DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

# CERTIFICATE OF WAIVER OR AUTHORIZATION

ISSUED TO

United States Air Force

147th Reconnaissance Wing
14657 Sneider St.
Houston, TX 77034

This certificate is issued for the operations specifically described hereinafter. No person shall conduct any operation pursuant to the authority of this certificate except in accordance with the standard and special provisions contained in this certificate, and such other requirements of the Federal Aviation Regulations not specifically waived by this certificate.

OPERATIONS AUTHORIZED

Operation of the MQ-1 Unmanned Aircraft System (UAS) in the Ft. Polk AAF Class D airspace at or below 2,500 feet Above Ground Level (AGL) under the jurisdiction of the Fort Polk Air Traffic Control Tower (ATCT).

LIST OF WAIVED REGULATIONS BY SECTION AND TITLE

N/A

**STANDARD PROVISIONS**

1. A copy of the application made for this certificate shall be attached and become a part hereof.
2. This certificate shall be presented for inspection upon the request of any authorized representative of the Federal Aviation Administration, or of any State or municipal official charged with the duty of enforcing local laws or regulations.
3. The holder of this certificate shall be responsible for the strict observance of the terms and provisions contained herein.
4. This certificate is nontransferable.

Note-This certificate constitutes a waiver of those Federal rules or regulations specifically referred to above. It does not constitute a waiver of any State law or local ordinance.

**SPECIAL PROVISIONS**

Special Provisions are set forth and attached.

This certificate 2010-CSA-34 is effective from March 26, 2011 to March 25, 2012, and is subject to cancellation at any time upon notice by the Administrator or his/her authorized representative.

BY DIRECTION OF THE ADMINISTRATOR

Dean E. Fulmer

FAA Headquarters, AJV-13
(Region)

Dean E. Fulmer
(Signature)

March 25, 2011
(Date)

Acting Manager, Unmanned Aircraft Systems
(Title)

**FAA Form 7711-1 (7-74)**

**ATTACHMENT to FAA FORM 7711-1**

**Issued To:** United States Air Force

**Address:** 147th Reconnaissance Wing
14657 Sneider St
Houston, TX 77034

**Activity:** Operation of the MQ-1 Unmanned Aircraft System (UAS) in the Ft. Polk AAF Class D airspace at or below 2,500 feet Above Ground Level (AGL) under the jurisdiction of the Fort Polk Air Traffic Control Tower (ATCT).

**Purpose:** To prescribe UAS operating requirements (outside of restricted and/or warning area airspace) in the National Airspace System (NAS) for the purpose of training and/or operational flights.

**Dates of Use:** This Certificate of Authorization (COA) 2010-CSA-34 is valid from March 26, 2011 through March 25, 2012. Should a renewal become necessary, the proponent shall advise the Federal Aviation Administration (FAA), in writing, no later than 60 days prior to the requested effective date.

**General Provisions:**

- The review of this activity is based on our current understanding of UAS operations, and the impact of such operations in the NAS, and therefore should not be considered a precedent for future operations. As changes occur in the UAS industry, or in our understanding of it, there may be changes to the limitations and conditions for similar operations.
- All personnel connected with the UAS operation must comply with the contents of this authorization and its provisions.
- This COA will be reviewed and amended as necessary to conform to changing UAS policy and guidance.

**Safety Provisions:**

Unmanned Aircraft (UA) have no on-board pilot to perform see-and-avoid responsibilities, and therefore, when operating outside of restricted areas, special provisions must be made to ensure an equivalent level of safety exists for operations had a pilot been on board. In accordance with 14 CFR Part 91, General Operating and Flight Rules, Subpart J-Waivers, 91.903, Policy and Procedures, the following provisions provide acceptable mitigation of 14 CFR Part 91.111/113 and must be complied with:

- For the purpose of see-and-avoid, visual observers must be utilized at all times except in Class A airspace, restricted areas, and warning areas. The observers may either be ground based or in a chase plane. If the chase aircraft is operating more

than 100ft above/below and or ½ nm laterally, of the UA, the chase aircraft PIC will advise the controlling ATC facility.

- In order to comply with the see and avoid requirements of Title 14 of the Code of Federal Regulations sections 91.111 and 91.113, the pilot-in-command and visual observers must be able to see the aircraft and the surrounding airspace throughout the entire flight; and be able to determine the aircraft's altitude, flight path and proximity to traffic and other hazards (terrain, weather, structures) sufficiently to exercise effective control of the aircraft to give right-of-way to other aircraft, and to prevent the aircraft from creating a collision hazard.
- UAS pilots will ensure there is a safe operating distance between manned and unmanned aircraft at all times in accordance with 14 CFR 91.111, *Operating Near Other Aircraft*, and 14 CFR 91.113, *Right-of-Way Rules*. Cloud clearances and VFR visibilities for Class E airspace will be used regardless of class of airspace. Additionally, UAS operations are advised to operate well clear of all known manned aircraft operations.
- The dropping or spraying of aircraft stores, or carrying of hazardous materials (included ordnance) outside of active Restricted, Prohibited, or Warning Areas is prohibited unless specifically authorized in the Special Provisions of this COA.

**Airworthiness Certification Provisions:**

- UA must be shown to be airworthy to conduct flight operations in the NAS.
- Public Use Aircraft must contain one of the following:

    - A civil airworthiness certification from the FAA, or
    - A statement specifying that the Department of Defense Handbook "Airworthiness Certification Criteria" (MIL-HDBK-516), as amended, was used to certify the aircraft or
    - Equivalent method of certification.

**Pilot / Observer Provisions:**

- **Pilot Qualifications:** UA pilots interacting with Air Traffic Control (ATC) shall have sufficient expertise to perform that task readily. Pilots must have an understanding of and comply with Federal Aviation Regulations and Military Regulations applicable to the airspace where the UA will operate. Pilots must have in their possession a current second class (or higher) airman medical certificate that has been issued under 14 CFR 67, Medical Standards and Certification, or a military equivalent. 14 CFR 91.17, Alcohol or Drugs, applies to UA pilots.

- Aircraft and Operations Requirements:
    - Flight Below 18,000 Feet Mean Sea Level (MSL).
        - UA operations below 18,000 feet MSL in any airspace generally accessible to aircraft flying in accordance with visual flight rules (VFR) require visual observers, either airborne or ground-based. Use of ATC radar alone does

not constitute sufficient collision risk mitigation in airspace where uncooperative airborne operations may be conducted.

- Flights At or Above 18,000 Feet Mean Sea Level (MSL)
  - When operating on an instrument ATC clearance, the UA pilot-in-command must ensure the following:
    1. An ATC clearance has been filed, obtained and followed.
    2. Positional information shall be provided in reference to established NAS fixes, NAVAIDS, and waypoints. Use of Latitude/Longitude is not authorized.

- **Observer Qualifications:** Observers must have been provided with sufficient training to communicate clearly to the pilot any turning instructions required to stay clear of conflicting traffic. Observers will receive training on rules and responsibilities described in 14 CFR 91.111, *Operating Near Other Aircraft*, 14 CFR 91.113, *Right-of-Way Rules,* cloud clearance, in-flight visibility, and the pilot controller glossary including standard ATC phraseology and communication. Observers must have in their possession a current second class (or higher) airman medical certificate that has been issued under 14 CFR 67, Medical Standards and Certification, or a military equivalent. 14 CFR 91.17, Alcohol or Drugs, applies to UA observers.

- **Pilot-in-Command (PIC) –**
  - **Visual Flight Rules (VFR) as applicable:**
    - The PIC is the person directly responsible for the operation of the UA. The responsibility and authority of the pilot in command as described by 14 CFR 91.3 (or military equivalent), applies to the UAS PIC.
    - The PIC operating a UA in line of sight must pass at a minimum the required knowledge test for a private pilot certificate, or military equivalent, as stated in 14 CFR 61.105, and must keep their aeronautical knowledge up to date.
    - There is no intent to suggest that there is any requirement for the UAS PIC to be qualified as a crewmember of a manned aircraft.
    - Pilots flying a UA on other than instrument flight plans beyond line of sight of the PIC must possess a minimum of a current private pilot certificate, or military equivalent in the category and class, as stated in 14 CFR 61.105.
  - **Instrument Flight Rules (IFR) as applicable:**
    - The PIC is the person directly responsible for the operation of the UA. The responsibility and authority of the pilot in command as described by 14 CFR 91.3 (or military equivalent), applies to the UAS PIC.
    - The PIC must be a certified pilot (minimum of private pilot) of manned aircraft (FAA or military equivalent) in category and class of aircraft flown.
    - The PIC must also have a current/appropriate instrument rating (manned aircraft, FAA or military equivalent) for the category and class of aircraft flown.

- **Pilot Proficiency – VFR/IFR as applicable:**
  - Pilots will not act as a VFR/ IFR PIC unless they have had three qualified proficiency events within the preceding 90 days.
    - The term “qualified proficiency event” is a UAS-specific term necessary due to the diversity of UAS types and control systems.
    - A qualified proficiency event is an event requiring the pilot to exercise the training and skills unique to the UAS in which proficiency is maintained.
  - Pilots will not act as an IFR PIC unless they have had six instrument qualifying events in the preceding six calendar months (an event that requires the PIC to exercise instrument flight skills unique to the UAS).

- **PIC Responsibilities:**
  - Pilots are responsible for a thorough preflight inspection of the UAS. Flight operations will not be undertaken unless the UAS is airworthy. The airworthiness provisions of 14 CFR 91.7, Civil Aircraft Airworthiness, or the military equivalent, apply.
  - One PIC must be designated at all times and is responsible for the safety of the UA and persons and property along the UA flight path.
  - The UAS pilot will be held accountable for controlling their aircraft to the same standards as the pilot of a manned aircraft. The provisions of 14 CFR 91.13, *Careless and Reckless Operation*, apply to UAS pilots.

- **Pilot/Observer Task Limitations:**
  - Pilots and observers must not perform crew duties for more than one UA at a time.
  - Chase aircraft pilots must not concurrently perform either observer or UA pilot duties along with chase pilot duties.
  - Pilots are not allowed to perform concurrent duties both as pilot and observer.
  - Observers are not allowed to perform concurrent duties both as pilot and observer.

**Standard Provisions**: These provisions are applicable to all operations unless indicated otherwise in the Special Provisions section.

- The UA PIC will maintain direct two-way communications with ATC and have the ability to maneuver the UA per their instructions, unless specified otherwise in the Special Provisions section. The PIC shall comply with all ATC instructions and/or clearances.
- If equipped, the UA shall operate with an operational mode 3/A transponder, with altitude encoding, or mode S transponder (preferred) set to an ATC assigned squawk.
- If equipped, the UA shall operate with position/navigation lights on at all times during flight.
- The UA PIC shall not accept any ATC clearance requiring the use of visual separation or sequencing.

- VFR cloud clearances and visibilities for Class E airspace will be used regardless of class of airspace the UAS is operating in, except when operating in Class A airspace where 14 CFR Part 91.155 will apply.
- Special VFR is not authorized.
- Operations (including lost link procedures) shall not be conducted over populated areas, heavily trafficked roads, or an open-air assembly of people.
- Operations outside of restricted areas, warning areas, prohibited areas (designated for aviation use) and/or Class A airspace may only be conducted during daylight hours, unless authorized in the Special Provisions section.
- Operations shall not loiter on Victor airways, Jet Routes, Q Routes, IR Routes, or VR Routes. When necessary, transit of airways and routes shall be conducted as expeditiously as possible.
- Operations conducted under VFR rules shall operate at appropriate VFR altitudes for direction of flight (14 CFR 91.159).
- The UA PIC or chase plane PIC (whichever is applicable) will notify ATC of any in flight emergency or aircraft accident as soon as practical.
- All operators that use GPS as a sole source must check all NOTAMs and Receiver Autonomous Integrity Monitoring (RAIM). Flight into GPS test area or degraded RAIM is prohibited without specific approval in the special provisions.
- At no time will TCAS be used in any mode while operating an unmanned aircraft.
- Only one UA will be flown in the operating area unless indicated otherwise in the Special Provisions.
- A copy of this COA will be maintained on site by the PIC or designated representative.
- The United States Air Force, and/or its representatives, is responsible at all times for collision avoidance with non-participating aircraft and the safety of persons or property on the surface with respect to the UAS.

**Special Provisions:**

1. In the event of a lost link, the UAS pilot will immediately notify (Fort Polk ATCT 337-531-4258), state pilot intentions, and comply with the following provisions:

    - Aircraft shall comply with the Lost Link Procedures depicted in Attachment 2 of this document.
    - While in Class D airspace, at Ft. Polk AAF, the initial lost link climb altitude and point 2 altitude will be 1,300 feet Mean Sea Level to ensure 1,000 feet Above Ground Clearance in accordance with Title 14 of the Code of Federal Regulations section 91.119.
    - If lost link occurs within a restricted or warning area, or the lost link procedure above takes the UA into the restricted or warning area – the aircraft will not exit the restricted or warning areas until the link is re-established.
    - The UA lost link mission will not transit or orbit over populated areas.
    - When outside of restricted/warning area airspace, lost link programmed procedures will avoid unexpected turn-around and/or altitude changes and will provide sufficient time to communicate and coordinate with ATC.

- Lost link orbit points shall not coincide with the centerline of Victor airways.

2. The Predator MQ-1 UAS must be operated in strict compliance with all provisions and conditions contained in the Airworthiness Release, including all technical orders, manuals, instructions, and operating procedures as provided or referenced in the COA application.

3. Any visual observer, or other person charged with providing collision avoidance for the Predator UA must have immediate communication with the pilot-in-command (PIC).

4. While outside of restricted airspace, the observer must maintain sufficient visual contact with the UA in order to ensure avoidance of other air traffic with the UA. The observer will not perform any Supervisor of Flying duties, as governed by AFI 11-418, or other duties while performing observer duties. If positioned in the Ft. Polk air traffic control (ATC) tower, the observer will only cooperate and coordinate with the PIC to ensure safe separation of aircraft. The observer will not interfere with tower controller operations. If the observer loses sight of the UA, lost link procedures must be executed immediately, as referenced in the COA application, until visual contact is regained.

5. The PIC must notify ATC immediately in the event of any emergency, loss and subsequent restoration of command link, loss and subsequent restoration of observer visual contact, or any other malfunction or occurrence that would impact air traffic safety or operations.

6. All crewmembers, including the PIC and visual observers, must be qualified under the direct supervision of a qualified instructor.

7. The use of cell phones or other telephonic communication is restricted to the operational control of the UA and any required communications with ATC.

8. A frequency integrity check must be conducted prior to the launch of the UA to ensure any electromagnetic interference does not adversely affect control of the UA.

9. Night operations are not authorized.

10. Use of visual observers in a linear fashion away from the control station (daisy chaining) is not authorized.

11. Sterile cockpit procedures must be observed during critical phases of flight. Crew Resource Management practices will be used during UA operations.

12. The holder of this COA, or delegated representative, is responsible for halting or canceling activity in the approved flight area if, at any time, the safety of persons

or property on the ground or in the air is in jeopardy, or there is a failure to comply with the terms or conditions of this COA. While exercising this COA, it is the responsibility of the 147th Reconnaissance Wing to provide for safety of flight in the National Airspace System and for the safety of persons and property on the ground.

**NOTAM:** A distance (D) Notice to Airmen shall be issued when UA operations are being conducted. This requirement may be accomplished through your local base operations or NOTAM issuing authority. You may also complete this requirement by contacting Flight Service Station at 1-877-4-US-NTMS (1-877-487-6867) not more than 72 hours in advance, but not less than 48 hours prior to the operation and provide:

- Name and Address of pilot filing NOTAM request
- Location, Altitude or the operating Area
- Time and nature of the activity

NOTE FOR PROPONENTS FILING THEIR NOTAM WITH DoD ONLY: This requirement to file with the AFSS is in addition to any local procedures/requirements for filing through DINS. The FAA Unmanned Aircraft Systems Office is working with the AFSS, and to eliminate the requirement to file a NOTAM with both the AFSS and DINS in the near future.

**Incident / Accident and Normal Reporting Provisions:** The following information is required to document routine and unusual occurrences associated with UAS activities in the NAS.

- The proponent for the COA shall provide the following information to Donald.E.Grampp@faa.gov on a monthly basis:
  - Number of flights conducted under this COA.
  - Pilot duty time per flight.
  - Unusual equipment malfunctions (hardware/software).
  - Deviations from ATC instructions.
  - Operational/coordination issues.
  - All periods of loss of link (telemetry, command and/or control)

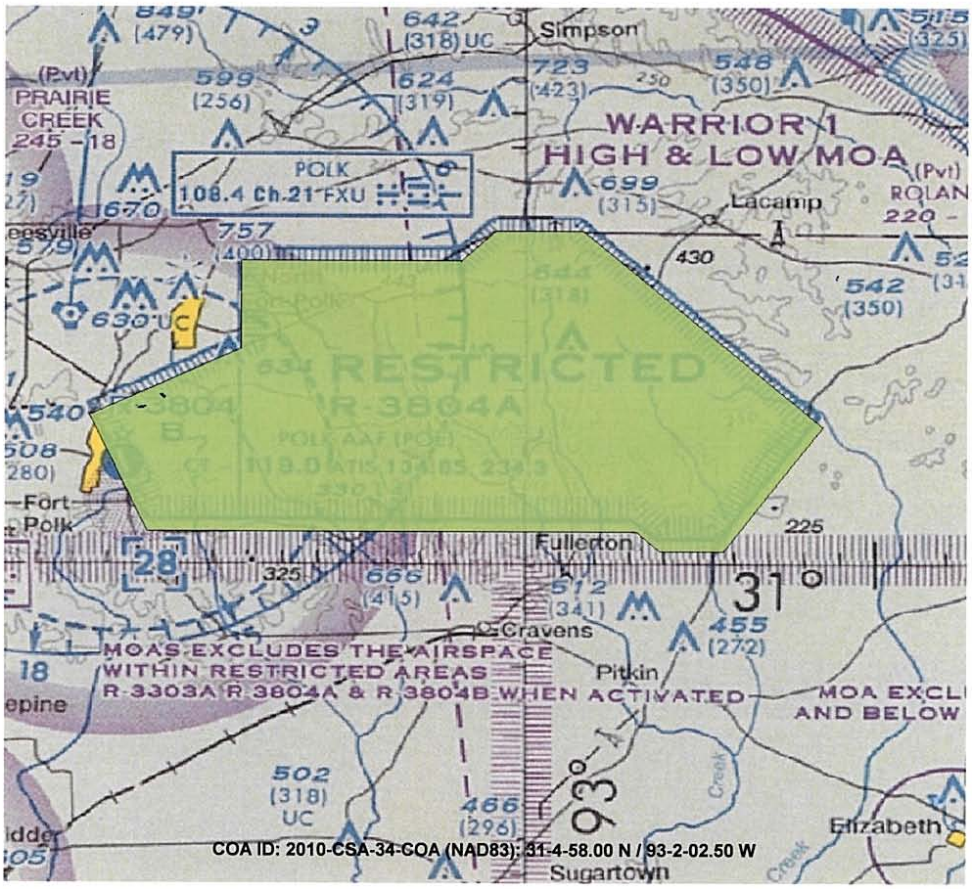
- The following shall be submitted via COA Online, email or phone (202-385-4542, cell 443-569-1732) to Donald.E.Grampp@faa.gov **within 24 hours and prior to any additional flight under this COA**:
  - All accidents or incidents involving UAS activities, including lost link.
  - Deviations from any provision contained in the COA.

This COA does not, in itself, waive any Federal Aviation Regulation (FAR) nor any state law or local ordinance. Should the proposed operation conflict with any state law or local ordinance, or require permission of local authorities or property owners, it is the responsibility of the United States Air Force to resolve the matter. This COA does not authorize flight within Special Use Airspace without approval from the Using Agency.

The United States Air Force is hereby authorized to operate the MQ-1 Unmanned Aircraft System in the operations area depicted in “Activity” above and attachment 1 below.

Attachment 1
Page 1

Attachment 1
Page 2



**147 RW MQ-1 Lost Link Procedures at Ft Polk AAF / R-3804**

## BACKGROUND

The MQ-1 Predator system is designed with the ability to fly manually or autonomously. Under normal operations, manual flight is via inputs from the pilot through use of a control stick, rudder pedals and power lever. Much like traditional aircraft, direct manipulation of the control stick fore and aft will, in turn, direct movement of the tailboards so as to produce a climb or descent. Likewise, movement of the control stick left or right will direct movement of the ailerons to produce a left or right banked turn. And, of course, movement of the power lever produces changes in aircraft power.

Autonomous flight is flight which occurs via the autopilot where missions are designed and uploaded into the autopilot memory for execution. There are two types of missions available for input: operational and emergency.

Operational missions are those which specify a geographic route of flight and can be up to 255 waypoints. Each waypoint contains the specific information of longitude and latitude, altitude, airspeed, sensor configuration and many others. Waypoints can be added, deleted and/or modified during flight. The pilot elects to fly an operational mission by turning on the autopilot (doing so will override any control stick and/or power lever input). Only operational missions that are loaded within the autopilot memory can be executed – each time a new operational mission is loaded, it replaces the previous mission (only 1 operational mission can be stored in the aircraft autopilot memory at a time).

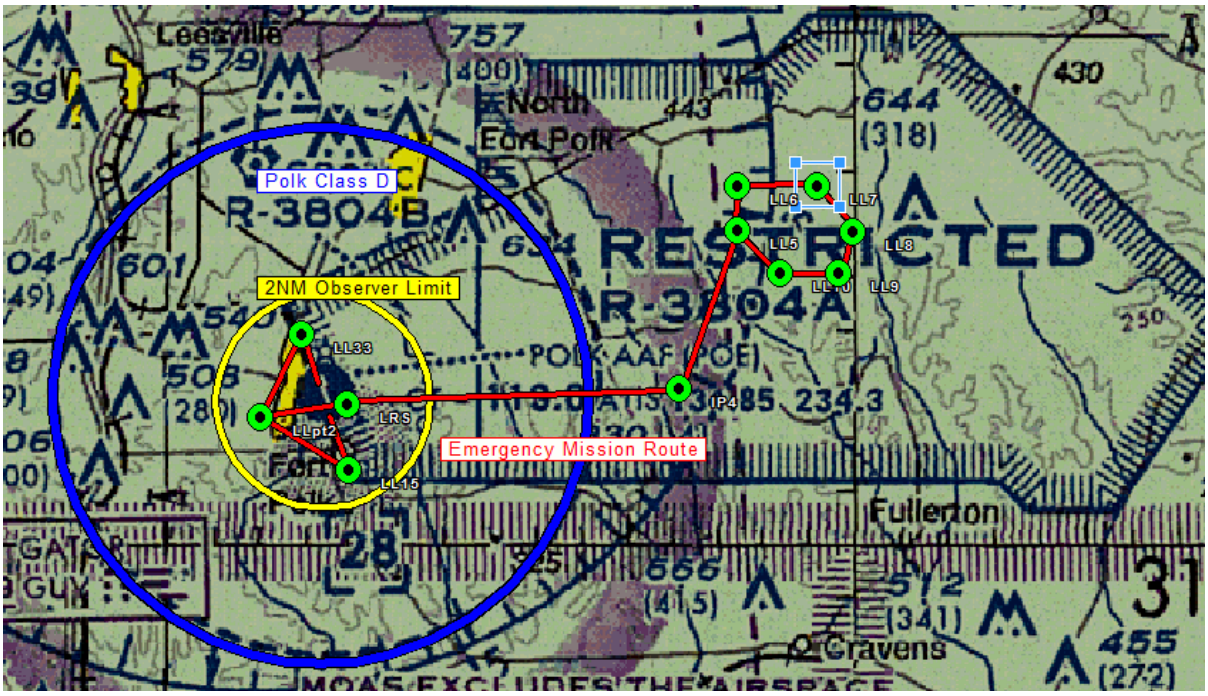
Emergency missions can have up to 100 waypoints. Each waypoint contains the same specific information as operational missions (longitude, latitude, airspeed, mode 3 codes, etc.). Likewise, emergency mission waypoints can also be added, deleted and/or modified during flight. However, unlike operational missions, emergency missions are not designed to be executed through pilot election. Emergency missions ***automatically*** execute whenever the aircraft senses the uplink signal between the aircraft and the ground control station is lost, regardless of the current mode of flying (manual or autonomous). Therefore, emergency missions override both manual flight and operational missions.

Like operational missions, each time a new emergency mission is uploaded into aircraft memory, it replaces the previous emergency mission (only 1 emergency mission can be stored at a time). As a safety precaution, anytime an emergency mission is non-existent within the aircraft memory (i.e. the pilot has not uploaded an emergency mission at least once), a warning is displayed.

There is no specific flight termination procedure for the MQ-1 Predator. The design of every Predator system is such that once the aircraft passes the last point of the emergency mission the
aircraft will continue to fly the last six waypoints, until the uplink is regained. While flying the last six waypoints, if an uplink with the aircraft if unattainable and the aircraft runs out of fuel, the aircraft kills the engine and lowers the landing gear while continuing to fly the routing and airspeed of the last six waypoints as the aircraft descends into the terrain.

In the event the aircraft loses link with the ground control station either in the pattern or in the range, the pilot will maintain two way communication with ATC at all times. Primary communication with ATC is accomplished through 2 UHF/VHF radios and antennas in the ground control station, or through one UHF/VH/FM radio onboard the aircraft. Backup communication with Polk AAF ATC and range airspace controllers is maintained through the use of handheld UHF/VHF radios and telephones in the ground control station and at the operations center.

**FORT POLK OPERATIONS**




For the particular flying operations at Ft Polk, there are essentially two separate “conditions” or phases of flight which must be accommodated for with regard to emergency missions: flight in the local pattern and flight within the restricted airspace

(R3804). A graphical depiction of the lost link procedures is contained at the end of this document.

**Local Area/Pattern Emergency Mission Waypoints**

Anytime the aircraft is in the pattern and there is a loss of uplink, the aircraft will immediately commence a climb to **1000' MSL** and fly directly to the entry (1st) waypoint of the emergency mission currently resident within the autopilot memory. The entry waypoint of the emergency mission anytime the aircraft is located within Class D airspace (within the local pattern area) will be located 1 NM from the departure end of the active runway. **Specifically, when runway 16 is active, the entry waypoint of the emergency mission will be point LL16 (N3101.4 W09310.9)** located southeast of the airfield. Likewise, **point LL34 (N3103.9 W09311.9) will be the entry waypoint for the emergency mission for runway 34** (see Emergency Mission Layout graphic). **The altitude for the entry waypoint is 1000' MSL** (700' AGL).

As per guidance from the Ft Polk airspace managers, all local pattern traffic must remain west of the field. Therefore, the **2nd waypoint of the emergency mission is located west of the runway - Pt 2 (N3102.4 W09312.9) assigned an altitude of 1000' MSL.** If the uplink with the aircraft has not been restored by Pt 2, then the aircraft will exit the Class D airspace and fly east to the 3rd waypoint to facilitate troubleshooting of the data-link system, conserve fuel and move the aircraft to a safer altitude over a less populated area. The 3rd waypoint of the emergency mission is **Pt 3 (N3102.6 W09311.0) assigned alt of 2500' MSL** which is collocated with the 1st point of the normal departure procedure as described in the Ft Polk LOA.

**Restricted Airspace Emergency Mission Waypoints**

Anytime the aircraft is located within the restricted area (or has executed the emergency mission while in the local pattern and has reached Pt LRS) and no uplink is present between the aircraft and control station, the aircraft will proceed direct to **Pt 4 (N3102.8 W09303.8)** while climbing to or remaining at the pre-coordinated "working" **altitude as assigned by Ft Polk Range Control (normally 8000'-9000' MSL).** Pt 4 is the 2nd waypoint of the normal departure procedure as described in the Ft Polk LOA.

Because of the design of the system to continually fly the last six waypoints of the emergency mission after the last point has been passed, the last six waypoints of the emergency mission are arranged in a circle located within the restricted airspace (see Emergency Mission Layout graphic). After reaching Pt 4, if the uplink with the aircraft has not been restored, the aircraft will continue on to these last six waypoints. The specific coordinates of the remaining emergency mission waypoints are:
Pt 5 (N3105.9 W09302.5)
Pt 6 (N3106.7 W09302.5)

Pt 7 (N3106.7 W09300.8)
Pt 8 (N3105.9 W09300.0)
Pt 9 (N3105.1 W09300.3)
Pt 10 (N3105.1 W09301.6)
Altitudes for points 5-10 are as assigned by range controllers.
Once the aircraft reaches Pt 10, it will fly to Pt 5 and continue the flying the last 6 waypoints.

NOTE: The last six waypoints of the emergency mission are located within the Redleg Artillery Impact Area. This area is free of civilian personal property (houses, etc.) and requires coordination with Ft Polk Range Control prior to personnel entry; thereby minimizing the chances of injury and/or personal property damage in case of a failure to regain uplink with the aircraft (and fuel starvation). While flying the last six waypoints, if an uplink with the aircraft if unattainable and the aircraft runs out of fuel, the aircraft kills the engine and lowers the landing gear while continuing to fly the routing and airspeed of the last six waypoints as the aircraft descends into the terrain.

**CONCLUSION**

This arrangement of waypoints and altitudes will ensure that regardless of where the aircraft is located during flight, if the uplink with the aircraft is lost, it will immediately execute an emergency mission that will ensure the aircraft begins safely climbing away from the ground and/or maintains a safe altitude, direct it to fly to specific coordinates that will help facilitate re-acquisition of an uplink signal, return the aircraft to restricted airspace (if in Class D airspace at the time of lost uplink) and ensure that it remains there. If an uplink is not regained, the aircraft will “land” in an artillery impact area which requires coordination with Ft Polk Range Control prior to entry of personnel and is free of civilian personal property.