NATE

THE COMMUNICATIONS INFRASTRUCTURE CONTRACTORS ASSOCIATION

sUAS Operations Best Practices Advisory

Photo credit: United Tower Alliance

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Photo Credit: Eagle Drones, LLC

0.1

PURPOSE

NATE: The Communications Infrastructure Contractors Association provides this resource as a guideline for carrying out sUAS operations for wireless and broadcast communications tower facilities (Tower(s)) in accordance with Title 14 of the Code of Federal Regulations Part 107 (hereafter referred to as Part 107) the UAS Pilots Code, and the recommendations and procedures herein.

The contents of this document do not override the necessity of reviewing and complying with any existing, new, or amended content published in the Federal Register by the Federal Government of the United States, the appropriate National Aviation Authorities, or any local/state regulations where RPICs intend to operate.

Further, it should be understood that this document is not exhaustive and is limited to sUAS-specific topics. With this in mind, understand that there are many relevant codes and regulations that are also relevant when operating around communication tower sites. Please refer to any other relevant code or regulatory documents for further guidance.

For the purpose of this document, it should be understood that these guidelines are directed towards commercial use of sUAS as described in Part 107. This should be understood to mean any use of sUAS that is not for fun or recreation. As an example, any use of an sUAS while performing a paid, commercial task would require the sUAS to be operated in compliance with Part 107.

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ACRONYMS & ABBREVIATIONS

AC	Advisory Circular
AGL	Above Ground Level
AIP	Aeronautical Information Publication
ALARP	As Low As Reasonably Practicable
AMSL	Above Mean Sea Level
ATC	Air Traffic Control
CFR	Code of Federal Regulations
CoW	Certificate of Waiver
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
MSL	Mean Sea Level
NOC	Network Operations Center
NOTAM	Notice to Airman
RF	Radio Frequency
PPE	Personal Protective Equipment
RPIC	107 Certified Remote Pilot in Command
RTH	Return to Home
sUAS	Small Unmanned Aircraft System
TOLP	Take Off/Landing Point
UAS	Unmanned Aircraft System
USC	United States Code
VLOS	Visual Line of Sight
VO	Visual Observer

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REFERENCED sUAS DOCUMENTS

Document	Version Number
Title 14 CFR Part 107	Applicable Version
UAS Pilots Code (http://www.secureav.com/)	Applicable Version
Advisory Circular 107-2	Applicable Version
NATE Unmanned Aerial Systems Operations Around Vertical Communications Infrastructure	Applicable Version

0.4

APPLICABLE LEGISLATION

This document is based on the Federal Aviation Regulations that are contained within Title 14 of the Code of Federal Regulations. Title 14 CFR Part 107 relates to the operation and certification requirements allowing sUAS to operate for other than recreation or hobby purposes. Additionally, it is expected that all operators will comply with all applicable Federal, State, and Local regulations (sUAS and non-sUAS specific).

1.1 DOCUMENT PURPOSE

This document is for the use of all Part 107 sUAS operators and contains recommended, operational procedures to encourage all tower-related sUAS operations to be conducted safely.

RPICs are expected to be fully conversant with the UAS Pilots Code and all applicable Federal, State, and Local regulations.

0.4 APPLICABLE LEGISLATION (CONT.)

1.2 DOCUMENT AMENDMENT

Amendments to the document will only be made by NATE. This document will be published on the NATE website. It is the responsibility of all sUAS pilots to make sure they are referring to the latest published version.

1.3 SCOPE

This manual applies to any flight operation defined as commercial use of an sUAS under AC107-2(4.1) when conducted by RPICs around towers for the purpose of inspections, monitoring, mapping or any other activity related to the maintenance, repair, or documentation of communications towers. Flights around tower sites, by any person on the site for paid commercial work, are not to be considered recreational and must follow all commercial flight requirements under Part 107.

1.4 APPLICATION OF AIRMANSHIP PRINCIPLES

NATE expects all RPICs to apply Airmanship Principles, including, but not limited to:

- Knowledge of the capabilities and limitations (in normal and non-normal scenarios) of all aircraft operated;
- Knowledge of personal limitations and habits that affect safety;
- Knowledge of the environment, airspace, weather, and the operation;
- Knowledge of the team through conducting briefings, use of observers, communications, being positive, and speedy and fair/just resolution of conflicts;
- Knowledge of the risks by always conducting a thorough risk assessment;
- Staying proficient through scenario-based training for emergencies by conducting "dry runs" of complex operations;
- Staying up-to-date and maintaining proficiency in both safety and operational matters, and technical information regarding operated sUAS; and
- Knowledge of hazards associated with work near communications structures.

2.1 SAFETY POLICY

All RPICs shall endeavor to fulfill their functions to the highest standards of safety. It is the responsibility of every RPIC to ensure that processes, policies, and procedures are fit for purpose and regularly reviewed in order to reduce the risks associated with the operation. Additionally, all RPICs must meet all applicable Federal, State, OSHA, FAA, and client contractual safety training and certifications.

2.2 SAFETY REPORTING

It is the responsibility of all RPICs to ensure all incidents are reported to the FAA in compliance with FAR 107.9. Additionally, all incidents should be reported to the customer or tower owner.

0.4 APPLICABLE LEGISLATION (CONT.)

2.3 GOALS

The overriding goal is to reduce the risk of operation to "As Low As Reasonably Practicable" (ALARP). Each individual job should be risk assessed and risks mitigated.

2.4 RISK MANAGEMENT

It is the responsibility of all people involved in any sUAS operation to identify risks and bring them to the attention of their manager or the RPIC as appropriate. It is recommended that assessments be undertaken prior to the day of the operation, which are a precursor to the RPIC responsibilities on the day under FAR Part 107.49.

Risks are to be scored according to the risk assessment matrix - see appendix C. If risks are identified, they should be mitigated using the ERICPD system. The order below indicates the priority that should be given to each control measure.

E liminate	The hazard totally
R educe	Make the Risk As Low As Reasonably Practicable (ALARP)
I solate	The hazard to a minimum number of people
C ontrol	The hazard (Notification)
P ersonal	Protective Equipment (Hi-Viz)
D iscipline	Safe system of work on-site, positive safety culture

All site-specific risks and their associated mitigating measures should be documented in the job hazard analysis form.

3.1 RESPONSIBILITIES OF REMOTE PILOT

In addition to the specific details below, it is the responsibility of the RPIC to provide the remote Part 107 pilot certificate and any other document, record, or report required to be kept under FAR Part 107 to any person making a lawful request to inspect them. The FAA may inspect and test the sUAS, the remote pilot, the person manipulating the flight controls of the sUAS, and the visual observer and determine compliance with Part 107. If this occurs at the place of operation, then this is also a RPIC responsibility to facilitate it.

RPIC responsibilities include:

- Carrying out site assessments
- Site-specific risk mitigation
- sUAS pre-flight preparation
- Ensuring aircraft load is safe and secure
- Ensuring aircraft has sufficient fuel for the task
- Carrying out flight procedures

0.4 APPLICABLE LEGISLATION (CONT.)

- Post-flight duties and record keeping
- Enactment of emergency procedures if required
- Coordinate with other sUAS operations personnel if applicable
- Reporting accidents or serious incidents to the FAA
- Understanding RF interference as it applies to sUAS

Per FAR 107.19, the Remote Pilot in Command is directly responsible for and is the final authority as to the operation of the small unmanned aircraft system.

3.2 RESPONSIBILITIES OF VISUAL OBSERVER

To ensure that the VO can carry out his or her duties, the RPIC must ensure that the VO is positioned in a location where he or she is able to see the sUAS sufficiently to maintain VLOS. The RPIC can do this by specifying the location of the VO. Consideration should be given to ambient noise and outlining acceptable communication methods (hand signals, yelling, walkie-talkie, phone, etc) and the need to establish what those signals mean before the operation starts.

The FAA requires that the remote RPIC and VO coordinate to scan the airspace where the sUAS is operating for any potential collision hazards and to maintain an awareness of the position of the sUAS through direct visual observation. Other responsibilities of the VO include:

- Assistance to the RPIC during site survey
- Attendance during any safety briefing
- Spotting for ground-based risks during flight
- Spotting for air-based risks during flight
- Assistance during an emergency event as described in specific procedure
- Observing obstructions on the tower
- Helping to document potential RF interference
- Any other duties as required by the RPIC

3.3 AREAS OF OPERATION

The RPIC must have all permissions, required licenses, certificates, and/or permits to legally perform the sUAS operation in the area where the operation is being carried out. Additionally, the RPIC has to have notified the client network operations center (NOC) for access to the site and must follow the proper access procedures.

All sUAS must be registered and insured to comply with the requirements of Federal, State, and Local regulations. This includes the correct display of the registration number on the exterior of the sUAS.

0.4 APPLICABLE LEGISLATION (CONT.)

3.4 SUPERVISION OF OPERATIONS

The RPIC is ultimately responsible for ensuring that procedures are in place and that any suggested processes are completed.

Suggested procedures may include:

- Pre-flight operations are documented (including checklists)
- Procedures for flight planning for operational environments are appropriate
- Normal procedures are documented
- Procedures are in place to cope with abnormal and emergency situations
- Hand over/take over procedures are documented
- Navigation tolerances and operations around airports are applied
- Post-flight procedures (checklists)
- Job hazard analysis
- Adjacent landowner notification

3.5 LOGS & RECORD

It is recommended that the RPIC maintain documents/logs recording all aspects of safety and risk assessment, flight planning, equipment maintenance, usage, and defects, training, and licenses. Remember that all documents must be provided to the FAA if requested.

Suggested records may include:

- Flight planning
- Job safety and feasibility assessments
- Accident and incident reporting
- Individual aircraft flight logs
- Individual aircraft, including details of registration, marking, and insurance
- Individual aircraft maintenance and repairs (including maintenance, alteration, and repair)
- Component logs - including use of genuine and non-genuine parts, defective parts, and replacement and spare parts
- Individual aircraft software/malware update logs
- General software/malware update logs
- Individual battery usage
- Safety log of all potential hazards
- Emergency response plan
- Safety training
- Landowner notification logs
- Notice to proceed
- Network operations center clearance number

0.4 APPLICABLE LEGISLATION (CONT.)

4.1 SAFETY EQUIPMENT

Appropriate safety equipment should be available to all members involved with the sUAS operation. Personnel should follow all applicable Federal, State, OSHA, and client contractual site safety requirements.

Suggested safety equipment may include:

- Personal Protection Equipment (eye protection, sun protection, work boots, hard hat, etc.)
- First aid kit
- Fire extinguisher
- Safety vest
- Warning signage (overhead operations, do not distract workers, etc.)

4.2 JOB FEASIBILITY AND SAFETY

Feasibility

Upon initial contact from a client, the RPIC should prepare the Job Feasibility and Safety Assessment. This document contains the feasibility and accountability outlines as well as the risk assessment and hazard analysis.

The purpose is to obtain this initial information to decide whether the task is within the scope of a safe sUAS operation. The client must be informed that full flight planning and site assessment may uncover findings that could result in the inability to complete the scope of work.

Additionally, the RPIC should be aware of any other site-specific, non-sUAS training requirements. The RPIC should also understand that the flight should not be initiated or flown when any other commercial entity is on the site.

Job Safety

Once the initial feasibility of the proposed task has been agreed upon, then the RPIC should obtain further information from the client in order to conduct a thorough job hazard analysis.

The hazard analysis should include things like:

- Tower type (guyed, monopole, self-supported)
- Tower height
- Obstructions (power lines, trees, guy wires)
- RF equipment present (as it relates to health and safety concerns and sUAS interference)
- Proximity to building
- Weather
- Restricted airspace
- Endangered species
- Ambient Noise Levels

0.4 APPLICABLE LEGISLATION (CONT.)

4.3 WEATHER

The RPIC should ensure that the following are within specifications of the sUAS and his/her abilities:

- Precipitation
- Minimum weather visibility of three miles from control station
- Wind speed
- Temperature range
- Humidity levels must not be outside of the design characteristics of the aircraft

(Refer to the checklists in the appendix of this document for further details.)

The forecast weather should be obtained for the period that the operation is expected to take place. Reference should be made to sUAS limitations, as well as any regulatory limitations. Note that where any legal or manufacturer limitations differ, the most restrictive should apply.

4.4 ON-SITE PROCEDURES

On the day of flight, but prior to any flight operations taking place, the RPIC should fully inspect the site.

The purpose of this survey is to confirm hazards identified during flight planning and to identify other hazards, such as hidden public access points or previously unseen obstacles. The operating frequency of the drone should be considered when conducting the site survey and any possible sources of electronic (RF) interference should be identified and noted.

Operating Area

As part of the site survey, the RPIC should identify a TOLP. The RPIC should consider the following guidance when selecting the best area depending on sUAS type and requirements:

- Size
- Shape
- Surrounds
- Surface
- Slope
- Tower type
- Compound size
- Tower height
- Guy wires

This TOLP should be appropriate for an automatic RTH when in failsafe mode so as to not cause damage to the communication structure. If this is not possible, then an alternative RTH landing point should be selected.

0.4 APPLICABLE LEGISLATION (CONT.)

Briefing

The RPIC should brief all members involved in the sUAS operation regarding their respective duties. The briefing should always culminate with a check of understanding and an opportunity for all members of the flight team to ask questions. At a minimum, the following items should be included in the brief:

- Nature of task
- Identified hazards
- Operating areas (normal and alternate)
- Review of standard calls
- Review of hazards analysis
- Discussion of personal protective equipment
- Stop work authority
- Location of personnel
- IMSAFE checklist (see appendix)

The briefing should also include emergency actions as outlined in 4.10, and all personnel should be made aware of location and contents of Emergency Procedures documentation. The RPIC should satisfy him or herself that all personnel involved in the operation understand their role and are capable of carrying out their responsibilities.

Cordon Procedure

As part of the site survey, it should be decided where a cordon is to be established. This will be governed by a dynamic risk assessment.

Potential distraction to the RPIC should be minimized; at minimum, a psychological barrier between the RPIC and onlookers should be established. Some examples on how to accomplish this include high visibility vests, cones, or signage.

Weather Checks

Prior to flight, the current meteorological conditions at the operating site should be measured and recorded. The RPIC is responsible for ensuring local conditions are within the operating parameters of the sUAS and all applicable regulations. Additionally, it is recommended that a weather radio be accessible on-site for accurate weather conditions.

Power Systems

The RPIC should ensure the batteries are charged to a suitable level and that the charging area is away from any other sources of ignition. A fire extinguisher should be in close proximity to the charging station.

Loading of Equipment

The RPIC should ensure all removable payloads are attached securely to the sUAS prior to flight. The method and mountings for attaching the payload should be fitted according to the manufacturer's instructions.

0.4 APPLICABLE LEGISLATION (CONT.)

4.5 ASSEMBLY AND FUNCTIONAL CHECKS

Once the site survey has been completed and all appropriate risks have been mitigated, then the RPIC should assemble and calibrate/prepare the sUAS as per the manufacturer's recommendations.

When operating in GPS mode (or equivalent), the RPIC should ensure the sUAS has sufficient satellite coverage to obtain an accurate position. It is important to set the action on failsafe, RTH point, and return height, bearing in mind local obstacles.

If satellite coverage is insufficient or the RPIC opts to fly in a non-GPS mode, then he or she should consider the following implications:

- The impact on the aircraft failsafe mode(s) (RTH)
- Aircraft control and handling (pilot skill, weather)
- Ability to complete task

4.6 PRE-FLIGHT CHECKS

When the RPIC is ready for flight and providing all flight planning and on-site procedures have been completed to his or her satisfaction, the pre-flight checks using the Pre-Flight Checklist should be carried out. (See checklist section in this document for details.)

4.7 FLIGHT PROCEDURES

It is recommended that all phases of the sUAS operation have a corresponding procedure and checklist to ensure all relevant steps are completed. Recommended operation phases and items may include:

- **Start**

The RPIC should ensure the area is clear of any hazards.

- **Take-off**

Arm the system/start the motors, and ensure no errors are present.

- **In Flight**

During the flight, the RPIC should constantly evaluate if the sUAS is responding correctly to control inputs and periodically scan the operating area and beyond for possible infringements. It is the responsibility of the RPIC to ensure VLOS is maintained and risks are mitigated. The RPIC should also periodically review the battery level and other status messages from the drone to ensure continuing safe flight.

- **Landing**

The RPIC should ensure that the landing area is clear and free of personnel and obstacles.

- **Shutdown**

The RPIC should power off the sUAS, retrieve any needed product (pictures, videos, SD Card, etc.) and prepare it for the next flight or proceed with pack-up procedures.

0.4 APPLICABLE LEGISLATION (CONT.)

4.8 EMERGENCY PROCEDURES

The following table details possible recommended actions to be taken by the RPIC and support staff in the event of an emergency. They should be committed to memory. In the event an emergency occurs, the appropriate procedure should be carried out without delay. The RPIC may deviate from the procedures listed in the table, if to NOT do so would result in a higher level of risk. This list is not exhaustive, and it is recommended that RPICs add or adjust as needed.

4.8 EMERGENCY PROCEDURES TABLE

Event	RPIC Actions	Support Crew Actions	Further Information and Preventative Measures
MOTOR FAILURE	• Call drone crashing. • Attempt to control descent. • Carry out post-crash procedures.	• Acknowledge RPIC call. • Locate crash site. • Assist with post-crash actions.	Due to quadcopter design, a motor failure will likely be uncontrollable.
BATTERY FAILURE	• Announce battery issue. • Attempt to control descent.	• Acknowledge RPIC call. • Assist with emergency landing location identification.	On battery powered sUAS, control or time of control will be limited.
TRANSMITTER FAILURE	• Announce lost link. • Visually determine if sUAS is activating RTH.	• Acknowledge RPIC call. • Verify TOLP is clear.	Determine if transmitter failed due to hardware or battery failure.
CONTROL FREQUENCY INTERFERENCE	• Attempt RTH. • Call RTH.	• Ensure RTH path is clear. • Acknowledge RPIC call.	Site survey should identify sources of interference. Further investigation required prior to further flight.
PILOT INCAPACITATION	• Announce issue. • Initiate RTH. • Hand off controller to designated person.	• Ensure RTH path is clear. • Safely land sUAS. • Get medical attention if needed.	Determine cause and implement any possible mitigation (sun protection, minimum sleep requirements, etc.).
AIRSPACE INCURSION	• Take evasive action. • Announce incursion.	• Acknowledge RPIC call. • Monitor deconfliction of sUAS and aircraft. • Provide additional safe locations to navigate to.	Determine if a source of information could have prevented this (ATC radio, local heliport notification of operation, etc.).

0.4 APPLICABLE LEGISLATION (CONT.)

4.8 EMERGENCY PROCEDURES TABLE

Event	RPIC Actions	Support Crew Actions	Further Information and Preventative Measures
GROUND INCURSION	• Take evasive action to ensure the sUAS stays away from individuals. • Announce incursion. • Land in a safe area if individuals do not comply with requests to stay clear.	• Acknowledge RPIC call. • Monitor deconfliction of sUAS and aircraft. • Approach/notify individuals to stay away from the operational area. • Notify law enforcement if individuals are aggressive or do not comply.	Consider better visual barriers and cordons.
FLY - AWAY	• Announce lost fly-away. • Attempt to regain control with other flight modes (ATTI, etc.).	• Acknowledge RPIC call. • Notify any individuals in immediate path. • Notify any airspace controllers within range. • Notify law enforcement.	Check for cause of the issue and mitigate (compass calibration issue, component failure, interference, etc.).
FIRE - GROUND	• Announce fire. • Move to location that is safe. • Identify safe landing location and land. Notify any other individuals of the issue. • Attempt to control the fire and notify/request fire department.	• Acknowledge RPIC call. • Move to location that is safe. • Notify any other individuals of the issue. • Attempt to control the fire and notify/request fire department.	Investigate the cause and take mitigating steps to prevent future cause (safe battery charging location, etc.).
FIRE - AIR	• Announce fire on sUAS. • Identify safe landing location and land. • Notify any other individuals of the issue. • Attempt to control the fire and notify/request fire department.	• Acknowledge RPIC call. • Notify any other individuals of the issue. • Attempt to control the fire and notify/request fire department.	Investigate the cause and take mitigating steps to prevent future cause (change battery inspection/usage procedures).

APPENDIX A

APPENDIX A – RISK ASSESSMENT

The following approach is used to categorize the risks identified in Part B - Risk Management.

Key to the **Risk Matrix table**:

- S = Severity of an impact if an occurrence happens
- L = Likelihood of an occurrence

Multiplying Severity and Likelihood will give an overall score. The thick black line is the **"Line of tolerance"**. Anything above this line represents an unacceptable level of risk and requires additional analysis and mitigation before any job may proceed.

	Critical 5	5	10	15	20	25
	Major 4	4	8	12	16	20
	Significant 3	3	6	9	12	15
	Minor 2	2	4	6	8	10
	Insignificant 1	1	2	3	4	5
		Very Unlikely 1	Slight 2	Feasible 3	Major 4	Critical 5
		LIKELIHOOD OF OCCURRENCE (L)				

Green = Low Risk

Amber 9 = Medium Risk

Amber 10-12 = High Risk

Red = High Risk

Severity of Impact (S)

1 - Insignificant	(have no effect)
2 - Minor	(little effect)
3 - Significant	(may pose a problem)
4 - Major	(will pose a problem)
5 - Critical	(immediate action required)

Likelihood of Occurrence (L)

1 - Very Unlikely	(hasn't occurred before)
2 - Slight	(rarely occurs)
3 - Feasible	(possible, but not common)
4 - Likely	(has before, will again)
5 - Very Likely	(occurs frequently)

APPENDIX B

APPENDIX B – QUICK REFERENCE GUIDE AND FORMS

Introduction

The purpose of this appendix is to assist you through the phases of your flight operations. It contains template forms and procedures for you to use and quick reference material.

The forms and procedures are not prescriptive. You are free, and recommended, to adapt them to your own needs. However, should you choose to use them, you should integrate them with the relevant sections of your operation.

Flight Planning Form

This form documents the basic intentions of the operation, and the pre-site evaluation of airspace, ground conditions, and weather forecast. You may also want to use it as the basis for documentation to be sent to your client.

Site Assessment Form

This details your assessment of the flight location itself and will be completed either on the day of your operation or on a prior pre-assessment visit. It should include a thorough assessment of hazards/risks and the mitigations you will employ.

Normal Procedures

All your flights should follow a set of prescribed procedures. These are often described in a company Operations Manual. The procedures here are generic, and it is recommended that you develop your own procedures and checklists that are specific to your aircraft type and operational model.

Normal Procedures Checklist

This checklist can be used once the normal procedures have been completed, to ensure that all critical items have been completed.

Emergency Procedures

This section outlines the actions required should an emergency occur. Given the time-critical nature of an emergency, it is important that the actions can be recalled from memory. Again, these are a guide, and it is recommended that you develop your own procedures that are specific to your operation and aircraft.

Flight Documentation

The FAA requires that you produce documentation relevant to your operations upon request. While these are not specified, it is reasonable to expect that they should include a pilot flight log, aircraft technical log, and risk assessments, as well as your pilot certification and any applicable waivers.

It is suggested that you adapt the template logs below to suit your aircraft and operational model.

FLIGHT PLANNING FORM

SECTION 1: MISSION DETAILS			
Date of Flight:		Job Number:	
Aircraft Model:		Aircraft Registration:	
Pilot in Command (1):		Mission Summary/Flight Objective:	
Pilot in Command (2):			
Visual Observer:			
Payload Operator:			

SECTION 2: CLIENT INFO			
Tower Owner: Tel: Email: Client: Tel: Email:		Site Address: Site Number: Tower Type: Tower Height Site Name:	
Site Coordinates:			
Vehicle Access:	Y / N		
Site Elevation (ft. AMSL):			
Local Hospital: Zip Code: Contact Number:		Local Law Enforcement:	

FLIGHT PLANNING FORM

SECTION 3A: AIRSPACE		
Controlled or Uncontrolled Airspace in Area of Operation:	Controlled / Uncontrolled	
Airspace Classification of Your Operation:		
Airspace Authorization Required to Operate:	Y / N	
Any Other Regulated Airspace Within 10nm:	Y / N	Classes

SECTION 3B: AIRPORTS (WITHIN 10NM)		
Airport Name	Traffic Pattern Conflict?	Contact Name / Number / Notification Date
1:	Y / N	
2:	Y / N	
3:	Y / N	

SECTION 3C: SPECIAL USE AIRSPACE AND AIRSPACE HAZARDS (WITHIN 10NM)			
Item	Airspace Ref Number(s)	SUA Prohibited	Comments / Restrictions / Control Agency Phone Number
Warning Areas:	W		
Restricted Areas:	R	Y / N	
Prohibited Areas:	P	Y / N	
Military Operations Areas:		Y / N	
Alert Areas:	A		
Controlled Firing Areas:			
Other Airspace:		Y / N	
Temporary Flying Restrictions:		Y / N	
NOTAM Restrictions:		Y / N	

FLIGHT PLANNING FORM

SECTION 4: GROUND ASSESSMENT		
Item	Comments / Restrictions	Mitigations
Populated Areas (within 500m):		
Structures: (Including Structure Elevation - if Operating Above 400ft AGL I.A.W f107.51)		
Protected Wildlife Concerns:		
Site Infringement Risk and Control:		
Roads and Highways:		
Livestock: (Gate and Enclosures)		
Recreational Spaces:		
Adjacent Landowner Notifications: (If Applicable)		
Other Restrictions: (Including Local State Regulations)		

SECTION 5: WEATHER FORECAST			
Wind Strength:		Temperature (Max/Min):	
Sunrise/Sunset: (If Limiting)		Humidity (Approximate):	
Legal Visibility Required:		Forecast Visibility:	
General Forecast:			
K Index: (Space Weather)			

FLIGHT PLANNING FORM

SECTION 6: NOTES, PLANS AND COMMENTS

SECTION 7: APPROVAL TO OPERATE			
Based on the flight planning assessment, I believe the flight can be conducted safely, in accordance with the Federal Aviation Regulations, company Operations Manual, any held CoW, and local state regulations.			
Y / N	Prepared By:	Signed:	Date:

SITE ASSESSMENT FORM

SECTION 1: MISSION DETAILS			
Date of Flight:		Job Number:	
Aircraft Model:		Aircraft Registration:	
Pilot in Command (1):		Mission Summary:	
Pilot in Command (2):			
Visual Observer:			
Payload Operator:			

SECTION 2: CONTACTS			
Person:	Contact Name:	Number:	Details:
PIC (1):			
PIC (2):			
Visual Observer:			
Payload Operator:			
Client:			
Local Hospital:			
ATC (1):			
ATC (2):			
Tower Owner:			
Landowner:			
Network Operations Center:			
Notice to Proceed:			

SITE ASSESSMENT FORM

SECTION 3: WEATHER (ACTUAL)			
Wind Strength:		Temperature:	
Cloud Base:		Dew Point:	
Sunrise/Sunset: (If Limiting)		Relative Humidity:	
Legal Visibility Required:		Actual Visibility:	
Solar weather: (Geomagnetic Index (L/M/H))			
Weather briefings Received: (Summary)			
General Comments: (Sun/Precipitation/Cloud)			

SITE ASSESSMENT FORM

SECTION 4: SITE ASSESSMENT				
Item	Details	Initial Risk Score	Mitigations	Final Risk Score
Proximity to Obstructions:				
Sources of Radio Interference:				
Livestock:				
Site Infringement Risk:				
Proximity to Road: (Overflight of Moving Vehicles)				
Line of Sight Obstructions:				
Surface Condition:				
NOTAMs:				
Climb Out and Approach Path Obstructions (f/w):				
Tower Type:				
Tower Height:				
Guy Wires:				
Cordoning:				

SITE ASSESSMENT FORM

SECTION 5: OPERATIONS	
Item	Comments
Site Secure:	
Two Way Communications: (radio/verbal/other)	
Take-off and Landing Zone Identified:	
Emergency Landing Area(s):	
Emergency Inflight Holding Area Identified:	

SECTION 7: APPROVAL TO OPERATE			
Based on the flight planning assessment, I believe the flight can be conducted safely, in accordance with the Federal Aviation Regulations, company Operations Manual, any held CoW, and local state regulations.			
Y / N	Prepared By:	Signed:	Date:

NORMAL PROCEDURES

These procedures are designed to assist the pilot in site preparation and unmanned aircraft operation. The procedures are generic for multi-rotor small unmanned aircraft, so they may not be suited to all types.

BEFORE START		✓
SITE ASSESSMENT	COMPLETE	
• Complete the site assessment form • Complete any actions required to mitigate risk • Secure the site from third parties • Secure take-off and landing zones if required		
IMSAFE	REVIEW	
• **Illness:** Do you have current or recent illnesses that could affect flight? • **Medication:** Have you been taking any meds that could impair your ability to fly? • **Stress:** Are you experiencing unusual psychological pressure and/or anxiety? • **Alcohol:** Have you had any alcohol in the last eight hours? Are you hungover? • **Fatigue:** Are you tired and/or not adequately rested? • **Emotion:** Are you emotionally upset about anything?		
TECHNICAL LOG	REVIEW	
• Review technical log for defects • Check any maintenance action/defects has been completed/cleared		
AIRFRAME	ASSEMBLE	
• Assemble airframe (propellers, motors, gimbal and payload)		
SAFETY EQUIPMENT	CHECK and DISTRIBUTE	
• Check condition of equipment • Position equipment as required		
BATTERIES	CHECK and INSTALL	
• Check condition and charge sufficient for flight • Connect to aircraft electrical system • Check mountings for security		
PRE-FLIGHT INSPECTION	COMPLETE	
• Propellers: check position, mounting and condition • Battery: check mounting • Airframe: check general condition, connections and fittings • Payload mounting: secure		
EMERGENCY ACTIONS	REVIEW	
• Review emergency landing and holding areas		
CONTROL LINK		
• Establish as per manufacturer's recommendation		

NAVIGATION SENSORS AND AVIONIC	CALIBRATE	
• Program and align any sensors on the aircraft		
BEFORE START CHECKLIST	COMPLETE	
• Complete the before takeoff checklist • Start engines • Note start time		
TAKEOFF AREA	CLEAR	
• Check takeoff area clear of persons and foreign objects		
AFTER TAKEOFF		✓
CONTROLS AND RESPONSE	CHECK	
• Once stable in hover at a low-level, check flight controls and correct response		
AFTER TAKEOFF CHECKLIST	COMPLETE	
• If single pilot - this is a memory item		
AFTER LANDING		✓
ENGINES		
• Shutdown engines • Note shutdown time • Log flight parameters • Switch off remaining equipment		
BATTERIES	DISCONNECT	
• Disconnect all batteries from the electrical system • Check overall condition • Allow batteries to cool		
AFTER LANDING CHECKLIST	COMPLETE	
POST FLIGHT INSPECTION	COMPLETE	
• Airframe: check condition • Propellers: check condition • Payload mounting: check condition • Landing gear: check condition		
POST FLIGHT		✓
BATTERIES	SECURE	
• Secure batteries in a safe container		
TECHNICAL LOG	COMPLETE	
• Complete aircraft records • Complete logs for propellers and batteries • Record any defects that have occurred during flight • Record and submit Incident Report if applicable		
PILOT LOG	COMPLETE	
COMPANY PAPERWORK	COMPLETE	
• Complete any paperwork relating to the task • Notify NOC if required		

NORMAL PROCEDURES CHECKLIST

These procedures are designed to assist the pilot in site preparation and sUAS operation. The checklist is designed generically for multi-rotor unmanned aircraft, so they may not be suited to all types. In this instance, the pilot should refer to the manufacturer's instructions or develop his or her own operating procedures. The normal checklist is used to check that critical items have been completed prior to the commencement of a particular flight phase.

BEFORE START		✓
Site Assessment	COMPLETED	
Pre-Flight Inspection	COMPLETED	
Battery Charge	SUFFICIENT	
Control Link	ESTABLISHED	
Navigation Sensors and Avionics	CALIBRATED and SET	
Takeoff Area	CLEAR	
Network Operations Notification	NOTIFIED	
AFTER TAKE-OFF		
Flight Controls	CHECKED	
AFTER LANDING		
Engines	OFF	
Battery	DISCONNECT	
POST FLIGHT		
Aircraft Inspection	COMPLETED	
Technical Log	COMPLETED	
Post Flight Paperwork	COMPLETED	

EMERGENCY PROCEDURES

These procedures are designed to assist the pilot in carrying out the required actions in the event of an emergency. The checklist is designed generically, for multi-rotor unmanned aircraft, so they may not be suited to all types. In this instance, the pilot should refer to the manufacturer's instructions or develop his own operating procedures. Due to the time - critical nature of emergencies, the pilot should be able to recall any critical actions from memory, and then refer to the checklist when time is available.

SITE INCURSION
Incursion into the flight area by person or vehicle not under the control of the PIC.
REPOSITION AIRCRAFT Reposition aircraft to increase separation and hold until third party is clear. If third party continues to encroach site or approaches pilot: **LAND ASAP** Land at first available safe location.

AIRSPACE INCURSION
Aircraft noise heard in the vicinity of the site.
ATTEMPT TO LOCATE AIRCRAFT If unable to locate aircraft: **REDUCE ALTITUDE** Bring aircraft to low level hover. If aircraft located: **ASSESS THREAT** If no threat: **CONTINUE FLIGHT AND MONITOR** If threat: **REDUCE ALTITUDE OR LAND**

LOSS OF ENGINE POWER
Partial or complete loss of power of one or more engine.
LAND ASAP Land aircraft at the nearest available safe location.

EMERGENCY PROCEDURES

FIRE OR SMOKE

Smoke and/or fire coming from aircraft.

LAND AIRCRAFT ASAP

Land at the nearest available safe location.

ENGINES OFF

Shut engine(s) down and make safe.

CLEAR AREA

Clear people and hazards from around the aircraft

REQUEST ASSISTANCE

Raise the alarm and request assistance (emergency services, if required).

GATHER SAFETY EQUIPMENT

If safe to approach, do so:

EXTINGUISH FIRE

Use CO2 or a powder extinguisher.

DISCONNECT BATTERY

LEAVE TO COOL

TRANSMITTER BATTERY FAILURE

Failure of the transmitter battery.

AIRCRAFT ENTERS FAILSAFE MODE

LOSS OF CONTROL LINK

Failure of the signal between the transmitter and aircraft.

AIRCRAFT ENTERS FAILSAFE MODE

GPS FLYAWAY

Operating in GPS mode control of aircraft is lost or becomes erratic.

SELECT "ATTI" MODE (OR EQUIVALENT WHERE FITTED)

This disables the GPS.

LAND ASAP

Once control has been recovered, discontinue flight.

If unsuccessful:

LAND ASAP

Reduce throttle to increase the rate of descent. Attempt to land in safe location.

If unsuccessful:

CONTACT ATC IF REQUIRED

If the flyaway is in the direction of an airspace hazard, contact appropriate ATC unit or authority.

EMERGENCY PROCEDURES

AIRCRAFT BATTERY FAILURE (APPLICABLE TO MULTI BATTERY AIRCRAFT ONLY)

Failure of a battery on an aircraft with additional multiple batteries connected.

ESTABLISH FLIGHT TIME

Determine remaining flight time and monitor endurance.

RETURN AIRCRAFT HOME

Return the aircraft to the landing zone.

If remaining endurance is insufficient to return home:

LAND ASAP

Land aircraft in nearest available safe location.

PILOT INCAPACITATION

Pilot becomes unwell to the extent that the safety of the flight is/will be compromised.

ADVISE GROUND CREW MEMBER

LAND AIRCRAFT

Return the aircraft to the landing zone or land in the nearest safe location.

If unable to maintain control of aircraft:

ACTIVATE AIRCRAFT RTH FUNCTION

This will activate failsafe mode.

If unable to activate RTH function:

GROUND CREW ALERT

Ground crew should activate RTH function.

POST CRASH (MINOR)

PROTECT

Clear people and hazards from around the aircraft.

Turn off the motors and the controller.

REQUEST ASSISTANCE

Inform team members of the event.

GATHER SAFETY EQUIPMENT

If there is any risk of battery damage, use appropriate PPE (Personal Protective Equipment).

CONTROL THE DAMAGE

If safe to approach,

DISCONNECT BATTERY

LEAVE TO COOL

COLLECT EVIDENCE

Gather as much information as possible.

Take detailed pictures and get statements from witnesses.

Collect data and prepare company air safety report, if required.

EMERGENCY PROCEDURES

POST CRASH (MAJOR)

PROTECT

Clear people and hazards from around the aircraft.
Provide lifesaving first aid if required.
Do not approach the aircraft.

REQUEST ASSISTANCE

Raise the alarm and request assistance (emergency service, if required).

GATHER SAFETY & MEDICAL EQUIPMENT

Only approach the Aircraft using PPE (Personal Protective Equipment).

CONTROL THE DAMAGE

Provide first aid if required.
Prevent or extinguish any fire.
If safe to approach and to do so:

EXTINGUISH FIRE

Use CO2 or a powder extinguisher.

DISCONNECT BATTERY

LEAVE TO COOL

COLLECT EVIDENCE

Gather as much information as possible.
Take detailed pictures and get statements from witnesses.
Collect data and prepare company air safety report if required.

INCIDENT REPORT

POST INCIDENT REPORT			
Date Time of Flight:		Job Number:	
Pilot in Command (Name and Contact):		Mission Summary:	
Observer/Payload Operator:			
Aircraft Type/Registration:			

DESCRIPTION OF INCIDENT	
Written Description (Use Additional Paper, if Required):	
Persons and/or Property Injured and Material Losses	
Sketch of Incident Site (Include as Much Detail as Possible):	
Weather Details:	
Details of Police Report, if Applicable.	

INCIDENT REPORT

POST INCIDENT CHECKLIST		
Evidence	Y	Evidence Collected:
File Safety Report	Y	Ref Number and Date:
File report to FAA Regional Operations Center	Y	Ref Number and Date:
Include Flight Paperwork	Y	
Notify NOC	Y	

PILOT FLIGHT LOG

PILOT FLIGHT LOG						
PAGE [ ]						
Pilot in Command	Date (DD/MM/YYYY)	Job Number	Aircraft	Payload(s)	Location	Flight Duration (HH:MM)
					CUMULATIVE TOTAL:	

AIRCRAFT TECHNICAL LOGS

PART 1: AIRCRAFT

TECH LOG PART 1: AIRCRAFT								
AIRCRAFT TYPE/SERIAL NUMBER: [ ]								
PAGE [ ]								
Date (DD/MM/YYYY)	Job Number	Flight Duration (HH:MM)	Battery Location One		Battery Location Two		Defect Raised (Y/N)	Defect Number(s)
			Number	Capacity Consumed (mAh/%)	Number	Capacity Consumed (mAh/%)		
CUMULATIVE TOTAL:								

AIRCRAFT TECHNICAL LOGS

PART 2: BATTERY (B) LOG

TECH LOG PART 2: BATTERY (B) LOG									
PAGE [ ]									
B1		B2		B3		B4		B5	
Flight Time (HH:MM)	Capacity Consumed (mAh/%)	Flight Time (HH:MM)	Capacity Consumed (mAh/%)	Flight Time (HH:MM)	Capacity Consumed (mAh/%)	Flight Time (HH:MM)	Capacity Consumed (mAh/%)	Flight Time (HH:MM)	Capacity Consumed (mAh/%)
CUMULATIVE TOTALS:									

* Some pilots also maintain a log of the hours of flight conducted on each propeller to track maintenance and replacement. This is a personal choice, but more pertinent to those pilots operating larger types with hand-balanced wooden props or carbon fiber props that have a defined life span.

AIRCRAFT TECHNICAL LOGS

PART 3: DEFECT AND MAINTENANCE LOG

TECH LOG PART 3: DEFECT AND MAINTENANCE LOG				
PAGE [ ]				
Defect or Maintenance Number	Defect Raised/Maintenance Reason	Work Carried Out	Parts Replaced	Cleared for Flight (NAME) Date (DD/MM/YYYY)

PART 107 QUICK REFERENCE

TYPE OF OPERATION	LIMITATIONS	COMMENTS
Weight Restriction	The sUAS must be <55lb to be operated under Part 107	>55lbs falls under Section 333 exemption
Max Ground Speed	100mph (87 knots)	
Max Height	400ft (AGL)	or higher than 400ft AGL when within 400ft of the structure
Min Visibility	3 Miles from Control Station	
Clouds	Aircraft must be >500ft below cloud Aircraft must be >2000ft horizontally from cloud	
Operating Over People	Not Permitted Unless:	EITHER The person is directly participating. OR The person is located under or within a protective structure or inside a stationary vehicle, that can provide reasonable protection. OR Waiver has been obtained.
Operating From a Moving Vehicle	Permitted over a sparsely populated area only.	The PIC must not be driving the vehicle.
Transportation of Property	Permitted, but only within state boundaries.	
Controlled Airspace (class A, B, C, D, E)	Not permitted without ATC permission.	
In the Vicinity of Airports	No notification or authorization required, BUT There must be no interference with airport operations or traffic patterns.	Voluntary notification should be considered.
Night Operations	Not Permitted	Waiver can be obtained.
Daylight Operations	Sunrise to sundown including "civil twilight" defined as 30 minutes before dawn and 30 minutes after dusk with anti-collision lighting visible at least 3 statute miles away equipped to the sUAS	

Photo Credit: Eagle Drones, LLC