

PLACER
MOSQUITO
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CONTROL
DISTRICT

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Mosquito Assessment and Vector Control (MAC) Small Unmanned Aircraft System (sUAS) Aviation Training Manual

Unmanned Aircraft System Program (MAC-UASP)

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Abbreviations & Terms

- AGL Above Ground Level
- AIR Plan Accident Incident Response Plan
- AOO Area of Operation
- CONOPs Concept of Operations
- Contractor Any Vendor, Contractor or Subcontractor engaged in flight operations in support of MAC operations
- C.F.R. Code of Federal Regulations
- ETA Estimated Time of Arrival
- FOM Flight Operation Manual
- LZ Landing Zone
- MAC-UASP Mosquito Assessment and Control UAS Program
- Memos Operations Memos
- MEL Minimum Equipment List
- MSA Minimum Safe Altitude
- NOTAM Notices to Airmen
- OEM Original Equipment Manufacturer
- PPE Personal Protective Equipment
- QIP Qualified Instructor Pilot
- ROW Right of Way
- RPIC Remote Pilot in Command
- RTH Return to Home
- SMS Safety Management System(s)
- sUAS Small Unmanned Aircraft Systems
- SWEAP Safe Worker & Environmental Awareness Program
- TFR Temporary Flight Restriction
- TM sUAS MAC Training Manual
- TSAP Temporary Structure Access Pad
- UA (sUA) The vehicle component of the overall unmanned system
- VFR Visual Flight Rules
- VMC Visual Meteorological Conditions
- VLOS Visual Line of Sight
- VO Visual Observer

1. Introduction

1.1 Purpose

This MAC Small Unmanned Aircraft System Aviation Training Manual (hereinafter referred to as the TM) outlines, introduces, and provides the requirements and procedures for qualification as a MAC Small Unmanned Aircraft System Pilot for the current approved aircraft under the Placer Mosquito and Vector Control District (District) Mosquito Assessment and Control-Unmanned Aircraft System Program (MAC-UASP) and in accordance with all regulatory approvals. It serves as a guideline for required elements in contractor training curricula to satisfy requirements for flight on behalf of the District. It also outlines the understanding and expectations for training to operate small unmanned aircraft systems (sUAS) in compliance with all Federal, State, Local, and District requirements.

The topics covered in this manual include the knowledge, skills, and abilities requisite for safe flight as determined by the District. All Pilots-in-Command (PICs), Visual Observers (VOs), and Payload Operators (PO) must meet the requirements contained in this manual before taking part in commercial flights before approval from a qualified instructor.

Safety is considered above all mission focus, and therefore it must be recognized that all elements included in this manual are done so to develop and mature safety. Safety requires continued development and attention and therefore Safety Management Systems (SMS) training has been included in this manual.

1.2 Objectives

The objectives of the TM are to:

- Ensure safe and effective sUAS aviation training in support of MAC operations meeting all regulatory, and organizational requirements;
- Standardize unmanned aircraft crew member communications and operations through an ongoing CRM training program (in accordance with AC 107-2);
- Facilitate the ability of personnel from different contractors to develop training programs that meet MAC requirements;
- Provide quick and easy documentation for successful flight operations including, but not limited to, checklists, AIR response plans, and reporting tools.

1.3 Authority

All sUAS flight operations conducted either by MAC employees are subject to the policies and procedures included in this TM. Should the AOM policies and procedures differ from those included in this Manual, the District will be notified immediately for resolution.

Any conflict between this manual and applicable Federal Regulations, District's approvals and operations specifications is unintentional. Should a conflict be discovered, the regulation, approvals, or operations specifications will take precedence, and the MAC-UASP Manager will be notified immediately.

All aircraft flown in support of MAC will be operated in accordance with the Manufacturer's User Manual (MUM). If a conflict arises, the MUM will take precedence (except when the FOM presents a higher level of safety such as maximum flight speed, altitude, or flight in populated environments), and the MAC-UASP should be notified of the conflict.

1.4 Distribution & Revision

The TM will be made available to all personnel involved in flight operations, their management, and MAC representatives as well as pilots flying in support of MAC, and should be available for all operations. A copy must be kept with the operator crew as part of an "operations kit" in either digital or hardcopy. The original TM copy will be kept and maintained by the MAC-UASP Manager.

The MAC-UASP Manager will revise the TM as needed, and will notify employees and contractors when changes have been made. For changes of a more immediate nature, particularly those involving safety, the company will use Operations Memos to supplement, but not change, the guidance contained in the TM. Operations Memos will not be issued with an expiration date, and will periodically be reviewed for validity and pertinence, and for potential incorporation into the TM or for cancellation. Operations Memos will be provided via e-mail, hardcopy, or newsletter and made available to all operators. All significant revisions will be documented and maintained in the revision section of the TM.

1.5 Mission-Specific Guidance

Other manuals may be created as needed for specialized missions not otherwise addressed by this manual. These may include chemical dispersion, beyond visual line of sight (BVLOS), or other higher risk operations that go beyond the 14 CFR Part 107 allowances.

1.6 Integrity

Safety is the mission. The policies and procedures in the FOM, and its companion regulatory documents, are primarily designed to enhance safety. Deviations from these policies and procedures should *only* be made in extraordinary circumstances and when prior approval, when possible, is obtained from the District. Other violations of these procedures may result in permanent removal from MAC-UASP worksites, and, for contractors, contractual termination and possible financial penalties.

1.7 Safety

The District is committed to providing an accident-free and healthy workplace with the belief that safety is an ongoing objective, rather than a goal that is simply “met.” The TM supports MAC-UASP’s objectives of:

- The continuous pursuit of “no harm to people or property;”
- Promoting a culture of open and voluntary reporting of all safety risks through “Just Culture;”
- Developing effective safety, environmental, and health management policies and systems;
- Conducting regular audits of safety objectives, policies, practices and procedures;
- Ensuring compliance with all Federal, State, and Local regulations;
- Providing the necessary company resources to support these policies.

District employees are expected to make safety their first priority for all operations and to maintain a safe work environment through adherence to approved procedures, training and communications. They should familiarize themselves and comply with all relevant safety, health and environmental policies and regulations and should also work in a manner that safeguards themselves, their coworkers and other persons with whom they are working.

The mechanisms through which the District will accomplish its safety goals, and affect the empowerment of all personnel to become actively involved in the safety culture, are detailed in the Safety Management System (SMS) in Section 6 of this manual. Perhaps the most important element of developing a clear understanding of safety, is to understand all elements of the sUAS itself, the operating environment within which each operation will take place, and the mission goals and parameters. These elements are often recognized as the Concept of Operations (CONOPs), and is a fundamental component of any risk assessment.

2. Qualifications

2.1 Regulatory

The current regulatory environment requires a MAC Remote Pilot in Command (RPIC) to hold and keep current a 14 C.F.R 107 compliant Remote Pilot Certification. This authorizes, for compensation or hire, sUAS flight operations as of the date of its issuance. It comes with a restriction on the types of aircraft capable of being flown for commercial purposes, including a weight, speed, and altitude limitation that can be waived in accordance with FAA application.

As the regulations governing flight operations change, it is recognized that flight limitations will adapt to the needs and availability of the national airspace. This Training Manual considers the regulatory and standards guidance offered by the International Civil Aviation Organization (ICAO) in Doc 10019 An/507: Manual on Remotely Piloted Aircraft and Industry Best Practices until such time that the FAA has outlined specific needs for sUAS Flight Training Manuals.

The FAA Certification process has not identified minimums for qualification of pilots for the commercial nature of the MAC sUAS operation. As such, MAC will voluntarily train their PICs, VOs, and Payload Operators to a higher training standard as determined by MAC-UASP. As the flight qualifications change through continued rulemaking and industry best practices likewise evolve, all efforts will be made to meet and exceed those standards using this Training Manual.

2.2 Qualified Instructor Pilot

A Qualified Instructor Pilot (QIP) will be a pilot within the MAC organization (or chosen contractor) chosen based upon overall flight experience, experience in type of sUAS used by MAC, and related training. Their demonstrated performance in the field will be an important qualification for becoming a QIP. A QIP will be designated by MAC-UASP management and based on flight time on the system being used, and previous performance in UAS industry. There may be more than one QIP throughout the organization and it is the intent of MAC to enable all pilots to be qualified to train others. They will also meet the following criteria:

- FAA certified flight instructor (when a sUAS flight instructor designation becomes available)
- sUAS experience
- Experience in type
- Training in simulators if possible
- Previous UAS instructor qualifications
- Knowledge of the MAC mission and AOO
- Demonstrated performance

The QIP must possess all required qualifications for sUAS training including, currently, a Remote Pilot in Command (RPIC) License. The QIP must also meet flight review requirements specified in 14 C.F.R. 61.56 for the sUAS being considered. These requirements include a minimum one (1) hour (or three (3) successful sUAS mission simulations) of flight training and one (1) hour of aeronautical knowledge review:

- A review of the current general operating and flight rules of 14 C.F.R. part 107 and additional waivers
- A review of the current regulatory requirements for sUAS Operations.

- The QIP will have the following duties regarding training of PICs, VOs, and Payload Operators:
- Conducting and Evaluating Initial Training Qualification Flights
- Evaluating proficiency check flights for PICs
- Maintaining all training and flight records for each sUAS RPIC
- Assisting the MAC-UASP Manager to maintain all flight and maintenance records for each Aircraft, Remote Controller, and battery on which they train
- Maintaining an on-going knowledge of, and relationship with, the FAA and other authorities to understand the regulatory requirements for MAC as they develop
- Determining if the sUAS RPIC is qualified to operate and under what conditions

A QIP may also be responsible for developing training courses, providing training and student evaluation and documentation, and developing new procedures for promoting safety within the organization in conjunction with MAC-UASP Management.

2.3 Initial Training

Remote Pilot in Command (RPIC)

Initial training will consist of the following prior to confirmation of active flight qualification:

- All operators seeking to begin training will hold either an FAA RPIC 14 C.F.R. 107 Certification or Temporary Certification.
- QIP supervised flight training program that includes no less than three (3) successful “mission specific” training flights using “hands-on” (Non-automated) flight methods
- QIP supervised flight training program that includes no less than three (3) successful “mission specific” training flights using “hands-off” (automated) flight methods
- QIP supervised instruction regarding maneuvers that test knowledge and response when encountering emergency or unsafe conditions which may arise.
- AOO focused training that includes local area knowledge applicable to sUAS operations

Initial training will be documented using Form ATM 2.3 (Appendix 3) and kept in PIC’s file.

Visual Observer (VO)

VO will have annual training which will include day and night operations. Training will consist of the following prior to being assigned to a MAC-UAS RPIC:

- Knowledge to recognize and overcome visual illusions
- Understand physiological conditions which may degrade night vision
- Understand the PMVCD MAC-UAS Night Ops Safety Plan
- 14 CFR Part 107 Regulations
- Understand all terms and provisions of PMVCD MAC-UAS Waivers
- Understand VO responsibilities in District Flight Ops Manual (Section 4.1)

Annual training will be documented using Form ATM-VO (Appendix 6) and filed with QIP.

2.4 Maintaining Currency on Type

To be considered “current” by the MAC MAC-UASP, a RPIC must have one (1) successful qualifying take-off and landing within the last ninety (90) day period using sUAS which they are qualified to operate with and plan to use, including the user interface.

Example: If a RPIC seeks to fly a rice-field inspection mission involving a water landing and larvae detection, they will have had to have had at least one (1) rice-field inspection mission flight (or simulated flight) within the previous 90-day period using the same software interface as would be used in field.

If 90 days have passed, and a successful flight have not been flown, the RPIC must regain currency by reviewing normal and emergency procedures, familiarizing themselves with this sUAS, including associated software, and providing documentation that this review has taken place.

If 180 days have elapsed, the sUAS pilot must complete a checkout as developed by the QIP at their discretion. This may include up to three (3) successful training flights. Currency training will be documented using Form ATM 2.4 (Appendix 4) and kept in the PIC’s file.

2.5 Recurrent Training

Each RPIC must complete an annual review and refresher class every 12 months to ensure proficiency in the sUAS as well as aeronautical knowledge relevant to the AOO and mission tasking. The re-currency training date shall be based upon the last day of the month in which the proficiency flight is accomplished. The recurrent training requirements will be determined by the QIP and documented in the RPIC records. At a minimum, the recurrent training will include an aeronautical knowledge exam along with a “simulated mission” currency flight administered by the QIP. Recurrent training will be documented using Form ATM 2.5 (Appendix 5) and kept in the PIC’s file. Topics that should be included in the proficiency flight are:

- Flight Planning;
- Mission Briefing;
- Ground Procedures;
- sUAS Launch;
- Normal and Emergency maneuvers;
- Post Landing Procedures;
- Mission Debrief.

2.6 Logging of Flight Time

sUAS pilot qualifications for all MAC aircraft will be maintained by the MAC-UASP Manager. However, all RPICs shall log flight time for each flight, from the time the RPIC launches the aircraft until the aircraft has landed. There are several options for logging personal flight time, however currently the flight time will be logged via airdata software. It must also be tracked by the RPIC personally as a hardcopy backup.

Likewise, all VO and Payload Operator flight time should be kept by those individuals involved in the mission. Their personal log book should be kept up to date and available for inspection during any flight operation.

2.7 MAC Safety Training

“Safety Above All” is the motto of the MAC-UASP. Safety is the number one priority for all MAC employees and therefore on-going safety training will take place as needed and in a continuous and well regimented manner. It is up to the MAC-UASP Management and all crew members to identify safety concerns before they evolve into mishaps or accidents, and help cultivate a strong safety culture throughout the organization. Safety trainings will be conducted as specified in the Safety Management Systems Manual.

At a minimum, there shall be a specific Safety Training every 6 months where all medium and high risk operations will be discussed. All hazard reports will be examined for trends and presented at this bi-yearly meeting. MAC-UASP Management will provide a presentation on the “Top 5” safety concerns within the organization, and provide briefings on industry wide news that may impact safety.

2.8 RPIC Training for non-107 operations Under Current Authorizations

- **Non-Daylight Operations**
 - Night Hazard Training with RPIC and VO, Testing for RPIC
 - Mission Training with QIP
- **Part 137 Operations**
 - RPIC must obtain a VCT -UAS License from CA DPR
 - Understand District’s 137 FAA exemptions, conditions, and limitations
 - Mission training with Chief Supervisor of Agricultural Operations

2.9 Grounding of Flight Crewmembers

Mandatory, temporary, grounding of sUAS crew members will occur for any of the following reasons until the identified corrective action is completed:

- **Proficiency Flight Overdue**
 - MAC-UASP may waive this requirement if unforeseen circumstance arise, however a proficiency flight must be completed as soon as is practicable.
 - A proficiency flight cannot be waived by anyone other than the MAC-UASP Management in writing.
- **Mandatory Administrative Grounding**
 - Any sUAS flight crew involved in a mishap that results in loss of an aircraft, a midair collision with a manned aircraft, or creates a high possibility for death or serious injury, will be suspended from all sUAS flight activities pending a review by MAC-UASP.
 - A sUAS mishap due to technical problems beyond the control of the flight crew (i.e. such as to a lost link, a planned and briefed hazardous test, or vehicle loss due to a software design problem) may not necessarily result in a mandatory flight crew grounding for sUAS operations.

- In this instance, review of maintenance procedures and a root cause analysis will be conducted to determine how the vehicle failed and to prevent similar instances in the future
- The duration and release from grounding will not exceed 30 days without review by MAC-UASP Management.
- **Violations**
 - MAC-UASP has the authority and responsibility to ground any sUAS crew member, in writing, for a period of up to 30 days for disciplinary or flight safety violations or for other reasons as deemed appropriate. They also have the authority and responsibility to recommend permanent grounding of any flight crew.

3. System Specifications

All System Specification information can be found in the Flight Operations Manual (FOM) Appendices for the particular aircraft being utilized. All contractors must ensure they have understood the MAC FOM and its requirements, and can fly the their respective UAS safely. They must also ensure that the training program for that unmanned aircraft has been approved by MAC, and they meet all regulatory requirements.

The below section outlines all required specifications documentation necessary for approval prior to flight and reflects the same information contained within the MAC FOM.

3.1 System Change Management

MAC may choose to purchase products and services in to conform to greater need, application, or process change in the interest of safety, customer satisfaction, deliverables, or regulatory change. In this instance, MAC will undertake a full review of system specification in the Concept of Operations approach taking into consideration the following elements:

- **People** – training, availability, ability,
- **Environment** – AOO, altitude, population densities, regulatory compliance
- **System Capabilities** – payload, C2 capabilities, automation, reliability
- **Mission & Safety Considerations**– reliability, ease of use, etc.

Purchasing decisions will be made in consultation with MAC purchasing department and in the interest of safety and regulatory compliance and will be documented for future analysis and discussion.

Suppliers will be chosen in accordance with MAC practices, and MAC-UASP management discretion.

Any purchasing decision of system or service will be preceded by adequate testing and evaluation by MAC management and MAC-UASP sign off as needed.

3.2 Unmanned Aircraft System Specifications

- Flight Controls
- Engines, Propellers, Rotors
- Avionics
- Communications Equipment
- Control & Input
- Command and Control (C2) Link
- Frequencies

3.3 Performance & Limitation

- Weight
- Top Speed
- Endurance (Maximum Flight Time)
- Batteries
- Prohibited Maneuvers
- Maximum Operating Altitude
- Never Exceed Speed
- Maximum Wind Limitations

4. Flight Training

Initial training will provide the knowledge, skills, and abilities to fly sUAS in the National Airspace System in a manner consistent with the latest Federal, State, and Local regulatory environment, and MAC policies and procedures.

The following section illustrates the basic knowledge that RPICs will be required to exhibit prior to accepting operations. It must be noted that all elements of the flight crew – Payload Operator, RPICs, and Safety Officer/Visual Observer – require different training and that training in one does not denote qualification in another. Qualifications for each position will be tracked and managed by MAC-UASP and ideally each member of the flight crew should be able to take over for the other, which is why VOs should be trained as pilots as well.

4.1 Pre-Flight Planning & Authorization

The MAC-UASP Manager will receive all sUAS operational requests via the service request form developed and maintained by MAC-UASP staff. They will then conduct an initial assessment to ensure the location and time requested complies with regulatory and airspace restrictions in accordance with the training manual.

The MAC-UASP will assign the flight operation to an approved, current, and available pilot for the operation and notify them of any safety concerns identified in the assessment.

The RPIC will confirm with MAC-UASP that a Notice to Air Men (NOTAM) is filed not later than 24 hours prior to the operation if deemed necessary (not required under 14 C.F.R. 107 regulations, but may be for higher risk environment approvals such as flights over people, BVLOS, or night flights) and provide any other guidance to the assigned pilot for the situation in the area (potential aircraft, ground traffic, site-hazards previously mentioned, monthly safety items that may be relevant).

4.2 Refueling, On-site Maintenance, Battery Swap, Configuration Management

All maintenance will be currently conducted by manufacturer approved and trained personnel either on-site or off-site in accordance with their policies. If training has been provided to MAC personnel, or contractors, the following elements must be considered and documented:

- Procedures for battery testing and charging with all system elements
- Procedures for all battery swap and charging on—site
- Installation of protective elements for the sUA
- Cold weather operating procedures and storing to ensure system viability and health

4.3 Required Operations Knowledge

All phases of flight will be trained to, and all RPICS will be considered current and “flight ready” for the following phases of flight according to the policies and procedures of this manual. The specifics of these flight phases will be outlined and approved per the sUAS being certified to, and derived largely from manufacturer user manuals.

- On-Site Pre-Flight
- Launch of sUAS
- Landing of sUAS
- Post-Flight

4.4 Payload Operator Required Knowledge (if used)

Prior to flight authorization, all payload operators will be trained and knowledgeable about the payload being used in accordance with manufacturer user manual, and to the approval of the MAC-UASP manager or the RPIC. Applicable requirements include:

- Licensing (if required)
- Training
- Familiarity with RPA payloads being used
- System limitations knowledge
- Operational briefing

The success and continued operation of payload will be subject to audit to ensure proper use of payload, industry best practices, and manufacturer directed compliance.

4.5 Regulations Applicable to sUAS

MAC is permitted to operate sUAS for commercial operations through the Code of Federal Regulation 14 Part 107 and through amendments or approvals to that regulation. The following documents that are directly related to these regulations and/or approvals are listed below and a working knowledge of their requirements is expected of all RPICs:

- 14 C.F.R. Part 107: Operation and Certification of Small Unmanned Aircraft Systems (sUAS)
- 14 C.F.R. Part 91: General Operating and Flight Rules
- 14 C.F.R Part 137: Commercial Agricultural Aircraft Operations
- All active MAC Certificate of Authorizations or Waivers (CoAs)

4.6 Required Documentation for Operations

MAC RPICs and contractors must maintain the following documentation throughout all aspects of the flight operations at all time:

- All active MAC Certificate of Authorizations or Waivers (CoAs)
- All crew certification documentation
- Flight time logs and pilot certifications
- MAC MAC-UASP Flight Operations Manual & SMS Manual

- MAC Risk Assessment Worksheet
- Manufacturer User Manual & Manufacturer Checklists
- FAA Registration Documentation
- MAC AIR Plan

4.7 Airspace Classification

Basic aeronautical knowledge, as it pertains to all aviation, should be known including all airspace classifications. This knowledge will be acquired through the 14 C.F.R. 107 sUAS Pilot Licensing Exam and preparation.

All RPICs should be able to identify and explain airspaces as illustrated in the chart below:

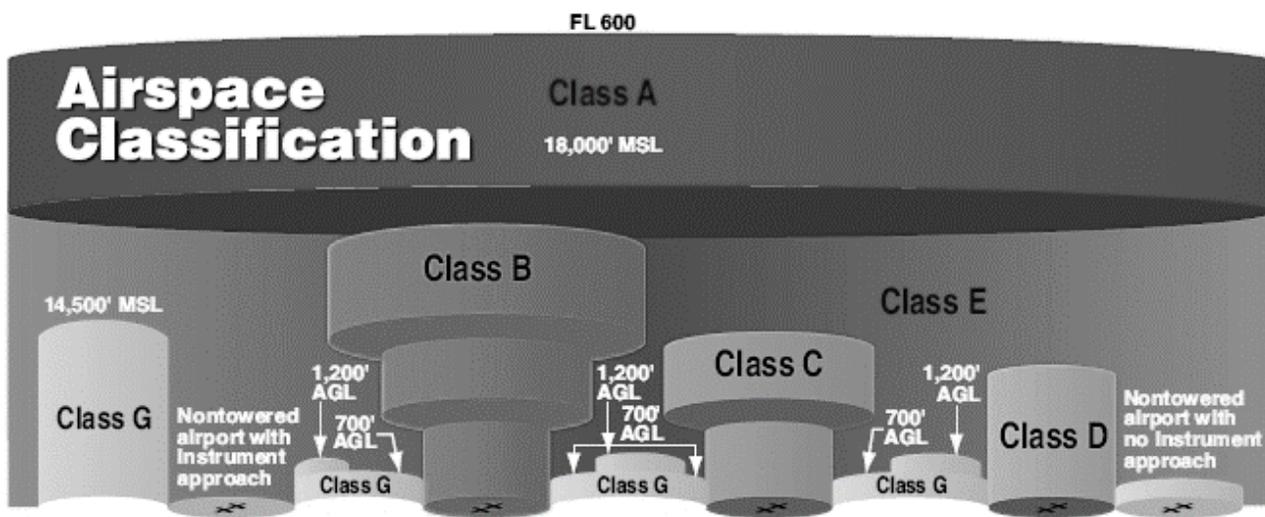


Figure 1: Airspace Classifications, Credit: FAASafety.gov

RPICs should be able to explain what airspace they are permitted to operate in, under what regulation, exemption, or authorization and what may happen if they enter other types of airspace.

4.8 Flight Restrictions

Flights are restricted to Line of Sight Operations only unless specifically approved by MAC-UASP Manager upon receipt of approval or waiver for 14 C.F.R. 107.

All UAS flights should be reviewed by MAC-UAS Lead Pilot.

All UAS flights must be approved by MAC-UAS Program Manager prior to mission.

4.9 Pre-Flight Briefing, Inspection, Assessment

Flight planning, briefing, and area assessment is a fundamental part of the sUAS flight process to achieve safe and efficient conditions. All sUAS flights conducted by the RPICs will be planned and briefed in accordance with the MAC-UASP procedures.

A Pre-flight inspection should be conducted by both the RPIC and VO according to the Manufacturer User Manual.

The pre-flight inspection should, at a minimum, identify and confirm the operational condition of the following:

- Rotor Blades
- Power Plant (motors)
- Batteries
- Mechanical Dynamic Components (each single rotor)
- Autopilot Systems
- Remote Control
- Landing Gear
- All Wires & Connections

The crew briefing is normally the last formal briefing prior to sUAS flight and should be conducted by the RPIC with all crew members involved in the flight present for the pre-flight briefing.

The pre-flight briefing should cover the following:

- Weather
- Operation Flight Plan
- Mission Rules and Limitation, including any needed “Go and No-Go” Criteria
- Aircraft Status
- Crew Status
- Crew Coordination Items
- Risk Assessment Worksheet (Appendix 2)
- Emergency Procedures
- Warning and return to home battery levels (20% and 15% currently)

4.10 Flight Maneuvers

- Automated Flight Maneuvers
 1. Automatic flight maneuvering must be certified by the QIP and is considered the most fundamental approach to MAC commercial operations for VTOL aircraft according to manufacturer user manuals.
 2. These flights consist of three-dimensional maneuvering of the sUA through a combination of waypoint management and flight planning.
 3. A RPIC must first be qualified on fully controlled flight maneuvers before proceeding to automated maneuvers under the supervision and qualification of the QIP.
 4. It will be up to the QIP to determine when the RPIC in training has successfully attained the skill and abilities to fly for MAC/contractor in question.
- Qualification and Documentation
 1. Once a RPIC has demonstrated competence for automated flight maneuvering, the QIP will provide verification and documentation, to that effect.
 2. Once a RPIC has demonstrated competence for both “hands-on” and “hands-off” flight types, they may now be considered active and ready for flight operations.
 3. The MAC-UASP will maintain records as to the completion and qualification of training.

4.11 Clearing an Obstacle During Flight

- Unidirectional maneuvers should be used to clear all obstacles during flight, when possible.
- Do not fly within 20’ of any obstacle if possible.
- It is best to minimize any flight over very high obstacles.
- Do not fly behind any obstacles, as this limits the VLOS between VO and the sUA and can create unknown risk to those beyond the obstacle.

4.12 Weather and Micrometeorology

All pilots are expected to abide by their company's weather regulations outlined in their respective authorizations for flight and must never fly a UAS during a "Red Flag Warning" event.

All flights must take place under Visual Meteorological Conditions (VMC) which are described as:

- At least 3 statute mile visibility
- At least 2,000' horizontally from clouds
- 500' below clouds

Further, no operations will take place when rain, thunderstorms, or lightning is present in the vicinity. In case of unexpected inclement weather, the following procedures should be taken:

1. If practical and safe, return to the departure point
2. If impractical, land as soon as is considered safe by the RPIC
3. If weather conditions permit and if the RPIC and aircraft are appropriately qualified, store all equipment and wait until weather has passed to attempt mission again

For up to date weather information, the MAC-UAS preferred resource of choice is www.1800wxbrief.com (Flight Service). If a visual check of the weather in the area is not sufficient to confirm Visual Meteorological Conditions (VMC), then a weather check is required.

5. Emergency Procedures & Failures

5.1 Fly-Away

This failure condition occurs when the sUAS fails to respond to any control system commands and proceeds on a route unknown to the pilot. This failure condition creates significant risk to other aircraft and persons and is therefore considered a reportable event to all air traffic in the area and MAC-UASP management. If VLOS is compromised during a Fly-Away condition (the sUA position is lost and cannot be reasonably deduced based on current flight conditions or dependable software) an emergency call will be given on the local FX broadcast.

In the event of a Fly-Away the following procedure should be followed:

| S | Action |
|---|---|
| 1 | Switch to Direct Control. |
| 2 | Check for control response and return to the recovery area if control established. |
| 3 | Initiate the Return-to-Land function if control is not established. |
| 4 | Activate the Flight Termination System, if equipped, as needed. See the Flight Termination System section of this standard. |
| 5 | The RPIC is responsible for calling the control tower of any affected airport if control is not regained or if the flight is not terminated. At a minimum, the following information should be provided: <ul style="list-style-type: none">• Estimated position and altitude of the UAV.• Estimated heading, ground speed.• Time of the fly-away and estimated remaining endurance in minutes.• A physical description of the UAV. |

The Fly-Away condition is considered over only when the sUA is either taken control of or landed and recovered. This event must be reported to MAC-UASP management if it occurs at all.

5.2 Lost Link

Any aircraft that fails to respond to positive control, due to any assumed condition, and does not respond within 30 seconds will be considered “Lost Link” and directed to land as soon as is safe. The direction to land will take place even if control is regained after that 30 seconds.

Lost Link can indicate high electromagnetic interference in the area and therefore must be well documented during flight debrief. While it alone is not an emergency condition, it often indicates the potential for signal degradation and should not be taken lightly. The Lost Link event should be documented and reported to MAC-UASP management after the flight, but does not need to be broadcasted on the local area frequency unless it becomes a Fly-Away event.

The RPIC may choose to land immediately at the sUAS current position, or return to the take-off/landing position at their discretion and in the interest of safety. The RPIC should consider all crew member communications in the decision to land or continue. All flight decisions should be made with safety as the main priority.

In the event of Lost Link condition, the following procedure should be followed:

| Step | Action |
|------|--|
| 1 | RPIC alerts the crew of the C2 link loss. |
| 2 | VO maintains visual contact with the UA. |
| 3 | Raise the transmitter making sure that you do not point the antenna at the UA. |
| 4 | Be prepared to maneuver the UA in case a heading or position change caused by execution of the fail-safe allows the C2 link to be reestablished. |
| 5 | If unable to reestablish the C2 link and the UA does not properly execute the Return-to-Land function, execute the Loss-of-Positive-Control procedure. |

5.3 Loss or Degradation of Payload Control

Loss of payload control is not an emergency condition, but often indicates interference with signal from an unknown source. This can indicate signal degradation and the RPIC should be notified by the Payload Operator (if one is in use) as control is degraded, latency between input and execution of commands increases, or otherwise the payload acts strangely. As the flight is focused on mission completion, the inability for payload operation negates the need for the mission to continue.

If at any point the payload becomes inoperable or difficult to control, the Payload Operator should communicate that loss to the RPIC. The RPIC should consider the mission unable to complete and begin return to launch/landing procedures. If payload control is regained, the mission may continue but the loss or degradation should be documented during the post-flight debrief

5.4 Loss or Degradation of Situational Awareness

If at any time during the flight the Visual Observer, Payload Operator, or RPIC experience a loss or degradation of situational awareness, they will communicate that loss to the other crew members. The RPIC will determine if the flight must return to the launch/landing location or if other maneuvers could be done to increase situational awareness in a safe manner. An example would be when flying against a low contrast background, if the VO loses VLOS, the RPIC could ascend above the low contrast background into blue sky, offering an easy to identify sUA. Once the VO positively identifies the sUA, the mission could proceed. If situational awareness remains degraded, sense and avoid ability in relation to the aircraft is degraded and the risk to those on the

ground or in the air increases dramatically. All efforts should be made to regain VLOS.

If at any time the position of sUA becomes unknown, or VLOS is lost when flying under VLOS conditions, the following procedure should be followed:

| Step | Action | |
|------|--|--|
| 1 | Announce: "Loss of visual contact." | |
| 2 | During Direct VLOS Operations, RPIC switches to Position Hold. | |
| 3 | Determine whether other crew members have visual contact with the UA. | |
| 4 | Record the time. | |
| 5 | Look at the ground control station telemetry display for visual-search cueing. | |
| 6 | If ... | Then ... |
| | Visual contact is reestablished, | Continue operations. |
| | Visual contact is not reestablished within 60 seconds after initiating a Return-to-Land function or telemetry does not indicate that the UA is on a Return-to-Land function, | Initiate Autonomous Landing or activate the Flight Termination System (if equipped). |

5.5 Unexpected Aircraft in Flight Environment

If unexpected aircraft come into the AOO, all efforts will be made to make the presence of the sUAS operation known over the local area FX. If traffic increases to an unsafe level, the RPIC will land the Aircraft as soon as is considered safe and shall not launch again until the unexpected air traffic has left the AOO.

5.6 Unexpected People in Flight Environment

All persons within 500' radially from the operating environment will be appropriately identified and warned prior to the first flight in which they are present to develop their understanding of potential hazards with sUAS operations. The warning will include operational information, privacy concerns, emergency procedures, smoking and cell phone policies, the use of fire extinguishers, communication procedures for interacting with the flight crew, safety protocols, and headset usage as is reasonable in the environment of operation.

Persons in the area do not need to receive a full briefing on subsequent flights during the day, but the Visual Observer or other non-RPIC crew member will ensure that these persons understand and comply with all briefing directives.

The RPIC will not take off until they have received verbal or visual confirmation that all persons in the operational environment are not at risk from launching the sUA. Likewise, the RPIC will not land until they have received verbal or visual confirmation that all persons are not at risk from landing the sUA.

If unexpected people or vehicles on the ground enter the AOO, all efforts will be made to avoid flying directly over or near those vehicles and/or people. If traffic increases to an unsafe level, the RPIC will land the Aircraft as soon as is considered safe and shall not launch again until the unexpected people leave the AOO. If they do not leave, the VO has the responsibility to engage with the community to ask them to move to a different location in the interest of safety. If they will not move, operations should be halted and MAC-UASP UAS Advisor should be contacted to discuss further options.

5.7 Accident, Fire or Injury

Any accident, fire, or injury caused or unrelated to flight operations may impact the AOO in negative and unforeseen ways. If an accident, injury, or fire occurs, follow the following procedures to ensure safe environments and in protection of human safety:

| Step | Action |
|------|--|
| 1 | Call 911 if there is a serious injury. |
| 2 | Identify and remove any potential hazards and the energy store (batteries/fuel) from any flammable materials if possible. |
| 3 | Render first aid to any injured person until medical assistance arrives. |
| 4 | Notify Dispatch. |
| 5 | Secure the accident site. Do not remove or disturb anything from the accident site except as needed to provide aid to injured individuals. |
| 6 | If safe to do so, make all efforts to extinguish any fires resulting from the unmanned aircraft (UA) crash or incident. |
| 7 | Once all of the injured have been turned over to the care of emergency responders, the remote pilot-in-command (RPIC) or visual observer (VO) may take photographs, but should not disturb the accident site without permission from local law enforcement and the MAC MAC-UASP Manager. |

For any fire specifically caused by ruptured Lithium-ion—polymer (LIPO) batteries, the following procedure should be followed:

| S | Action |
|---|--|
| 1 | Land as soon as possible. Land at the first location that a safe landing can be |
| 2 | On the ground, disconnect the battery unless it is dangerous to do so. |
| 3 | Use a fire extinguisher to put out secondary fires. <i>NOTE:</i> Do not attempt to put out the battery fire directly unless you are using a Class “D” dry chemical fire extinguisher. |

CAUTION!!: Damaged lithium-ion-polymer (LIPO) batteries are a potential fire hazard due to internal cell short circuits. The accident site must not be left unattended if there are damaged LIPO batteries present. Upon any incident resulting in crash, fire, or injury, local authorities must be notified immediately.

CAUTION!!: If it is safe to do so, damaged batteries should be placed on a fire-resistant surface clear of any flammable material. MAC personnel must never attempt to charge a damaged LIPO battery. All damaged LIPO batteries must be placed in a designated container for containment and disposal.

6. Safety Management Systems

The Mosquito Assessment and Control (MAC), Safety Management System (SMS) is designed to provide the highest level of safety awareness and organizational management of risk. The SMS provides all employees and Contractors with the pathways, system, and knowledge to monitor and report any safety deficiencies and identified hazards anywhere in the organization, and to be involved in developing mitigations strategies for the assessed risk. The SMS provides foundational knowledge and processes for identifying these hazards, assessing their correlated risks, and providing mitigations in a well-documented and efficient way.

This Mosquito Assessment and Control Safety Management Manual (SMM) provides organizational policies and approaches to managing organizational risk including the necessary organizational structure, accountabilities, processes and procedures. This manual follows the recommendations provided by the current edition of the International Civil Aviation Organization (ICAO) Safety Management Manual Document 9859, ICAO Annex 19 and the Federal Aviation Administration SMS Implementation Guide for determining acceptable levels of risk within the organization. This is accomplished, at its core, by collecting and incorporating safety assurance data to develop safety performance targets and safety performance indicators both quantitatively and qualitatively.

Placer Mosquito and Vector Control's MAC-UASP and its leadership are responsible for incorporating SMS risk management processes and procedures into their procedures where needed to ensure the highest level of safety and risk management. Operational leaders, including contractors and involved department representatives, are responsible to determine the level of risk associated with any operation in-situ to identify and assess any unforeseen hazards due to environmental conditions or changes.

Mosquito Assessment and Control internal evaluations and external audits will be used to determine the effectiveness of MAC's policies and procedures in an on-going effort to promote safety and security in all MAC-UASP operations.

The Mosquito Assessment and Control MAC-UASP Manager is the Safety Officer representative, and the General Manager is the Safety Management System "Accountable Executive." This position holds the spending power and resource allocation authority to support the Mosquito Assessment and Control Safety Management System.

6.1 Safety Management Systems Components

The Placer Mosquito and Vector Control, Safety Management Manual contains the organization's policies, processes and procedures on how MAC will comply with the 4 ICAO SMS components and 12 ICAO SMS elements of ICAO Annex 19 Safety Management and the FAA Implementation Guide which are:

- **Safety Policy:** The documented organizational policy defining management's commitment to safety as well as the accountability by various levels of the organization. Key personnel should be identified and tasked with monitoring and assessing compliance with safety instructions.
- **Safety Risk Management (SRM):** This is the process for identifying hazards, assessing the risk associated with those hazards, determining the need for mitigations or approvals by management, and mitigating the associated risk to an acceptable level.
- **Safety Assurance:** A set of processes within the SMS used to verify that the organization is meeting or exceeding its safety performance objectives through risk mitigation by examining documentation, performing safety audits and line inspections, and other organizational assessments.
- **Safety Promotion:** The dissemination of information related to safety, and used to encourage the growth of safety culture, mitigations used to both success and failure, and the two-way dialogue between management, operators, and non-operational personnel.

6.2 Safety Policy

Dedication to safety is identified in the foreword of the Flight Operations Manual, however further safety policies and principles are identified below to explain the responsibilities and authorities for operational safety.

- Safety is a vital duty and responsibility for every job function relating to operation.
- Even personnel without direct flight operations involvement contribute to hazard identifications at all levels of an organization and every person can have a positive impact on safety.
- Safety is always given the top priority, even above mission success.
- Every individual within MAC and contractor operations will perform with concern for safety at all time.
- The RPIC has exclusive and final authority for proceeding with any flight operation or test, and will consider resources made available to them. The RPIC may delegate some safety responsibility for flight termination to accompanying VO or other crew members, however the RPIC is ultimately responsible for the outcome of flight.
- All RPICs should understand the importance of listening to their other crew members, and be encouraged to heed safety concerns from their crew.

6.3 Safety Risk Management

Risk is an ever present and fundamental aspect of all missions and operations. It is up to management, RPICs, contractors, and all other stakeholders to be a part of the mission to limit, reduce, and eliminate unacceptable risk.

SRM enables operators and managers to quickly understand risks inherent in an upcoming mission, and to mitigate that risk using techniques that have been established beforehand.

The following elements are vital to the SRM process and must be trained to:

- Describe the System:
 - Define the scope of work to be completed
 - Define success parameters for the mission
 - Define the crew, personnel, and responsibilities for each position involved
 - Identify any changes or abnormal conditions that may be present
- Identify Hazards:
 - Use a structured approach to identifying hazards that includes all members of the crew and other personnel
 - Employ lessons learned from past flights and apply information from briefings
 - Employ standard checklists in a comprehensive and complete manner
- Analyze Risk:
 - Using personal experience, any data available, and local experts assess the risk of any hazards that were identified
 - Examine the likelihood of an event occurring based on the hazards present
 - Examine the severity of that same event
- Assess Risk:
 - Assign risk scores for each of the identified hazards, based on the combined analysis of severity and likelihood. Population Density may also be included as an indirect multiplier for both severity and likelihood per industry best practice.
 - Apply personal understanding of risk and determine if mitigations are required to reduce or eliminate the associated risk.
 - For ease of reference and standardization, the RPIC is encouraged to use the Risk Assessment Matrix provided in Appendix A.
- Mitigate Risk:
 - Provide strategies to mitigate those risks deemed intolerable, and maintain documentation as described in the SMS Manual.
 - Develop performance targets to measure those mitigations and continue monitoring that operation
- Document:
 - Identify what strategies were used to mitigate risk, and what basis any residual risk can be accepted via the Change Management and Hazard Identification Worksheet.

6.4 Safety Promotion

Developing culture of safety is one of the most challenging objectives for any safety focused organization, and yet it is a prerequisite for any organization seeking to create an atmosphere of honest communication. To cultivate an environment within which all employees and contractors feel comfortable and encouraged to identify potential problems before they become problems, management must take a proactive approach to encouraging organizational safety. The MAC safety culture is given priority for all levels in the organization and reflects leadership adoption of a “Top-Down” safety approach.

To encourage the continued development of safety, MAC encourages policies and standard operating procedures that align safety goals with organizational standards, training, voluntary reporting, and industry best practices.

The following list of Safety Promotion activities are a sampling of what MAC includes in all safety meetings in an on-going effort to provide organizational safety training in support of Just Culture and open communication:

- **Safety Priority Top 5** – High priority factors that have been identified to contribute to risk in the MAC operational environment should be identified based on data obtained through the Risk Assessment Process and described in case studies or examples.
- **Lessons Learned** – Through research, partnerships, industry newsletter, conferences, webinars, and speaking engagements leadership will actively describe deficiencies that have been identified by other organizations (including utility companies, manufacturers, regulators, academia, etc.) as having a negative safety effect on UAS operations. Standard operating procedures will be considered for lessons learned by others and discussed accordingly.
- **Are You Fit to Fly?** – The question “Are You Fit to Fly?” will be asked of every pilot, before every mission to mitigate the effect of fatigue risk. If the true and honest answer is “No,” a new pilot will be found and assigned.
- **Training** – On-going training designed by MAC-UASP and continuously reviewed by the MAC-UASP Manager and contractors or operational leaders will focus on UAS RPIC, VO, Payload Operators, support staff, and any personnel directly related to operations. Training is the most recognized and accepted form of Safety Promotion.

6.5 Safety Assurance (SA)

Overall performance of the Safety Management System (SMS) will have a direct result on the safety, efficiency, and performance of MAC and contractor sUAS operations. Often the Safety Assurance element of SMS incorporates the fundamental understanding of a Quality Management System (QMS). Though MAC is still testing and evaluating several QMS systems (including airdata.com), currently data is collected via flight data programs and hardcopy. This program continues to evolve, and contractors are expected to maintain all flight data for deviations from anticipated flight plans, procedures, and policies.

The goal of the SA program is to track the overall safety performance of sUAS operations and encourage confidence in the way all sUAS operations are being run.

To ensure that the SMS program is functioning appropriately, hazards are being identified before they become incidents, and that the operation is continuing to focus on safety development rather than safety results, the following four major components exist to collect data beyond Flight Data Analytics.

- **Inspections** – MAC will conduct internal inspections to establish if the SMS is continuing to meet the needs of the organization and overall safety goals. At least once per year, the MAC-UASP Manager will conduct internal review of MAC and contractor operational processes to include the following:
 - Maintenance and inspections processes, checklists, airframe and component lists, ground control condition, parts and material control, documentation and technical data management
 - Certification and qualification systems
 - Training requirements and performance records
 - Flight Operations data and documentation
- **Audits** – Verifying compliance with the operations manual, standard operating procedures, and policies is vital to ensuring that the SMS program is functioning effectively. Audits are an integral component to the SMS program and must cover all aspects of operations, support, and infrastructure to ensure completeness.

The MAC-UASP Manager will ensure regularly scheduled MAC audits, and contractor audits, will be performed at a minimum bi-annually to examine the performance and effectiveness of risk mitigation strategies and controls. The MAC-UASP may delegate evaluation to inspectors for the auditing process, though the MAC-UASP is responsible for the following:

- Scheduling and communicating audit evaluations
- Recording and reporting results to personnel
- Maintaining documentation relevant to the audit

Safety audits will cover the following areas and evaluate them for relevance, effectiveness, organizational structure, and impact.

- Safety policy & safety culture
- Key personnel and their functions responsible for safety
- Effectiveness of hazard identification
- Risk management process success
- Safety Assessment Procedures & Documentation

All audits must be conducted in an objective and unprejudiced manner, with auditors who are not assessing their own work, and with findings that are well documented, communicated, and archived for a minimum of five (5) years. The MAC-UASP manager is responsible for ensuring that these requirements are met through engaging internal and external stakeholders who are equipped for such responsibilities. The processes and procedures recognized as needing change should be considered by MAC-UASP manager and communicated to all parties as to the decision for each finding.

- **Investigations** – Mishaps, Incidents, Accidents, and other events will be investigated as required in cooperation with authorities and in alignment with MAC corporate policy. Information gathered in the course will populate briefings to further the interests of safety for all MAC UAS operations.

Each safety investigation will be led by the MAC-UASP Manager and will include the following elements within any MAC and contractor report. These elements may also be applied to the audit process for eliminating nonconformities.

- Analysis focused on determining the “root cause” of the event
 - An understanding that “human error” is not a root cause, but reflects latent conditions that lead to an active error.
 - An analytical and systematic approach to accident causation
 - A detailed report of all findings that includes specific recommendations for reducing the effects or probability of the event occurring in the future
- **Performance Monitoring, Data Analysis, Change Management** – Understanding safety impacts through monitored change, and data that reflects a need for change, is only helpful in an environment in which change can be managed. With any organizational, operational or procedural change, new hazards may arise and therefore a process for addressing those is extremely important.

MAC recognizes the need for positive change management and has therefore created and therefore outlines the following requirements:

- Identify any new hazards that may arise from any change, and assess that hazard for new risk to the operation
- Identify any need for new procedure, process, or checklist item that may mitigate that

- risk if the risk is deemed unacceptable
- Follow the FOM change management process in order to update the document with changes as needed
- Communicate all changes to MAC MAC-UASP, and contractor, personnel to whom it may affect and provide listing of all changes in a monthly safety briefing

6.6 Accidents and Incidents

The safety of those involved in any suspected incident or accident is the first priority. Response to any such incident or accident will include the coordination of emergency response and medical care if necessary. All members of the MAC-UASP, contractors, and departments involved in flight operations should be familiar with the AIR Plan Manual.

6.7 Crew Safety

All personnel who regularly interact with sUAS during their work will complete an MAC-UASP-approved Safety Training class. Alternatively, on a case by case basis, the RPIC or their designee can provide on-site safety training prior to any sUAS operation(s) as needed. Employees and contractors are expected to question any unsafe condition or activity in and around the operating environment, and will not initiate launch procedures for sUAS if they have any question or concerns about the safety of the crew, public, or the planned operation.

6.8 Flight Time and Duty Time

MAC utilizes the flight time and duty time guidance provided in Title 14 C.F.R., Part 135, even if the flight is being conducted under the MAC regulatory authorizations for 14 C.F.R. Part 107. Pilots will not plan to exceed the one or two pilot crew flight time limits of 8/10 hours respectively. When the 8/10 hour flight time limit is exceeded during a regularly scheduled 14 hour duty day, compensatory rest, in accordance with Part 135.267(e) must be taken. All pilots must have at least 13 rest periods, of 24 consecutive hours, during each calendar quarter.

6.9 Aeronautical Decision making

Traditionally, the belief was that good decision making in aircraft flight operations came from experience rather than training and cannot be taught, however recent studies have shown that by using checklists and understanding how to interpret signals, better decisions can be made without long careers in aviation. This is vital knowledge for new and old pilots alike. Training from QIP, MAC-UASP Management, and any/all contractors should include aeronautical decision making.

Aeronautical decision making is grounded in the following 6 steps identified by FAA in Advisory Circular (AC) 60-22, re-iterated in the qualification for 14 C.F.R. 107 certification and in conjunction with the doctrine of SMS:

1. Identifying personal attitudes hazardous to safe flight.
2. Learning behavior modification techniques.
3. Learning how to recognize and cope with stress.
4. Developing risk assessment skills.
5. Using all resources.
6. Evaluating the effectiveness of one's ADM skills

6.10 Crew Resource Management

“Crew Resource Management” is fundamental to safe and effective flight in all aviation. It is the key to understanding the “total crew concept” underlying the core of all safety operations. Each crewmember is trained to do their job, to demand that other crewmembers do theirs, with each monitoring the other, and giving assistance on demand or soliciting assistance as necessary.

Any person can make a mistake or error and no one is to be considered the master of all emergencies. Each crewmember must continuously monitor all that goes on in relation to the aircraft; they must speak up when discomforted, and advise when advice is needed regardless of title, experience, or seniority. Leaders understand that crew communication is what makes the mission success.

All crewmembers operate as a team, with the RPIC responsible for team management. Crewmembers are not, however, required to comply with any procedure, technique, or other action that they believe is unauthorized or unsafe. If a crew member is uncomfortable with any particular directive, they must speak up in an effort to alleviate the discomfort for the sake of safety.

Studies have shown that a well-defined role structure reduces ambiguity and enhances each crewmember's performance. Each RPIC must find and practice a balance between a command role that is too overbearing and one that is too passive. Balancing leadership and direction with acceptance and understanding is extremely difficult, yet provide a crew the requisite elements for success.

6.11 Airport Operations and Radio Communications

It is important for RPICs to understand the aircraft operations and requisite radio communications necessary within their AOO. Largely, the radio communications will be limited to requesting launch from MAC-UASP personnel and reporting successful landing to MAC-UASP personnel. In the case of emergency, however, radio communication will take place on the local area frequency (FX) to report the condition of a fly away and missing aircraft. In this instance, the message should be determined by MAC-UASP Management prior to any emergency as much as possible, though it may be tailored at the time of emergency occurrence.

6.12 Physiological Effects of Drugs and Alcohol

It is extremely important that all persons involved in aviation activities, including all crewmembers regardless as to their flight role, not be impaired in any manner. Therefore, all MAC personnel shall not at any time be under the influence of any psychoactive substance that might in any way limit their ability to perform their duties in a safe and effective manner.

Flight performance can be seriously hampered by prescription and over the counter medication. The MAC-UASP Project Advisor and all members of the piloting team will be advised anytime such drugs are being taken. If it is determined that the medication being taken could hamper an operator, that member shall be prohibited from undertaking the mission until such time that the risk is no longer a factor.

Any member of the flight team who voluntarily reports being unable to perform flight duties due to medication or illness will not be punished.

Appendix 1
sUAS Flight Operations Checklist/Post Mission Report

Date: _____ **PIC:** _____ **VO:** _____

Mission: _____ **Location:** _____

Aircraft (sUAS):

| Phase of Flight & Notes | Item | Status |
|-------------------------|------|--------|
|-------------------------|------|--------|

Flight Assignment

| | | |
|----------|--|--|
| | MAC-UAS Flight Notification sent to Appropriate Departments | |
| Manager: | Part 137 Operation Approved via (Circle) E-mail Phone Verbal | |

Prior to Departure to Operation Site

| | | |
|--|---|--|
| | Aircraft (AC) and Remote Control (RC) battery charged to appropriate % | |
| | Ground Control Station charged to appropriate % | |
| | UAS GPS Trackers charged to appropriate % (If Applicable) | |
| | Portable Radio charged / FX for Operational Area | |
| | Firmware Updated on AC, batteries, and RC | |
| | Payload Memory available appropriate Free Space (SD Card) | |
| | Inspect registration markings (proper display / legibility) | |
| | PIC has appropriate paper work (license, checklist, waivers) | |
| | Weather Conditions Allow for Operations (>500' Cloud Layer, 3 mile Visibility, Wind within UAS parameters, Sunrise/Sunset Times) | |

On-Site Check

| | | |
|--|---|--|
| | Operational Area Free of Obstructions | |
| | Wireless Interference appears minimal | |
| | Confirm Operation is in Class G Airspace (unless authorized) | |
| | Weather Conditions Confirmed On-Site (Wind, Visibility, Clouds) | |
| | On-Site Safety Briefing Conducted / UAS Crew informed of Duties | |

Physical Aircraft Check

| | | |
|--|--|--|
| | Positioning System is Free of Dirt or Debris and Nominal Condition | |
| | Cable Connections (Camera, Gimbal and other payloads) | |
| | Motor Clear of Foreign Object Debris (FOD) | |
| | Payload is Mounted Per Manufacturer Guide | |
| | Payload Communicating with Recording Hardware/Software | |
| | UAS GPS Tracker turned on (If Applicable) | |
| | Propellers in Nominal Condition | |

Remote Controller Check

| | | |
|--|-------------------------------------|--|
| | Antennas/Repeater oriented properly | |
|--|-------------------------------------|--|

Interface for RPIC

| | | |
|--|--|--|
| | Maximum Flight Altitude Set to 400' | |
| | RC Signal Lost set to Appropriate Failsafe Setting (RTH, RTR, hover) | |
| | Ensure Batteries are at 90% or Higher | |
| | Ensure Satellites connectivity is nominal | |
| | Face AC into the Wind | |
| | Check Heading of AC is true to Physical Positioning | |
| | Calibrate Aircraft Per Manufacture Specifications | |

Appendix 2
sUAS Operation Risk Assessment Worksheet

| Pilot Name | | | Date | | | Signature of Pilot in Command | |
|---|--|-----|--|-----|---|-------------------------------|-------|
| Payload OP Name | | | Location | | | | |
| UAS type | | | Mission Type | | | | |
| ITEM | LOW | PTS | MEDIUM | PTS | HIGH | PTS | Score |
| Crew Flight Experience | All crewmembers have flown this mission in the last 7 days | 0 | 1 crewmember has flown this mission in the last 7 days | 2 | No crewmembers have flown this mission in the last 7 days | 4 | |
| Crew Currency * | All flew in last 10 days | 0 | All flew in last 11 - 30 days | 2 | 1 or more crewmembers flew over 30 days ago* | 4 | |
| Crew Fatigue Management | All Rested | 0 | 1 crewmember feels tired | 3 | 2 or more crewmembers feel tired | 6 | |
| Crew Duty Day | Less than 8 hrs. | 0 | 8-12 hours | 2 | 12-16 hours | 4 | |
| Mission Type | Currency flight | 2 | Rural | 3 | Near Public | 4 | |
| Hardware changes to UAS | None | 0 | Changes with no effect on control | 2 | Changes that effect control | 4 | |
| Firmware Changes to UAS | No | 0 | No new control elements introduced | 2 | New control elements introduced | 2 | |
| Flight conditions | Day | 1 | Within 1/2 Hour of Dusk or Dawn | 3 | Night | 5 | |
| Visibility | > 10 miles | 1 | 3 to 9 miles | 2 | < 3 miles | 4 | |
| Ceiling in feet AGL | > 10,000 | 0 | 1001 to 9999 | 2 | < 1000 | 4 | |
| Winds | 0-10 MPH | 0 | 11-15 MPH | 2 | > 18 MPH | 4 | |
| Infrastructure in flight environment | None | 0 | Low traffic roads or unpopulated buildings | 3 | High traffic roads or populated buildings | 5 | |
| Other Infrastructure | None | 0 | Transmission Powerlines | 2 | Wind Turbines or Storage | 4 | |
| Other airspace activity | No | 0 | Expected Traffic | 2 | Not-Expected Traffic | 5 | |
| Temp (Include heat index and wind chill) | 40°F - 85°F | 0 | 20°F - 39°F or 86°F - 94°F | 3 | < 20°F or >95°F | 5 | |
| Planned flight background | Blue sky | 0 | High contrast terrain | 3 | Low contrast terrain | 5 | |
| * If a crewmember hasn't flown in over 90 days, is a currency flight required? Refer to currency requirements | | | | | | | |
| ** At or above 15, Crew decide whether to go or not | | | | | | Total Risk Factor | |
| Total Risk Factor | Overall Risk Level | | Action Required | | Operator Signature Verifying Approval | | |
| < 10 | Low | | None | | Not Required | | |
| 10 - 19 | Moderate | | Be Careful | | Not Required | | |
| 20 - 30+ | High | | MAC-UASP Manager | | Required | | |
| <p>The MAC risk assessment program is not a substitute for thought!</p> <p>IF 3 or more HIGH risks are marked, MAC-UASP may need to approve flight</p> | | | | | | | |

Appendix 3

Initial PIC Training Form: ATM 2.3

MAC-UAS Program- Initial Training for PIC

MAC-UAS Aviation Training Manual Section 2.3

Form: ATM 2.3

| PIC NAME: | | Date Passed 107 Exam: | | | |
|------------------|---------------------------|------------------------------|----------------------------|--------------------------|---|
| UAS Type | Autonomous Flights | Manual Flights | Emergency Maneuvers | Area of Operation | Qualified Instructor Pilot Signature |
| Phantom 3 | | | | | |
| Hex H20 V-2 | | | | | |
| MG-1S | | | | | |
| M-210 | | | | | |

| PIC NAME: | | Date Passed 107 Exam: | | | |
|------------------|---------------------------|------------------------------|----------------------------|--------------------------|---|
| UAS Type | Autonomous Flights | Manual Flights | Emergency Maneuvers | Area of Operation | Qualified Instructor Pilot Signature |
| Phantom 3 | | | | | |
| Hex H20 V-2 | | | | | |
| MG-1S | | | | | |
| M-210 | | | | | |

| PIC NAME: | | Date Passed 107 Exam: | | | |
|------------------|---------------------------|------------------------------|----------------------------|--------------------------|---|
| UAS Type | Autonomous Flights | Manual Flights | Emergency Maneuvers | Area of Operation | Qualified Instructor Pilot Signature |
| Phantom 3 | | | | | |
| Hex H20 V-2 | | | | | |
| MG-1S | | | | | |
| M-210 | | | | | |

| PIC NAME: | | Date Passed 107 Exam: | | | |
|------------------|---------------------------|------------------------------|----------------------------|--------------------------|---|
| UAS Type | Autonomous Flights | Manual Flights | Emergency Maneuvers | Area of Operation | Qualified Instructor Pilot Signature |
| Phantom 3 | | | | | |
| Hex H20 V-2 | | | | | |
| MG-1S | | | | | |
| M-210 | | | | | |

Appendix 4

Currency Check-Off Form: ATM 2.4

Appendix 5

Annual Recurrent Training Form: ATM 2.5

Appendix 6
Visual Observer (VO) Training
Day and Night Operations
Form ATM-VO

