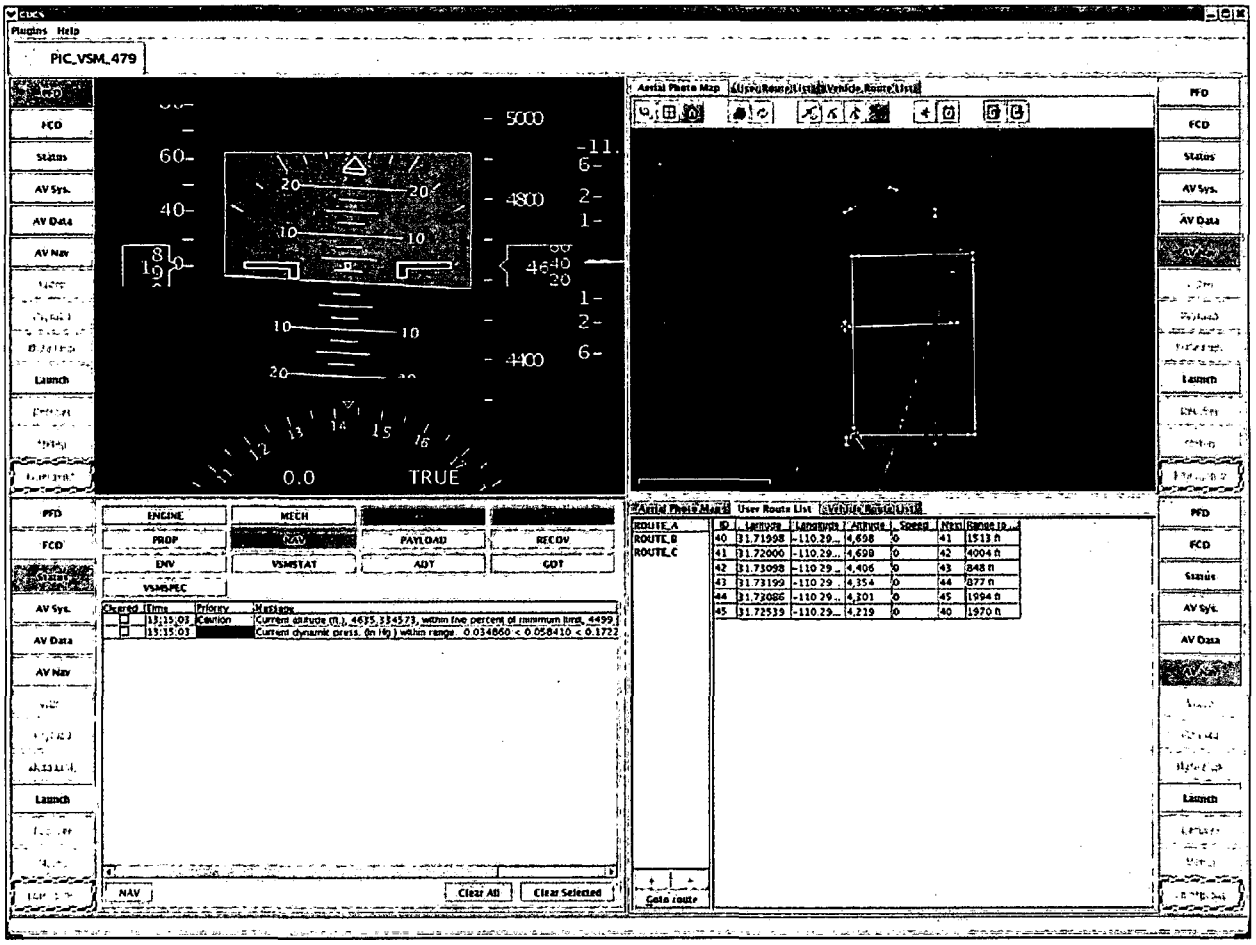


Figure: 5 MVCS CUCS

- Cloud Cap Piccolo Operator Interface

  See Appendix B – Piccolo Systems Users Guide. The Piccolo Operators Interface can be used as a stand alone or in concert with the MVCS. Often it is used for preflight and launch/recovery while the MVCS is used for cruise flight. This allows multiple pilots to manage multiple aircraft from a series of networked pilot consoles.

- Payloads
  - See Proprietary Addendum

- Include a description of aircraft/system performance characteristics:
  - Wing span: 10.166 FT.
  - Length: 9.33 FT.
  - Power Plant: Desert Aircraft, DA-150, 16 HP, Air Cooled, Two-Cylinder Opposed, 2 Stroke Gasoline Engine

- Max Gross Take Off Weight: 100 LBS
- Fuel capacity: 4.0 GAL, 87-100 Octane with 100:1 oil mix
- Payload Capacity: 30.0 LBS
- Max altitude: 15,000 FT. MSL
- Endurance: 4 hours
- Max airspeed: 95 KTS
- Wind Limitations: 20 KTS headwind 8 KTS crosswind
- Control/data frequencies: 420-450 MHz Primary, 902-928 MHz Secondary
- Guidance and navigation control: Cloud Cap Technologies Piccolo II Autopilot
- Flight termination frequencies, if any: 902-928 MHz. Raytheon uses the Microhard datalink as a flight termination device when developmental datalink is installed.

5. Inspection And Maintenance (14 CFR 91.7)

- Describe the inspection and maintenance program that will be used to maintain the aircraft and related systems (includes ground stations and/or other support systems).

  See Raytheon Cobra UAS Maintenance Plan

  An aircraft logbook will be maintained on each aircraft, and a separate logbook for the ground control station. An engine log will be maintained for each engine as well.

  The engines will be overhauled at 250 hours.

  Discrepancies and maintenance actions will be noted in an electronic format used by Raytheon Integration and Test, and repairs will be made by Flight Test Team engineers. Preflight and postflight inspections will be conducted for all flights, as well as periodic inspections during integration and development.

  Raytheon maintains a Test Readiness Review (TRR) process, where any changes to the configuration of the system must be approved by a board of senior engineers prior to testing. The status of all aircraft and any outstanding maintenance actions are reviewed at this time. Flight safety is the primary concern of the TRR.

- Provide copy of flight manual, if applicable, current weight and balance report, equipment list.

  The Raytheon Cobra UAS Operations and Weight and Balance are included as appendix C and D.

  The small size of the aircraft allows it to be weighed, and Center of Gravity (CG) calculations done prior to each flight. The data is collected and has been used to create a basic weight and balance calculator in a spreadsheet. The weight and cg envelope shows the limits of data collected to date. CG expansion tests will be conducted during aircraft performance testing.

A minimum equipment list is shown in Appendix E.

6. Pilot Qualification (14 CFR §§ 61.3, 61.5)

- Describe the qualifications for each pilot.

The Cobra requires a crew of 2 pilots; an Internal Pilot and External Pilot. One of the two pilots will be an FAA certified pilot for all flights, and shall be designated the Pilot in Command (PIC).

Internal Pilot – 2 Years previous UAS experience with a similar aircraft or FAA certified Private Pilot Airplane, physically and medically capable of completing all required tasks, and complete a UAS Practical Flight Test administered by the Raytheon Chief UAS Pilot or his designee. The IP must hold an FAA 3d class medical certificate.

External Pilot – 3 Years previous RC Model experience with a similar aircraft or FAA certified Private Pilot Airplane, physically and medically capable of completing all required tasks, and complete a UAS Practical Flight Test administered by the Raytheon Chief UAS Pilot or his designee. The EP must hold an FAA 3d class medical certificate.

Observer - physically and medically capable of completing all required tasks, and approved by the Raytheon Chief UAS Pilot or his designee. The Observer must hold an FAA 3d class medical certificate.

The Internal Pilot flies using the pilot computer console by reference to the Multi-Function Display, and other telemetry data, using the autopilot functions or the manual pilot console. The IP will take direction from Air Traffic Control, the EP, or Observer to avoid other aircraft.

The PIC is responsible for the conduct of the flight, coordination, weather and preflight planning.

The External Pilot flies by visual reference using the manual pilot console. When in control, the EP will maneuver as required to avoid other aircraft. The EP cannot act as Observer when in control of the aircraft.

An observer will be assigned for all flights. He can be on the ground or in the chase aircraft.

An example of the Raytheon pilot qualifications are listed below:

Chief UAS Pilot/Internal Pilot
Mark Ballinger – Raytheon Senior Principal Systems Engineer
FAA Cert#: 3012629
Certified Flight Instructor-Airplane, Commercial Instrument ASEL, AMEL, Commercial Glider, Commercial Helicopter, Airframe and Powerplant Mechanic, Chase Plane Pilot UAS Pilot, UAS Test Pilot, UAS Instructor, Sensor Operator, Observer, 1200+ UAS hours, Gnat 750, IGnat, Pioneer, Sentry STM-5A/B, Exdrone, Pointer, Manta, Silver Fox, Cobra

External Pilot
Keith Brock – Raytheon Aeronautical Engineer
RC Pilot, RC Test Pilot, UAS Pilot, UAS Test Pilot, UAS Instructor, Observer, 230+ UAS hours, Manta, Silver Fox, Micro Fox, MAV, SUAV, LUAV, Cobra

Note: All Raytheon UAS pilots are not listed.

- Pilots must be qualified and/or certificated in the appropriate category of aircraft, i.e., rotorcraft, powered lift, airplane, etc.

  All Raytheon UAS pilots are qualified to operate the Cobra UAS.

- Describe internal training program to qualify pilots.

  Pilots are chosen for their experience with UAS, manned or RC aviation. Manned aircraft pilots are trained to be Internal Pilots (IP), and RC pilots are trained to be External Pilots (EP).

  All pilots are given detailed information on the UAS system, including aircraft performance, limitations, flight controls, communications, autopilot functions, datalink operation, local procedures, crew coordination and emergency procedures.

  In addition, specific training will be given in the following areas as it pertains to UAS operations:

  - Applicable Federal Aviation Regulations
  - NTSB Accident reporting requirements
  - Aeronautical Information Manual and FAA advisory circulars
  - Aeronautical charts for navigation
  - Radio communication procedures
  - Weather, windshear avoidance, and aeronautical weather reports and forecasts
  - Aircraft collision avoidance, and wake turbulence;
  - Density altitude effects
  - Weight and balance computations
  - Principles of aerodynamics, powerplants, and aircraft systems
  - Stall awareness, spin entry, spins, and spin recovery techniques
  - Aeronautical decision making and judgment
  - Preflight action that includes how to obtain information on runway lengths at airports of intended use, data on takeoff and landing distances, weather reports and forecasts, and fuel requirements.
  - Preflight preparation, preflight procedures, airport operations, takeoffs, landings, and go-arounds, navigation, slow flight and stalls, emergency operations, and postflight procedures.

The IP is given additional training on the software operator interface, and mission commander duties and is required to be familiar with EP pilot duties. A simulator is used prior to IP flight training. Pilots will demonstrate this knowledge to the correlation level prior to Raytheon certification.

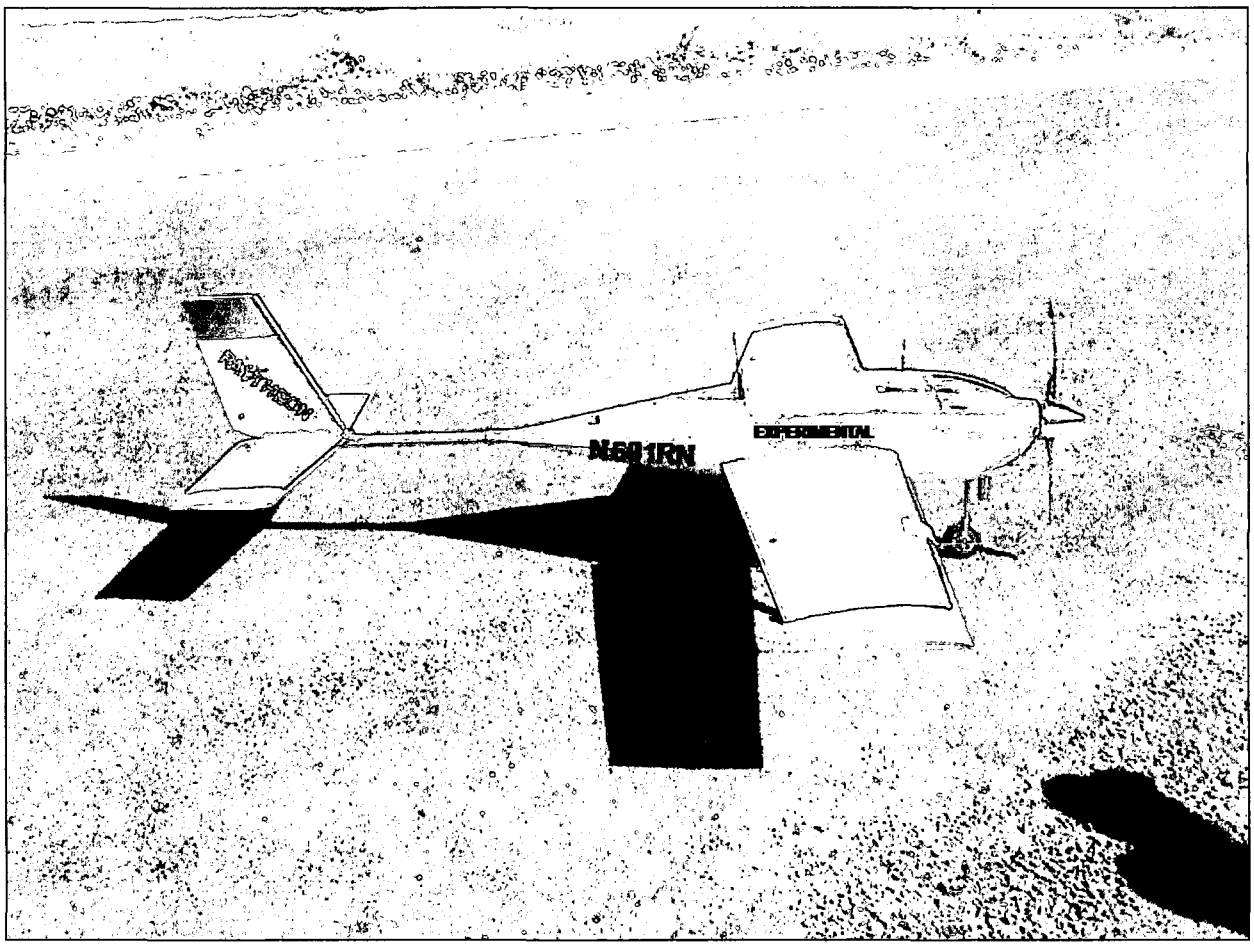
The EP uses a small and medium size scale trainer for initial and proficiency training. The EP is also trained to take manual control as required to avoid other aircraft and is required to be familiar with IP pilot duties.

- Describe the qualifications and training of observers.

  Observers are trained in scanning techniques, and to verbally communicate the location of other aircraft. Observers will have instruction on 14 CFR § 91.111 and 91.113.

7. Aircraft Marking (14 CFR § 45)

- All Cobra UAS are required to be registered and identified with the registration number. (45.29(f))
- Unless otherwise specified in the certificate, the aircraft will be marked on the aft fuselage surface using the N12345 format. 3" lettering will be used due to the small size of the aircraft. The word "Experimental" will be displayed on the fuselage over the wing in ½" letters.



8. ATC Transponder and Altitude Reporting System Equipment and Use (14 CFR § 91.215)

- Describe the aircraft altitude reporting system.

  The aircraft has a miniature air data system built into the autopilot. Altitude calibration is done daily via the GCS operator interface by setting the field elevation and local barometric pressure. The local barometric pressure is received from the ATIS broadcast from Libby Army Airfield.

  An onboard Transponder with altitude encoder may be installed. See Appendix E MEL. The pressure altitude for mode C will be provided by the Piccolo II autopilot air data system. During integration testing, the mode 3 code will be manually set to 1200 or as assigned before launch. When the software interface has been developed, the transponder will be accessible to the pilot for mode 3 code changes, ident, and Off/Standby/On/Alt functions.

9. Method for See and Avoid (14 CFR § 91.113a)

- In what manner, or by what means, will the requirement to "see and avoid" other aircraft be met?

For local flights a ground observer will be used to see other aircraft.

Raytheon will have a chase plane for all flights outside visual line of sight. The chase plane will be manned by a pilot and observer. Raytheon will comply with the FAA definition of observer. The roll of the observer will be to look for and call out all other air traffic. The observer will not have FTS capability. Voice communications between the chase aircraft and the UAS pilot at the Ground Control Station will be by VHF radio. In the event voice communication is broken with the chase aircraft for more than 1 minute, the UAS will be returned for landing. At any time during the flight, the UAS pilot will be able to take control and maneuver as required to avoid other aircraft as directed by the chase plane observer. In an emergency the UAS pilot can execute the terminate flight function built into the autopilot. The chase aircraft will be squawking 1200 or as assigned. The crew of the chase aircraft will attend the flight brief prior to all chase flights.

- What performance will the chase plane have?

  The chase aircraft will have the performance required to keep the UAS in sight at all expected airspeeds and altitudes.

10. Safety Risk Management

- An applicant must provide a hazard analysis that identifies and analyzes the hazards of UAS operations that are described in the program letter.

  See Appendix G

- Additional information is available by contacting the FAA representative.

11. System Configuration

- Provide description of aircraft system configuration and all on-board and ground-based equipment.

  Provided in paragraph 4, Aircraft Configuration. See Appendix F for a system diagram.

12. System Safety – Flight Termination and Lost Link

- What is the expectation of aircraft "Flight" if fuel is starved?

  The system will provide the pilot with a visual and aural warning that the engine has failed. The aircraft will glide at the current commanded airspeed and continue to navigate to the next waypoint on the active flight plan. The backup battery system will continue to power the aircraft and all electrical systems in excess of one hour at maximum load. If altitude permits, the pilot will navigate the aircraft to a landing point of his choosing, and if video is available, he will use video to avoid obstructions on the ground.

- Describe/explain aircraft lost link and emergency recovery procedures.
  - Command and Control

The Piccolo autopilot is programmed to fly to a "lost link" waypoint that is a point on a lost link flight plan. The lost link point can be changed during the course of the flight to follow the operational flight plan. The IP plans the lost link route to return to base at a safe altitude, and on a predictable flight path. The final 4 points on the lost link plan are looped to create a loiter pattern. The lost link timeout is set by the pilot during preflight. Raytheon procedure is to set the timeout to 10 seconds. During launch and recovery, the lost link point is set to a point on the departure end of the runway to prevent a turn close to the ground and in proximity to the GCS in case of lost link during the takeoff roll or during final approach.

A backup Piccolo GCS/datalink is available, and will be used in the event of GCS failure.

- Flight Termination
- In the event that datalink is lost and/or GPS becomes unusable, the Piccolo II autopilot can be set to automatically activate the flight termination function. The function will kill the engine, forcing a landing, or, if desired, can cause an aerodynamic termination. The details can be found in Appendix B, Piccolo II Users Guide. Raytheon sets this option to kill the engine if GPS fails. Figure 6 shows the settings available to the pilot for automatic flight termination. In Piccolo terminology, the "Deadman Line" is the ignition system.

  Manual termination is done by killing the engine or selecting manual control and overriding the autopilot.

  When the developmental datalink is installed, the Piccolo Microhard datalink can be used to sever the developmental link from the autopilot.

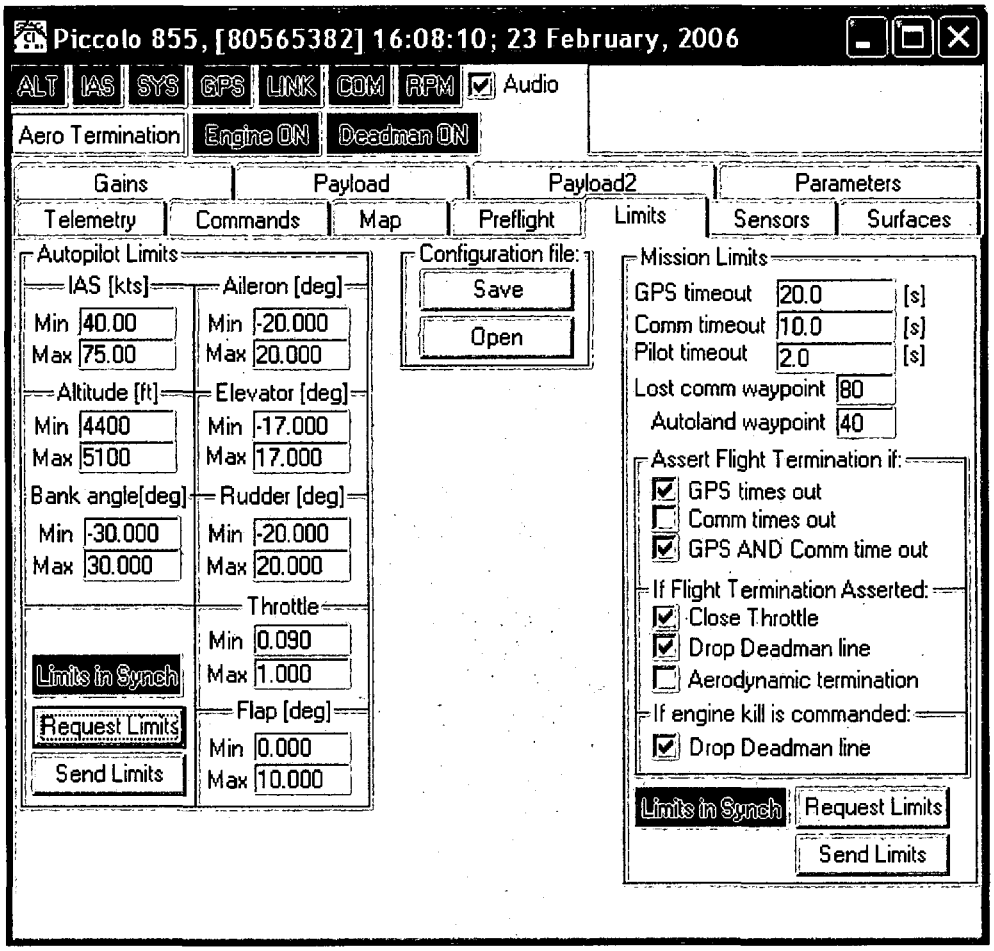


Figure: 6 Piccolo Autopilot Limits

- Loss of GPS

  In the event that the GPS signal is lost, the autopilot will navigate by Dead Reckoning (DR) with the magnetometer installed, or execute Flight Termination as selected by the pilot. Visual and aural warnings are given to the pilot if navigation accuracy cannot be maintained. The pilot has the option of visually navigating to landing.

13. Command and Control

- Provide a description of the system and/or procedures for command and control of the UAS.

  See Appendix C, Raytheon UAS Flight Manual

  The UAS is launched by the EP using manual control. Once the aircraft is airborne, the EP enters the pattern and verifies UA controllability. When the UA is trimmed for hands off flight, the IP captures the trims into the autopilot by selecting "capture trims" from the pilot console.

The UA is then set to "Auto" mode, which sends the aircraft to a pre-planned flight route that duplicates the traffic pattern. This is done to observe the UA response to autonomous flight while still in visual range of the observer. The route varies with the runway in use, but is overlaid on the landing pattern. The distance will be approximately 1/2 mile upwind or downwind at landing pattern altitude and 1/2 mile abeam. The external pilot watches the UAS and is ready to take manual control. The internal pilot is verifying heath and status and proper GPS tracking. The external pilot can take manual control with a switch on the manual controller if required. The internal pilot can rapidly change the waypoint, altitude or airspeed, or can select a heading to fly.

The internal pilot has several options with autonomous flight control. The flight plan controls the waypoint, turn type, slope, and altitude. The altitude hold can be overridden by the IP, while the aircraft continues to navigate to the selected waypoint. Airspeed hold is always set by the IP independent of the flight plan. During pre-flight, the IP sets minimum and maximum limits on the airspeed, altitude, pitch angle, and roll angle which prevents the autopilot from exceeding safe limits. The airspeed and altitude hold command value cannot be set to exceed the limits.

If desired the IP can override the waypoint navigation and set the aircraft to maintain a turn rate, or heading. The IP can also select a waypoint for "Direct To" navigation. Any waypoint previously loaded can be selected. Also the pilot can select a "loiter now" function, where the aircraft orbits around its current position. Given the "point and click" map interface for setting waypoints, any waypoint can be quickly and easily moved by dragging it to a new position on the map.

Two stability augmentation modes are available to assist with the manual pilot console. Steering Mode overrides the waypoint navigation allowing the EP or IP to steer the aircraft with the manual control stick, while maintaining airspeed and altitude hold. The manual control stick commands a turn rate proportional to the amount of stick deflection. Full Authority mode overrides waypoint navigation, altitude, and airspeed hold using the manual pilot console. Steering is accomplished the same as in Steering Mode, Altitude is set by throttle command, and airspeed is set by pitch command. For airspeed, the neutral pitch position will keep the UA at the current commanded airspeed hold, while pitch down/up will increase/decrease the airspeed proportional to the amount of stick deflection.

When required, the EP or IP can disconnect the autopilot from the flight controls by selecting manual control on the manual pilot console. All telemetry is available during manual operation.

When the flight is complete, the IP sends the UA to the pre-planned landing route. This is the Autoland function. These waypoints are designed to fly a landing pattern of a pre-selected length and glideslope to a specific landing point. A flair altitude and speed is set, and there is an option to kill the engine at the flair altitude. The pilot can select "go-around" with the push of a button which forces the aircraft back to the first point of the landing plan, or he can select any other waypoint or flight mode as described above.

If the IP chooses, he can use the stability augmentation modes to fly the pattern using his telemetry, instrumentation, and video to land the UA.

The RC controller is hard wired to the datalink for the external pilot. At any time he can take manual control by a switch and land using the manual controller. This is the normal landing mode for Raytheon.

14. Control Stations

- Provide a description of the ground/airborne stations used to control the UAS.

The GCS is composed of 1-4 laptop computers, a ground datalink module, and a power supply. These can be used in any shelter, or in the open. The manual pilot console is connected directly to the ground datalink module, and remains functional in the event of computer failure. Raytheon uses a panel truck to house all the equipment and provide environmental protection. An intercom system is installed allowing for crew communications during flight. An aviation band VHF radio is connected so that all voice communications are heard by the flight and ground crews. All video and voice communications are recorded onto a digital recorder.

The minimum configuration for flight is a laptop with the Piccolo Operator Interface (OI) pilot console software, the Piccolo ground datalink module, and Piccolo manual pilot console. The Piccolo OI has a moving map display, and screens for commanding all modes of flight and for observing all status telemetry received from the UA. See Appendix B. The maps used by Raytheon for the Piccolo OI are exported from the Falcon View PFPS route planning software. Falcon View is updated with current ECHUM and DAFIF information on a 28 day cycle. All telemetry files are logged onto the computer, and are archived during postflight. Visual and audible alarms are used to warn the operator of RPM, Altitude, Airspeed, System, Datalink (Comms) and GPS errors. There are additional data points in the displayed telemetry, but these are the only ones with an alert.

Additional computers can be added and networked together for additional functionality. MVCS consisting of a CUCS and VSM can be connected giving the pilot a virtual MFD. The CUCS pilot console has a moving map display, a PFD, and other displays for commanding all flight modes and receiving all status telemetry and the moving map display will show the location of every UA on the network. The VSM can be hosted on the GCS computer or in the ECM aboard the UA.

Both the Piccolo OI and the MVCS can manage up to 4 aircraft simultaneously, or a pilot console can be added to the network for each UA.

15. Control Frequencies

- Provide a description/listing of the frequencies used to control the UAS.
    - Microlight (Raytheon) Datalink
    - Primary: 420-450 MHz
    - Microhard (Piccolo) Datalink
    - Secondary: 902-928 MHz
- Video Datalink

- Blackwidow 2.4 GHz
- http://www.blackwidowav.com/bwav240200urban.html
- GMS 2.4 GHz
- http://www.gmsinc.com/product_details.asp?prod_idno=105

- Frequency Manager Points of Contact:
  - FAA Western Pacific Region
    Frequency Management Officer
    AWP-471
    Sidney Bradfield
    Federal Aviation Administration, Western-Pacific Region
    15000 Aviation Boulevard
    Hawthorne, CA 90250
    310-725-3671
    sydney.bradfield@faa.gov
  - DoD Area Frequency Coordinator State of Arizona
    Rod Hanson
    Arizona Ave Bldg 85846
    Ft. Huachuca, Arizona 85613-5000
    520-538-6423
    rodney.hanson@us.army.mil
  - Raytheon Frequency Coordinator
    Thomas J. Fagan
    Raytheon Missile Systems
    E3 & Spectrum Management
    P.O. Box 11337
    Bldg M02 M/S T16
    Tucson Arizona 85734-1337
    520-794-0227
    tjfagan@raytheon.com

Appendix A - Cobra Drawings and Photographs