AUSTIN FIRE DEPARTMENT'S

ROBITICS EMERGENCY DEPLOYMENT (RED) TEAM

GENERAL OPERATIONS MANUAL

Austin Fire Department Robotics Emergency Deployment Team

RECORD OF CHANGES

A master copy of all parts of the Austin Fire Departments (AFD) Robotics Emergency Deployment (RED) team general operating manual will be maintained electronically on the fire departments G-drive in a folder labeled RED team. A hard backup copy will be maintained at the Austin Fire Departments Wildfire Division.

The master copy and its backup will be kept updated with all major revisions to any part of the operating manual. Other copies of this manual will not necessarily be updated with each revision. It is at the discretion of the RED team program manager to distribute changes to other fire department sections that have a copy of the operations manual. All major revision should be documented. Minor revisions such as correcting typographical errors do not need to be documented.

Updates

AFD is responsible for its (sUAS) operators to use the most current operating manual. AFD will distribute changes and ensure the appropriate incorporation. Each change modification shall be recorded in the "Record of Changes" at the beginning of this document, and the appropriate changes implemented into this operating manual.

Change Requests

For changes to technical and operating procedures to this manual, any operator or Federal Aviation Administration (FAA) Administrator can make a request. These requests are reviewed by the Lead Pilot in Command (PIC) who implements the appropriate change via a serialized change notice, which will be distributed to all users of this manual.

A “Record of Changes” page will be inserted in each document upon revisions. As such, a new page detailing the changes can be seamlessly inserted upon each revision.

Instructions

Copy the information from the final page of this document and paste it into a new document, which will be appended to the document being revised. Fill in the document title in the table at the top of the page next to the words “**Document Title**”.

“**Brief Description of Change**” column:

Provide a brief description of the change.

Example: Changed responsibility from Pilot in Command (PIC) to Mission Supervisor (MS).

“**Date of Change**” column:

Enter the date the document was changed.

Example: 1/2005

“**Page(s) Affected**” column:

Enter the pages that were changed.

Example: 1, 3, 5-7, and 12

"**Change Made By**" column:

Enter the name of the person who made the change. If applicable, the person's title may also be listed here. The person making the change can initial the electronic kept in the RED Team folder on the Austin Fire Department G-drive.

Example: Richard Davis, Assistant Chief, Austin Fire Department

The above examples would produce a page similar to what is shown in figure 1. The document page may also have the appropriate header and footer.

Figure 1
Record of Changes

Document Title	**AFD RED Team General Operations Manual**

Brief Description of Change	**Date of Change**	**Page(s) Affected**	Change Made By
Changed responsibility from Pilot in command (PIC) to Mission Supervisor (MS)	1/2005	1, 3, 5-7, and 12	Richard Davis, Assistant Chief, Austin Fire Department

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Table of Contents

Chapter 1

INTRODUCTION

1.1. Overview

This manual presents the standard operating procedures to be conducted by all Austin Fire Department RED Team members that operate small Unmanned Aerial Systems (sUAS) s. Furthermore, this guide governs all procedures conducted by AFD operators. AFD conducts sUAS pre and post wildfire mapping, emergency scene aerial observation, search and rescue support. While extremely detailed, this manual cannot capture all possible operational scenarios. In these circumstances, the operator should apply sound judgment.

1.2. FAA Authorization

There are currently two ways to get FAA authorization to operate a UAS. The first is to obtain a Special Airworthiness Certificate for private sector (civil) aircraft, which are typically for research and development (R&D), training, and flight demonstrations. The second is to obtain a COA for public aircraft, and civil operations only for aircraft that have received an airworthiness certificate from the Aircraft Certification Service (AIR).

1.3. Methods

The methods of approval include the issuance of a COA for public aircraft operations, or for civil aircraft that have received an FAA airworthiness certificate from AIR. In the case of public aircraft operations, the operating entity applying to conduct the UAS operation must comply with its own processes, policies, and standards in the following areas:

1.3.1. Pilot certification

1.3.2. Crew certification

1.3.3. Recent pilot experience

1.3.4. Medical certificates

1.3.5. Airworthiness of public UAS

1.4. FAA Exemptions

AFD sUAS operations shall adhere to applicable portions of Title 14 Code of Federal Regulations (CFR), Part 91; however, due to sUAS operations, exemptions are required before any operations may be launched in the U.S. National Airspace System (NAS).

1.5. Certificate of Authorization

The Certificate of Authorization (COA) must be obtained before sUAS operations are conducted

by AFD. AFD will adhere to all provisions dictated by the FAA's COA. In addition to the COA, AFD will operate within the appropriate state and local requirements to operate Unmanned Aerial (UA) platforms.

1.6. Emergency COA.

1.6.1. Emergency COA Conditions. The FAA may consider issuing an emergency UAS COA when all of the following conditions apply:

1.6.1.1 A situation exists that is defined as a condition of distress or urgency.

1.6.1.2 The proposed UAS is operating under a current, approved COA for a different purpose or location.

1.7. Non-Emergency COA. Requests for UAS COAs that fall outside of these parameters will be processed through the normal online COA application process. Emergency UAS COAs will not be considered for:

1.7.1. Demonstration flights;

1.7.2. Flights to test capabilities;

1.7.3. Training;

1.7.4. Flights in Class B airspace; or

1.7.5. Flights over congested areas, unless a suitable mitigation strategy is proposed and found to be acceptable.

1.8. FAR/AIM and NOTAM Requirement

The FAA ensures the safe, efficient, and secure use of the nation's airspace, promotes safety in air commerce, and encourages the development of civil aeronautics while supporting national defense requirements. All AFD sUAS operations will be conducted by the guidelines set forth by the Federal Aviation Regulations (FAR) / Aeronautical Information Manual (AIM), the Notice to Airmen (NOTAM) system, and appropriate publications (e.g. Visual Flight Rules (VFR) sectional charts) when applicable.

1.9. Warnings, Cautions, and Notes

Throughout this instruction and make/model operating manuals, the following applies to the terms WARNING, CAUTION, and NOTE:

1.9.1. A **WARNING** pertains to a condition that could cause severe injury or death, if not carefully followed.

1.9.2. A **CAUTION** pertains to a procedure or condition that could cause damage to equipment, if not carefully followed.

1.9.3. A **NOTE** pertains to a procedure or condition that is essential for emphasis.

1. 10. Other Terminology. Use of the following terms represents specific meanings in context of AFD operating manuals. In addition, acronyms utilized in this manual can be found in Appendix A.

1.10.1. "Shall" is used when a procedure is mandatory.

1.10.2. "Should" is used when a procedure is recommended.

1.10.3. "Land Immediately" is used during a condition when a landing must be performed immediately without regards to making it to a designated landing area.

1.10.4. "Land as Soon as Possible" is used during a condition when an immediate landing is needed, but can be delayed until reaching a designated landing area.

Chapter 2

DEFINITIONS

2.1. Terms

2.1.1. Aircraft. A device used or intended to be used for flight in the air, including unmanned aircraft (UA).

2.1.2. Airworthiness. A condition in which the UAS (including the aircraft, airframe, engine, propeller, accessories, appliances, and control station (CS)) conforms to its type certificate (TC), if applicable, and is in condition for safe operation.

2.1.3. Airworthiness Certification**.** A repeatable process that results in a documented decision that an aircraft system has been judged Airworthy. It is intended to verify that the aircraft system can be safely maintained and safely operated by fleet pilots within its described and documented operational envelope.

2.1.4. Airworthiness Statement**.** Document required from public UAS applicants during a Certificate of Waiver or Authorization (COA) application process, which confirms aircraft airworthiness.

2.1.5. Certificate of Waiver or Authorization (COA). An FAA grant of approval for a specific operation. COAs may be used as an authorization, issued by the Air Traffic Organization (ATO), to a public operator for a specific UA activity. COAs for civil and commercial operations are only for aircraft that have received an airworthiness certificate from Aircraft Certification Service (AIR). Provisions or limitations may be imposed as part of the approval process to ensure the UA can operate safely with other airspace users.

2.1.6. Civil Aircraft. Aircraft other than public aircraft.

2.1.7. Congested Area. A congested area is determined on a case-by-case basis. The determination must take into consideration all circumstances, not only the size of an area and the number of homes or structures (e.g., whether the buildings are occupied or people are otherwise present, such as on roads).

2.1.8. Crewmember (UAS). In addition to the crewmembers identified in Title 14 of the Code of Federal Regulations (14 CFR) part 1, a UAS flight crew member includes pilots, sensor/payload operators, and visual observers (VO), but may include other persons as appropriate or required to ensure safe operation of the aircraft.

2.1.9. Crew Resource Management (CRM). The effective use of all available resources including human, hardware, and information resources.

2.1.10. Deviations:

2.1.10.1. SUAS-Os may deviate from any flight rule when:

2.1.10.2. An in-flight emergency requires immediate action.

2.1.10.3. Deviation is required to protect lives.

2.1.10.4. When safety of flight dictates. Note: Consideration of hazards created must be factored into a decision to deviate. Preservation of the UA is not paramount.

2.1.11. Dimensional Units. Visibility distances are in statute miles (SM). All other distances referred to in this instruction are in nautical miles (NM) unless otherwise identified.

2.1.12. Flight Termination**.** The intentional and deliberate process of performing controlled flight into terrain (CFIT). Flight termination must be executed in the event that all other contingencies have been exhausted, and further flight of the aircraft cannot be safely achieved, or other potential hazards exist that require immediate discontinuation of flight.

2.1.13. Flyaway. An interruption or loss of the control link, or when the pilot is unable to effect control of the aircraft and, as a result, the UA is not operating in a predicable or planned manner.

2.1.1.4. Lost Link. The loss of command-and-control link contact with the remotely piloted aircraft such that the remote pilot can no longer manage the aircraft's flight.

2.1.1.5. PUBLIC AIRCRAFT OPERATIONS. The Unmanned Aircraft Systems (UAS) operator or applicant must provide an airworthiness statement specifying compliance with the proponent's applicable airworthiness criteria. Airworthiness statements must be provided on agency letterhead and include:

2.1.15.1 The date the statement is effective,

2.1.15.2 A signature of the responsible certifying authority within the agency,

2.1.15.3 A point of contact (POC), and Any warnings/limitations.

Chapter 3

QUADCOPTER OVERVIEW

3.1. General

When learning how to fly a quad-copter, it is important to understand the machine you are commanding. If something goes wrong, you want to be able to diagnose and fix the issue. You also want to understand the capabilities of each part and how they play into flying a quad-copter.

3.2. Components of a quad-copter:

3.2.1. The frame

3.2.2. Motors

3.2.3. Electronic Speed Control (ESC)

3.2.4. Flight Control Board

3.2.5. Radio Transmitter and Receiver

3.2.6. Propellers

3.2.7. Battery and Charger

3.3 Modules defined

The frame connects all of the other parts. For a quad-copter, it is shaped in either an X or a + shape.

3.3.1. Electric Speed Controls (ESCs) are wired components that connect the motors and the battery. They relay a signal to the motors that tells them how fast to spin.

3.3.2. The Flight Control Board is the “commander of operations”. It controls the accelerometer and gyroscopes, which control how fast each motor spins.

3.3.3. The radio transmitter is your remote control, and the receiver is the antenna on the copter that talks to the remote control. When you make an adjustment on the transmitter, the receiver is what understands that adjustment and sends it to the rest of the quad-copter system.

3.3.4. A quad-copter has four propellers, and each one helps determine which direction the quad-copter flies or whether it hovers in place.

3.3.5. The battery is the power source for the whole quad-copter. This needs to be charged and recharged, because without a battery, you cannot fly your quad-copter.
3.3.6. The charger charges your battery so you can take multiple flights.

3.4. Pre-flight checklist

Here is a checklist you can use before each flight:

3.4.1. If you have a camera, check that you have your micro SD card inserted.

3.4.2. Make sure the transmitter battery is charged.

3.4.3. Make sure the quad-copter battery is charged.

3.4.4. Insert the battery.

3.4.5. Make sure the battery is inserted securely.

3.4.6. Make sure each propeller is secure.

3.4.7. Check that there are no loose parts on the quad-copter.

3.4.8. Check for missing or loose screws.

3.4.9. Turn on the transmitter.

3.4.10. If your copter needs to calibrate and get satellite lock, wait until it finishes.

3.4.11. Make sure there is enough room for launch and flight.

3.4.12. Make sure the throttle (left stick) is all the way down.

3.4.13. Turn on the transmitter.

3.4.14. Back away three or four steps (or to a safe distance).

3.4.15. Keep facing the quad-copter the entire time.

3.4.16. Keep a direct line of site at all times when flying, so you can always see your quad-copter. You want to keep a direct line of site so you know when you are about to crash. In addition, sometimes, quad-copters can fly out of the range of the transmitter's signal, which can cause your copter to fly off on its own. Keep the transmitter's range in mind, and do not let your quad-copter fly out of that range.

3.5. General terms:

3.5.1. Line of site – The pilot can see their quad-copter during flight.

3.5.2 FPV (First Person View) — the pilot can see where they are flying through the UAV's camera.

3.6. UAV Parts:

3.6.1. Transmitter/Remote Control – The hand-held device that allows you to maneuver the quad-copter and adjust its settings.

3.6.2. Propellers – They spin according to the manual controls of the pilot. The intensity of the spin correlates to the intensity of the quad-copter's movement.

3.6.3 Camera – Many quad-copters either come with a camera or allow the pilot to attach a camera to them.

3.7. UAV Controls:

3.7.1**.** Roll – Done by pushing the right stick to the left or right. Literally rolls the quad-copter, which maneuvers the quad-copter left or right.

3.7.2. Pitch – Done by pushing the right stick forwards or backwards. Tilts the quad-copter, which maneuvers the quad-copter forwards or backwards.

3.7.3**.** Yaw – Done by pushing the left stick to the left or to the right. Rotates the quad-copter left or right. Points the front of the copter different directions and helps with changing directions while flying.

3.7.4. Throttle – Engaged by pushing the left stick forwards. Disengaged by pulling the left stick backwards. This adjusts the altitude, or height, of the quad-copter.

3.7.5. Trim – Buttons on the remote control that help you adjust roll, pitch, yaw, and throttle if they are off balance.

3.7.6. The Rudder – You might hear this term thrown around, but it's the same as the left stick. However, it relates directly to controlling yaw (as opposed to the throttle).

3.7.7. Aileron – Same as the right stick. However, it relates directly to controlling roll (left and right movement).

3.7.8. The Elevator – Same as the right stick. However, it relates directly to controlling pitch (forwards and backwards movement).

3.8. UAV Maneuvering:

3.8.1. Bank turn – A consistent circular turn in either the clockwise or the counterclockwise direction.

3.8.2. Hovering – Staying in the same position while airborne. Done by controlling the throttle.

3.8.3. Figure 8 – Flying in a "figure 8" pattern.

3.9. Flight modes: Flight modes can typically be adjusted with certain buttons on your remote control/transmitter.

3.9.1. Manual – Similar to flying a helicopter. Once you tilt the quad-copter (roll) it will not auto-level, itself back to its original position. Even if you let go of the stick and it returns to the middle, the quad-copter will stay tilted.

3.9.2. Altitude (Auto-level) – Once the sticks are centered, the copter will level itself out.

3.9.3. GPS Hold – Returns the quad-copter's position once the sticks have been centered. The same as attitude mode (auto-level) but using a GPS.

3.10. Quad-copter Controls (see figure 1). There are four main quad-copter controls:

3.10.1. Roll moves your quad-copter left or right. It is done by pushing the right stick on your transmitter to the left or to the right. It is called "roll" because it literally rolls the quad-copter.

3.10.2. Pitch is done by pushing the right stick on your transmitter forwards or backwards. This will tilt the quad-copter, resulting in forwards or backwards movement.

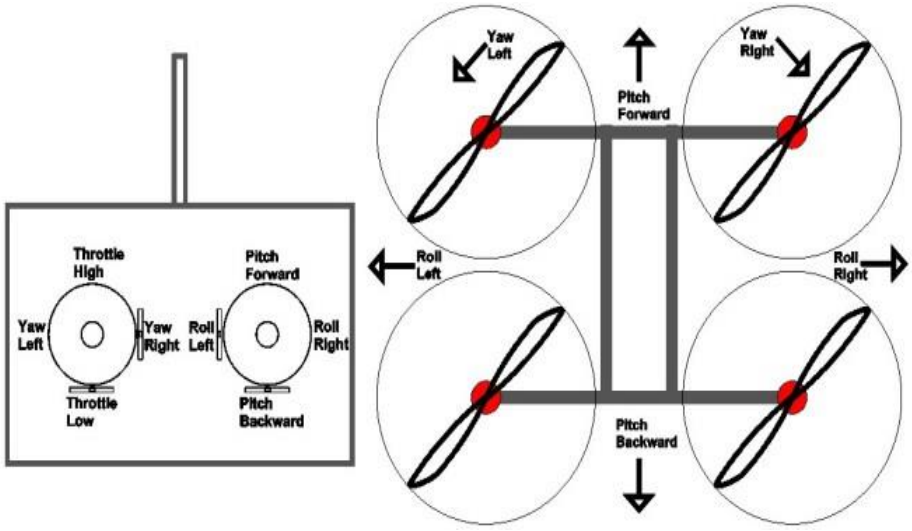
3.10.3. Yaw rotates the quad-copter clockwise or counter-clockwise. This is done by pushing the left stick to the left or to the right. Yaw is typically used at the same time as throttle during continuous flight. This allows the pilot to make circles and patterns.

3.10.4. Throttle gives the propellers on your quad-copter enough power to get airborne. When flying, you will have the throttle engaged constantly. To engage the throttle, push the left stick forwards. To disengage, pull it backwards.

3.10.5. When the quad-copter is facing you (instead of facing away from you) the controls are all switched.

Figure 1

Transmitter (left image) and quad-copter (right image).



Chapter 4

NATIONAL AIRSPACE SYSTEMS (NAS) OPERATIONS

4.1. Airspace restrictions for the National Airspace System (NAS). The FAA defines the NAS as a common network of United States airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information, and manpower and material. Included are system components shared jointly with the military. There are two types of airspace within the NAS, controlled and uncontrolled.

4.2. Uncontrolled Airspace. The portion of airspace that air traffic control has neither the authority nor the responsibility for exercising control over air traffic.

4.3. Controlled Airspace. Airspace of defined dimensions, which air traffic control service, is provided to IFR flights and to VFR flights in accordance with airspace classification. Controlled airspace is a generic term that covers Class A, Class B, Class C, Class D, and Class E airspace. Listed below is a brief description and depiction of each class of airspace.

4.3.1. Class A**.** Generally, that airspace from 18,000 feet MSL up to and including flight level 600, including the airspace overlying the waters within 12 nautical miles of the coast of the 48 contiguous States and Alaska. Unless otherwise authorized, all persons must operate their aircraft under instrument flight rules (IFR).

4.3.2. Class B**.** Generally, that airspace from the surface to 10,000 feet MSL surrounding the

nation's busiest airports in terms of IFR operations or passenger handling. An ATC clearance is required for all aircraft to operate in the area, and all aircraft that are so cleared receive separation services within the airspace.

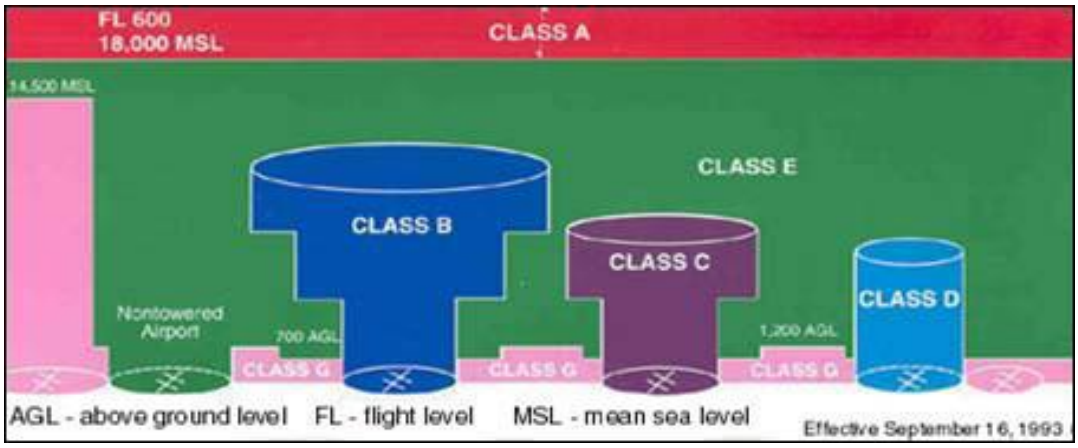
4.3.3. *Class C.* Generally that airspace from the surface to 4,000 feet above the airport elevation surrounding those airports that have an operational control tower, are serviced by a radar approach control, and have a certain number of IFR operations or passenger handling. The airspace usually consists of a surface area with a 5 NM radius, and an outer circle with a 10 NM radius that extends from 1,200 feet to 4,000 feet above the airport elevation. Each person must establish two-way radio communications with the air traffic control (ATC) facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while within the airspace. VFR aircraft are only separated from IFR aircraft within the airspace.

4.3.4. Class D. Generally, that airspace from the surface to 2,500 feet above the airport elevation surrounding those airports that have an operational control tower. Unless otherwise authorized, each person must establish two-way radio communications with the ATC facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while in the airspace. No separation services are provided to VFR aircraft.

4.3.5. Class E. Generally, if the airspace is not Class A, Class B, Class C, or Class D, and it is controlled airspace, it is Class E airspace. Class E airspace extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace. Also in this class are Federal airways, airspace beginning at either 700 or 1,200 feet AGL used to transition to/from the terminal or enroute environment, enroute domestic, and offshore airspace areas designated below 18,000 feet MSL (see figure 2). Unless designated at a lower altitude, Class E airspace begins at 14,500 MSL over the United States, including that airspace overlying the waters within 12 nautical miles of the coast of the 48 contiguous States and Alaska. Class E airspace does not include the airspace 18,000 MSL or above.

4.3.6. Class G. (uncontrolled airspace). That airspace not designated as Class A, B, C, D, or E.

Figure 2.
Controlled Airspace.



4.4. Operations in Class D Airspace. SUAS operations in Class D airspace require a Certificate of Authorization (COA) or other FAA approval.

4.5. Restricted Area. Restricted areas contain airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Activities within these areas must be confined because of their nature or limitations imposed upon aircraft operations that are not a part of those activities or both. Restricted areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Penetration of restricted areas without authorization from the using or controlling agency may be extremely hazardous to the aircraft and its occupants.

4.6. Warning Area. A warning area is airspace of defined dimensions, extending from three nautical miles outward from the coast of the U.S. that contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning areas is to warn nonparticipating pilots of the potential danger. A warning area may be located over domestic or international waters or both.

Chapter 5

PREFLIGHT REQUIREMENTS

5.1. Preflight Planning

5.1.2 The Pilot in Command (PIC) and Mission Supervisor (MS) are responsible for all preflight planning to ensure the Unmanned Aerial (UA) operates within its FAA exemptions and COA directives. The PIC ensures the UA is operating in the appropriate, authorized airspace.

5.1.3. The PIC and MS ensure the weather forecast is appropriate for the operation of the UA. The PIC and MS checks the applicable NOTAMs and TFRs. In addition, the MS ensures the NOTAM for the associated UA flight event has posted.

5.1.4. Upon validation of the airspace, the PIC and VO survey the operating area to note all hazards (terrain, obstructions, structures, other hazards) near operations. The launch and landing areas are surveyed for potential obstructions that may interfere with the launch and recovery of the UA. The launch and landing zones designated and marked with bright orange markings.

NOTE

Electromagnetic Interference should be considered in order to prevent inadvertent lost link with the UA.

5.1.5. Upon completion of the preflight planning, the PIC shall conduct a preflight inspection of the UA and its ground control system, if applicable. The detail for this procedure is outlined in each respective make/model operating manual.

5.2. Weather

5.2.1. Weather shall be obtained for the local area of operation to include Meteorological Aerodrome Reports (METAR) and Terminal Area Forecasts (TAF) from the closest airport reporting weather conditions. Additional weather information should be obtained from the National Oceanic Atmospheric Administration (NOAA) website (http://www.aviationweather.gov/adds/), to review the following: radar, ceiling/visibility, wind/temperatures, turbulence, Significant Meteorological Information (SIGMET), and icing.

5.2.2. All flight events shall operate in Visual Meteorological Conditions (VMC) only. The UA shall not operate in visibility less than 3 statute miles (sm). The UA shall not operate 500 feet or less vertically (below) from clouds or 2,000 feet or less laterally from clouds. The UA shall never operate in actual icing conditions or forecasted icing during the time of the flight event.

5.2.3. Maintain situational awareness of weather conditions and trends. Avoid turbulence that exceeds operating handbook limitations and be prepared to change altitudes or course to mitigate turbulence and escape headwinds that may prevent recovery**.**

5.2.4. Avoid flight into precipitation that exceeds operating limitations. Be aware of icing levels and follow operating handbook procedures for escaping or mitigating icing.

5.2.5. The PIC will obtain sufficient weather information to safely conduct the flight and comply with this instruction.

5.2.6. Weather Considerations. All SUAS mission planning requires careful attention to weather and its effects on the UA during flight operations; particular attention should be paid to temperature, winds, precipitation, and hazardous weather phenomena. These factors include, but are not limited to:

5.2.6.1. Wind effects on launch, navigation legs, loiter, and landing. Operators must keep in mind small unmanned aircraft avionics may be more sensitive to turbulence.

5.2.6.2. Restrictions to visibility (fog, smoke, haze, precipitation, sun angle) and effects on observation of the UA and UA sensor capability.

5.2.6.3. Temperature extremes and its effects on aircraft, payloads, and batteries.

5.2.6.4. Effects of high humidity on internal and external payloads (sensors).

5.2.6.5. Effects of precipitation on payloads, batteries, and electronics.

5.2.6.6. Hazardous weather (i.e., thunderstorms, turbulence, icing, clouds, precipitation, and poor visibility during launch and recovery) pose hazards to SUAS operations.

5.3. Mission Briefings

5.3.1. The lead sUAS PIC must ensure each crewmember is briefed on items affecting safety or

mission completion. These briefings will include, but need not be limited to:

5.3.1.1. Emergency procedures.

5.3.1.2. Airspace/working area and frequencies authorized for operations and method of complying with restrictions.

5.3.1.3. Precautions and restrictions.

5.3.1.4. Any special procedures and instructions required for use during training, formation, or operational missions.

5.3.2. Briefing Times. Start briefings in sufficient time to complete the briefing prior to flight operations.

5.3.3. Mission Brief. All crewmembers scheduled to fly the mission will receive a mission briefing prior to assuming control of the UAS.
5.3.4. Mission Debrief. After changeover or landing, debrief all missions.

Chapter 6

GENERAL FLIGHT RULES

6.1. Flight Risk Assessment Tools

When implementing a Safety Management System (SMS), one of the most critical components to develop is a Flight Risk Assessment Tool (FRAT). Because every flight has some level of risk, it is critical that pilots are able to differentiate, in advance, between a low risk flight and a high-risk flight, and then establish a review process and develop risk mitigation strategies. A Flight Risk Analysis Tool enables proactive hazard identification, is easy to use, and can visually depict risk. It is an invaluable tool in helping pilots make better go/no-go decisions and should be a part of every flight.

6.2. Operating Airspace

All operations are conducted at 400 'feet Above Ground Level (AGL) or lower inside Class G uncontrolled airspace. The airspace being utilized by the UA is restricted to private property, and the owner provides written consent to the operation of an AFD UA.

6.3. NOTAM Requirement

For all AFD flight events, a NOTAM shall be requested and approved before flight operations commence. Each flight event must apply for a NOTAM within 72 hours but not later than 48 hours from the time of the flight event. All applicable NOTAMs shall be reviewed before each flight event. In addition, Temporary Flight Restrictions (TFR) s shall be reviewed near the area of operation.

6.4. Altimeter Requirements

The UA's primary means for altitude measurement is a Global Positioning System (GPS) triangulated altitude. The GPS altitude is generated from the GPS aided flight computer and verified by the PIC during preflight operations. The altitude is expressed in AGL, and all operations shall remain below 400 feet AGL. The PIC may initiate a zero altitude point during prelaunch procedures. The GPS altitude is continually transmitted to the ground station via a telemetry data feed. The PIC monitors the UA to ensure the 400 feet AGL ceiling is never violated.

NOTE

In the case the UA operates well below 400 feet AGL, the GPS altitude data feed readout is not required. The GPS altitude data feed readmit is required when the aircraft operates above 330 feet AGL.

6.5. Operating Restrictions

The PIC must maintain UA visual line of sight (VLOS) at all times with the use of unaided devices other than corrective lenses. A VO must be utilized during each flight event, and the PIC and VO must be able to verbally communicate.

NOTE

The operation of the UA shall never be conducted from a moving device or vehicle

6.6. Aircraft Restrictions

All UAs in the AFD inventory shall weigh less than 55 pounds fully loaded. The current weight of the heaviest UA is less than 10 pounds fully loaded with all systems. The UA maximum airspeed shall be less than 50 knots.

NOTE

No explosive materials or highly flammable liquids shall be carried onboard AFD UAs.

6.6.1. The UA shall not be operated at an altitude that is hazardous to people or animals. The intentional over flight of people is strictly prohibited.

6.6.2. Operations shall not be conducted within 5 nautical miles (nm) of non-tower controlled airports unless a Letter of Agreement (LOA) is established for operations near the respective airport.

6.7. Separation Procedures

The UA shall never intentionally fly over people, vehicles, vessels, and structures unless the individuals obtain written consent affected.

6.7.1. The UA should avoid people on the ground by 500 feet laterally.

6.7.2. The UA shall avoid all manned aircraft by 1,000 feet vertically and 1 statute miles (sm) laterally within 1,000 feet vertically.

6.8. See and Avoid

6.8.1. All manned airborne assets have the right of way to the UA. These manned systems

include but are not limited to the following:

6.8.1.1. fixed-wing,
6.8.1.2. Rotary,
6.8.1.3. Ultra lights,
6.8.1.4. Paragliders,
6.8.1.5. Balloons,
6.8.1.6. Gliders,
6.8.1.7 Airships.

6.8.2. When a PIC or VO spots a manned aircraft within 1,000 feet vertically or 1 sm laterally within 1, 000 feet vertically, the PIC commands a Return to Land Mode and maintains a safe altitude and distance from the manned aircraft.

6.8.3. Upon returning to the landing area, the UA is recovered, and the situation of the manned aircraft assessed. Once the manned aircraft has cleared the area, the UA may relaunch to continue the flight event.

6.8.4. Failure to recover an UA operating closely to manned aircraft, could lead to a possible mid-air collision. In the event the manned aircraft has penetrated quickly and deep into the UA operating area, then the PIC shall land immediately.

6.9. Aircraft Markings. All UAs shall have identification markings that are as large as practicable in accordance with 14 CFR parts 45. The markings are identified by serial number, registered in accordance with 14 CFR part 47.

6.9.1 If feasible, All RED Team UAV's will be painted red and have the Austin Fire Department logo attached to its equipment.

6.10. Operational Standards.

6.10.1. Reckless Flying. The SUAS operator is responsible for ensuring the aircraft is not operated in a careless or reckless manner that could endanger life or property. SUAS will not be used to conduct flights for personal use.

6.10.2. Off-Station Training. The SUAS operator will ensure the execution of all off-station training activities are unit commander-approved, flown to achieve valid training requirements, present a positive image of the Air Force and does not present an image of waste and/or abuse of government resources.

6.10.3. Unauthorized SUAS Flight Demonstrations. Unauthorized or impromptu SUAS flight demonstrations, maneuvers, or ―fly-byes are prohibited.

6.11. Proximity of Aircraft. The sUAS PIC must not allow the aircraft to be flown so close to another that it creates a collision hazard. Use 500 ft. of separation (well clear) as an approximate guide except

6.12. Right-of-Way Rules. Usually, right-of-way is given to the aircraft least able to maneuver, which normally permits that aircraft to maintain course and speed. However, visibility permitting, each pilot must take whatever action is necessary to avoid collision, regardless of who has the right-of-way. When another aircraft has the right-of-way, the yielding aircraft must not pass over, under, abeam, or ahead of the other aircraft until well clear.

NOTE

Due to the size and paint scheme, other aircraft may not easily see a small UA. Therefore, the SUAS operator must always be prepared to take evasive action to include flight termination and potential destruction of the aircraft.

6.12.1. Distress. Any aircraft (manned or unmanned) in distress has the right-of-way over all other air traffic. Manned aircraft in distress have the right-of-way over SUAS in distress.

6.12.2. Approaching Head-On. If aircrafts are approaching each other head-on or approximately so, each shall alter course to the right.

6.12.3. Overtaking Aircraft. An overtaken aircraft has the right-of-way. The overtaking aircraft must alter course to the right.

6.12.4. Landing. An aircraft established on final approach has the right-of-way over other aircraft on the ground or in the air, except when two or more aircraft are approaching to land. In this case, the aircraft at the lower altitude has the right-of-way if it does not use this advantage to cut in front of or overtake the other.

6.13. Aircraft Lighting

6.13.1. Anti-collision and Strobe Lights. Anti-collision lights and strobe lights are not the same. For the purposes of this section, anti-collision lights are the primary flashing light system on the aircraft intended to attract the attention of others, while the strobe lights are systems such as wingtip strobes or other similar strobe light installations.

6.13.2. Ground Operations. Aircraft equipped with anti-collision lights will display these lights

6.13.3. Airborne Operations. Aircraft equipped with anti-collision and strobe lights will operate these lights as follows:

6.13.3.1. Anti-collision lights must be on from takeoff to landing.

6.13.3.2. Strobe lights shall be operated in accordance with aircraft operating manual.

6.14. Local Flight Standards District Office

6.14.1. Before each flight event, AFD shall notify the local Flight Standards District Office (FSDO) with jurisdiction over the area of operation. The notification must contain the following for each flight event:

6.14.1.1. Dates and times

6.14.1.2. Name and number of the person that received the grant of exemption

6.14.1.3. Name and number of the on-scene supervisor

6.14.1.4. Make/model and serial or N-number of the UA

6.14.1.5. Name and certificate number of the UA PIC

6.14.1.6. A statement by the property owners or local officials that give permission of the operation

6.14.1.7. A description of flight activity, to include charts and altitudes flown

6.14.1.8. Signature of exemption-holder

6.15. Required Onsite Documentation
During sUAS operations, the flight team shall maintain the proper documents at the site to include private pilot certificate, aircraft registration certificate, general operating manual, the make/model operating manual, COA, and exemption letter.

6.16. Radio Frequency Spectrum

All radio transmissions for sUAS operations with AFD comply with part 15 of the Federal Communication Commission (FCC) rules for frequency allocation. The radio frequency spectrums utilized are shown in the figure 3.

Figure 3
Frequency Utilization

System	Frequency,	Output
Radio Transmitter.	2.4 to 2 .4835 GHz	100 mW
Telemetry	915 MHZ	100 mW

Chapter 7

TRAINING AND CERTIFICATION

7.1. Administration Requirements
Each position attained is designated by written documentation to indicate the level of qualification achieved by each individual. Only individuals with the required written documentation are able to operate in the designated position. To be considered fully qualified, each designation letter is maintained in each operator's record with other required documentation

(e.g., private pilot certificate, third-class medical certificate, etc.)

7.2. Pilot in Command

7.2.1. Pilot in Command (PIC). This person has final authority and responsibility for the operation and safety of flight. The PIC designation requires the appropriate category, class, and type of rating, if applicable, for the conduct of flight. The PIC controls the sUAS by means of direct radio link with a radio transmitter and directs the UA platform by Visual Line of Sight (VLOS).

7.2.2. The PIC position may rotate duties as necessary with equally qualified pilots. The PIC can only be the PIC for one aircraft at a time.

7.2.3. The following requisites are required for an AFD PIC designation:

7.2.3.1 Obtained private pilot's written certificate of completion or private pilot certificate.

7.2.3.2. Obtained third-class medical certificate and remain current.

7.2.3.3. Accumulated (and logged) at a minimum of 100 cycles (takeoff/landing) and 10 hours of total time operating any UA platform, and at least 5 hours logged as a PIC in a similar type (i.e., multi-rotor or fixed-wing).

7.2.3.4. Complete and remain current in the qualification process set forth in this document. The qualification process encompasses both knowledge and skills based tests.

7.2.3.5. Member must pilot AFD's specific make/model UA platforms for a minimum of five hours before operating in the NAS for commercial purposes.

7.2.3.6. Member must remain current in AFD's make/model UAV platforms by performing three takeoff and landings within the preceding 90 days before operating in the NAS for commercial purposes.

7.2.3.7. In addition to the general qualification requirements set forth in the General Operations Manual, the PIC shall log at a minimum 5 flight hours controlling the AFD (sUAS).

7.3. Visual Observer

7.3.1. A visual observer (VO) is a trained person who assists a sUAS pilot in the duties associated with collision avoidance and navigational awareness through electronic or visual means. Collision avoidance includes, but is not limited to, avoidance of other traffic, clouds, obstructions, terrain and navigational awareness.

7.3.2. The VO immediately notifies the PIC of the airborne threat, and the PIC shall conduct the appropriate action to avoid the airborne threat safely. The VO shall be qualified as a sUAS pilot and may act as PIC if necessary.

7.4. Payload Operator

7.4.1. The Payload Operator (PO) is the subject matter expert for any component carried by the sUAS for the collection of data. The PO is responsible for manipulating the sUAS payload in order to ensure the most accurate information is obtained.

7.4.2. The PO shall immediately notify the PIC anytime a component becomes inoperative or a hazardous situation becomes apparent. The PO shall be qualified as a sUAS pilot.

7.5. Mission Supervisor

7.5.1. The Mission Supervisor (MS) plays a critical role in the planning and logistics during a mission. The MS coordinates the notification of the governing air traffic control, notification for manned aircraft, and communication between the AFD sUAS flight team and incident command. The MO shall be qualified as a sUAS pilot.

7.6. Lead Instructor

7.6.1. The Lead Instructor position is held by the most experienced and skilled PIC on AFD's RED Team. This person has demonstrated exceptional skill at operating the sUAS and shows superior skills in their ability to instruct. The sUAS lead instructor requires the following:

7.6.1.1. The member has logged in at least 100 total hours in UA platforms.

7.6.1.2. The member has logged in at least 25 total hours in the specific make/model for instructor designation.

7.6.1.3. Lead Instructors can also be designated as evaluators

7.7. Instructor

7.7.1. This position is held by those individuals that show the aptitude to instruct and possess the following:

7.7.1.1. The member has logged in at least 75 total hours in UA platforms.

7.7.1.2. The member has logged in at least 25 tota1 hours in the specific make/model for instructor designation.

7.7.1.3. Members who are Instructors can also be designated as evaluators.

7.8. Evaluator

7.8.1. This position is available to PICs that demonstrate superior knowledge and skill operating the UA platform. The evaluator conducts the annual flight assessments required by each PIC and VO. The prerequisite requirements to be an evaluator are the same as an instructor.

7.9. Qualification Process

7.9.1. The AFD qualification process is conducted by both instructors and evaluators. The purpose of the instructor is to train the PIC, VO, PO and MO. The evaluator's position is not to train but rather objectively evaluate a competent level of knowledge and skill. In addition, the evaluator sets the standard requirements to be designated a sUAS PIC, sUAS VO, sUAS PO, or sUAS MO.

7.9.2. Each instructor and evaluator is designated in writing for the respective make/model for which the qualification has been achieved.

7.9.3. In addition, each PIC and VO is designated in writing for the appropriate make/model qualification achieved.

7.10. Pilot in Command Qualification

7.10.1. The student Pilot in Command (PIC) begins training through a familiarization of this operating manual, and the appropriate make/model operating manual assigned. The appropriate curriculum guide sets the appropriate syllabus for each respective make/model.

7.10.2. Each curriculum guide begins with a familiarization of systems, operating procedures, and FAA requirements for-the respective UA. The student PIC is given a review of the knowledge based exam.

7.10.3. After the academic phase, a flight preparation course is conducted to prepare the student PIC for all phases of flight operations to include event planning, Emergency Procedures (EP), preflight execution, and post flight.

7.10.4. After completing the ground school, the PIC in training enters the flight phase. Here the student is given thorough training to gain experience and proficiency in all aspects of the UA flight characteristics. A designated sUAS Instructor conducts all training events.

NOTE

All training events are conducted with essential personnel (i.e. Instructor PIC and VO) and no other personnel allowed in the vicinity during training evolutions unless needed to successfully complete an event and with prior written consent by the individual.

WARNING

All training operations shall be conducted with an adequate safety buffer from people, vehicles, and structures.

7.10.5. Upon completion of the flight syllabus, the student PIC is given a flight assessment by a designated sUAS evaluator. Upon successfully completing this assessment, the student PIC is fully designated in writing and given the responsibility to operate the AFD make/model UA.

NOTE

In addition to their initial syllabus requirements, all PICs are tested annually on their knowledge of the U.S. NAS and the UA's procedures and systems. In addition, the PICs receive an evaluation of their skills with an annual flight assessment.

7.10.6. Below is a review of the Curriculum Guide (see figure 4) requirements for an AFD UA PIC.

Figure 4
PIC Qualification Process

Lesson Description	**Duration (hours)**
Review of FAA Procedures	3. 0
Intro to sUAS	2.0
FAA Regulations	2.0
Systems	3.0
Advanced Systems	5.0
Emergency Procedures.	2.0
Maintenance	2.5
Operations	3. 0
Safety and Crew &Risk Management	2.0
Review	2.0
Operations Exam	1.0
FAA Procedures Exam	1.0
Emergency Procedures Bold Face Test	0.5
Flight Preparation	5.0
Familiarization of the sUAS	2.0
Total Ground School	**36.0**

7.10.7. Each student PIC flight event (see figure 5) is 30 minutes in-duration and requires a set number of events that emphasize emergency procedures on every flight. The familiarization flights stress proficiency with handling the UA and takeoff/landing proficiency. The student PIC achieves the majority of their flight cycle requirements during the Familiarization Flight phase.

Figure 5
Student PIC flight event

Lesson Description (number of events)	**Duration (hours)**
Familiarization Flight events (20)	10.0
Systems Integration Flight Events (20)	10.0

Solo Flight Events (9)	4.5
Check Flight Event (1)	0.5
Total Flight Events .(50)	**25.0**

NOTE All exams require an 80% or higher for a passing grade.

7.10.8. The student and instructor PIC utilize dual flight controls until the solo flight event block. The systems integration flights develop the' student PIC's ability to integrate fully the ground station with the UA and continue to build upon the student's experience. The solo flight events instill further confidence in the student PIC to operate the full system on their own. After the Instructor PIC supervised solo flight events, the student PIC receives a check flight by a PIC Evaluator.

7.10.9. Prior to receiving a check flight the student PIC receives an Operations Exam and FAA Procedures Exam. The Operations Exam evaluates the student's knowledge of this operating manual and the respective operating manual for the make/model of the UA being operated.

7.10.10. The FAA Procedures Exam is a review exam of the PIC's knowledge from the Private Pilot test and emphasizes FAA procedures and requirements. These exams are a recurring annual requirement for all PICs (see figure 6).

Figure 6
PIC annual requirements

Lesson Description	**Duration (hours)**
FAA Procedures Exam	1.0
Operations Exam	1.0
Emergency Procedures Bold Face Test	0.5
Crew Resource Management Training	1.5
Annual Evaluation Flight Event	0.5

7.10.11. In addition to the annual exam requirements, each PIC undergoes an annual evaluation flight to ensure each PIC is performing to the standardization set forth by the FAA and the operating manuals.

7.10.12. Depending on the level of prior sUAS experience the operator under training may have a portion of their UA flight events waived. This decision is granted by the discretion of the Lead Instructor PIC and may waive up to 15 hours of the 25-hour flight syllabus.

NOTE

All PIC must log at least 10 flight hours for the type of UA (i.e. multi-rotor or fixed-wing) utilized for commercial operations.

7.10.13. Depending on the performance of the student PIC, additional training may be required in order to meet the minimum standard in order to progress in the training syllabus.

7.11. Visual Observer Qualification

7.11.1. The Visual Observer (VO) qualification is designated as a single qualification and is not designated to a specific make/model UA. The duties of the VO remain the same whether a multi-rotor or fixed-wing sUAS is airborne. The following are required before an AFD VO designation:

7.11.1.1. Successfully completed the FAA Procedures exam.

7.11.1.2. Conduct five hours of flight observation at a training facility with an instructor VO.

7.11.1.3. Completed the VO evaluation of flight event.

7.11.2. Student Visual Observers must be given sufficient ground school training (see figure 7) and situational rehearsal procedures to communicate clearly to the PIC any instructions necessary to keep the UA clear of other air traffic, terrain and obstacles.

Figure 7
Student VO Ground School

Lesson Description	**Duration (hours)**
Review of FAA Procedures	3. 0
Intro to sUAS	2.0
FAA Regulations	2.0
Systems	3. 0
Emergency Procedures	2.0
Operations	3. 0
Safety and Crew &Risk Management	2.0
FAA Procedures Exam	1.0
Total Ground School	**18.0**

7.11.3. Each Student VO flight event (see figure 8) is 30 minutes in duration and requires a set number of events that emphasize emergency procedures on every flight. The VO flight events stress the importance of a good visual scan of the airspace and crew management with the PIC.

Figure 8
Student VO Flight Events

Lesson Description (number event's)of	**Duration (hours)**
Visual Observer Events (10)	5.0
Visual Observer Check Event (1)	0.5
Total Flight Events (11)	**5.5**

7.11.4. The procedures exam is a review of the VO's knowledge of the standards set forth by

the FAA and operating manuals. These exams are a recurring annual requirement for all VO's (see figure 9).

Figure 9
The annual VO requirements

Lesson Description	Duration (hours)
FAA Procedures Exam	1.0
Crew Resource Management Training	1.0
Visual Observer Annual Evaluation	0.5

7.12. Payload Operator Qualification

7.12.1. This position is the vital link between the flight team and its stakeholders in the collection of data for the mission. Training begins with a thorough familiarization of a specific payload. Different payload components shall require a separate qualification.

7.12.2. After familiarization, a flight preparation course is conducted to prepare the student for operating payload from a UA. This training will include payload ground station deployment, payload/UA assembly, and operation of payload during flight. Following this phase of training, the student will become proficient in the processing of the data collected. A knowledge exam, which includes a practical exercise, will follow completion of the course.

7.13. Mission Supervisor Qualification

7.13.1. The Mission Supervisor (MS) prerequisites include PIC and VO qualification. Additionally, the MS student must demonstrate superior knowledge of FAA rules and regulations pertaining to airspace, air traffic notification procedures, weather collection and interpretation, COA submittal.

7.13.2. Each Curriculum Guide begins with a review of FAA regulations and airspace. The MS student is then taught the procedure for filing a COA. The MS student is then given an exam, which will include filing NOTAMS, TFRs, notifying ATC of operations, obtaining a weather briefing, constructing, and filing a COA.

7.14. Technician Qualifications

7.14.1. The sUAS technician is designated for each make/model. The student technician curriculum focuses on sUAS systems, maintenance procedures, and a performance lab that breaks down each component of the system in detail. After the completion of the syllabus, an exam tests the knowledge and skill of the student technician in regards to system integration and maintenance procedures.

NOTE

All exams require an 80% or higher for a passing grade

7.14.2. A technician that demonstrates exceptional skill at maintaining the UA make/model

and the ability to instruct will be designated an instructor technician. The following is a summary of the curriculum required for a sUAS technician (see figure10).

Figure 10
Student Technician School

Lesson Description	Duration (hours)
Intro to sUAS	2.0
Systems	3.0
Advanced Systems	5.0
Maintenance	2.5
sUAS Lab	5.0
Maintenance Review	2.0
Maintenance Exam	1.0
Total Ground school	**20.5**

7.15. ROLES AND RESPONSIBILITIES

7.15.1. Pilot in Command:

7.15.1.1. Shall be the most experienced SUAS operator on the Flight Team.

7.15.1.2. Shall be qualified in the duties of Payload Operator, Visual Observer, and Mission Supervisor

7.15.1.3. Shall have overall command of the SUAS and retains ultimate responsibility for its safe operation.

7.15.1.4. Shall file emergency COA with FAA and coordinate with Mission Supervisor.

7.15.1.5. Shall complete a mission/site safety assessment and brief the flight team on all hazards associated with the mission.

7.15.1.6. Shall yield all SUAS right of way to manned aircraft.

7.15.1.7. Shall ensure communications between manned aircraft and SUAS operations when simultaneous flights are being conducted

7.15.1.8. Shall ensure coordination with manned aircraft during joint operations.

7.15.1.9. Shall ensure the SUAS logbook is current.

7.15.1.10. Shall assemble the SUAS for operation.

7.15.1.11. Shall conduct SUAS preflight checks. (See preflight checklist for details)

7.15.1.12. Shall obtain a pre-flight briefing, mission/flight objectives, and approve the flight plan.

7.15.1.13. Shall approve/identify a SUAS launch/recover site.

7.15.1.14. Shall identify an emergency landing site inside the mission perimeter in the event of a forced landing

7.15.1.15. Shall confirm flight authorization and mission GO status from Mission Supervisor and Visual Observer Payload Operator.

7.15.1.16. Shall alert the flight team of any SUAS problems and corrective action taken.

7.15.1.17. Shall perform POST-FLIGHT procedures.

7.15.1.18. Shall retain responsibility for SUAS transport and storage.

7.15.1.19. Shall complete POST-Mission reports including mission documentation and after action report (AAR).

7.15.2. Payload Operator**:**

7.15.2.1. Shall be qualified as SUAS pilot and may perform PIC duties if needed or if the current PIC is unable to do so.

7.15.2.2. Shall set up the payload, video/payload downlink, and ensure the recording capabilities are functional on the SUAS.

7.15.2.3. Shall test the camera command and control functions and all SUAS and all payload telemetry.

7.15.2.4. Shall set up and test video monitoring ground stations

7.15.2.5. Shall communicate payload/ground station monitors are a GO status to the PIC.

7.15.2.6. Shall maintain communication with MS.

7.15.2.7. Shall monitor GROUND STATION telemetry data during mission flights to verify flight data is being reported accurately to the PIC.

7.15.2.8. Shall obtain a pre-flight briefing, mission/flight objectives, and understand the flight plan related to his payload data collection tasks.

7.15.2.9. Shall report any payload related issues to the PIC.

7.15.2.10. Shall be responsible for post-mission processing of the payload-recorded data.

7.15.2.11. Shall be responsible for payload transport and storage.

7.15.2.12. Shall complete POST-Mission report including all mission documents and AAR.

7.15.3. Visual Observer:

7.15.3.1. Shall be qualified as SUAS pilot. Additional trained VO's can be activated based on mission parameters. In the event that more than one VO has been activated, a Primary VO will be designated and shall be responsible for VO communications to the PIC.

7.15.3.2. Shall maintain a continuous line of sight (LOS) of the SUAS and assist in "see and avoid" of manned aircraft and other potential flight hazards. The VO is responsible for keeping direct communication with the PIC at all times.

7.15.3.3. Shall obtain a pre-flight briefing, mission/flight objectives, and review the flight plan.

7.15.3.4. Shall assist Mission Supervisor with pre-deployment logistics

7.15.3.5. Shall complete a POST-Mission report including all mission documents.

7.15.4. Mission Supervisor:

7.15.4.1. Shall be qualified as a SUAS pilot.

7.15.4.2. Shall communicate intentions with governing Air Traffic Control (ATC).

7.15.4.3. Shall file applicable NOTAMs prior to operations.

7.15.4.4. Shall file for TFR prior to operations

7.15.4.5. Shall ensure submission of FAA Certificate of Authorization (COA)/Emergency-COA submission/approval.

7.15.4.6. Shall ensure a mission briefing takes place inclusive of all flight team members prior to operations. Mission briefing shall include:

a) Weather
b) Airspace
c) Launch/Recovery
d) Mission
e) Emergency Plan
f) Assigning/assessing mission parameters- maximum altitude, maximum distance from home/launch, number of mission flights, and flight duration.

7.15.4.7. Shall confer with scene incident commander prior to operations.

7.15.4.8. Shall coordinate communication with the flight team and incident commander.

7.15.4.9. Shall collaborate on "go/no go" mission status with PIC.

7.15.4.10. Shall ensure flight team logistical needs.

7.15.4.11. Shall co-locate and maintain direct communication with PIC

7.15.4.12. Shall maintain direct communication with PIC, VO and IC.

7.15.4.13. Shall complete POST-MISSION report including all mission documents.

Chapter 8

NORMAL OPERATING PROCEDURES

8.1. Checklists. Accomplish all checklists (see Appendix A) with strict discipline. A checklist is not complete until all items are accomplished. The SUAS-O operating the UA will initiate/complete all checklists. Operator checklists will be used for all operations from preflight through post flight.

8.2. Video/Data Capture. Each flight will be recorded using the system's data recorder in order to capture both telemetry and video data. This data is used for training as well as review in the case of an incident or lost UA. Recordings may be discarded if there is no incident or mishap. Data recordings from any reportable SUAS incident will be secured to support an investigation to determine cause.

8.3. Day/Night Operations.

8.3.1 Day Operations**.** UAS operations outside of Class A airspace, active restricted or warning areas designated for aviation use, or approved prohibited areas, will be conducted during daylight hours unless otherwise authorized.

8.3.2. Night Operations. Night operations may be considered if the operator/applicant provides a safety case and sufficient mitigation to avoid collision hazards at night.UAS night operations are those operations that occur between the end of evening civil twilight and the beginning of morning civil twilight, as published in the American Air Almanac, converted to local time. (This is equal to approximately 30 minutes after sunset until 30 minutes before sunrise, except in Alaska.) External pilots and observers must be in place 30 minutes prior to night operations to ensure dark adaptation.

8.4. Team Structure

8.4.1. The RED team has eight team members who are dedicated towards further evaluating and refining the use of robotics in the fire service and other public safety related fields. Collectively, this team is made up of individuals who have private pilot licenses, FAA knowledge exams, FAA ground school certifications and commercial flight instructors both in the fixed and rotary wing formats.

8.4.2. The sUAS Pilot in Command (PIC), Visual Observer (VO), Payload Operator (PO) and Mission Supervisor (MS) is the maximum crew requirements for sUAS operations conducted by AFD. These four positions provide maximum efficiency toward operating the sUAS safely and effectively in the National Air Space (NAS).

8.5.3. The sUAS PIC and VO are the minimum crew requirements for all sUAS operations

conducted by AFD. These two positions must effectively communicate throughout each flight event while minimizing distractions. Proper coordination is vital to the successful execution of sUAS operations.

NOTE

At all times during the flight event, the PIC and VO shall be in verbal contact with each other.

8.5. Flight Logbooks

8.5.1. An accurate logbook of the flight event shall be kept by the PIC or the VO. Flight logbooks document PIC and VO flight time. In addition, aircraft landings logged for the PIC. The logbook contains date, flight time, landings, aircraft make/model, serial number, location, and signature

8.5.2. Post Flight Requirements. Complete Operators Flight Log (See Appendix B) after each flight (to include simulator flights) or as soon as possible in contingency operations. Every operator is required to record his/her flight on a flight log that captures all the information required for entering into SUASMAN and maintain the log until transferred to the SUAS Web Application (e.g. SUASMAN) as soon as possible.

8.6. Document proficiency

8.6.1. Updates. AFD is responsible for its (sUAS) operators to use the most current operating manual. AFD will distribute changes and ensure the appropriate incorporation. Each change modification shall be recorded in the "Record of Changes" at the beginning of this document, and the appropriate changes implemented into this operating manual.

8.6.2. Change Requests. For changes to technical and operating procedures to this manual, any operator or Federal Aviation Administration (FAA) Administrator can make a request. These requests are reviewed by the Lead Pilot in Command (PIC) Instructor-Evaluator who implements the appropriate change via a serialized change notice, which will be distributed to all users of this manual.

Chapter 9

ABNORMAL OPERATING PROCEDURES

9.1. General. Conduct of flight operations that deviate from the briefed mission for reasons of adverse weather, low fuel/battery state, system abnormalities, or other unforeseen event are defined as ―abnormal‖ and require specific actions.

9.2. Initial Actions. Maintain aircraft control and situational awareness. The general priority order of ―Aviate, Navigate, Communicate is the most effective method of handling abnormal events. Well-integrated crews will frequently accomplish these tasks in parallel but the priorities remain in order.

9.2.1. First priority must always be to maintain control of the aircraft and retain situational awareness. Loss of the aircraft due to loss of situational awareness makes the rest of the process irrelevant. While aviating, the crew analyzes the situation and takes the proper action to mitigate the situation.

9.2.2. Navigation must be the second priority. Correct analysis of the situation leads to the decision to continue the mission, navigate to a safe area for further action, or navigate towards a suitable recovery location while remaining clear of unauthorized airspace.

9.2.3. The third priority is to communicate information to appropriate agencies. UAS operations typically require airspace control agencies to be notified of any loss of link, navigational difficulty, or UA loss and mission control agencies to be notified of any change in mission capability. Consider communicating with external agencies for assistance in unusual events. However, never cease aviating, while seeking assistance or troubleshooting.

9.3. Emergency Procedures (EP). This section highlights the proper guidelines for managing emergencies (see Appendix A) that may arise during flight. To execute proper EPs, the PIC must have a thorough knowledge of the procedures and execute simulated EPs on a routine basis. It is not possible to forecast every EP that can occur and in these situations, the PIC must use sound judgment. Systems knowledge aids the PIC in making the proper decisions needed in an EP situation.

9.3.1. Each UAS technical order, operating handbook or equivalent vendor-provided publication specifies critical emergency procedures, which shall be committed to memory and acted upon without reference to a checklist.

9.3.2. When encountering a system malfunction, take the time to analyze the situation and select the appropriate emergency procedure. The non-flying crewmember will back up the flying crewmember to insure correct selection and execution of the EP. The crew will execute non-critical EPs with reference to the appropriate checklist.

9.4. Fail Safes

Each UA incorporates various fail-safe conditions that include the loss of link, loss of GPS, and low battery voltage. In addition to these fail-safes, geo-fencing can be utilized to ensure an aircraft does not fly outside an area's boundary.

9.5. Lost Link Procedures. There are many acceptable approaches to satisfy lost link requirements. The intent of any lost link procedure is to ensure that airborne operations remain predictable. Operators will comply with the UAS lost link procedures as specified in the COA or Special Airworthiness Certificate operating limitations. Lost link is not considered flyaway.

9.5.1. In the event the UA experiences a loss of link, the PIC shall make every attempt to reestablish the radio link to the UA. This may be accomplished through antenna adjustments or removing an obstacle blocking antenna transmission. Further guidance is given in the make/model operating manual.

9.5.2. The PIC or VO continually calls out verbal position reports of the UA as it conducts its return to land sequence. During the loss of link and if the link is never reestablished, the UA returns to land.

9.6. Loss of GPS
When GPS lock is lost for 3 seconds, the UA automatically switches to Loiter Mode until the signal is regained. If the signal is regained, then the UA continues its flight plan.

9.6.1. In the event the GPS does not acquire a position after 20 seconds, the aircraft conducts dead reckoning until the signal is regained. In the case where the GPS position is permanently lost, the PIC of the UA conducts, the proper make/model EP.

9.6.1. In the event the permanent Loss of GPS occurs, the mode of operation shall be switched to MANUAL or ASSISTED, and the PIC executes an unaided GPS mode to the designated recovery area. Further guidance is given in the make/model operating manual.

9.7. Low Battery Voltage
If the battery voltage drops below 33%, the UA returns to land position and orbits. The PIC conducts the appropriate make/model low battery voltage EP.

9.8. Geofencing. For geofencing, boundaries are set using the event planning software. In addition to geographical boundaries being set, floors and ceiling can be set as well.

9.8.1. If the UA goes outside the UA boundary, the UA returns to a predetermined guide point at a set altitude and loiter until commanded otherwise. This predetermined guide point is typically set near the center of the operating area.

9.8.2. For all AFD flight events, a geofenced boundary should be set around the operating area, and the ceiling set to 400 feet AGL.

Chapter 10

SAFETY/OPERATIONAL RISK MANAGEMENT

10.1. Introduction

Safety is paramount to AFD and is briefed before all flight events. In addition to the daily briefings on safety, an annual safety stand down is administered in order to highlight the importance of safety in the field and in the air. Safety stand-downs enhance the safety culture within AFD by stressing its importance by devoting attention to the subject as it relates to aviation safety in general and specifically sUAS operations within the NAS.

10.2. Safety Handling of Unmanned Aircraft
It is strictly prohibited for human, contact to be placed inside a rotor/propeller arc of a motor when the battery has been connected to the UA.

WARNING

While handling a UA near a propeller with a battery connected, an inadvertent throttle control switch movement, mode of operation switch, or electrical malfunction could cause an inadvertent rotation of the motor causing a propeller strike to encounter human skin.

10.2.1. If human contact must be made within the propeller arc, then all electrical power shall be eliminated in order to prevent inadvertent propeller strikes with human skin.

10.2.2. The maintenance performed shall be documented in the UA's maintenance record. The make/model operating manual shall outline a record of the aircraft maintenance, preventative maintenance, and overhaul of components, replacement parts, other alterations, and the total time in service. Only a designated technician is able to sign off the work performed on the UA.

10.3. Reporting Incidents and Accidents

Any incident, accident, or violation of operating space as defined by the COA shall be reported to the Unmanned Aircraft System (UAS) Integration Office within 24 hours of the incident. Accidents shall be reported to the National Transportation Safety Board (NTSB) per its guidance. Further operations are grounded until the UAS Integration Office has reviewed and authorized operations.

10.4. Mishap reporting:

10.4.1. Mishaps resulting in the loss of an aircraft, non-repairable damage or requiring depot level repair; injury to personnel or damage to property will be reported the AFD safety office.

10.4.2. Incidents/ mishap reports (see Appendix A) will be completed and processed by the PIC and routed to the safety office.

10.4.3. Impound Ground Control Station (GCS). Impound the GCS and preserve operations data for any of the following:

10.4.3.1. Sustained Loss of Link resulting in automatic recovery.

10.4.3.2. Un-commanded control inputs not resolved by published emergency procedures.

10.4.3.3 Loss of UA control resulting in forced landing or uncontrolled flyaway.

10.5 Crew Resource Management

All flight teams brief Crew Resource Management (CRM) before each flight event in order to increase flight event effectiveness, maximize coordination, and minimize preventable errors. In addition to CRM, the utilization of risk management is addressed as well before each flight event. Operators must implement the recommended training and procedures included in Advisory Circular 120-51, or in an FAA-recognized equivalent.

10.5.1. The PIC of a UAS must ensure no activities other than those duties required for safe flight operation are performed. No UAS crewmember may engage in any activities unrelated to those required for safe operation of the UAS during critical phases of flight such as launch/takeoff and landing/recovery.

10.5.2. CRM centers on human factors being the leading cause of aviation mishaps. CRM seeks to optimize human performance through proper crew coordination.

10.5.3. The flight event sets the tone for CRM by setting the professional atmosphere between flight team members in order to effectively conduct flight operations.

NOTE

Once the flight event is briefed, the PIC and VO should maximize their attention to the flight operation, and minimize all other distractions not related to the flight.

10.5.4. It is vital for clear channels to be open between the PIC and VO in order for time critical information to be relayed as quickly as possible.

10.5.5. During flight operations, non-crew members are kept a safe distance away in order to allow for complete crew coordination between the PIC and VO.

10.5.6. The PIC and VO relationship is viewed as a flight deck environment during sUAS airborne operations; therefore, the relationship shall not be impeded by needless distractions by non-essential crewmembers and other distractions (i.e. television, radio, etc).

10.5.7. CRM training is established by an initial baseline during the student PIC/VO syllabus and subsequently administered as an annual recurrence qualification. CRM, a required flight event briefing item, is reinforced before each flight event and discussed during each debrief.

10.6. Accident Prevention

10.6.1. The AFD (sUAS) crews ensure ground and air operations are conducted within the safest parameters. Each sUAS crew must minimize human error. Below are common practices required for all crewmembers:

10.6.1.1. A thorough knowledge and understanding of aircraft systems and procedures
10.6.1.2. Utilization of Crew Resource Management (CRM) and risk management
10.6.1.3. Checklist usage
10.6.1.4. Emergency Procedures (EP) familiarity and continual review

10.7. Risk Management

10.7.1. A risk management assessment and subsequent operational risk assessment tool (ORAT) is conducted before each UA launch. Risk factors are addressed during each brief and before each event. Crews are trained to utilize their risk management skills throughout the flight event.

10.7.2. An ORAT (see Appendix A) is filled out and signed by each PIC before each flight event. The worksheet identifies the hazards associated with the environment.

10.7.3. Risk management begins with each member of the crew assessing their own ORAT personal risk by utilizing the IMSAFE (Illness, Medication, Stress, Alcohol, Fatigue, and Emotion) checklist (see Appendix A). After identifying the hazards, the assessment continues with the aircraft, environment, and external pressures. If a level other than LOW is achieved during the risk assessment, then cancel the flight event shall.

Chapter 11

SERVICE AND HANDLING

11.1. Introduction

This section addresses specific service and handling requirements for AFD (sUAS) with the utilization of a Functional Check Flight (FCF) process.

11.2. Aircraft Handling

Before performing any service and handling procedures, the following checks must be accomplished to prevent technician injury and/or damage to the aircraft.

11.2.1. Batteries removed
11.2.2. Pitot-static system covered
11.2.3. Do not push movable surfaces

11.3. Maintenance of Components

The AFD (sUAS) maintenance requirements for aircraft components include preventative maintenance, overhaul of components, replacement parts, other alterations, and the total time in service. The maintenance records contain the history and scheduled maintenance requirements for each AFD (sUAS) aircraft by serial number.

NOTE

AFD must operate at the level of the manufacturer requirement or more conservatively. AFD shall adhere to any manufacturer safety bulletin.

11.4. Servos/Actuators

11.4.1. Servo Linkages are rigid in metal and do not stretch or shrink. These linkages are secured to the servo horn and clasp closed with an additional rubber ring to secure in place.

11.4.2. Servo Daily Inspection. The servos and linkages are inspected before all flights as part of the Preflight Checklist. Members should ensure that they are properly attached and connection integrity maintained. In addition to checking the servos, the servo horn must be inspected to ensure that it has not separated from the airframe. Be sure that the rubber ring is inspected for decay and it clamps to the connection servo horn.

11.4.3. Servo Routine Inspection. Servos are inspected for binding by listening for abnormalities in the servo. The servo is further tested for smooth control throw. In addition, the technician

ensures the servo horn and arm are secure. If the servo horn or arm is discolored, then the servo horn or arm is replaced.

11.4.4. Servo Overhaul/Time in Service. After each overhaul process or anytime a servo is removed and reattached, the AFD (sUAS) must receive a functional check flight and have it recorded into the maintenance log for the respective aircraft.

11.5. Motor

11.5.1. Motor daily inspection will be in accordance with the operational manual associated with the UAV's make and model.

11.5.2. Motor Routine Inspection will be in accordance with the operational manual associated with the UAV's make and model.

11.5.3. Motor Overhaul will be in accordance with the operational manual associated with the UAV's make and model.

11.5.4. After each overhaul process or anytime the motor is removed and reattached, the AFD (sUAS) receives a FCF with a record entry made in the maintenance log for the respective aircraft.

11.5.5. Motor Time in Service. Theoretically, a brushless motor should last indefinitely with bearing replacements; however, over all metal fatigue and coiled wire degradation deems it prudent to replace the entire engine.

11.6. Electronic Speed Controller

11.6.1. Programmable Functions will be in accordance with the operational manual associated with the UAV's make and model.

11.6.2. ESC Protection Functions will be in accordance with the operational manual associated with the UAV's make and model.

11.6.3. ESC Daily Inspection will be in accordance with the operational manual associated with the UAV make and model.

NOTE

Due to its electromagnetic properties, the Electronic Speed Controller (ESC) should be placed as far from the receiver as possible to avoid electromagnetic interference with the radio receiver.

11.6.4. During preflight and flight event inspections, the ESC is visually inspected for its general condition in regards to wires and circuit board.

11.6.5. ESC Routine Inspection in accordance with the operational manual associated with the UAV make and model.

NOTE

The latest manufacturer safety bulletin shall be followed.

11.6.6. ESC Overhaul/Time in Service in accordance with the operational manual associated with the UAV make and model.

11.6.7. At any time the ESC displays any abnormalities, such as visual abnormalities to the circuit board or smoke emitting from the circuit board, the ESC shall be replaced with a new system.

11.6.8. If the motor displays abnormalities in pitch or tone, then the ESC should be investigated for the possible cause of the motor abnormality.

11.6.9. After each overhaul process or anytime the ESC is removed and reattached, the AFD (sUAS) receives an FCF with a record entry made in the maintenance log for the associated aircraft.

11.7 Propeller

11.7.1. Propeller Daily Inspection in accordance with the operational manual associated with the UAV's make and model.

11.7.2. The propeller is inspected during the preflight and the daily inspection. Special attention is given to the leading edges of the propeller to ensure no damage has occurred such as chips or dents. In addition, the propeller is ensured that it is tightened appropriately to the motor.

11.7.3. Propeller Routine Inspection in accordance with the operational manual associated with the UAV's make and model.

11.7.4. Propeller Overhaul/Time in Service in accordance with the operational manual associated with the UAV's make and model.

11.7.5. When there is a need for an overhaul or replacement of a motor, a new propeller should be balanced and installed.

11.8 Receiver

The main receiver and remote receiver are placed away from carbon fiber components and the telemetry transceiver to ensure no electromagnetic interference occurs. The path diversity of the transmitter's signal is improved by placing the main and remote receivers as far apart as possible. In addition to placing these receivers apart, the receivers are placed perpendicular to each other. The main receiver is placed on the floor of the electronic bay, while the remote receiver is placed on the wall. This positioning optimizes the RF environment and provides a strong signal link.

11.8.1. Receiver Daily Inspection will be in accordance with the operational manual associated

with the UAV's make and model.

11.8.2. Receiver Routine Inspection will be in accordance with the operational manual associated with the UAV's make and model.

11.8.3. Receiver Overhaul/Time in Service will be in accordance with the operational manual associated with the UAV's make and model.

11.8.4. The receiver is replaced during any condition that reveals a breach of the receiver's structural integrity. For example, a missing or loose lead plug pin, case crack revealing the circuit board, or any other indication that calls into question its condition.

11.9 Flight Computer

11.9.1. Pitot-Static System will be in accordance with the operational manual associated with the UAV's make and model.

11.9.2. Telemetry System will be in accordance with the operational manual associated with the UAV's make and model.

11.9.3. A subsystem of the flight computer the telemetry system provides the ability to transmit and receive flight computer information from a remote ground station.

11.9.4. The telemetry system is not required to keep the aircraft safely airborne, but rather gives a secondary method of changing flight plans and providing aircraft flight computer data. On the aircraft, a transceiver with antenna is used to relay data and receive commands from the ground station.

11.9.5. Flight Computer Preflight/Daily Inspection in accordance with the operational manual associated with the UAV's make and model.

11.9.6. Flight Computer Routine Inspection in accordance with the operational manual associated with the UAV's make and model.

11.9.7. If any major damage is observed to the circuit board, then the flight computer shall be replaced. After the routine inspection, the AFD (sUAS) receives a FCF with a record entry made in the maintenance log for the associated aircraft.

11.10 Modes of Operation. The UA utilizes a sophisticated flight computer that integrates advanced processors, accelerometers, gyroscopes, magnetometer, barometer, compass, and GPS.

11.10.1. There are six flight modes available to AFD UA. The primary modes of operation (see figure 11) for the flight computer include manual mode, assisted flight modes, autonomous mode, and commanded modes. The transmitter commands these modes. These six flight modes are independent of the ground station. The transmitter executes all flight modes.

Figure 11
Flight Modes

Primary Mode	Flight Mode
Manual	Manual
Assisted	Stabilize
Assisted	Fly by Wire
Autonomous	Autonomous
Commanded	Loiter
Commanded	Return to Land

11.11 Transmitter

11.11.1. The transmitter is the primary flight controller, and telemetry with the ground station is a secondary means of flight control.

NOTE

The PIC must be prepared to take control of the aircraft quickly in the event the telemetry control fails.

11.11.2. Transmitter Daily Inspection will be in accordance with the operational manual associated with the UAV's make and model.

11.11.3. Transmitter Routine Inspection will be in accordance with the operational manual associated with the UAV's make and model.

11.12 Ground Station

A laptop computer with flight event software and a telemetry transceiver with antenna comprise the ground station. The computer software shall be kept up to date with the latest manufacturer-operating version. The computer must utilize an anti-virus to ensure malware or other viruses that do not corrupt the system and/or severely degrade the performance. Since the ground station augments all operations, the ground station can have a total failure.

11.13. Battery

11.13.1. Operations/Endurance. The PIC shall ensure adequate battery power exists onboard the UA to successfully perform the flight event.

11.13.2. During flight events, the battery shall be monitored by a primary telemetry link and a secondary voltage alarm attached directly to the operating battery. The primary link indicates low voltage via audible warning on a ground station or transmitter. The secondary voltage alarm emits a loud alarm from the UA to indicate the battery is low, and the UA shall land as soon as possible.

11.13.3. Both primary and secondary alarms sound at 3.8 volts (50% capacity), and the

aircraft lands as soon as possible. The Lithium-Polymer (LiPo) battery should never drop below 3.72 volts per cell due to its capacity reaching 25%.

CAUTION

Improper flight planning may cause the UA to fail reaching the designated landing area; therefore, proper event planning requires the PIC to plan the event with enough reserve battery power to achieve a safe recovery.

11.13.4. Battery health is vital to the success and safety of flight events. It is essential for each battery cell to be checked for its health before each launch of the UA. This check takes place during preflight and monitored via telemetry during the flight event.

11.13.5. The power source for all AFD sUAS operations is electric motors driven by LiPo batteries. These batteries require safety awareness and proper handling to ensure the LiPo battery does not overheat and possibly catch fire.

WARNING

Failure to follow appropriate safety guidelines could lead to an overheated battery that may lead to a fire causing a potentially hazardous situation.

11.13.6. Ensure any battery that is damaged is appropriately discarded. Damaged cells can create a condition where batteries can ignite and cause a fire causing a potential hazardous situation.

11.13.7. Charging procedures for LiPo batteries require only LiPo specific battery chargers, set to the appropriate cell count for the respective battery to be charged. Slow charges are recommended and the balance of each cell should be kept relatively close to each cell. Care should be taken to avoid imbalances of each cell (i.e., do not allow individual cells to exceed 0.1 volts in comparison).

NOTE

In cases where cells must be balanced, attempt one balance and if it is unsuccessful, then carefully discharge the battery and properly dispose of the failed battery.

11.13.8. A metal or other non-combustible surface shall be used when recharging batteries. Special attention must be given during the first few minutes of charging to ensure proper charging has taken place. Batteries should not be left unattended during the charging, discharging, and balancing process. A well-ventilated area and a fire-extinguishing agent should be within close proximity during battery charging/discharging/balancing process.

11.13.9. The LiPo battery shall never exceed 4.2 volts per cell. To allow the battery to discharge below 3.0 volts per cell causes the battery irreversible damage. In the case of over discharge, the battery shall be disposed properly. For storage, the LiPo battery should be stored at 3.8 volts per cell (50% of the useful charge).

11.13.10. Batteries shall be stored in fire retardant woven fabric bags (LiPo Bags) at all times not in use. The storage shall be kept in a well-ventilated area, and temperatures should never exceed 130°F or the manufacturer recommendation, whichever is lower.

11.13.11. Battery Inspections. Batteries are inspected every flight and during charging/discharging/balancing processes. If any abnormalities occur such as puffs of smoke or excessive swelling, then the battery shall be properly discharged and recycled.

11.13.12. During charging/discharging/balancing processes, the maximum voltage and internal resistance are monitored in order to forecast the battery's performance capability.

11.13.13. A battery struggling to reach its maximum voltage or an increasing internal resistance could be an early sign of battery degradation. This battery should be monitored closely in its performance and consideration should be made in regards to retiring the battery.

11.13.14. Battery Service Life. If a battery is not consistently performing to its standard, then this battery should be recycled. If a battery shows signs of excessive swelling (i.e., thermal runaway), then this battery shall be properly discharged and recycled. In addition, punctured battery cells shall be properly discharged and recycled.

11.14. Maintenance Records

11.14.1. The maintenance records contain the history and scheduled maintenance requirements for each UA make/model by serial number.

11.14.2. These records document preventive maintenance, alterations, daily inspections, routine inspections, overhaul, and time in service. Each record for the appropriate flight time interval is documented.

11.14.3. The comprehensive maintenance history and future maintenance are documented in these records. These records include a description of the work performed, the date of completion, and a signature from a qualified technician.

11.14.4. Daily inspections ensure the UA is meeting an acceptable condition before flight events. A more thorough inspection is conducted through routine maintenance, which ensures the component is functioning properly at certain time intervals.

11.14.5. Overhaul maintenance requires the aircraft component to be reworked or replaced. All inspections require a qualified technician to sign off the appropriate level of maintenance achieved, and the aircraft declared safe to fly.

11.14.6. Each major component is documented by serial number in each UA's maintenance record. These major components include:

11.14.6.1. Servos/actuators

11.14.6.2. Motor
11.14.6.3. Rotor/Propeller
11.14.6.4. Electronic Speed Controller (ESC)
11.14.6.5. Receiver Flight computer

11.14.7. For each serialized UA, the servos, motor, propeller, ESC, receiver, and flight computer will be documented in the maintenance record for each component's total time in service. In addition to the total time in service, the current status of life limited components are documented as well.

11.14.8. For inspection work for each component, the time since last overhaul for the specified time basis is documented in the maintenance record. The current UA inspection status is documented, which includes the make/model manual's directed time of last inspection.

11.14.9. For certain components, the maintenance records are not kept for the specific make/model serialized airframe but rather an independent maintenance record kept for each component.

11.14.10. The purpose of independent maintenance records is due to the interchangeability of these components between airframes. These components include:

11.14.10.1. Batteries
11.14.10.2. Transmitter
11.14.10.3. Ground station

11.14.11. Aircraft and acceptance forms identify the aircraft make/model, serial number, battery charge, aircraft weight, and a place for the PIC to sign acceptance of the aircraft for operations. The acceptance form is the first document in the UA's maintenance record for each make/model aircraft. Once signed over to the PIC, they accept full responsibility of the safe operation of the aircraft.

NOTE

The PIC signs acceptance forms for each independent component as well.

11.14.15. The maintenance records are retained until the work is repeated or superseded by other work or for 1 year after the work. All maintenance records are available for inspection by the FAA or authorized personnel from the National Transportation Safety Board (NTSB).

11.15. Functional Check Flights. Functional check flights (FCF) are not certification test fights. There should never be a situation where a sUAS is flown outside of its flight limits. Functional Check flights must be approached from a methodical point of view with a sharp focus on what the objective of the flight is and all of the potential risks associated with it.

11.15.1. FCF Procedures. The functional check flights (FCF) shall be completed with a minimum crew of the PIC and VO. Personnel should be minimized during the FCF event operating area. A daily inspection is required prior to the FCF along with a thorough preflight

with special attention placed on the overhauled or replaced component.

11.15.2. For an FCF event, the FCF PIC shall be briefed by a qualified technician about the execution of required checks. The technician gives a list of the replaced components, and the FCF PIC shall conduct each evaluation check. The required checks are to be completed in the most logical and efficient order. The FCF PIC shall be familiar with these requirements prior to the check.
11.15.3. FCF Checklist. For all FCF events, all checklist procedures are conducted in accordance with the Normal Procedures chapter of this manual. The exceptions to the Preflight Checklist places emphasis on the components that were overhauled or replaced.

11.15.4. FCF Evaluation Check. For the FCF evaluation check, the technician gives a list of performance test requirements to the FCF PIC based on the overhaul of replaced components. The following key questions should be ascertained:

11.15.4.1. What is the objective of the flight?
11.15.4.2. Are there other alternatives to achieve the required objective?
11.15.4.3. Which systems have been worked on?
11.15.4.4. Which systems have been disturbed?
11.15.4.5. Have adverse outcomes been considered, evaluated and briefed?

11.15.5. An FCF must never be treated as a routine flight without careful consideration of multiple factors. In many cases, an FCF is probably not even warranted and a simple discovery flight using 100% normal procedures is more appropriate. In those cases where an FCF is conducted, risk mitigation, through a series of in-depth questions is critical to the safe operation.

Appendix A

ACRONYMS

Acronym	Definition
AFD	Austin Fire Department
AIM	Aeronautical Information Manual
AGL	Above Ground Level
CFR	Code of Federal Regulation
COA	Certificate of Authorization
CRM	Crew Resource Management
EP	Emergency Procedure
ESC	Electronic Speed Controller
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FCC	Federal Communications Commission
FCF	Functional Check Flight
FSDO	Flight Standards District Office
GPS	Global Positioning System
IMSAFE	Illness, Medication, Stress, Alcohol, Fatigue, Emotion
LiPo	Lithium-Polymer
LOA	Letter of Agreement
METAR	Meteorological Aerodrome Report
MEC	Minimum Essential Criteria
MTR	Military Training Route
NAS	National Airspace System
NOAA	National Oceanic Atmospheric Administration
NOTAM	Notice to Airmen
NTSB	National Transportation Safety Board
ORAT	Operational Risk Assessment Tool
PJA	Parachute Jumping Area
PIC	Pilot in Command
SIGMET	Significant Meteorological Information
sUAS	Small Unmanned Aircraft System
TAF	Terminal Area Forecast
TFR	Temporary Flight Restriction
UA	Unmanned Aircraft
UAS	Unmanned Aircraft System
VFR	Visual Flight Rules
VLOS	Visual Line of Sight
VMC	Visual Meteorological Conditions
VO	Visual Observer

Appendix B

EVENT PLANNING CHECKLISTS

EVENT PLANNING

Prior to each flight event, the PIC conducts proper event planning to ensure the operation is conducted safely. Event planning begins by ensuring all proper prerequisites are fulfilled before operating the AFD (sUAS) in a commercial environment.

Mission Plan

- All actions and contingencies for the mission planned.
- Contingency planning should include safe routes in the event of a system failure, degraded performance, or lost communication link, if such a failsafe exists.
- Mission plans and flight plans should be shared with other operators in the vicinity.

1. NOTAM of flight event----------POSTED AND ACCURATE

2. Local FSDO Documents----------FILED/COPY (if applicable)

3. Required PIC and AFD----------COPIES

NOTE

The PIC and AFD documents include private pilot certificate, aircraft registration certificate, AFD General Operations Manual, AFD (sUAS) Operations Manual, Certificate of Authorization (COA), and exemption letter.

4. Weather----------CHECKED

NOTE

All flight operations commence 30 minutes after sunrise and complete 30 minutes before sunset.

5. NOTAMs and TFRs----------CHECKED

6. Airspace----------IN COMPLIANCE

NOTE

Ensure airspace is in compliance with Section 3.6 of the AFD General Operations Manual.

1. Property Owners----------LETTER OF AUTHORIZATION

2. Flight planning for operation----------COMPLETED

EVENT BRIEF CHECKLIST

EVENT BRIEF

The brief shall be conducted at the site before operations begin. Before the event brief, the PIC and VO shall survey the area of operation to note obstacles, terrain, structures, and any other hazards that may cause an issue with operations. In addition to surveying the property, winds are checked at the site, and a designated launch and recovery is designated with bright orange markings.

1. General
    a. Crew assignment/responsibilities
    b. Documentation
    c. Takeoff and land times/in compliance with NOTAM
    d. Time hack

2. Event Overview
    a. Weather/NOTAMS
    b. Go/no-go criteria
    c. Airspace/operating area
    d. Launch procedures
    e. Event flight profile
    f. Recovery procedures
    g. Planned endurance
    h. Contingency plan

3. Crew Resource Management
    a. Ground/in-flight checks
    b. Communications discipline
    c. Sterile flight deck

4. Emergency Procedures
    a. Crew responsibilities
    b. Battery operations
    c. See and avoid
    d. Loss of link procedures
    e. Loss of GPS procedures

5. Miscellaneous
    a. Risk Management
    b. Others

PREFLIGHT CHECKLIST

PREFLIGHT PROCEDURES
After the Event Brief, the PIC shall conduct a preflight inspection of the AFD (sUAS) and its ground control system (if applicable).

1. Operating Area----------SURVEYED
2. Launch/Landing Area----------DESIGNATED
3. Required Documents----------PRESENT
4. Aircraft Wing----------ATTACHED
5. General Aircraft Condition----------INSPECT
6. Wing----------SECURE/INSPECT
7. Tail----------SECURE/INSPECT
8. Fuselage----------SECURE/INSPECT
9. Motor----------SECURE/INSPECT
10. Propeller----------SECURE/INSPECT
11. Servos/Actuators (4)----------SECURE/INSPECT
12. Servo Rods (4)----------SECURE/INSPECT
13. Electronic Bay----------INSPECT
14. Batteries----------CHECK VOLTS
15. Battery Compartment----------INSPECT
16. Transmitter----------CHECK SWITCHES
17. Transmitter----------CHECK VOLTS
18. Ground Station----------CHECK (if applicable)

Other things to consider:

- Verifying all transmitter, on-board aircraft and camera batteries are fully charged; (confirm voltages)
- Ensure no frequency conflicts with both video and transmitter / receiver
- Checking all control surfaces for signs of damage, loose hinges, and overall condition; Looking over the wing/rotors to ensure they are in good structural condition and properly secured;
- Check motor/engine and mounting attached to the airframe;
- Study propellers / mounting hardware (tight) / rotor blades for chips and deformation;
- Check the landing gear for damage and function
- Test electrical connections, plugged in and secure
- Ensure photo / video equipment mounting system is secure and operational.
- Check location of GPS equipment controlling the autopilot.
- Check the IMU movements in the ground control software.
- UAV in stabilization mode, ensure control surfaces move towards the correct positions
- UAV / Drone is in a level location safe for takeoff
- FPV / Power up ground station
- FPV / Power up Video receiver / goggles
- If using Video recorder turn on camera system
- Camera settings are correct (still images, video, framerate)
- SD camera memory clear and inserted into the camera
- Action / Start filming
- All transmitter controls move freely in all directions
- All transmitter trims in neutral position
- All transmitter switches in correct position(typically away)
- Transmitter throttle to zero
- Radio transmitter on
- Connect / power on battery to airframe
- Ensure led indicators and audible tones are correct
- Timer on (if applicable)

- FPV, confirm video is in monitor / goggles
- Scan for nearby cars / people / animals
- Say “CLEAR!”
- Arm flight controller
- Increase throttle slightly listening for any abnormalities
- Short 20-30 second hover at 3-5 feet (listen for vibrations / loose items)
- Confirm Voltage levels are correct

AREA & ENVIROMENT CHECKLIST

- Hazards / Site Selection
    - Check for wires / cables
    - Animals
    - People / bystanders
    - Property in the vicinity
    - Site is away from nonessential participants
    - Ability to maintain adequate buffer zones between aircraft and personnel;
    - Minimize departures and landings over populated areas
    - Take into account local topography, ensuring a visible line of sight towards the UAV at all times. Ensure the telemetry connection is not obstructed.
    - Investigate potential alternative landing sites in case take-off site is obstructed.
- Psychological consideration (are you well rested, rushed, “get there-itis”, are you being pressured by client)
- Weather considerations
    - Temperature
    - Visibility
    - Precipitation
- Wind Speed
    - Upper winds / at altitude
    - Rotor (lee side of large objects)
- Notify any bystanders or nearby property owners of your intentions (permission)
- Discuss flight plan with your co-pilot or spotter
- If flying in controlled airspace, have you notified airspace authority
    - NOTAMs
    - Can you reach authorities
    - Do you need to maintain communication?
- First Aid Kit stocked, readily accessible and visible to anyone in the area.

EQUIPMENT/UAV CHECKLIST

- Walk-around
- Crack in joints and structural members
- Loose or damaged screws, ties, fasteners, straps
- Loose or damaged wiring
- Loose or damaged connections (solder, plugs, etc.)
- Inspect prop mounts and screws and apply slight counter pressure on arms to check for loosened components
- FPV , inspect / clean FPV (Camera) Lens and insure it is secured and connects are firmly attached
- Camera settings are correct (still images, video, framerate)
- Battery / Batteries are fully charged, properly seated and Secured
- Fail-safe equipment functioning
    - RTH (return to home)
    - Recovery chute
    - Firmware Airport Proximity Detection Functioning
- Props are smooth and free of damage / defect (check blade, surface and hub)
- Prop adapters are tight / secure
- Ensure voltage alarm is connected
- Ensure arming / idle timeout is properly configured
- Correct model is selected in transmitter (if applicable)
- Check RC transmitter shows the right range and centering for all sticks
- Perform range test

OPERATIONS CHECKLIST

Once the UAV has reached its operating altitude and begins its event profile and periodically throughout the event, the PIC shall conduct an Operations Checklist. The Operations Checklist is to ensure all systems are operating normally.

1. Batteries----------VOLTAGE CHECKED

> Improper flight planning may cause the AFD (sUAS) to fail reaching the designated landing area therefore, proper event planning requires the PIC to plan the event with enough reserve battery power to achieve a safe recovery.

2. Altitude----------BELOW 400 FEET AGL

3. GPS Link---------- CHECKED (if applicable)

NOTE

> The sUAS shall avoid all manned aircraft by 1,000 feet vertically and 1 sm laterally within 1,000 feet vertically.

Other things to consider:

- Basics: If flying manually, always keep your fingers on the controller/transmitter.
- Never let the UAV out of your sight even for a second.
- Climb to a safe altitude away from potential hazards and to reduce noise pollution.
- Keep aircraft at a safe operating distance from people, electric utility lines and buildings.
- If the UAV must be flown over buildings or people, use a lightweight UAV and maintain a safe altitude for recovery and make every effort to minimize exposure.
- Spotter: Use a spotter whenever possible and appropriate, especially when flying by First Person View (FPV).
- Do not fly UAVs within distance defined by local laws of any private/commercial airport/helipad
- Do not fly around a pre-existing UAV flying site without a frequency-management agreement.
- Do not interfere with operations and traffic patterns at any airport
- Landing: Regardless of whether of a manual or automated UAV landing, scan landing area for potential obstruction hazards.
- Announce out loud “Preparing to Land”.
- Carefully land the aircraft away from obstructions and people.

RECOVERY CHECKLIST

Recovery Procedures

Once the AFD (sUAS) has completed the flight event, the aircraft returns to the recovery area. The PIC guides the aircraft to the designated recovery area and lands into the wind.

The PIC ensures at least-300 feet of the landing approach area is clear of obstructions and terrain. No people, vehicles, or structures shall be in the approach corridor. The PIC announces "LANDING," and the VO announces "ALL CLEAR" for the designated approach corridor and recovery area.

RECOVERY

1. Flight Mode----------MANUAL

2. Approach Corridor----------CLEAR

WARNING

Failure to ensure the approach corridor and recovery area are clear could result in a hazardous situation with the AFD (sUAS) impacting the ground, objects, or people.

3. Landing Pattern----------EXECUTE

Other things to consider:

- Shutting Down: Turn the power off to the aircraft and/or disconnect the batteries.
- Turn off the transmitter.
- Turn the power off to the photo equipment.
- Visually check aircraft for signs of damage and/or excessive wear.
- Remove the unused fuel if applicable. Secure the aircraft.
- Check pictures: Verify that the UAV camera actually took the pictures.
- LOG FLIGHT

After Recovery Procedures

Once the AFD (sUAS) has landed, the PIC shall secure the aircraft.

Event Debrief

The debriefing shall be conducted after each flight event to discuss the previous operation. The debrief allows the PIC and VO to discuss any safety issues or abnormal situations that may have occurred.

- Safety of Flight Issues
- Abnormal Situations
- CRM issues
- Miscellaneous

Appendix C

Pilot logbook Example

Every 6 minutes is 0.1 of an hour. Use the table below to convert minutes to decimal hours

0 – 6 minutes	=	0.1 Hour
7 – 12 minutes	=	0.2 Hour
13 – 18 minutes	=	0.3 Hour
19 – 24 minutes	=	0.4 Hour
25 – 30 minutes	=	0.5 Hour
31 – 36 minutes	=	0.6 Hour
37 – 42 minutes	=	0.7 Hour
43 – 48 minutes	=	0.8 Hour
49 – 54 minutes	=	0.9 Hour
More than 54 minutes	=	1.0 Hour

Date	Crew	Aircraft Tail Number	Flight Time (Hours)	Location	Weather Conditions	Flight Description
an 1, 2015	PIC: Frank Flyer VO: Edward Eaglie	LEP001	0.3	Lat.: N 039.54321° Long.: W 105.12345°	Winds: 030° @ 12kt Temp: 75°F	Flight Training: Takeoff & Landing
an 2, 2015	PIC: Frank Flyer VO: Edward Eaglie VO: Edward Eaglie	LEP001	0.3	Lat.: N 039.54321° Long.: W 105.12345° Long.: W 105.12345°	Winds: 030° @ 12kt Temp: 75°F Temp: 75°F	Flight Training: H-pattern
an 4, 2015	PIC: Frank Flyer VO: Edward Eaglie VO: Edward Eaglie	LEP001	0.2	Lat.: N 039.54321° Long.: W 105.12345° Long.: W 105.12345°	Winds: 030° @ 12kt Temp: 75°F Temp: 75°F	Flight Training: Tail-in-the-Box
an 8, 2015	PIC: Frank Flyer VO: Edward Eaglie	LEP001	0.2	Lat.: N 039.54321° Long.: W 105.12345°	Winds: 030° @ 12kt Temp: 75°F	Leisure Flight

TOTAL TIME FORWARDED FROM PREVIOUS PAGE:	**20.4**
TOTAL TIME THIS PAGE:	**1.9**
TOTAL TIME TO DATE:	**22.3**

I CERTIFY THAT THE INFORMATION ON THIS LOG IS TRUE AND CORRECT

Pilot Signature: *Frank Flyer*

Blank Pilot Logbook

Date	Crew	Aircraft Tail Number	Flight Time (Hours)	Location	Weather Conditions	Flight Description
	PIC:			Lat.:	Winds:	
	VO:			Long.:	Temp:	
	PIC:			Lat.:	Winds:	
	VO:			Long.:	Temp:	
	PIC:			Lat.:	Winds:	
	VO:			Long.:	Temp:	
	PIC:			Lat.:	Winds:	
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TOTAL TIME FORWARDED FROM PREVIOUS PAGE: ☐

TOTAL TIME THIS PAGE: ☐

TOTAL TIME TO DATE: ☐

I CERTIFY THAT THE INFORMATION ON THIS LOG IS TRUE AND CORRECT
Pilot Signature:___________________

Appendix D

GUIDELINES for EMERGENCY PROCEDURES

All **BOLD FACE** procedures are time critical steps and must be committed to memory by the PIC.

GROUND EMERGENCIES

SMOKE ON THE GROUND

IN FLIGHT EMERGENCIES

ABORTED LAUNCH

1. Altitude----------CLIMB TO A SAFE ALTITUDE

NOTE

If an aborted launch is due to a catastrophic failure, the PIC should control crash into an open field away from people, vehicles, and structures.

2. Flight Mode----------MANUAL

3. Perform Recovery Checklist

ABNORMAL MOTOR IN FLIGHT

1. Flight Mode----------RETURN TO LAND

NOTE

An abnormal motor may lead to a motor failure; therefore, altitude may need to be conserved. Consideration should be made for the PIC to switch out of the RETURN TO LAND Mode in order to maintain a higher altitude that does not breach the 400 feet AGL ceiling.

2. Flight Path----------LAND AS SOON AS POSSIBLE

MOTOR FAILURE

1. Flight Mode----------**MANUAL**

2. Flight Path----------LAND IMMEDIATELY

NOTE

If distance and altitude permit, the landing should be made at the designated recovery area (LAND AS SOON AS POSSIBLE) ; however, if the landing cannot be made, then the PIC shall steer into an open field away from people, vehicles, and structures.

SMOKE OR FIRE IN FLIGHT

1. Flight Mode---------- RETURN TO LAND

2. Flight Path----------LAND IMMEDIATELY

NOTE

Upon landing this emergency becomes a SMOKE or FIRE ON THE GROUND EP.

NOTE

If distance and altitude permit, the landing should be made at the designated recovery area (LAND AS SOON AS POSSIBLE); however, if the landing cannot be made, the PIC shall steer into an open field away from people, vehicles, and structures.

ABNORMAL FLIGHT CHARACTERISTICS

1. Flight Mode----------MANUAL

2. Flight Path---------- LAND AS SOON AS POSSIBLE

ABNORMAL VOLTAGE

1. Flight Mode----------RETURN TO LAND

2. Flight Path----------AND AS SOON AS POSSIBLE

LOSS OF LINK

1. Antennas----------UNBLOCK

NOTE

An obstacle may be blocking the antenna transmission and/or reception.

If link is regained:

2. Flight Mode----------RETURN TO LAND

3. Flight Path----------LAND AS SOON AS POSSIBLE

If link is never reestablished, the AFD (sUAS) returns to land and the aircraft cuts the throttle and lands immediately.

NOTE

The PIC or VO continually call out verbal position reports of the AFD (sUAS) as it attempts to

return to land.

WARNING

Failure to ensure the approach corridor and recovery area are clear could result in a hazardous situation with the AFD (sUAS) impacting the ground, objects, or people.

LOSS OF GPS

1. Flight Mode----------MANUAL OR ASSISTED

CAUTION

Failure to shift the Flight Mode into MANUAL or ASSISTED may result in the aircraft flying to an erroneous GPS position.

2. Flight Path----------LAND AS SOON AS POSSIBLE

MANNED AIRCRAFT AVOIDANCE

1. Flight Mode----------RETURN TO LAND

NOTE

Depending on the closure rate of the manned aircraft, the Flight Mode may need to be shifted to MANUAL or an ASSISTED Mode in order for the aircraft to descend and/or flight path altered.

WARNING

Manned aircraft operating closely to the AFD (sUAS) could lead to a possible mid-air collision. The PIC must return the AFD (sUAS) to the landing site and recover.

1. **Altitude----------As Required**

2. **Flight Path----------LAND AS SOON AS POSSIBLE**

NOTE

If the manned aircraft has penetrated quickly and deep into the AFD (sUAS) operating area, then the PIC shall LAND IMMEDIATELY.

GROUND STATION FAILURE

If the aircraft is above 330 feet AGL:

1. Flight Mode----------RETURN TO LAND

2. Flight Path----------LAND AS SOON AS PRACTICABLE

NOTE

During flight events above 330 feet AGL, the ground station shall be utilized in order to verify the GPS triangulated altitude of 400 feet AGL is not violated. The PIC ensures the GPS altitude is initiated at a zero altitude point as part of the Prelaunch Checklist. If the aircraft is at or below 330 feet AGL, then the flight event can proceed as normal.

Appendix E

sUAS MISHAP WORKSHEET

This worksheet should be completed in the field, whenever there is an incident that involves the loss of a UAS. This includes damage that renders the UAS non-repairable/non-recoverable, or an injury incurred as a result of UAS operation.

1. Owning Unit: _____
2. Date of loss _____ (DD/MO/YR) Time_____ (Local/Zulu)
3. Type of system: _____
4. Recovered: _____ not recovered _____
5. Site/location of incident: _____MSL altitude of GCU _____
6. Map sheet reference number: _____
7. UA (or lost/destroyed item) fuselage number: _____

8. Flight Log information:

A. Unit_____
Channel: _____
GPS Keyed: _____Y_____N____
Launch Time: _____
Land/Crash Time: _____
Duration of Flight: _____
Weather Conditions: _____ Temperature: ____Wind Speed: ____
Wind Direction: _____
Lighting: Night _____ Dawn ____ Day _____ Dusk_____
Ground Control Unit #_____
Remote Video Terminal#_____
UA Battery type:
Camera Type: _____Day _____F/L _____Night _____S/L Night
Other Factors:
Moonlight/illumination: _____
Precipitation: _____
Clouds: _____
Other):_____

9. Crew information
A. SUAS (Name, Rank):_____
B. Date/location of SUAS completion of certified training:
_____
C. Mission Controller (Name, Rank): _____
D. Date and location of MC completion of certified training:
_____

10. Circumstances:
A. Origin/launch site: _____

B. Mission: _____
C. Launch problem: _____
D. Landing problem: _____
E. Problem during flight: _____
F. Fight mode at time of loss: M___ A ___ H___ L___ N___
NOTE: M=Manual, A=Autopilot, H=Hover, L=Loiter, N=Night
G. Commanded altitude or throttle setting: _____
H. Air vehicle altitude above ground (AGL): _____Feet
I. Air vehicle heading: _____ Degrees magnetic
J. Last known UA location: _____
K. Rally point location and altitude: _____
L. Loss-of-Link indications: _____
M. GPS startup problems: _____
N. Previous problems/maintenance issue that may have contributed:
_____

11. Flight recorded/taped. Y/ N Location of data _____

12. Summary of mishap and damage:
_____
_____

13. Actions taken upon/after loss (search pattern used, number of searchers, duration of search, use of aircraft to assist, etc.): _____
_____

14. Damage
A. Aircraft: _____
B. City of Austin property damage: _____
C. Private property damage_____

15. Injuries
A. Names of injured person: _____
B Status/extent of injuries: _____
C. Actions at time of injury: _____

16. Witnesses: (Name, Rank, and role (i.e., RVT Data Capture, UAS Team Leader, etc.)_____

17. Worksheet completed by:
A. Name/Rank: _____
B. Unit: _____
C. Duty Phone: _____

Appendix F

OPERATIONAL RISK ASSESSMENT TOOL (ORAT)

sUAS Risk Assessment

Date: 17 Jul 2014 Aircraft: Leptron rdass Serial #: 003

UAS Crew/Station: _____/_____ _____/_____

_____/_____ _____/_____

Mission Type	SUPPORT 1	TRAINING 2	PAYLOAD CHECK 3	EXPERIMENTAL 4	
Hardware Changes	NO 1			YES 4	
Software Changes/Calibration	NO 1			YES 4	
Airspace of Operation	WIDE OPEN 1	MINIMAL HAZ 2	MODERATE HAZ 3	ABUNDANT HAZ 4	
Operator Experience with this Aircraft	EXPERT 1	ADVANCED 2	INTERMEDIATE 3	NOVICE 4	
Flight Time	DAY 1			NIGHT 4	
Type of Flight	LOS 1	LOS/BLOS 2	BLOS 3	FPV 4	
Visibility	> 10 MILES 1	6-9 MILES 2	2-5 MILES 3	< 2 MILES 4	
Surface Winds		0-5 KTS 2	5-15 KTS 3	> 15 KTS 4	
Forecast Winds		0-5 KTS 2	5-15 KTS 3	> 15 KTS 4	
Weather Deteriorating	NO 1			YES 4	
Other Airspace Activity	NO 1			YES 4	
Established Lost Link Procedures	YES 1			NO NO FLIGHT	
GPS Satellites Acquired	ALL 3 1	2 2	1 3	NONE 4	
Proper "home" Location Set	YES 1			NO 4	
Potential For Tx/Rx Interference	NONE 1	SOME 2	MODERATE NO FLIGHT	SEVERE NO FLIGHT	
Total					

RISK LEVEL			
18-27 LOW	28-36 MEDIUM	37-45 SERIOUS	45-56 HIGH

Aircraft Number: _____ Aircraft Type: _____

Flight Released By: _____ Date: _____ Time: _____

Appendix G

Flight Fitness | The "I'm Safe" Checklist

I	**Illness**	**Do I have an illness or any symptoms of an illness?**
M	**Medication**	**Have I been taking prescription or over-the-counter drugs?**
S	**Stress**	**Am I under psychological pressure from the job? Worried about financial matters, health problems or family discord?**
A	**Alcohol**	**Have I been drinking within eight hours? Within 24 hours?**
F	**Fatigue**	**Am I tired and not adequately rested?**
E	**Eating**	**Am I adequately nourished?**