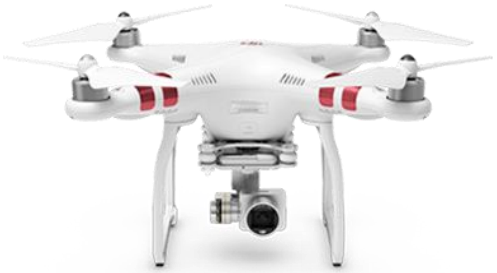
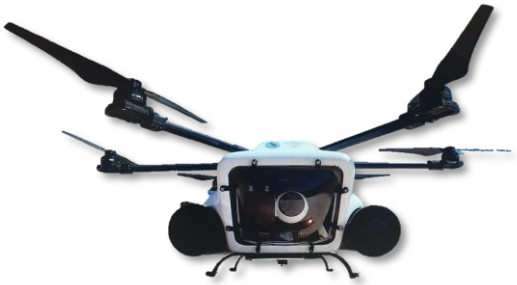
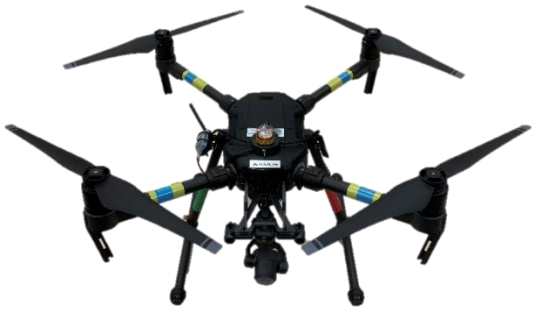
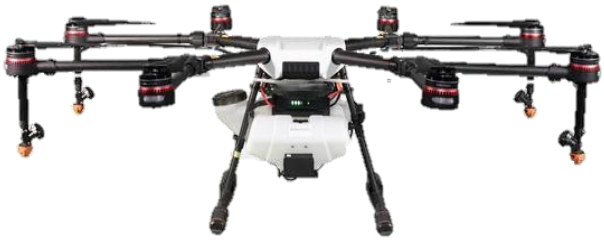
PLACER MOSQUITO & VECTOR CONTROL DISTRICT

Protecting Public Health since 2001









Mosquito Assessment and Control Small Unmanned Aircraft System (sUAS)

Flight Operations Manual (FOM)

Unmanned Aircraft System Program (MAC-UASP)

Document Version 3: 2/07/2020

Foreword

This Flight Operations Flight Manual (FOM) is developed to define a standard approach and language for the Placer Mosquito and Vector Control District (District) Mosquito Assessment and Control Unmanned Aerial Systems (MAC-UASP) flight personnel and all contractors who may conduct operations on behalf of the District. It contains instructions as to how flights are to be conducted, information relevant to the success and safety of the overall MAC-UASP mission, priorities and approaches to those operations, and required documentation for reporting incidents or accidents. MAC-UASP is fully committed to the highest level of professional flight in unmanned operation, and as such, have identified safety as the number one priority. Our unmanned flight operations core mission is:

To provide safe, reliable, and cost effective sUAS operations that provide unparalleled support to the District's MAC-UASP core mission. Our focused approach can be summarized as "Safety Above All."

All District personnel and contractors must use this resource to ensure the safety of all members of the flight team, and the public, within their operational environment, or that may enter their operational environment without prior notice. Use of small Unmanned Aircraft Systems (sUAS) are an important part of the MAC-UASP mission. The goal is to operate safely any sUAS in the interest of data collection and eventually in the application chemicals. It is required of all those involved in these new operations to understand the responsibilities for safety that are addressed in this manual and accompanying referenced manuals.

It is the duty and responsibility of all employees and contractors to openly and honestly report events and hazards that occur during, prior to, and immediately following operations of sUAS. Any hazards, incidents, or accidents will be thoroughly investigated in a non-punitive manner to maintain the positive culture of safety reliant upon accurate hazard identification. MAC-UASP recognizes the immense value of operating to best practice standards, and therefore this manual has been developed in compliance with Federal Aviation Administration (FAA), International Civil Aviation Organization (ICAO), and sUAS Industry Consensus Best Practices. It is developed in consideration of ASTM Standard Specification F2908 *Aircraft Flight Manual (AFM) for a Small Unmanned Aircraft Systems (sUAS), F2909 Practice for Maintenance and Continued Airworthiness of Small Unmanned Aircraft Systems (sUAS), F3003 Specification for Quality Assurance of a Small Unmanned Aircraft Systems (sUAS), F3005 Specification for Batteries for Use in Small Unmanned Aircraft Systems (sUAS), and F3178-16 Standard Practice for Operational Risk Assessment of Small Unmanned Aircraft Systems.* These standards were developed through an industry consensus process applied widely in the manned aviation community and, as such, reflect the highest standards of operational safety for both manned and unmanned aviation. It is also consistent with manned aviation best practices for the implementation of Safety Management Systems (SMS) as identified in the ICAO Safety Management Manual Doc. 9859 and the FAA SMS Framework identified in the FAA SMS Implementation Guide.

The operational need, availability, and use of sUAS will not supersede the interests of safety as required by FAA, ICAO and all entities involved in regulating aviation safety. The District identifies sUAS operations as an extension of their safety focused core competencies and therefore holds safety above all else.

All personnel involved in any way with unmanned flight operations are to be familiar with this manual and are to comply with all its provisions. All changes to the manual will be promptly disseminated to all personnel involved in flight operations and briefed for complete understanding according to the timelines set forth in the manual.

A safety culture is only possible through direct responsibility. Therefore, I am personally assuming responsibility for keeping the Aviation Operations Flight Manual current, in the interest of organizational safety promotion, and for the conduct of the operations by District personnel and contractors in accordance with the manual.

UAS Program Management

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Revision Record

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Original	8/2/2017	All	Wolf UAS
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Abbreviations & Terms

- AGL — Above Ground Level
- AIR Plan — Accident Incident Response Plan
- ASB — Alert Service Bulletin
- AOO — Area of Operation
- FOM — Flight Operations Manual
- CA DPR — California Department of Pesticide Regulations
- CAP — Congested Area Plan
- CONOPs — Concept of Operations
- Contractor — Any vendor, contractor or subcontractor engaged in flight operations in support of MAC-UASP
- CFR — Code of Federal Regulations
- CSO — Chief Safety Officer
- ETA — Estimated Time of Arrival
- MAC-UASP — Mosquito Assessment and Control
- MEL — Minimum Equipment List
- MUM — Manufacturer's User Manual
- NOTAM — Notices to Airmen
- OEM — Original Equipment Manufacturer
- OOS — Out of Service
- PPE — Personal Protective Equipment
- ROW — Right of Way
- RPIC — Remote Pilot in Command
- SMS — Safety Management System
- sUA — The flying element of the sUAS including aircraft and payload
- sUAS — Small Unmanned Aircraft Systems
- SWEAP — Safe Worker & Environmental Awareness Program
- TFR — Temporary Flight Restriction
- MAC-UASP — Unmanned Aircraft System Program Office
- VFR — Visual Flight Rules
- VMC — Visual Meteorological Conditions
- VLOS — Visual Line of Sight
- VO — Visual Observer

1. Introduction

1.0 Purpose

This MAC-UASP Small Unmanned Aircraft System Flight Operations Manual (hereinafter referred to as the FOM) provides procedures for the performance of unmanned aviation operations under section 14 of the Code of Federal Regulations Part 107 Commercial sUAS Flight Operations regulatory framework on the District's behalf and within the District's jurisdiction if conducted by another entity. It provides specific procedures to enable all aviation contractor personnel to carry out their assigned duties and responsibilities in accordance with District policies, applicable laws and FAA regulations. Further it outlines the understanding and expectations for operating small unmanned aircraft systems (sUAS) in compliance with all Federal, State, Local, and District requirements.

All Remote Pilots-in-Command (RPICs) flying in support of the District retain full operational control over their aircraft, though there may be instances when operating procedures allow any crew members to halt an operation in the interest of public safety. All aviation operators are required to perform their flight operations in a safe and professional manner in accordance with all applicable District safety policies and procedures and shall comply with this FOM as well as all relevant FAA regulations. Aviation providers who wish to work for the District must follow all applicable bidding or contractor selection process.

1.1 Objectives

The objectives of the FOM are to:

- Ensure safe, cost-efficient and effective unmanned aviation services in support of MAC-UASP's goals and objectives
- Standardize unmanned aircraft management and operational controls for Primary Contractors and MAC-UASP Operators providing aviation services
- Through standardization, facilitate the ability of personnel from different Contractors to work cooperatively and to create cohesive program operations throughout MAC-UASP
- Provide a common approach in MAC-UASP's relationship with sUAS Contractors.
- Provide a framework within which local management and operational groups can provide supplemental, site-specific guidance

1.2 Authority

All sUAS flight operations conducted by District employees or Contractor(s) in support of MAC-UASP are subject to the policies and procedures included in this FOM. Should the Contractor's own policies and procedures conflict with or differ from those included in this Manual, District management will be notified immediately for resolution. Deviations from the FOM in such cases may be granted by the District on a case by case basis.

Any conflict between this Manual and applicable Federal Regulations, the District's Operating Certificates and Operations Specifications is unintentional. Should a conflict be discovered, the regulation, certificate, or operations specifications will take precedence, and the District will be notified immediately.

All aircraft flown in support of MAC-UASP will be operated in accordance with the Manufacturer's User Manual (MUM). If a conflict occurs between the MUM and the FOM, the MUM will take precedence, and MAC-UASP should be notified of the conflict.

1.3 Distribution & Revision

The FOM will be made available to all appropriate personnel and pilots flying in support of MAC-UASP always, and should be available for all operations. A copy must be kept with the operator crew as part of an operation's "kit". The original FOM copy will be kept and maintained by the District in hardcopy and digital copy.

The District will revise the FOM 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 Internal Memos to supplement, but not change, the guidance contained in the FOM. Internal Memos will not be issued with an expiration date, and will periodically be reviewed for validity and for potential incorporation into the FOM or for cancellation. All significant revisions will be documented and maintained in the revision section of the FOM.

1.4 Mission-Specific Guidance

Other manuals (or additions to this manual) may be created as needed for specialized missions not otherwise addressed by this Manual. These may include additional operational environments for certified operators, new regulatory developments that enable special missions, etc.

1.5 Integrity

The success of the MAC-UASP relies upon the professionalism and integrity of the pilots, visual observers, managers, administrators and other personnel who are involved with aviation operations.

Safety is our top priority and will never be compromised. The policies and procedures in this FOM, and its companion regulatory documents, are primarily designed to enhance safety. Deviations from these policies and procedures should *only* be made in exigent circumstances and when prior approval, when possible, is obtained from MAC-UASP. Other violations of these procedures may result in permanent removal from MAC-UASP worksites, and, for contractors, contractual termination and possible financial penalties.

2. Safety

2.0 Safety Commitment

The District's MAC-UASP is committed to providing a safe, accident-free and healthy workplace. This FOM supports MAC-UASP's objectives of:

- Pursuing constant operations that negate harm to people or property
- Promoting a culture of open and voluntary reporting of all safety hazards
- 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 resources to support this policy
- Complementing, but not replacing, any current OSHA recommendations and requirements

District employees and Contractors are expected to make safety their first priority for all operations, and to maintain a safe work environment through an adherence to approved procedures, trainings and communications. They should, therefore, 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 MAC-UASP will accomplish 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) Manual that accompanies the FOM. The SMS manual must be familiar to all MAC-UASP personnel and maintained by management. 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.

2.1 Accidents and Incidents

In the instance of an actual or suspected accident or incident, the safety of those involved is the priority. Response actions, therefore, will include the coordination of emergency response and medical care if necessary. When safe to do so, those present should also attempt to proceed through the accident/incident checklist found in the Accident Incident Response (AIR) Plan.

UAS flight crew(s) will notify the District immediately in case of any accident or incident. The notification will either be via radio, phone, or in person. Additionally:

- Contractors and employees are not to communicate any information regarding the accident or incident with any member of the public, including all television and news agencies, unless explicitly authorized by the District, regardless of the landing location or persons involved on the ground.
- The District will coordinate and conduct any communications with any entities requiring or requesting information pertaining to the accident or incident, including the FAA, NTSB, TSA, or local or state police. Any employee or contractor who is contacted by any such officials should immediately report such contact to the District. While the District understands that each Contractor has its own reporting requirements in such instances, and while the District will honor any time limitations placed upon the Contractor by its regulatory authorities, the content of any reports submitted to those authorities will be provided to the District in advance of submission.
- In addition to these requirements, an initial written statement from the Contractor will be submitted to the District within 24 hours of the accident or incident. That statement should include as much detail as is known and should indicate next steps the Contractor intends to take to complete its investigation of the accident or incident.

In addition to the standard definitions of an accident and incident as provided by the NTSB, the District requires its employees and Contractors to include the following as incidents:

- Near mid-air misses (defined as the unintentional proximity of two or more aircraft that requires immediate and/or evasive action to avoid a collision)
- Any main rotor or payload strike to vegetation or ground objects
- Any time the aircraft exceeds operating limits (operational, physical or environmental) that result in a temporary out of service condition and/or requires maintenance intervention
- Bird or other wildlife strikes
- Unnecessary maneuvering (“hot dogging”, proximity to infrastructure, excessive elevation, etc.)
- Any movement of the sUAS that injures or endangers persons or property on the ground
- Precautionary landings, and any unplanned or diverted landings that are the result of an inflight emergency
- Lost or compromised communications that last greater than 30 seconds
- Loss or failure of on board GPS and/or flight following equipment
- The failure or malfunction of any external load equipment not immediately recoverable during flight

- Damage or injury to non-MAC-UASP related persons or equipment as the result of aircraft operations.
- Any time a RPIC, under their emergency authority, deviates from any FAA regulation
- Any time a RPIC's duty period exceeds 14 hours.
- Battery anomalies
- Inadvertent encounters with weather (clouds, rain, lightning)
- A pilot or mechanic who appears to be under the influence of drugs or alcohol while on duty

Any time that the safety of flight or airworthiness of the aircraft is in question, the RPIC will discontinue the flight. The aircraft should not be flown until the RPIC has determined, in accordance with Contractor's internal operating procedures that the aircraft is safe to operate. It is expected that Contractor's maintenance personnel will inspect and release the aircraft for flight per manufacturer specifications and/or in accordance with Contractor policies and procedures. Pilots who make an unscheduled landing for reasons such as unexpected traffic in area, or any other in-flight non-emergency that does not result in significant damage negatively impacting flight capability may take-off again without additional approval.

2.2 Personal Protective Equipment (PPE)

PPE consists of clothing and equipment that provide protection to an individual in a hazardous environment. PPE are listed in the table in Section 2.2.

If any crewmember refuses to adhere to PPE requirements, the RPIC or work-site supervisor will assess the flight characteristics for increased risk. If the RPIC or work-site supervisor deems that the PPE requirement non-compliance represents an unacceptable risk to the organization, personnel, or public they will terminate the operation and report the non-compliance to MAC-UASP.

For specialized missions, such as those taking place in increased wildlife environments or hazardous conditions, other PPE equipment may be required by the District or the RPIC. For extreme weather conditions, additional PPE or substitute equipment may be authorized by the District on a case by case basis and in accordance with a conducted risk assessment matrix - Appendix 1.

Personal Protective Equipment		Crew (if Present)		
		Remote Pilot in Command	Safety Officer or Visual Observer	Payload Operator
Head	Well Fitting Hard hat	X	X	X
Body	Reflective Vest	X	X	X
	Full Length Work Pants	X	X	X
	Mosquito Uniform	X	X	X
Feet	Closed Toed leather work Boots	X	X	X
Eyes	ANSI-Approved Safety Sunglasses	X	X	X
Area Signage	4 cones for 2 Safety Zones (8 total)			

2.3 Passenger and Ground 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 or public during the planned operation.

2.4 Flight Time and Duty Time

MAC-UASP 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 14 CFR 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.

During rest periods, pilots may not be assigned duties or be required to respond to work- related requests (including phone calls).

Pilots will report for duty with the required rest and able to perform the functions of a flight crewmember. Additionally, sUAS pilots who perform non-MAC-UASP flying for compensation or hire will ensure that those activities do not interfere with their ability to perform their duties while flying for MAC-UASP.

2.5 Service Bulletins

Any notifications issued by the original equipment manufacturer (OEM) will be considered mandatory knowledge for the operator to fully and appropriately execute their mission.

The MAC-UASP may also issue mandatory communications to alert members of flight operations to safety related information vital to mission success. These will be communicated in-person, via e-mail, phone or MAC-UASP Newsletter.

2.6 Document Management

All documentation referenced throughout the Flight Operations Manual, Safety Management Manual, Training Manual, and AIR Plan will be made available through hardcopy and electronic means, by District management responsible for identifying, archiving, protecting, recovering, and retaining all documentation related to the District.

All requests for current documentation should be made to the District General Manager who will ensure safe and secure maintenance per District data management policies.

The MAC-UASP manager is responsible for all approval prior to issue and usage, as well as any final review and update of contained materials or dissemination. The current version of all documentation to be used in operations will be listed and maintained by the District, and any changes will be communicated by that program and authorized representatives only.

The MAC-UASP manager will ensure that the appropriate versions of all documents will be made available to all users. Updated lists of all versions will be made available at the MAC-UASP program office and electronically.

An up-to-date list of all document versions will be made available once every 90 days to coincide with recurrent training to ensure all operators and supervisors avoid using obsolete information.

3. General Information & System Description

This FOM is developed with the understanding that MAC-UASP will seek out several highly qualified and airworthy unmanned aircraft systems to meet the various operational challenges unique to the mosquito and vector control industry and its overall mission within the agency. The systems of record for MAC-UASP will change depending on the mission tasking, the MAC-UASP decision process, and contractors involved and therefore Section 3 of this manual will identify the information required in the attached Appendices (and additional specifications to be knowledgeable of).

This version of the FOM references the DJI Phantom 3 Standard, HEXH20ProV2, DJI Matrice M-210, and AGRAS MG-1S. All aircraft are manufactured by DJI Inc., and their software control mechanisms are similar. For specific maintenance, control, and calibration requirements operators must consult the specific Manufacturer User Manuals (MUM) for their aircraft system. Further, RPICs should consult the respective MUM for information regarding updating firmware, software, or flight profiles. Any difference between this FOM and the Manufacturer provided specifications and user manuals should defer to manufacturer provided documentation when deemed appropriate by MAC-UASP.

Contractors to MAC-UASP will be able to use any aircraft of their choosing for Visual Line of Sight (VLOS) operations, however they must submit a system description for any aircraft to be used in support of operations for MAC-UASP that matches those items described in Sections 3.0 and 3.1. The required documentation is listed below. Different systems used will require appendices with the below information. These requirements meet ASTM Standard Specification F2908 *Aircraft Flight Manual (AFM) for a Small Unmanned Aircraft Systems.*

3.0 Unmanned Aircraft System Specifications

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

3.1 Performance & Limitation

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

3.2 Operational Control

MAC-UASP requires a three-tier system of operational control for any operations conducted by Contractors. The first tier consists of the Contractor's management, including those in management and leadership positions listed in the Contractor's Operations Specifications. This management structure will be responsible for ensuring the contractor's pilots are appropriately trained and qualified, that they are assigned to an aircraft that is airworthy and that can complete the assigned mission, and that the risks associated with the flight are identified, assessed, and mitigated acceptably accordingly to SMS best practices. The contractor's management structure has the authority to initiate, divert, or terminate any flight conducted by its own pilots. All aircraft flown by a Contractor will be listed on that Contractor's Operations Specifications. For example, a contractor may not utilize another company's sUAS, for any reason, without placing that sUAS on the contractor's operations specifications. Additionally, Contractors will not use another company's pilots without prior notification to MAC-UASP.

The second tier consists of the operational control the RPIC exercises as the final authority over the operation of the aircraft and is the same for MAC-UASP and Contractor operations. The RPIC determines whether a flight can be accepted, initiated, and conducted or whether it must be terminated. The RPIC is expected to operate in compliance with Title 14, C.F.R. 107, and any regulatory waivers or approvals deemed necessary by the FAA, and this FOM. If the RPIC has any doubts that a flight can be safely completed in accordance with applicable rules and regulations, they will contact their company's management for additional guidance.

The third tier of system operational control lies with Mosquito Assessment and Control MAC-UASP. MAC-UASP management can terminate, postpone, or change flight operations at any time. Reasons for alteration of flight operations may be related to any aspect of the flight operation including personnel, property, or mission.

All aviation operators shall provide to the District a written notification prior to operating in the District's jurisdiction (preferably 2 weeks in advance of any planned operation, though not limited to two weeks prior). All aviation operators must fully brief MAC-UASP prior to work in the District. As part of the briefing process, aviation operators must acknowledge receipt of, and be prepared to utilize, approved and compatible flight tracking devices (GPS enabled) and approved radios, or will not be allowed to operate. Aviation operators shall notify MAC-UASP prior to the first flight of each day with the following specific information:

1) When and where they will be operating
2) What data is being collected
3) What the expected mission details include.

MAC-UASP reserves the right to conduct a safety audit of any aviation operator contracted to work in MAC-UASP service territory. MAC-UASP also reserves the right to exclude any aviation operator from operating on any MAC-UASP projects, work or property.

3.3 Flight Release/Flight Following

All Contractors flying for or in support of MAC-UASP or on a MAC-UASP project or operation will, prior to any flight, obtain a flight release number from MAC-UASP. All RPICs will receive a MAC-UASP flight release number. This flight release number requirement is in addition to, and does not replace, any regulatory requirement a Contractor may have regarding operational control of its aircraft.

MAC-UASP will issue a flight release upon notification by the RPIC of the following:

- The full names of all crew members, and a confirmation that all crew members have required PPE
- The specific nature of the work to be conducted by the RPIC, including intended areas of operation and intended landing zones
- Concept of Operations information

Should the pilot receive a request from personnel that differs significantly from the information above, the RPIC will contact MAC-UASP to update the original information and flight data provided. Updated information should include:

- Crewmembers not on the original manifest
- Requests to perform a different mission
- Requests to operate in different areas
- Requests to exceed operational limitations and why
- Unexpected traffic in the area including people, vehicles, and wildlife
- Additional Emergency procedures unique to the hazards presented in the area

Additionally, a pilot who is experiencing a delay arriving to the work site of more than 30 minutes, for whatever reason, should the contact MAC-UASP Manager.

All Contractors flying for MAC-UASP will have established flight following procedures in place to track all flights, including training, maintenance, battery configurations, and payload management. MAC-UASP may require pilots to submit data files from any flight following devices and control software (usually daily), and may require pilots to periodically load files into the devices as needed (usually daily, although more frequent uploads may be required).

3.4 Contractor and Customer Management

MAC-UASP shall comply with all internal purchasing requirements for controlling company contracts, and provide documentation to MAC-UASP management as needed, including:

- Requirements specified by customers;
- Applicable regulatory requirements for operations
- Maintenance service through manufacturers, or as specified
- Recycling or disposing of products

As higher risk environment operations are sought, conformities with command and control link requirements will be identified. MAC-UASP management will have the responsibilities for ensuring the following command and control link items have been identified for beyond visual line of sight operations, flights over dense populations, and night flights as those become available to the program:

- Bandwidth and frequency control
- Communication performance
- Notification of degradation in frequency and performance
- Acceptance of provision of command and control link by FAA
- Redundant C2 capabilities as needed
- Spectrum interference protection through on-site analysis and monitoring

The MAC-UASP is responsible for ensuring oversight with any C2 Link provider if necessary and that all communication between these providers and operators takes place.

Another requisite element to be considered when examining BVLOS operations or night flights, is the need for high-visibility equipage to ensure other airspace users can identify and avoid the sUA. MAC-UASP will provide guidance and insight into the sufficient application of high-visibility technologies during the purchasing and sourcing phase of CONOPS discussion.

3.5 Accident Incident Response (AIR) Plan

MAC-UASP will develop and maintain the AIR Plan to ensure appropriate steps are taken once an accident or incident has occurred. Such steps will include timely notification to appropriate internal MAC-UASP personnel and to appropriate external agencies.

The AIR Plan has protocols that address the following situations (when aviation-related): medical emergencies, weather or mechanical difficulties that result in an unscheduled landing, overdue and missing aircraft, accidents, aircraft-related fires, and any injuries or deaths. The AIR Plan will also incorporate procedures to request assistance from law enforcement and other emergency services. The AIR Plan will be tested and evaluated at least semi-annually and should be updated consistently to ensure information is accurate.

3.6 Flight Characterization

All MAC-UASP sUAS flights are required to follow the rules prescribed in14 C.F.R. Part 107 unless specific permission to deviate from 14 C.F.R. Part 107 is granted by the FAA to MAC-UASP, or such rules are wholly inapplicable. 14 C.F.R. Part 91 guidance should only be used in the absence of any corresponding guidance in Part 107. The expected deference will be for operators to of both MAC-UASP and Contractors to follow all regulatory and institutional policies, procedures, regulations, and standards unless an emergency arises in which, in the interest of safety, another option prevents loss of life or injury. In these extreme cases, deference should be given to safety.

As MAC-UASP is a public entity, there may other instances in which the organization fly under separate flight rules.

3.7 Maintenance

All Maintenance will be conducted by responsible organization representatives per the manufacturer user manual, maintenance manual, and operational considerations. All MAC-UAS Equipment maintenance will be documented using airdata.uav.com The contractor operator will be responsible for ensuring that proper maintenance has been conducted via a maintenance tracking documentation within the contractor manufacturer relationship and reported to the MAC-UASP if any deviations from normal operations are found. If maintenance has not been conducted according to the prescribed plan, a risk analysis must be conducted to determine any increased likelihood of an incident or accident according to the risk assessment process. The RPIC must document this process.

4. Roles and Responsibilities

4.0 Remote Pilot in Command (RPIC)

The RPIC is the final authority for the safety of on-site personnel, crew, and the public in the Area of Operations (AOO) and has full operational control over any flight which they initiate. Additionally, the RPIC will:

- Be appropriately licensed, insured, and current on all flight proficiencies and certifications required for the operating environment, the system, or corporate/regulatory policy.
- Accomplish and appropriately document preflight inspections of aircraft and equipment to be used per Appendix 1.
- Inspect maintenance documents, including any status sheets, to determine the airworthiness of the aircraft. Report any discrepancies to the appropriate maintenance authority.
- Complete all training and qualification events required to maintain currency as dictated by Title 14, C.F.R. 107, MAC-UASP policies and procedures, and any other documentation as appropriate.
- Conduct all flight operations in compliance with Title 14, C.F.R. 107, FAA regulatory authorizations and/or waivers that accompany sUAS flight operations, this FOM, and MAC-UASP's policies and procedures.
- Not exceed duty time limits.
- Familiarize themselves with all pertinent information regarding flights to be undertaken, including but not limited to NOTAMS, TFRs, weather information, and mission specific requirements.
- Protect the aircraft from damage from weather or similar events. If relocation of the aircraft is required, notify MAC-UASP immediately.
- Not fly an aircraft with a known problem such as incorrect firmware or software, or hardware issues such as broken or bent propellers, or malfunctioning batteries.
- Utilize all required safety equipment (PPE, radios, etc.).
- Complete and submit all relevant flight and maintenance forms immediately following the end of daily flight operations, and ensure any relevant "pass-down" is completed to either the following RPIC or designated maintenance personnel.
- Ensure the proper briefing of crew members in accordance with this manual
- Ensure the appropriate aircraft navigation aids are up to date, and ensure the aircraft's GPS database is functioning properly.
- Notify MAC-UASP immediately if any contact with the FAA, NTSB, TSA, or law enforcement authorities is made (e.g., safety audits, official inquiries, accident or incident reporting, on-lookers).
- Notify MAC-UASP immediately when a safety of flight issue is discovered.
- Perform a complete 360-degree "walk-around," to include inspection of the tail rotor (if applicable), prior to powering on the aircraft for flight and upon completion of each flight

- Ensure GPS and flight following systems are operational prior to engine stop. Maintain positive control of the aircraft always. In no instance, may a RPIC put down the controller while the motors are running or its propellers are turning. For example, at flight idle due to loss of visual observation, the RPIC must still maintain positive control and may not put down their controller. If the RPIC perceives a need to lose physical contact with the controller, an emergency landing order must be given to the sUAS.
- Maintain positive control of the aircraft at all time, unless the RPIC is in the process of training. In this case, the RPIC and individual operating the controls, must follow all MAC-UASP training guidance in accordance with Title 14 C.F.R. 107.
- An up-to-date ATC communications list will be provided by MAC-UASP to provide radio frequency communication to RPIC in the event of an emergency.

4.1 Visual Observer

The main function of the Visual Observer (VO) is to maintain situational awareness of the aircraft in relation to all other air traffic in the area. The VO is intended to satisfy the Visual Line of Sight (VLOS) requirements and recommendations by the FAA in support of operational success and safety, but is not a requirement under 14 C.F.R. Part 107. For any non-standard Part 107 operations, a VO will be an important safety requirement. The secondary priority of the VO is to maintain situational awareness on the ground and to maintain an environment free from distractions for the RPIC. In support of this goal, the VO, therefore, will:

- Maintain Visual Line of Sight (VLOS) with the sUAS always, or delegate that responsibility to another crew member as available.
- The Visual Observer acts as the Detect-and-Avoid function for VLOS operations and satisfies that requirement for sUAS flight in higher risk environments when required.
- Maintain a “Third-Person” understanding of the aircraft operation and condition.
- If VLOS is lost, at any time, the VO will communicate that loss to the RPIC. While some VLOS degradation is permitted as explained in AC 107-2, Section 5.7, line of sight with the aircraft must be regained as soon as practicable.
- Maintain visual separation from infrastructure, people, and aircraft in accordance with the briefed flight plan and alert the RPIC to any “imminent collisions.”
- Provide on-site safety duties to enable any communication between the public, external crew members, or any other individual that may enter the AOO and MAC-UASP.
- The VO is responsible for ensuring the RPIC does not become distracted by external stimuli.
- Provide additional physical checking of aircraft condition before and after each flight.
- Assist the RPIC in readying the aircraft in accordance with MAC-UASP flight procedures found in Section 5.

4.2 Payload Operator

As payloads require more engagement and individual control, a Payload Operator may be designated in addition to RPIC. The Payload Operator will control the sUAS payload and is responsible for ensuring that all elements of that system are operable including remote control, payload, and sensor payload. While they do not have direct oversight for safety of flight, their valued role in the operation necessitates reporting of hazards and proper communication to the RPIC always and therefore should be considered to have a responsibility for safety of flight. In addition to their sensor training, the Payload Operator will:

- Capture all relevant mission focused data while minimizing none relevant data that may put MAC-UASP at risk of privacy related concerns.
- Maintain a "First-Person" understanding of the aircraft operation and condition to aid situational awareness of the RPIC and all crew members.
- Use proper communication with RPIC to enhance safety of flight.
- Ensure the payload is operating nominally throughout the flight to system standards as described by the manufacturer.
- Relate any loss of control or interference of the payload system to the RPIC immediately as it may represent strong signal interference and impact safety of flight.
- Ensure the payload recording is turned off appropriately and that the payload is maintained or stowed for transportation.

4.3 Lead Pilot

Each work site at which sUAS operations will occur will be reviewed by the Lead Pilot. Lead Pilot also serves as the Qualified Instructor Pilot (QIP), a complete list of roles and responsibilities can be found in the MAC-UAS Aviation Training Manual section 2.2. Duties include initial operational training, and recurrent training for all MAC-UAS RPIC and VO.

The Lead Pilot's primary responsibility is the safe operation of the sUAS in an area of operation (AOO). The Lead Pilot is also responsible for scheduling and approving operational support to MAC-UASP requests for part 107 sUAS operations. In support of this primary role, the Lead Pilot will be responsible for the following:

- Ensure all RPIC's flight logs and data are uploaded to airdata.uav
- Manage maintenance, including documentation on all MAC-UAS Program equipment (batteries, payloads, and sUAS)
- Manage firmware and software upgrades for all components (batteries, sensors, aircraft, iPads, and apps). Includes researching new firmware to determine the safest, most reliable firmware version for MAC-UAS sUA.
- Coordinate, conduct, and document trainings for MAC-UAS crewmembers (RPIC, VO, PO) as specified in the MAC-UAS Training Manual.
- Act as the primary coordinator of all sUAS support requests to determine appropriateness,

capability, and safety through risk analysis.

- Provide a response to requestors of service and coordinate service.
- Schedule Flights with enough notice to chosen RPICs to ensure proper planning in accommodation of crew duty times, rest requirements, filling NOTAMs, etc.
- Conduct a daily briefing of all crewmembers and work-site personnel prior to the first flight of the day regarding the following:
    - Expected flight activities of the day
    - Forecasted weather of the day (temperature, winds, ceiling/visibility, any weather phenomena such as rain, lightning, etc.)
    - Temporary Flight Restrictions (TFR) and NOTAM
    - Required communications on the ground and when airborne
    - AOO primary and backup frequencies
    - Likely ground and airspace traffic in AOO.
    - Recent and/or relevant safety information
    - Local hazards specific to the AOO
    - AOO Specific "Go/No-Go" Criteria if needed
- Evaluate the appropriateness of the sites, including emergency landing areas, and take any necessary action to ensure safety and regulatory requirements are met
- Ensure Personal Protective Equipment (PPE) is available and appropriately used
- Schedule and coordinate all aircraft flights in the MAC-UASP AOO.
- Provide alerts to pilots if:
    - Non-MAC-UASP aircraft are known to be operating in or around the Right of Way (ROW)
    - Adverse weather is known to exist around operation
- Support the RPIC's requests for assistance, including emergencies
- Track the status of all aircraft to include out of service times, public relations mission, and maintenance related missions
- Coordinate flight requests between requesters and pilots
- In the case of a medical emergency, assist UAS Program Manager in coordinating the notification of emergency services
- In the case of a field fire emergency, assist UAS Program Manager in coordinating the assignment of MAC-UASP assets in support of company, local and state fire agencies

4.4 UAS Program Manager

Each work site at which Part 137 sUAS operations will occur will be approved by the MAC-UASP Manager.

The MAC-UASP Manager's primary responsibility is the safe operation of the sUAS in an area of operation (AOO). The MAC-UASP Manager is also responsible for scheduling and approving operational support to MAC-UASP requests for Part 137 sUAS operations. In support of this primary role, the MAC-UASP Manager will be responsible for the following:

- Act as the primary coordinator of all sUAS support requests to determine appropriateness, capability, and safety through risk analysis.
- Act as the primary coordinator between District and Private UAS contractors (provide safety and policy information)
- Alert MAC-UAS crew members of any District manned aircraft operations near AOO
- Provide a response to requestors of service and coordinate service.
- Schedule Flights with enough notice to chosen RPICs to ensure proper planning in accommodation of crew duty times, rest requirements, filling NOTAMs, etc.
- Conduct a daily briefing of all crewmembers and work-site personnel prior to the first flight of the day regarding the following:
    - Expected flight activities of the day
    - Forecasted weather of the day (temperature, winds, ceiling/visibility, any weather phenomena such as rain, lightning, etc.)
    - Temporary Flight Restrictions (TFR) and NOTAM
    - Required communications on the ground and when airborne
    - AOO primary and backup frequencies
    - Likely ground and airspace traffic in AOO.
    - Recent and/or relevant safety information
    - Local hazards specific to the AOO
    - AOO Specific "Go/No-Go" Criteria if needed
- Evaluate the appropriateness of the sites, including emergency landing areas, and take any necessary action to ensure safety and regulatory requirements are met
- Ensure Personal Protective Equipment (PPE) is available and appropriately used
- Support the RPIC's requests for assistance, including emergencies
- Coordinate flight requests between requesters and pilots
- In the case of a medical emergency, coordinate the notification of emergency services
- In the case of a field fire emergency, coordinate the assignment of MAC-UASP assets in support of company, local and state fire agencies

5. Normal Operating Procedures

5.0 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

No operations will take place when rain, thunderstorms, or lightning is present in the vicinity unless the sUAS is certified for those conditions and MAC-UASP has acknowledged the conditions. VFR conditions are a requirement for flight operations. In case of unexpected inclement weather, the following procedures should be taken if currently in flight:

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

Preflight and operational weather information should be found through Flight Service at www.1800wxbrief.com. On-site weather can be observed directly, measured through a ground or pole mounted Kestrel weather station, or by using the airdata.uav.com.

5.1 Pre-Flight Planning & Authorization

MAC-UASP Manager and the Lead Pilot 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 Lead Pilot will assign the flight operation to an approved, current, and available pilot for the 107 operation and notify them of any safety concerns identified in the assessment.

The MAC-UASP will assign the flight operation to an approved, current, and available pilot for the 137 operation and notify them of any safety concerns identified in the assessment.

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 BVLOS operations, night flights, or flights over people) 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).

RPIC will send an email to the Public Affairs Manager (PAM) containing the times, general location, UA ID and purpose of the planned flight.

5.2 On-Site Pre-Flight

In this section, items identified by a ● should occur throughout the flight, while numbered lists should take place in the order they appear:

- sUAS flight operations begin prior to arriving to the flight site. Prior to leaving for the AOO, a RPIC has several responsibilities to ensure all equipment is well maintained and in flight conditions. These include:

    1. Ensuring the Aircraft (AC) and Remote Control (RC) battery percentage are both above 90%
    2. Ensuring the tablets (or computers) used for controlling the aircraft and on-board payloads are charged above 85%
    3. Ensuring the portable radio used for communications with local air traffic frequencies are charged above 85%
    4. Inputting the correct Frequency (FX) for the AOO has been input into the portable radio
    5. Confirming the firmware is up-to-date for all elements of the sUAS (No Warning Notifications upon power up)

6. If flight app alerts PIC of a new firmware, PIC should contact Lead Pilot before downloading any new firmware
7. Confirming the memory element used for recording flight data has appropriate free space (Blank is preferred)
8. Checking to see if the meteorological conditions allow for operations

- Once these checks are complete, the RPIC may proceed with the full aircraft system to the AOO to begin preparations for flight launch. The following items must take place on-site, and prior to launch of the sUAS:

1. Determine a launch location free of overhead obstructions.
    a. If an approved operational environment has overhead obstacles, ensure that proper mitigations are in place to reduce the risk of collision prior to flight.
2. Confirm that the wireless connection between the controller and the UA is satisfactory, and determine if GPS connectivity is appropriate for operations.
    a. If wireless interference has been noted in this area, with this aircraft, or earlier in the day brief the crew to be aware of such performance.
3. Confirm the meteorological conditions on-site allow for flight operations
4. If the flight will take place near a MAC-UASP facility, container, or infrastructure, confirm the relevant departments have been notified.
5. Confirm the Remote Control and Software User Interface is adjusted appropriately for flight.
    a. The sUAS used by MAC-UASP and contract pilots should have the following system settings confirmed:
        i. Maximum altitude set to 400’ AGL unless being flown within 400’ radius of a structure in which case it may be set to the maximum height of the obstruction + 400’ AGL
        ii. The maximum speed is set to less than 40 MPH
        iii. Any Fail-Safe Mode Set for 3.3’ Clearance above highest obstacle
        iv. If possible, set the RC Signal Lost to Return-to-Home Per Pre-Flight Briefing.
            1. If not possible, ensure that all crew are briefed for a “loss of control” condition for roles, responsibilities, and what to expect.
        v. Minimum of 12 satellites locked into the system for waypoint controlled flight.
        vi. Physical heading of the sUAS is the same as the digital displayed
        vii. The blue dot representing the remote control is accurately represented on the map
        viii. Home Point is accurately set on the map
        ix. Elevation reads zero (0)
        x. Battery for the RPIC Remote Control reads at least 90%
6. Brief all members of the flight crew on current conditions, safety concerns, and questions

7. Conduct, with assistance from the VO, a Risk Assessment (RA) using the MAC-UASP Risk Assessment Worksheet, Appendix 2.
8. If the result of the Risk Assessment requires no further mitigations, the RA form will be filed and the RPIC will ask for confirmation that all members of the crew are ready for flight
9. Upon the positive confirmation, the RPIC will prepare to launch the sUAS for flight, per the sUAS User Manual.

- While the RPIC is checking the sUAS per their pre-flight checklist (Appendix 1), the Payload Operator if present and using another remote control, should be undertaking the following items prior to flight:
    1. Ensure that the command and control element and the payload are set to the appropriate mode per the Manufacturer Operations Manual
    2. Confirm the Software and the Remote Controller are connected to the payload on-board the sUAS
    3. If all elements of the Payload Operation are set, working correctly and no warning notifications are present, the Payload Operator should give a confirmation to the RPIC that they are ready for flight operations

- Once all crew members have given the "Go-Head," the RPIC may undertake the next phase of the operation, after checking that the Flight Mode is set appropriately per the Manufacturer Operations Checklist.
- Prior to the first flight of the day or at any new flight location, the RPIC must now calibrate the sUAS per the manufacturer User Manual to ensure "return to home feature" returns to desired location if activated.
- Prior to first flight of the day the RPIC and other crew members should verify that there are sufficient supplies and provisions (including water) for psychological needs to be met for flight operations.
- Prior to first flight of the day, crew members should verify that the operation can be conducted in safe and secure method, with the ability to store items on site (in a car is fine) where technical data, equipment, tools, and parts will not be stolen or damaged.
- If multiple sUA will be flying simultaneously in close proximity all PIC's are responsible for deconflicting the airspace. Depending on mission type this can include coordinating appropriate buffer zones, designating flight altitudes for each sUA, designating separate emergency landing zones all prior to launch.

5.3 Launch of sUA

- Flight operations will consist of approved movements as recognized by current training and contractor operations as approved by MAC-UASP Manager.
- If any deviations from approved flight methodology occurs, the MAC-UASP manager will be notified upon completion of the flight according the non-nominal flight operations procedures

5.4 Landing of sUAS

- All crew members will be notified of the intent to land by the RPIC
- The landing area will be cleared of all personnel (within and without the flight operation) up to 30' if possible.
    - If 30' cannot be cleared for the landing area, it must be considered within the risk assessment process
    - Any flight operations that may take place for launch and recovery should be practiced, and any non-standard flight mode must be considered in the risk assessment process.
- Upon deciding to return to land, the payload recording should be turned off as the mission is considered over and unintended recording puts the operation in risk of privacy incursion
- The sensor in use should always be returned to 90 degrees perpendicular from the ground prior to final landing to protect it from uneven surface landings.
- All landings will be controlled landings unless the RPIC has been trained to use the automatic landing function of the sUAS.
- All pilots must initiate a return to home, automated or manual, when the battery reads a 20% charge and the battery shall not be reduced below 15% unless an unsafe condition unless in the interest of safety.
- Automated landings using the Return-to-Home function will not be used during normal operations unless training for automated landings has taken place and is approved by MAC-UASP Management

For aircraft recovery, procedures will need to be developed ad-hoc on-site based on the following criteria:

- **Environment** – Tall brush, mud, power-generation, or other higher risk environment require additional equipage or protections when recovering aircraft.
- **Position** – orientation of the aircraft may prevent identification of the battery, propeller(s), or payload condition and require additional mitigations in the interest of safety or system protection
- **Manufacturer's operating procedures** – manufacturer recovery instructions as to where to hold, dismantle, or store the aircraft and accompanying GCS may require additional procedures
- **Coordination between crew, MAC-UASP (if needed)** – constant communication to ensure proper shutdown and coordination is vital

5.5 Post-Flight

Upon successfully landing, the following procedures must take place before moving on to the next flight, or if the concluded flight were the last flight of the day, beginning to stow and transport the sUAS:

1. The RPIC, or Payload Operator if present, should ensure the payload has stopped recording and power down equipment according to manufacturer guidelines
2. If any incidents or accidents took place during the flight, an incident or accident report will be filled out and filed as needed (Appendix 7)
3. A debrief covering safety, mission performance, and questions or concerns will take place and documented in the post mission report (Appendix 1)
4. After the last flight of the day ensure all flight logs are synced, and uploaded to airdata.uav.com

5.6 Non-Daylight Flight Operations

- When flying per any waivers in conjunction with part 107, ensure that the location matches the location identified in the waiver.
- Follow any requirements identified in the waiver to ensure compliance
- Additional pre-flight risk assessment will be necessary to understand and mitigate any risks associated with night operations.
- Specific additional knowledge and requirements can be found in Appendix 9.

5.7 Aerial Pesticide Applications (Part 137)

- Currently chemical dispersion from sUAS will be performed under Part 107 and Part 137 authorizations, future operations may be conducted under a Public Certificate of Authorization (COA)
- Follow any requirements identified in the District's Part 137 Exemption, including conditions and limitations (Appendix 11)
- Crew members will be trained in accordance with MAC-UAS Training Manual Section 2.8.
- To pursue chemical dispersion, a new flight operations methodology will be developed in conjunction with the MAC-UASP and inserted here.
- Note that the minimum PPE for the State of California requires long sleeves, pants, socks, closed toe shoes, eye protection, and gloves. Additional PPE may be required such as N95 masks, disposable coveralls with a hood, or respirator.
- Mixing and loading of pesticides should be conducted by the VO, and may require face shield and apron depending on the chemicals being applied.

6. Emergency Procedures & Failures

6.0 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) an emergency call will be given on the local FX broadcast to alert other stakeholders in the AOO.

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

Step	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.
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: • 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.

6.1 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, if appropriate, 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 Fly-Away procedure.

6.2 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 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 landing procedures. If payload control is regained, the mission may continue but the loss or degradation should be documented during the post-flight debrief.

6.3 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 if other crew members have visual contact with the UA.	
4	Record the time.	
5	Look at the ground control in use for expected position of the UA to aid in search.	
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).

6.4 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.

6.5 Unexpected People in Flight Environment

All persons within 500' radially from the operating environment will be appropriately briefed prior to the first flight in which they are present to develop their understanding of potential hazards with sUAS operations. The briefing 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.

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.

6.6 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 the injury is serious.
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-UASP MAC-UASP Manager.

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

Step	Action
1	Land as soon as possible. Land at the first location that a safe landing can be made.
2	On the ground, disconnect the battery unless it is dangerous to do so.
3	Use a fire extinguisher to put out secondary fires. ***NOTE:*** 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-UASP 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.

7. Training

All personnel involved with MAC-UASP aviation operations will receive initial and recurrent training appropriate to their station:

- Pilots will receive initial and recurrent Local Area Training (LAT), designed to establish a working knowledge of the MAC-UASP area of operations, the aviation SMS, and the rules and regulations under which they will be required to operate

- Payload Operators will be provided initial and recurrent training on general sUAS operations, the aviation SMS, and specific protocols surrounding the operation and maintenance of payload payloads

- Visual Observers will receive training on sUAS safety procedures, the aviation SMS, and techniques for ensuring safe separation from air and ground traffic as well as Crew Resource Management at an interval determined by MAC-UASP

The training curricula for all training events will be detailed in the Aviation Training Manual.

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	
	Ensure navigation software is working nominally	
	Ensure Home Point is accurately set on Map	
	Ensure Elevation reads zero (0)	
In-Flight Operations		
	Follow Operations in Accordance with Training and Flight Plan	
Post-Flight		
	Ensure Data has stopped Recording / Other payloads off	
	Power off aircraft / Remove Battery	
	Fill-out Incident/Accident Report as Needed	
	Debrief as Needed / Post Mission Report	

PMVCD MAC-UAS Program
Post Mission Report

Date:

Mission:

Crew Members:

Notes:

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	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 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?**							
**** 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 Approval	Required

The MAC-UASP risk assessment program is not a substitute for thought! This is set up as a guideline.

IF 3 or more HIGH risks are marked, MAC-UASP may need to approve flight

Appendix 3
DJI HEXH20ProV2
Specification Sheet

AIRCRAFT

Model	HexH2O
Airframe	Epoxy fibre composite
Frame weight (no electrics)	1400g
Absolute size (unfolded)	W740 x H240 x L650 mm
Takeoff weight	4.7kg (fully loaded; 2 flight batteries, gimbal and GoPro)
Battery	6S 7000mAh (or more), 25C (Run two in parallel recommended)
Usable battery space	W130 x H100 x L200mm, aperture: 120 x 90mm
Motors	DJI E600
Motor mount	16×19 mm pattern
Propellers	DJI E600 (14 inch max)
ESC	DJI E600
Forward speed	~56 km/h / ~35 miles/h (no wind)
Flight Time	25+ minutes (based on 14000mAh +)
Center of Gravity	Inline with the center (fixed) arms
Max wind/gust	25 mph +
Max additional payload	2KG

Appendix 4
DJI Phantom 3 Standard
Specification Sheet

AIRCRAFT

Weight (Battery & Propellers Included)	1216 g
Diagonal Size (Propellers Excluded)	350 mm
Max Ascent Speed	5 m/s
Max Descent Speed	3 m/s
Max Speed	16 m/s (ATTI mode)
Max Tilt Angle	35°
Max Angular Speed	150°/s
Max Service Ceiling Above Sea Level	19685 feet (6000 m)
Max Flight Time	Approx. 25 minutes
Operating Temperature Range	32° to 104°F (0° to 40°C)
Satellite Positioning Systems	GPS
Hover Accuracy Range	Vertical: ±0.5 m Horizontal: ±1.5 m

CAMERA

Sensor	1/2.3” CMOS Effective pixels:12 M
Lens	FOV 94° 20 mm (35 mm format equivalent) f/2.8
ISO Range	• 100-3200 (video)

	• 100-1600 (photo)
Electronic Shutter Speed	8 - 1/8000 s
Image Size	4000×3000
Still Photography Modes	• Single Shot • Burst Shooting: 3/5/7 frames • Auto Exposure Bracketing (AEB): 3/5 bracketed frames at 0.7 EV Bias • Timelapse
Video Recording Modes	• 2.7K: 2704 x1520p 24/25/30 (29.97) • FHD: 1920x1080p 24/25/30 • HD: 1280x720p 24/25/30/48/50/60
Max Video Bitrate	40 Mbps
Supported File Systems	FAT32 (≤32 GB); exFAT (>32 GB)
Photo	JPEG, DNG (RAW)
Video	MP4, MOV (MPEG-4 AVC/H.264)
Supported SD Cards	Micro SD Card 8 GB included
Operating Temperature Range	32° to 104°F (0° to 40°C)

CHARGER

Voltage	17.4 V
Rated Power	57 W

APP / LIVE VIEW

Mobile App	DJI GO

Live View Working Frequency	2.4 GHz ISM
Live View Quality	720P @ 30fps
Latency	Low Latency Video (depending on conditions and mobile device)
Required Operating Systems	• iOS 8.0 or later • Android 4.1.2 or later
Recommended Devices	• ios: iPhone 5s, iPhone 6, iPhone 6 Plus, iPhone 6s, iPhone 6s Plus, iPod touch 6, iPad Pro, iPad Air, iPad Air Wi-Fi + Cellular, iPad mini 2, iPad mini 2 Wi-Fi + Cellular, iPad Air 2, iPad Air 2 Wi-Fi + Cellular, iPad mini 3, iPad mini 3 Wi-Fi + Cellular, iPad mini 4, and iPad mini 4 Wi-Fi + Cellular. This app is optimized for iPhone 5s, iPhone 6, iPhone 6 Plus, iPhone 6s and iPhone 6s Plus. • Android: Samsung tabs 705c, Samsung S6, Samsung S5, Samsung NOTE4, Samsung NOTE3, Google Nexus 9, Google Nexus 7 II, Ascend Mate7, Huawei Mate 8, Nubia Z7 mini, SONY Xperia Z3, MI 3, MI PAD *Support for additional Android devices available as testing and development continues.

Appendix 5
DJI Matrice M-210
Specification Sheet

M210

AIRCRAFT

Model	M210
Package Dimensions	31.1×15.4×11.4inch (790×390×290mm)
Dimensions (unfolded)	34.9×34.6×14.9 inch (887×880×378 mm)
Dimensions (folded)	28.2×8.7×9.3 inch (716×220×236 mm)
Folding Method	Folded Inward
Diagonal Wheelbase	25.3 inch (643 mm)
Number of Batteries	2
Weight (TB50)	Approx.3.84kg (with two standard batteries)
Weight (TB55)	Approx.4.57kg (with two standard batteries)
Max Takeoff Weight	6.14KG
Max Payload (2 TB50)	Approx.2.3kg (with two standard batteries)
Max Payload (2 TB55)	Approx.1.57kg (with two standard batteries)
Hovering Accuracy (during safe flights)	Vertical: ±0.5，Downward Vision System enabled: ±0.1 Horizontal: ±1.5，Downward Vision System enabled: ±0.3
Max Angular Velocity	Pitch: 300° /s ; Yaw:150° /s
Max Pitch Angle (Dual Downward Gimbals)	P Mode: 25°（Forward Vision System enabled: 25°） ; A Mode: 25° ; S Mode: 30°
Max Pitch Angle(Single Upward/Downward Gimbal)	P Mode: 30°（Forward Vision System enabled: 25°） ; A Mode: 30° ; S Mode: 35°
Max Ascent Speed	16.4 ft/s (5 m/s)
Max Descent Speed	Vertical: 9.8 ft/s (3 m/s)
Max Speed(Dual Downward Gimbals)	S Mode: 40.3mph (64.8kph) P Mode: 38mph (61.2kph) A Mode: 38mph (61.2kph)

Max Speed (Single Upward/Downward Gimbals)	S Mode: 51.4mph (82.8kph) P Mode: 38mph (61.2kph) A Mode: 51.4mph(82.8kph)
Max Service Ceiling Above Sea Level	1.86 miles (3000 m)
Max Wind Resistance	39.4 ft/s (12 m/s)
Max Flight Time(No Payload, with TB50)	27min
Max Flight Time(No Payload, with TB55)	38min
Max Flight Time(Full Payload, with TB50)	13min
Max Flight Time(Full Payload, with TB55)	24min
Motor Model	DJI 3515
Propeller Model	1760S
Operating Temperature	-4° to 113° F (-20° to 45° C)
IP Rating	IP43

GIMBAL INSTALLATION

Downward Gimbal Mount	Supported
Upward Gimbal Mount	Supported
Downward Dual Gimbal	Supported

CHARGER

Model	IN2C180
Voltage	26.1 V
Rated Power	180 W

FORWARD VISION SYSTEM

Obstacle Sensing Range	2.3-98.4 feet (0.7-30 m)
FOV	Horizontal 60°, Vertical 54°

Operating Environment	Surfaces with clear patterns and adequate lighting (> 15 lux)

DOWNWARD VISION SYSTEM

Velocity Range	<32.8 ft/s (10 m/s) at height of 6.56 feet (2 m)
Altitude Range	<32.8 feet (10 m)
Operating Range	<32.8 feet (10 m)
Operating Environment	Surfaces with clear patterns and adequate lighting (> 15 lux)
Ultrasonic Sensor Operating Range	0.33-16.4 feet (10-500 cm)
Ultrasonic Sensor Operating Environment	Non-absorbing material, rigid surface (thick indoor carpeting will reduce performance)

GIMBALS

Compatible Gimbals	Zenmuse X4S Zenmuse X5S Zenmuse Z30 Zenmuse XT Zenmuse XT2 SLANTRANGE 3PX Sentera AGX710

BATTERY

Model	TB50
Capacity	4280 mAh
Voltage	22.8V
Battery Type	LiPo 6S
Energy	97.58 Wh
Net Weight	Approx. 520 g
Operating Temperature	-20°C to 45° C
Storage Temperature	Storage Temperature Less than 3 months: -4° to 113° F (-20° to 45° C)

	More than 3 months: 72° to 82° F (22° to 28° C)
Charging Temperature	41° to 104° F (5° to 40° C)
Max Charging Power	180 W
Model	TB55
Capacity	7660 mAh
Voltage	22.8V
Battery Type	LiPo 6S
Energy	176.93Wh
Net Weight	Approx. 885 g
Operating Temperature	-4° to 113° F (-20° to 45° C)
Storage Temperature	Less than 3 months: -20° C to 45° C More than 3 months: 22° C to 28° C
Charging Temperature	41° to 104° F (5° to 40° C)
Max Charging Power	180 W

DJI GO 4 APP

Name	DJI GO 4
Mobile Device System Requirements	iOS 9.0 or later,Android 4.4.0 or later
Supported Mobile Devices	iOS:iPhone 5s, iPhone SE, iPhone 6, iPhone 6 Plus, iPhone 6s, iPhone 6s Plus, iPhone 7, iPhone 7 Plus, iPad Air, iPad Air Wi-Fi + Cellular, iPad mini 2, iPad mini 2 Wi-Fi + Cellular, iPad Air 2, iPad Air 2 Wi-Fi + Cellular, iPad mini 3, iPad mini 3 Wi-Fi + Cellular, iPad mini 4 and iPad mini 4 Wi-Fi + Cellular. This app is optimized for iPhone 7, iPhone 7 Plus. Android:Samsung tabs 705c, Samsung S6, Samsung S5, Samsung NOTE4, Samsung NOTE3, Google Nexus 6p, Nexus 9, Google Nexus 7 II, Ascend Mate7, Huawei P8 Max, Huawei Mate 8, LG V20, Nubia Z7 mini, Sony Xperia Z3, MI 3, MI PAD, Smartisan T1. *Support for additional devices available as testing and development continues.

UPWARD INFRARED SENSOR

Obstacle Sensing Range	0-16.4 feet (0-5 m)
FOV	±5°
Operating Environment	Large, diffuse and reflective obstacles (reflectivity >10%)

CENDENCE

Type	GL800A
Operating Frequency	2.400-2.483 GHz; 5.725-5.825 GHz
Max Transmitting Distance (unobstructed, free of interference)	2.4 GHz: 4.3 miles (7 km, FCC); 2.2 miles (3.5 km, CE); 2.5 miles (4 km, SRRC) 5.8 GHz: 4.3 miles (7 km, FCC); 1.2 miles (2 km, CE); 3.1 miles (5 km, SRRC)
EIRP	2.4 GHz: 26 dBm (FCC); 17 dBm (CE); 20 dBm (SRRC) 5.8 GHz: 28 dBm (FCC); 14 dBm (CE); 20 dBm (SRRC)
Power Supply	Extended Intelligent Battery (Model: WB37-4920mAh-7.6V)
Intelligent Battery	4923 mAh LiPo
Charging	DJI charger
Output Power	20 W (supplying power to DJI CS550 monitor) 12 W (without supplying power to monitor)
Video Output Ports	USB, HDMI, SDI
USB Supply Power	iOS: 1 A, 5.2 V (Max); Android: 1.5 A, 5.2 V (Max)
Dual User Capability	Master-and-Slave connection
Operating Temperature	-4 ° to 104 °F (-20 ° to 40 °C)
Storage Temperature	Less than 3 months: -4 ° to 113 °F (-20 °to 45 °C) More than 3 months: 72 °to 82 °F (22 °to 28 °C)
Charging Temperature	32 ° to 104 °F (0 °to 40 °C)
Charging Time	About 2 hours and 24 minutes (using a 180 W charger)

Supply Power Time	About 4 hours (only Master remote controller function enabled and without supplying power to monitor)
Weight	1041 g

Appendix 6
DJI AGRAS MG-1S
Specification Sheet

MG-1SSPECS

AIRCRAFT FRAME

Diagonal Wheelbase	1515 mm
Frame Arm Length	625 mm
Dimensions	1471 mm×1471 mm×482 mm（arm unfolded, without propellers） 780 mm×780 mm×482 mm（arm folded）

SPRAY SYSTEM

LIQUID TANK

Volume	10 L
Standard Operating Payload	10 kg
Max Battery Size	151 mm×195 mm×70 mm

NOZZLE

Model	XR11001VS（0.379L/min）
Recommend Model	TK-VK8（0.525L/min）
Quantity	4
Droplet Size	XR11001VS：130 - 250 μm（subject to working environment and spraying speed）

FLIGHT PARAMETERS

Total Weight	10 kg (without battery)
Standard Takeoff Weight	23.8 kg

Max Takeoff Weight	24.8 kg (at sea level)
Max Thrust-Weight Ratio	1.71 (with 23.8 kg takeoff weight)
Power Battery	DJI Designated Battery (MG-12000S)
Max Power Consumption	6400 W
Hovering Power Consumption	3800 W（@with 23.8 kg takeoff weight）
Hovering Time*	22 min（@12000 mAh & 13.8 kg takeoff weight） 10 min（@12000 mAh & 23.8 kg takeoff weight） *Hovering time acquired at sea level, with wind speeds lower than 3m/s.
Max Operating Speed	7 m/s
Max Flying Speed	12 m/s（P & F Mode，with GPS）；15 m/s （A Mode）
Max Service Ceiling Above Sea Level	2000 m
Recommended Operating Temperature	0 ℃ to 40 ℃

REMOTE CONTROLLER

Model	DLG60A
Operating Frequency	2.400 GHz to 2.483 GHz
Max Transmission Range	1 km (unobstructed, free of interference)
EIRP	≤20 dBm
Built-in Battery	9000 mAh，2S LiPo
Output Power	7 W
Operating Temperature Range	-10 ℃ to 40 ℃
Storage Temperature Range	Less than 3 months: -20 to 45℃ More than 3 months: 22 to 28℃
Charge Temperature Range	5 ℃ to 40 ℃

RADAR MODULE

Detection Range	1- 5 m

Working Range	1.5 - 3.5 m
Precision	< 10 cm

REMOTE CONTROLLER CHARGER

Model	A14-057N1A
Voltage	17.4 V
Rated Power	57 W

PROPULSION SYSTEM

MOTOR

Stator Size	60×10 mm
KV	130 rpm/V
Max Thrust	5.1 kg/rotor
Max Power	770 W
Weight	280g (with cooling fan)

FOLDABLE PROPELLER

Material	High-performance engineered plastics
Diameter/Pitch	21×7 inch
Weight	58 g

ESC

Max Allowable Current (Continuous)	25 A
Operating Voltage	50.4 V（12S LiPo）
Drive PWM Frequency	12 kHz

Appendix 7
Incident / Accident Report

MAC-UAS Incident / Accident Report

Pilot in Command:

First Name: _____

Last Name: _____

FAA Airman Certificate: _____

UAS Aircraft Registration: _____

Time of Incident/Accident:

Local Date: _____
Local Time: _____

Location:

Address: _____
City: _____

Did the Accident Involve…

1) ☐ Serious Injury
2) ☐ Death
3) ☐ Property damage greater than $500.00 (excluding the unmanned aircraft)
4) ☐ None of the Above

* If yes to numbers 1, 2, or 3 above file report with FAA within 10 days of accident.
* Check with MAC-UAS Manager about filing a UAS Incident/Accident Report with NASA

Description of Incident / Accident:

Appendix 8
Industry Best Practice Resources

1. ASTM Industry International Best Practice Standards
2. FAA Advisory Circular 107-2, “Small Unmanned Aircraft Systems,”
3. ICAO Annex 19, Safety Management Systems 2013
4. ICAO Document 9859 (Safety Management Manual), 3rd Edition. May 2013.

Appendix 9
Placer Mosquito and Vector Control District
Night Operations Safety Guidelines

PMVCD Night Operations Safety Plan

- Always use a Visual Observer (VO).
- Always use anti-collision lights on UAS that are visible for at least 3 statute miles. Anti-collision lights are DS-30 LED white strobes. The manufacturer of these lights (North American Survival Systems) claim they are visible up to 10 miles at night and up to 1 mile during daylight operations. Separate white and red running lights will be used in addition to the anti-collision strobe to identify the orientation of the UAS to crew members.
- File a UAS Operating Area in Designated Location with flight services or file a Notice to Airmen (NOTAM) via the FAA NOTAM portal if required as a condition of this waiver.
- Selecting familiar locations for night operations. We have had experience flying at this particular location during daylight hours which has provided us with extensive knowledge of the conditions and hazards present. In addition, we will arrive at the location during daylight hours so we can proactively examine and identify any new potential hazards, and so we can perform all preflight checklist items while there is still adequate lighting.
- Additional lighting for ground safety during night operations will be provided.
- Launch site of UAS will be marked will bright orange cones surrounding a landing mat in the center.
- UAS crew will have District vehicles parked at site that are marked with logos and contact information. Vehicles also have amber caution lights that will remain lit during night operations.
- If bystanders become interested in UAS Operations, we will have the resources to bring additional staff on site to intercept the concerned citizens, so the Remote Pilot in Command (RPIC) and VO will not be distracted. Anyone that is not involved with UAS Operations will not be permitted near site, which will be clearly marked with orange cones. Should anyone not directly involved and briefed in the operation make their way near our site, the RPIC will immediately fly the UAS to a safe location while a crew member not directly related to flight (non-RPIC/VO) will make contact with the person and assist them to a safe location outside the flight area.
- RPICs and VO's will be wearing high visibility vests that are labeled RPIC and VO. This will allow easy identification of all crew members involved in operation.
- All maneuvers involved with UAS will be announced verbally to alert crew members in consideration of Crew Resource Management best practices outlined in Advisory Circular 107-2 (Take-off, altitudes readings of UAS, landing of UAS)
- In the unlikely event of a lost link, all crew members will be alerted verbally, and fail safe return to home will be activated in accordance with standard operating procedures and in according to with UAS technical manual.
- Placer Mosquito and Vector Control District has already notified local law enforcement (Roseville PD and Placer County Sheriff's Office) about our UAS program. Prior to flights, a notification will be given to dispatches of both agencies to notify law enforcement of our operations, and to provide dispatch information should they receive any calls by concerned residents. All callers will be asked to stay away from the UAS operational area.
- Monitor VHF radio for air traffic around LHM and MCC airports.
- All members of UAS operation will be included in a preflight safety briefing before commencing night operations. The safety briefing will include, at least, a review of the night operations safety plan such that all members of the crew are able to:
    - report and identify hazards
    - conduct risk assessment of those hazards
    - recall specific knowledge and hazards of flying at night
    - identify emergency landing zones should primary landing zone become compromised
    - understand roles and responsibilities of each crew member should any incident or accident occur

Performance –Based Standards

1. RPIC and VO, will continuously use UAS lights and anti-collision lights to maintain visual line of sight during all night time operations. Because this operation involves the UAS flying vertically, all crew members will be in close proximity of UAS making it easier to keep aircraft in visual line of sight.

2. VO will scan for any potential hazards including but not limited to unmanned aircraft, manned aircraft, people on the ground, or any other potential hazards during nighttime operations. RPIC and VO will be in close enough proximity to verbally alert each other of any hazards.
3. RPIC will use telemetry data from the drone that will be displayed on the pilot's ground station. This information includes the position of UAS, altitude, flight mode, orientation of aircraft, vertical speed, horizontal speed, and movement of UAS. In addition, all maneuvers including take-off, altitudes, and landing will be verbally announced to all crew members that cannot directly view telemetry data from UAS.
4. All UAS crew members will have knowledge and skills to recognize and overcome visual illusions and other hazards caused by darkness. Crew members that have a current Part 107 certificate will comply with this requirement by reading the required night operations training material and passing a written exam with a score of 80% or better to demonstrate their understanding of the challenges of night flights. This exam will be administered by the District General Manager.

    a. The Night Operations Training required reading material will consist of the following:
        i. The District's Night UAS Operations Safety Plan
        ii. Pilots Handbook of Aeronautical Knowledge pages 16-17, 16-18, 16-19, and 16-20
        iii. Helicopter Flying Handbook Chapter 13 (https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/helicopter_flying_handbook/media/hfh_ch13.pdf)

    b. Knowledge and skills assessed specifically for safe night operations will include at minimum:
        i. Hazard Assessment for Night Operations
            1. Additional physiological and environmental hazards exist when operating a UAS at night.
            2. Hazards can be mitigated by providing additional training for crew on the following: vision in flight, night vision, night vision illusion, visual deficiencies, aircraft lighting, and visual illusions.
            3. All night operations will have at least one night-operations trained Visual Observers (VO) to increase safety and situational awareness of the RPIC.
        ii. Night Scanning
            1. Effective night scanning should include a series of short eye movements in 10 degree sectors.
            2. RPIC and VO's should scan slowly to prevent blurring, and start scanning at a father distance (around 500 meters) then move in closer. Scans should be in a left to right or right to left pattern.
        iii. Night Vision
            1. The ability of a crew member to see at night is important for safety and dependent on a number of physiological and environmental factors.
            2. Bright lights can impair a crew members' night vision
            3. Manage sources of bright lights so they do not impact the crew's night vision including lights on the UAS.
            4. Keep ground vehicle parked behind the RPIC and ground crew to minimize looking at the flashing amber light on the vehicle.
            5. Brightness on all devices (IPad, lap top, etc.) will be dimmed to minimum useful levels in order to help preserve our night vision.
        iv. Autokinesis
            1. Caused by focusing on a single point of light in the dark for longer than a few seconds. After a few seconds the light may appear to be moving.
            2. This visual illusion can be avoided by maintaining a normal scan pattern of the sky.
        v. Flicker Vertigo
            1. Staring directly at a strobe/ blinking light will be a distraction to most people. Some individuals may be susceptible to flicker-induced epilepsy, which can cause a dangerous situation if that person is a crew member

2. Scanning the sky and not staring at one particular light will help mitigate this issue.
3. Individuals with a history of flicker induced epilepsy should not be assigned as crew for night operations.

vi. Reversible Perspective Illusion

1. At night aircraft may appear to be moving away from you, when in reality it may be approaching your location. This normally happens when aircraft are flying a parallel route.
2. In the event another aircraft is approaching the UAS, the RPIC will yield to all manned aircraft. During a night operation, if another aircraft's heading is unclear, both the RPIC and VO will verbally communicate with each other to confirm which direction the aircraft is headed. If it is heading in the direction of the UAS, the RPIC will yield to that aircraft accordingly.

c. Visual Observers must qualify to work as part of the crew for night flights. In order to qualify, VO's shall read the required training material and complete a training that will focus on the roles and responsibilities of a VO during a night flight and topics important to safe flying at night. The VO night operations training will be conducted by an RPIC and will consist of a classroom component and field component. Assessment of the VO's knowledge and skills will be made individually by the RPIC and documented on a training completion form. Once successfully completed, VOs shall requalify annually.

5. Before each mission, a pre-flight safety briefing for the entire crew will be conducted by the RPIC and include a review of: knowledge and skills for safe night operations identified in #4, review of crew roles and responsibilities, communication methods, and any other mission specific concerns.

6. To increase the safety of our night operations our UAS will have its standard running lights on, in addition to the anti-collision lights. All UAS lights will be running throughout the entire night operation. Our anti-collision lights include a flashing white strobe, white lights on the front of aircraft, and flashing red lights on the back of the aircraft. Having red and white strobe lights will allow crew members to easily spot the UAS in the dark and determine the orientation of the sUA.

Appendix 10
Placer Mosquito and Vector Control District
MAC-UAS Battery Maintenance

PMVCD MAC-UAS Battery Safety Guidance

1.0 Battery Safety

Lithium Polymer (LiPo) batteries are comprised of Lithium-based chemistry suspended in a solid polymer matrix. Most packs are not hardened beyond thin plastic heat-shrink tubing and therefore care must be taken to prevent mechanical damage or puncture.

Cell chemistry produces a nominal voltage of 3.7 volts per cell and operating voltages between 3.2 and 4.2V. It is critical that the cell voltage does not drop below the 3.2 V minimum as this can damage the cells, reducing performance or even rendering the battery useless.

Please refer to the manufacturer's safety guidelines as well as this document if you have any questions regarding the safe handling of a specific LiPo battery.

1.1 Battery Maintenance and Charging

UAS battery maintenance will be conducted using airdata.uav.com. Airdata will assist MAC-UAS crew members in keeping track of charging cycles, monitoring any major deviations in cell voltage, and performing and documenting routine maintenance on UAS batteries.

Charging of LiPo batteries shall be carried out in accordance with the following procedure:

1. Inspect batteries and charger for any damage. Do NOT attempt to charge any batteries that show signs of swelling, punctures, or any other types of damage. Any batteries showing signs of damage must be taken out of service.
2. Charge the battery using a charger that is qualified for LiPo charging in accordance with battery manufacturer's specifications.
3. Never charge batteries unattended.
4. Charge batteries in a well-ventilated area away from flammable materials.
5. Let the battery cool down to ambient temperature before charging. Never charge hot LiPo packs.
6. If a battery pack shows signs of swelling while charging carefully disconnect the battery from the charger and store in a safe place.
7. Do not leave batteries on charger after charging is complete.
8. Batteries equipped with a balancing lead should be charged on a balancing charger to ensure equal charging between cells.
9. In general, a charge rate of 1C (one times the capacity of the battery) is considered to be normal. Batteries with higher C-counts can handle higher charge rate, but should never exceed the manufactures rating as printed on the label. Higher charge rates may degrade the battery's lifespan, and should be avoided when possible.

1.2 Transporting Batteries

Transportation of LiPo batteries shall be conducted in accordance with the following requirements:

1. When possible transport batteries in a hard case to prevent physical damage.
2. Keep batteries away from moisture.
3. Do not leave batteries in a hot vehicle for extended periods of time (more than 2 hours) as it may cause damage to battery or cause a fire.
4. Do not expose batteries to direct sunlight for extended periods.
5. Ensure batteries are protected from possible short circuits; do not store other items, such as tools, in the battery container.
6. Damaged or suspected damaged batteries shall be transported in isolation using a fire-retardant container or LiPo bag. Only transport a damage battery after a 45-minute observation period to ensure ignition is unlikely.

1.3 Battery Storage

1. Store batteries at room temperature.
2. Remove batteries from aircraft.
3. Do not leave batteries in vehicles for extended periods of time. All batteries need to be brought inside at the end of your shift.
4. Have a class ABC or CO2 fire extinguisher nearby the storage area.
5. Do not store batteries in the refrigerator, it may create internal condensation when the battery is brought to room temperature, causing a higher risk when operating.
6. Batteries can be stored in a metal cabinet, make sure the batteries are not touching each other. Keeping batteries in a storage container will help prevent them from getting damage while not in use.
7. When LiPo batteries will not be used for several days they should be stored around 50-60% of the pack's rated capacity or around 3.8 V a cell. Some chargers will have a storage option. Do not leave batteries in an over discharged state.
8. Batteries should not be stored near flammable materials.
9. Battery Packs in long term storage should be inspected every few months in ensure adequate voltage and that the packs are not showing any signs of swelling.

1.4 Emergency Procedures

LiPo/Li-ion batteries pose additional risk due to their high energy density and flammable electrolyte. When LiPo are poorly manufactured, overcharged or over discharged, incorrectly handled, or exposed to excessive mechanical and physical stress, conditions may arise and lead to a thermal runaway that in turn may lead to the venting, leaking, explosion and/or fire of the battery cell or pack.

1.4.1 Battery Ignition While Charging

The primary risk associated with Lithium Polymer technology is battery ignition while charging. This can result from improper charging, or charging a physically damage battery pack. Please charge all LiPo batteries in accordance with the charging procedure in section 1.1. In the event of a battery ignition during charging, the following procedure shall be followed:

1. The battery shall be allowed to burn to completion.
2. If there is any danger to surrounding structures or property, contact emergency services immediately.
3. The fire shall be monitored and the fire extinguisher used to ensure that surrounding materials do not catch fire.
4. The fire extinguisher shall not be discharged at the battery charger unless necessary to prevent the spread of fire.
5. After ignition has subsided, continue to monitor the battery for at least fifteen minutes.
6. After fifteen minutes disconnect the charger, and carefully move the battery to a safe location.
7. Leave the battery in a safe location for at least 24 hours prior to disposing of battery remains.

1.4.2 Aircraft Crash with No Battery Ignition

The great majority of aircraft crashes involving LiPo batteries will not result in battery ignition. In the event of an aircraft crash involving LiPo batteries that does not result in immediate ignition, the following procedure shall be followed:

1. The RPIC shall immediately cut power to the motors.
2. The aircraft shall be left in place and monitored for a 45-minute period after the crash to ensure that ignition is not going to occur.
3. After 45 minutes the aircraft can be recovered and the battery removed and inspected.
4. The exception is crash sites which are in the midst of highly combustible materials. In this case, approach the crash site with caution, with an extinguisher (ABC), and upon inspection, determine if the aircraft can be moved without posing additional hazards. If so, move the wreckage to a safe site for the cooling-off period. Consider using PPE (protective gloves)
5. Damaged or suspected damaged batteries shall be transported in isolation using a fire-retardant container or LiPo bag.

1.4.3 Aircraft Crash with Battery Ignition

Although rare, LiPo batteries can ignite as a direct and immediate result of physical damage alone. In the event of a battery ignition subsequent to an aircraft crash the following procedures shall be followed:

1. If smoldering, the battery shall be allowed to burn to completion within the aircraft.
2. If there is any danger to surrounding structures or property, contact emergency services immediately.
3. If burning, monitor and use the fire extinguisher if surrounding materials are at risk.
4. After crash or ignition has subsided, continue to monitor the battery for at least 45 minutes.
5. Extract the battery from the aircraft using tools or protective gloves if possible.
6. Place remains in a fire-retardant container or LiPo bag for transport
7. Leave battery remains in a safe location for at least 24 hours prior to disposing.

1.5 Battery Disposal

LiPo batteries can be recycled at Battery Plus Bulbs Stores. Non-damaged LiPo batteries can be recycled for free, damage batteries will cost around $15.00 - $30.00. LiPo battery recycling locations:

Batteries Plus Bulbs

910 Pleasant Grove Blvd

Roseville, CA 95678

(916)-786-2222

Reference/Sources:

Safety & Usage Procedure for Lithium Polymer Batteries – Naval Postgraduate School

Lithium Ion Battery Safety Guide - MIT

Appendix 11
Placer Mosquito and Vector Control District
Part 137 Conditions and Limitations

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

800 Independence Ave., S.W.
Washington, D.C. 20591

May 23, 2018

Exemption No. 17848
Regulatory Docket No. FAA-2018-0249

Mr. Scott Schon
Lead Vector Control Technician
Placer Mosquito and Vector Control District
2021 Opportunity Drive
Roseville, CA 95678

Dear Mr. Schon:

This letter is to inform you that we have granted your request for exemption. It transmits our decision, explains its basis, and gives you the conditions and limitations of the exemption, including the date it ends.

The Basis for Our Decision

By letter dated March 22, 2018 you petitioned the Federal Aviation Administration (FAA) on behalf of Placer Mosquito and Vector Control District (hereafter PMVCD) for an exemption from §§ 107.36; 137.19(c), (d), (e)(2)(ii),(iii) and (v); 137.31(a) and (b); 137.33(a) and (b); 137.41(c); and 137.42 of Title 14, Code of Federal Regulations (14 CFR) to the extent necessary to allow PMVCD to operate the DJI Agras MG-1 small unmanned aircraft system (UAS) to conduct agricultural-related services, to manage risks from vectors and vector-borne diseases by utilizing small UAS for aerial applications of registered public health insecticides.

The FAA has issued a grant of exemption in circumstances similar in all material respects to those presented in your petition. In Grant of Exemption No. 17261 (copy enclosed), the FAA found that a grant of exemption is in the public interest.

Having reviewed your reasons for requesting an exemption, I find that—

- they are similar in all material respects to relief previously requested in the enclosed Grant of Exemption No. 17261;

- the reasons stated by the FAA for granting the enclosed Grant of Exemption No. 17261 also apply to the situation you present; and

- a grant of exemption is in the public interest.

Our Decision

The FAA has determined that good cause exists for not publishing a summary of the petition in the Federal Register because the requested exemption would not set a precedent, and any delay in acting on this petition would be detrimental to Placer Mosquito and Vector Control District.

Under the authority contained in 49 U.S.C.§ 106(f), 40113, and 44701, which the FAA Administrator has delegated to me, I hereby grant Placer Mosquito and Vector Control District an exemption from 14 CFR §§ 107.36; 137.19(c) and (d); 137.19(e)(2)(ii), (iii), and (v); 137.31(a) and (b); 137.33(a) and(b); 137.41(c), and 137.42 to the extent necessary to allow the petitioner to operate the DJI Agras MG-1 small UAS for the purpose of managing risks from vectors and vector-borne diseases by utilizing small UAS for aerial applications of registered public health insecticides. This exemption is subject to the conditions and limitations described below.

Conditions and Limitations

In this grant of exemption, Placer Mosquito and Vector Control District is hereafter referred to as the operator.

Failure to comply with any of the conditions and limitations of this grant of exemption will be grounds for the immediate suspension or rescission of this exemption.

1. Operations authorized by this grant of exemption are limited to any model small UAS with a maximum takeoff weight of less than 55 pounds, including everything that is on board or otherwise attached to the aircraft.

2. When adding any small UAS or new small UAS models that will be operated under this exemption, the operator must notify the Flight Standards District Office (FSDO) that holds the operator's operating certificate. Additionally, operations authorized by this exemption are limited to the small UAS listed on the operator's part 137 Letter of Authorization (LOA).

3. This exemption and all documents needed to operate the small UAS and conduct its operations in accordance with the conditions and limitations stated in this grant of exemption, are hereinafter referred to as the operating documents. The operating documents must be accessible during all small UAS operations and made available to the Administrator upon request. If a discrepancy exists between the Conditions and Limitations in this exemption, any applicable FAA-issued waivers/authorizations, and

the procedures outlined in the operating documents, the petitioner must comply with the most restrictive conditions, limitations, provisions, or procedures. The operator may update or revise its operating documents. It is the operator's responsibility to track such revisions and present updated and revised documents to the Administrator or any law enforcement official upon request. The operator must also present updated and revised documents if it petitions for extension or amendment to this grant of exemption. If the operator determines that any update or revision would affect the basis upon which the FAA granted this exemption, then the operator must petition for an amendment to its grant of exemption. The General Aviation and Commercial Division (AFS-800) may be contacted if questions arise regarding updates or revisions to the operating documents.

4. Any small UAS used by the operator that has undergone maintenance or alterations that affect the small UAS operation or flight characteristics, e.g., replacement of a flight critical component, must undergo a functional test flight prior to conducting further operations under this exemption. Functional test flights may only be conducted by a remote pilot in command (PIC) with a Visual Observer (VO) and other personnel necessary to conduct the functional flight test (such as a mechanic or technician). The functional test flight must be conducted in such a manner so as to not pose an undue hazard to persons and property.

5. The operator must follow the small UAS manufacturer's maintenance, overhaul, replacement, inspection, and life-limit requirements for the aircraft and aircraft components. Each UAS operated under this exemption must comply with all updates to these documents that the manufacturer makes for the purposes of ensuring safety of operations with the small UAS.

6. *PIC qualifications:* The remote PIC must demonstrate to the FAA the ability to safely operate the small unmanned aircraft system in a manner consistent with how it will be operated under this exemption. This demonstration must include the applicable knowledge and skills requirements for agricultural aircraft operations outlined in 14 CFR part 137, evasive and emergency maneuvers, and maintaining appropriate distances from persons, vessels, vehicles and structures before conducting non-training, proficiency, or experience-building flights under this exemption.

7. For small UAS operations conducted under 14 CFR part 137 aerial application where a Global Positioning System (GPS) signal is necessary to operate the small UAS safely, the remote PIC must immediately recover/land the small UA upon loss of GPS signal.

8. If the remote PIC loses command or control link with the small UA, the small UA must either follow a pre-determined route to reestablish link or immediately recover or land. The remote PIC must satisfactorily demonstrate his or her ability to respond appropriately to a lost-link occurrence as part of the knowledge and skill assessment that will occur in accordance with § 137.19(e).

9. The remote PIC must abort the flight operation if unpredicted circumstances or emergencies arise that could potentially degrade the safety of persons or property. The remote PIC must terminate flight operations without causing undue hazard to persons or property in the air or on the ground. Documents the operator must retain under §§ 107.13, 137.33, and in accordance with this exemption (including but not limited to: operator's exemption, any waiver held, a copy of the agricultural aircraft operator certificate, training manual, operations manual, and registration certificate) must be available to the remote PIC at the Ground Control Station of the small UAS at all times the aircraft are operating. These documents must be made available to the Administrator or any law enforcement official upon request. Airworthiness certificates applicable to the small UAS to which this exemption applies are not required for compliance with this condition.

10. The relief granted from § 107.36 is limited to the use of any economic poison as defined in § 137.3.

11. The remote PIC may operate the small UAS from a moving device or vehicle as described in § 107.25, which permits such operation in sparsely populated areas, provided the small UAS does not transport property for compensation or hire. If conducting agricultural aircraft operations in accordance with § 107.25, the remote PIC must satisfactorily demonstrate the applicable knowledge and skills requirements of § 137.19 in the type of device or vehicle to be used in agricultural aircraft operations.

12. This exemption is not valid for operations outside of the United States.

This exemption does not obviate the applicability of, or in any manner alter, the provisions of parts 107 and 137 that are not the subject of this exemption. In this regard, petitioner must adhere to the terms of any waiver the FAA has issued to petitioner under part 107, subpart D that is associated with the agricultural operations that are the subject of this exemption. In addition, petitioner must comply with all limitations and provisions of petitioner's agricultural aircraft operator certificate, which the petitioner must obtain prior to conducting agricultural operations in accordance with § 137.11.

This exemption terminates on May 31, 2020, unless sooner superseded or rescinded.

Sincerely,

/s/
John S. Duncan
Executive Director, Flight Standards Service

Enclosure

Appendix 12
Voluntary Best Practices for UAS Privacy, Transparency, and Accountability

I. INTRODUCTION

The benefits of commercial and private unmanned aircraft systems (UAS) are substantial. Technology has moved forward rapidly, and what used to be considered toys are quickly becoming powerful commercial tools that can provide enormous benefits in terms of safety and efficiency. UAS integration will have a significant positive economic impact in the United States. Whether UAS are performing search and rescue missions, allowing farmers to be more efficient and environmentally friendly, inspecting power lines and cell towers, gathering news and enhancing the public's access to information, performing aerial photography to sell real estate and provide insurance services, surveying and mapping areas for public policy, delivering medicine to rural locations, providing wireless internet, enhancing construction site safety, or more—society is only just beginning to realize the full potential of UAS. UAS technology is already bringing substantial benefits to people's daily lives, including cheaper goods, innovative services, safer infrastructure, recreational uses, and greater economic activity. Inevitably, creative minds will devise many more UAS uses that will save lives, save money and make our society more productive.

However, the very characteristics that make UAS so promising for commercial and non-commercial uses, including their small size, maneuverability and capacity to carry various kinds of recording or sensory devices, can raise privacy concerns. As a result, individuals may be apprehensive about the adoption of this technology into everyday life. In order to ensure that UAS and the exciting possibilities that come with them live up to their full potential, operators should use this technology in a responsible, ethical, and respectful way. This should include a commitment to transparency, privacy and accountability.

The purpose of this document is to outline and describe voluntary Best Practices that UAS operators could take to advance UAS privacy, transparency and accountability for the private and commercial use of UAS.[1] UAS operators may implement these Best Practices in a variety of ways, depending on their circumstances and technology uses, and evolving privacy expectations. In some cases, these Best Practices are meant to go beyond existing law and they do not—and are not meant to—create a legal standard of care by which the activities of any particular UAS operator should be judged. These

[1] The National Telecommunications and Information Administration (NTIA) has convened a series of multi-stakeholder efforts as a way to increase privacy protections based upon the Administration's framework for consumer information privacy. On February 15, 2015, President Obama issued a Presidential Memorandum instructing NTIA to convene such a process to develop and communicate best practices for privacy, accountability, and transparency issues regarding commercial and private UAS use in the National Airspace System. These Voluntary Best Practices are the result of that multi-stakeholder engagement process.

Best Practices are also not intended to serve as a template for future statutory or regulatory obligations, in part because doing so would make these standards mandatory (not voluntary) and could therefore raise First Amendment concerns.

II. APPLICABILITY

These voluntary Best Practices for UAS focus on data collected via a UAS, which includes both commercial and non-commercial UAS. The only section applicable to newsgatherers and news reporting organizations is Section V considering that their activity is strongly protected by the First Amendment to the Constitution of the United States. There is also an Appendix entitled, "Guidelines for Neighborly Drone Use" that is intended to be a quick and easy reference guide for recreational UAS operators.

These Best Practices do not apply to data collected by other means—for instance, a company need not apply these Best Practices to data collected via the company's website. These Best Practices do not apply to the use of UAS for purposes of emergency response, including safety and rescue responses.

Nothing in these Best Practices shall:

- Be construed to limit or diminish freedoms guaranteed under the Constitution;
- Replace or take precedence over any local, state, or federal law or regulation;
- Take precedence over contractual obligations or the representations of entities contracting UAS operators. However, entities contracting UAS operators should consider these Best Practices when setting the terms of a contract for UAS use, and UAS operators should consider these Best Practices when choosing to accept a contract for UAS use; or
- Impede the safe operation of a UAS.

UAS operators should comply with all applicable laws and regulations. These Best Practices are intended to encourage positive conduct that complements legal compliance. Operators who are aware of other best practices that may apply specific guidance to technologies deployed on or through UAS should consider how to incorporate that guidance into their privacy and security policies and practices.

These Best Practices are also not intended to serve as a template for future statutory or regulatory obligations, in part because doing so would raise First Amendment issues.

III. DEFINITIONS

The term "*consent*" means words or conduct indicating permission. Consent must be informed and conduct indicating permission may be express or implied, depending on the context.

"Covered data" means information collected by a UAS that identifies a particular person. If data collected by UAS likely will not be linked to an individual's name or other personally identifiable information, or if the data is altered so that a specific person is not recognizable, it is not covered data.

The term "*data subjects*" refers to the individuals about whom covered data is collected.

The terms *"where practicable"* and "*reasonable*" depend largely on the circumstances of the UAS operator, the sensitivity of data collected, and the context associated with a particular UAS operation.

IV. VOLUNTARY BEST PRACTICES

1. INFORM OTHERS OF YOUR USE OF UAS

1(a) Where practicable, UAS operators should make a reasonable effort to provide prior notice to individuals of the general timeframe and area that they may anticipate a UAS intentionally collecting covered data.[2]

1(b) When a UAS operator anticipates that UAS use may result in collection of covered data, the operator should provide a privacy policy for such data appropriate to the size and complexity of the operator, or incorporate such a policy into an existing privacy policy. The privacy policy should be in place no later than the time of collection and made publicly available. The policy should include, as practicable:

(1) the purposes for which UAS will collect covered data;[3]

[2] What qualifies as a practicable and reasonable effort to provide prior notice will depend on operators' circumstances and the context of the UAS operation. For example, delivery UAS operators may provide customers with an estimated time of delivery. Real estate professionals using UAS may provide a home seller (and possibly immediate neighbors) with prior notice of the estimated date of UAS photography of the property. Hobbyist UAS operators may not need to notify nearby individuals of UAS flight in the vicinity.

(2) the kinds of covered data UAS will collect;
(3) information regarding any data retention and de-identification practices;[4]
(4) examples of the types of any entities with whom covered data will be shared;
(5) information on how to submit privacy and security complaints or concerns; and
(6) information describing practices in responding to law enforcement requests.

Material changes to the above should be incorporated into the privacy policy.

2. SHOW CARE WHEN OPERATING UAS OR COLLECTING AND STORING COVERED DATA

2(a) In the absence of a compelling need to do otherwise, or consent of the data subjects, UAS operators should avoid using UAS for the specific purpose of intentionally collecting covered data where the operator knows the data subject has a reasonable expectation of privacy.

2(b) In the absence of a compelling need to do otherwise, or consent of the data subjects, UAS operators should avoid using UAS for the specific purpose of persistent and continuous collection of covered data about individuals.

2(c) Where it will not impede the purpose for which the UAS is used or conflict with FAA guidelines, UAS operators should make a reasonable effort to minimize UAS operations over or within private property without consent of the property owner or without appropriate legal authority.

2(d) UAS operators should make a reasonable effort to avoid knowingly retaining covered data longer than reasonably necessary to fulfill a purpose as outlined in § IV.1(b). With the consent of the data subject, or in exceptional circumstances (such as legal disputes or safety incidents), such data may be held for a longer period.

2(e) UAS operators should establish a process, appropriate to the size and complexity of the operator, for receiving privacy or security concerns, including requests to delete,

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[3] These Best Practices recognize that UAS operators may not be able to predict all future uses of data. Accordingly, these Best Practices do not intend to discourage unplanned or innovative data uses that may result in desirable economic or societal benefits.

[4] If it is not practicable to provide an exact retention period, because, for example, the retention period depends on legal hold requirements or evolving business operations, the UAS operator may explain that to data subjects when disclosing its retention policies.

de-identify, or obfuscate the data subject's covered data. Commercial operators should make this process easily accessible to the public, such as by placing points of contact on a company website.[5]

3. LIMIT THE USE AND SHARING OF COVERED DATA

3(a) UAS operators should not use covered data for the following purposes without consent: employment eligibility, promotion, or retention; credit eligibility; or health care treatment eligibility other than when expressly permitted by and subject to the requirements of a sector-specific regulatory framework.

3(b) UAS operators should make a reasonable effort to avoid using or sharing covered data for any purpose that is not included in the privacy policy covering UAS data.

3(c) If publicly disclosing covered data is not necessary to fulfill the purpose for which the UAS is used, UAS operators should avoid knowingly publicly disclosing data collected via UAS until the operator has undertaken a reasonable effort to obfuscate or de-identify covered data —unless the data subjects provide consent to the disclosure.

3(d) UAS operators should make a reasonable effort to avoid using or sharing covered data for marketing purposes unless the data subject provides consent to the use or disclosure. There is no restriction on the use or sharing of aggregated covered data as an input (*e.g.*, statistical information) for broader marketing campaigns.

4. SECURE COVERED DATA

4(a) UAS operators should take measures to manage security risks of covered data by implementing a program that contains reasonable administrative, technical, and physical safeguards appropriate to the operator's size and complexity, the nature and scope of its activities, and the sensitivity of the covered data.

Examples of appropriate administrative, technical, and physical safeguards include those described in guidance from the Federal Trade Commission, the National Institute of Standards and Technology (NIST) Cybersecurity Framework, and the International Organization for Standardization's 27001 standard for information security management.

For example, UAS operators engaging in commercial activity should consider taking the following actions to secure covered data:

[5] This may be as simple as talking to an individual who approaches the UAS operator with a concern.

- Having a written security policy with respect to the collection, use, storage, and dissemination of covered data appropriate to the size and complexity of the operator and the sensitivity of the data collected and retained.[6]

- Making a reasonable effort to regularly monitor systems for breach and data security risks.

- Making a reasonable effort to provide security training to employees with access to covered data.

- Making a reasonable effort to permit only authorized individuals to access covered data.

5. MONITOR AND COMPLY WITH EVOLVING FEDERAL, STATE, AND LOCAL UAS LAWS

5(a) UAS operators should ensure compliance with evolving applicable laws and regulations and UAS operators' own privacy and security policies through appropriate internal processes.

V. BEST PRACTICES FOR NEWSGATHERERS AND NEWS REPORTING ORGANIZATIONS

Newsgathering and news reporting are strongly protected by United States law, including the First Amendment to the Constitution. The public relies on an independent press to gather and report the news and ensure an informed public.

For this reason, these Best Practices do not apply to newsgatherers and news reporting organizations. Newsgatherers and news reporting organizations may use UAS in the same manner as any other comparable technology to capture, store, retain and use data or images in public spaces. Newsgatherers and news reporting organizations

[6] As with the privacy policy referenced in § IV.1(b), UAS operators may modify a broader existing security policy to incorporate data collected via UAS. A security policy should include, at minimum, such basic steps as keeping software up to date and downloading security patches for known vulnerabilities.

should operate under the ethics rules and standards of their organization, and according to existing federal and state laws.

APPENDIX

Guidelines for Neighborly Drone Use

Drones are useful. New, fairly cheap drones are easy to use. But just because they are cheap and simple to fly doesn't mean the pictures and video they take can't harm other people. The FAA and partner organizations have put safety guidance online at http://knowbeforeyoufly.org. But even safe flight might not respect other people's privacy. These are voluntary guidelines. No one is forcing you to obey them. Privacy is hard to define, but it is important. There is a balance between your rights as a drone user and other people's rights to privacy. That balance isn't easy to find. You should follow the detailed "UAS Privacy Best Practices", on which these guidelines are based, especially if you fly drones often, or use them commercially. The overarching principle should be peaceful issue resolution.

1. If you can, tell other people you'll be taking pictures or video of them before you do.

2. If you think someone has a reasonable expectation of privacy, don't violate that privacy by taking pictures, video, or otherwise gathering sensitive data, unless you've got a very good reason.

3. Don't fly over other people's private property without permission if you can easily avoid doing so.

4. Don't gather personal data for no reason, and don't keep it for longer than you think you have to.

5. If you keep sensitive data about other people, secure it against loss or theft.

6. If someone asks you to delete personal data about him or her that you've gathered, do so, unless you've got a good reason not to.

7. If anyone raises privacy, security, or safety concerns with you, try and listen to what they have to say, as long as they're polite and reasonable about it.

8. Don't harass people with your drone.