

Mutual Aid Box Alarm System – Illinois Unmanned Aircraft Systems Program (UAS)

Index #: B-08-04

Adopted: 2/7/2018

Revised: DRAFT

Page 1 of 6

Subject: Unmanned Aircraft Systems Program (UAS)
Functional Area: Special Operations Team
Category: Policy, Procedure and Guideline
Approved By: MABAS Executive Board



PURPOSE

The purpose of this document is to provide guidance and structure to MABAS operational staff for building a statewide standard and roadmap to assist MABAS Divisions in establishing, developing, and implementing an aerial drone program. The MABAS UAS Program Guideline provides a framework for member agencies to effectively mobilize and deploy assets without the cost, complexity, and liability of building them individually. The UAS Program Guideline outlines a framework detailing how MABAS will develop, maintain, and deploy a safe and highly effective response of aerial assets to support member agencies and their jurisdictions in response to man-made, technological or environmental threats. Shared MABAS divisional cooperative UAS programs are strongly encouraged for their efficiency and cost-effective benefits.

ROLES, RESPONSIBILITIES AND AUTHORITIES

MABAS-Illinois assumes the role, responsibility, and authority to:

- coordinate, facilitate, and monitor compliance of the UAS Program Guidelines;
- recognize and designate MABAS-Illinois UAS divisionally operated UAS special operations team programs which are guideline compliant;
- withdraw statewide special operations UAS divisional recognition for those failing to comply with program guidelines.

MABAS divisions assume the role, responsibility, and authority to:

- develop and assign UAS program coordination and administration to MABAS division member agency(ies) in a cooperative and cohesive manner;
- understand participation of MABAS divisions or agency(s) are voluntary and not required;
- support, sponsor, and assure guideline compliance efforts are actively monitored and acted upon;
- support participation in the MABAS UAS work group as the source of subject matter expertise, guidance and sharing of efforts to improve MABAS division UAS programs

MABAS member divisional agencies assume the role, responsibility, and authority (when designated as a MABAS divisional Coordinator and Administrator of a statewide UAS recognized team) to:

- understand right and authority for program operation as the authority having jurisdiction (AHJ) and avoidance of inappropriate or liable UAS uses or applications;
- understand acceptance and involvement in a lead role as a UAS Program Administrator and Coordinator is purely voluntary;
- understand scope and intent of administrating and coordinating AHJ requires awareness and efforts to comply with statewide team recognition policies and guidelines.

REASON AND RATIONALE

Drones have proved to be an invaluable tool for saving lives in the public safety industry. Due to the cost and resources required for implementing a safe and effective program, MABAS proposes that special ops teams be created allowing divisions to build out operational capabilities based on need, functionality, and budget. The structure of MABAS Special Operations Teams lends itself to supporting UAS operations by specifying crewmember roles, training, certification, recurrent

Mutual Aid Box Alarm System – Illinois Unmanned Aircraft Systems Program (UAS)

Index #: B-08-04

Adopted: 2/7/2018

Revised: DRAFT

Page 2 of 6

training, and program maintenance standards. Authorization on the federal level will be granted to MABAS, as well as federal certification of each Pilot in Command (PIC) to ease the startup and program maintenance expenditures for individual agencies.

SPONSORSHIP AND SUPPORT

Insurance: MABAS-Illinois will negotiate special MABAS group insurance rates.

FAA Authorizations/Compliance: MABAS-Illinois will secure FAA authorizations that divisions can utilize easing the FAA compliance burden at the divisional level.

ADMINISTRATION

Rules of Construction:

1. Unless otherwise specified in an attachment or expressly prohibited by any federal aviation regulation, waiver, or authorization granted to MABAS-IL; MABAS UAS Operations shall be conducted in accordance with the *NFPA 2400 Standard for Small Unmanned Aircraft Systems (sUAS) Used for Public Safety Operations*.
2. Nothing in this standard shall inhibit the adoption of methods, systems, or devices of equivalent or superior quality, efficacy or performance.
3. This standard shall apply to public entities, and any non-public entities operating for the purposes

Definitions: Defined terms used in this standard are available for reference. In the *Unmanned Aircraft Systems Program (UAS) Policy*, chapter 5, and *NFPA 2400 Standard for Small Unmanned Aircraft Systems (sUAS) Used for Public Safety operations*, chapter 3.

SPECIAL TEAMS

MABAS-Illinois will create and recognize Statewide Special Operations UAS Teams.

References: Chapter 1 Personnel Roles, Responsibilities, and Qualifications and Chapter 3 Flight Operations and Deployment, in the *Unmanned Aircraft Systems Program (UAS) Policy*.

UAS PROGRAM PLANNING PROCESS

1. Identify mission, search and rescue, fire observation, fire investigations, flooding, logistics, hazardous material response, and other.
2. Identify operational needs: aerial video, aerial photography, 3D mapping, aerial thermography, or payload (drop or other).
3. Create a budget for equipment, training, certification staffing, insurance, and consulting services.
4. Purchase UAS hardware, software, accessories, and extended warrantee.
5. Identify staffing needs and resource allocation.
6. Assess training and certification requirements.
7. Understand FAA, state, local regulations, and compliance issues.
8. Create UAS Program Guidelines for building an effective, efficient, and safe UAS Program.
9. Build program awareness in the community.

Reference: Attachment A UAS Program Planning. In *Unmanned Aircraft Systems Program (UAS) Policy*.

Mutual Aid Box Alarm System – Illinois Unmanned Aircraft Systems Program (UAS)

Index #: B-08-04

Adopted: 2/7/2018

Revised: DRAFT

Page 3 of 6

STANDARD OPERATING GUIDELINES

Training / Certification:

This guideline will include minimum requirements for classroom and practical training for each crewmember, plus a periodic flight review for the Pilot in Command (PIC) to be signed off by UAS Branch Chief or UAS Coordinator.

Reference: Chapter 1 Personnel Roles, Responsibilities, and Qualifications. In *Unmanned Aircraft Systems Program (UAS) Policy*.

Reference: Chapter 5 Professional Qualifications for sUAS Public Safety Personnel. In *NFPA 2400 Standard for Small Unmanned Aircraft Systems (sUAS) Used for Public Safety Operations*.

Equipment Selection and Purchase:

Based on the operational needs assessment, the division will select standard UAS equipment. Criteria should be based on effectiveness, reliability, and interoperability. Considerations include requirements for aerial video/photography, thermal imagery, or specialty equipment (payload drop, carry, gas detection or other).

Purchase extended warrantee that includes repair/replacement if cost effective vs. self-insuring for Hull Damage Insurance.

Reference: Chapter 2 Equipment Selection, Purchase, and Maintenance. In *Unmanned Aircraft Systems Program (UAS) Policy*.

Reference: Chapter 4, Organizational Deployment and Considerations for sUAS, (see 4.5). In *NFPA 2400 Standard for Small Unmanned Aircraft Systems (sUAS) Used for Public Safety Operations*.

Maintenance:

The UAS, accessories, and batteries shall be in a state of readiness to fly at all times.

The assigned Pilot in Command (PIC) is responsible for validating UAS readiness, including pre-flight and post-flight checklist. The PIC will refer to manufacturer's guidelines on equipment maintenance and if none are in place, will develop guidelines to ensure that equipment is functional and airworthy.

Reference: Chapter 2 Equipment Selection, Purchase, and Maintenance. In *Unmanned Aircraft Systems Program (UAS) Policy*.

Reference: Chapter 6 Maintenance sUAS. In *NFPA 2400 Standard for Small Unmanned Aircraft Systems (sUAS) Used for Public Safety Operations*.

Crew Roles and Responsibilities Assignment:

Before deployment, a flight crew will be assigned to each UAS. Flight Crew assignment guidelines will cover the roles and responsibilities of crewmembers, qualifications, and training recency, to ensure crewmembers are qualified to act in the capacity of Pilot in Command, Sensor Operator/Visual Observer or other designated role. These guidelines are developed to ensure maximum interoperability between MABAS Divisions and immediate deployment of crewmembers.

Reference: Chapter 1 Personnel Roles, Responsibilities, and Qualifications; Chapter 3 Flight Operations and Deployment. In *Unmanned Aircraft Systems Program (UAS) Policy*.

Mutual Aid Box Alarm System – Illinois Unmanned Aircraft Systems Program (UAS)

Index #: B-08-04

Adopted: 2/7/2018

Revised: DRAFT

Page 4 of 6

Mobilization Procedures:

To effectively mobilize a UAS response, MABAS UAS units will maintain the UAS and supporting equipment in a persistent state of readiness. In addition, the UAS mobilization procedures document the actions taken by the flight crew after dispatch, before and after a UAS response.

Reference: Chapter 3 Flight Operations and Deployment. In *Unmanned Aircraft Systems Program (UAS) Policy*.

Reference: Chapter 4 Organizational Deployment and Considerations for sUAS. In *NFPA 2400 Standard for Small Unmanned Aircraft Systems (sUAS) Used for Public Safety Operations*.

Flight Operations:

Once deployed, it is imperative that the UAS flight crew operate safely, efficiently, and effectively in challenging environments. These guidelines describe the actions required by the flight crew to prepare the aircraft to respond safely including flight planning, procedures for navigating the National Airspace System, and weather related operating conditions. The guidelines outline procedures for preflight inspection, takeoff, cruise flight, arrival, and landing. They also set forth the contingencies the UAS Pilot in Command (PIC) will use to respond to in-flight emergencies and abnormal operating conditions as well as log the pertinent information required for documenting the flight.

Reference: Chapter 3 Flight Operations and Deployment, and Attachment D Operational Application Guideline – General. In *Unmanned Aircraft Systems Program (UAS) Policy*.

Reference: Chapter 4 Organizational Deployment and Considerations for sUAS. In *NFPA 2400 Standard for Small Unmanned Aircraft Systems (sUAS) Used for Public Safety Operations*.

Specialty Operations:

Frequently MABAS UAS units will deploy for incidents requiring UAS support for special operations. These operations require additional knowledge and proficiency from the flight crew, including HazMat, Tech Rescue, Dive, Water and Ice Rescue, Hazardous Weather and Natural Disasters, and Structure Fire Support. In addition, certain authorizations or waivers granted to MABAS could require additional training. Procedures on implementing and documenting this training can be found in the Specialty Operations Guideline.

Reference: *Unmanned Aircraft Systems Program (UAS) Policy*.

Chapter 3 Flight Operations and Deployment.

Attachment E Operational Application Guideline – Firefighting.

Attachment F Operational Application Guideline – Search and Rescue.

Attachment G Operational Application Guideline – Hazardous Materials Response.

Reference: Chapter 4 Organizational Deployment and Considerations for sUAS. In *NFPA 2400 Standard for Small Unmanned Aircraft Systems (sUAS) Used for Public Safety Operations*.

Mutual Aid Box Alarm System – Illinois Unmanned Aircraft Systems Program (UAS)

Index #: B-08-04

Adopted: 2/7/2018

Revised: DRAFT

Page 5 of 6

Data Collection / Retention:

UAS Responses collect a wealth of useful data. It is paramount that data be collected and retained in a manner that does not pose additional liability to MABAS or its member agencies. This guideline describes the manner in which data including images, videos, flightlog files, and pilot's log, and other information is stored and retained.

Reference: Chapter 4 Data Collection and Retention. In *Unmanned Aircraft Systems Program (UAS) Policy*.

Program Reporting and Compliance:

▪ Mandated Reporting

Certain operating permissions granted by the FAA entail a specific burden for reporting the specifics of flights that occur under that permission. This guideline describes how flight operations are reported to the FAA through the MABAS Command Structure.

▪ Aircraft Incident Reporting

Maintaining the safety and effectiveness of the MABAS UAS program relies on full transparency regarding in-flight emergencies, aircraft accidents, and incidents. The procedures for reporting aircraft incidents internally are separate from FAA mandated incident reporting, and are designed to allow MABAS to continuously improve the safety and efficacy of the MABAS UAS Program.

▪ Operational Safety Assessment

Based on the information collected in the mandated reporting guideline, each UAS unit will undergo a yearly operational safety assessment of their training, maintenance, and operating procedures. This assessment will identify areas of improvement and the team's eligibility to operate.

Reference: Chapter 3 Flight Operations and Deployment. In *Unmanned Aircraft Systems Program (UAS) Policy*.

Insurance Considerations:

Liability Insurance and Hull Insurance Options.

Reference: Attachment C Insurance Recommendations. In *Unmanned Aircraft Systems Program (UAS) Policy*.

Program Awareness and Support:

The success of a UAS program is dependent upon the department's and community's acceptance. Concerns over safety and privacy exist and education and transparency are key to adoption. It is highly recommended that departments educate their communities on the lifesaving benefits of using UAVs in public safety.

Reference: Attachment A UAS Program Planning. In *Unmanned Aircraft Systems Program (UAS) Policy*.

Mutual Aid Box Alarm System – Illinois Unmanned Aircraft Systems Program (UAS)

Index #: B-08-04

Adopted: 2/7/2018

Revised: DRAFT

Page 6 of 6

RESOURCES

Referenced Publications:

- NFPA 2400 Standard for Small Unmanned Aircraft Systems (sUAS) Used for Public Safety Operations.
- Title 14, Code of Federal Regulations Part 1 “General Definitions and Abbreviations”.
- 2016 FEMA — ICS Glossary, Incident Command System Training, 2008.
- Title 49, United States Code § 40125: Qualifications for Public Aircraft Status.
- Title 14, Code of Federal Regulations, Part 91, “General Operating and Flight Rules”.
- Title 14, Code of Federal Regulations, Part 107, “Operation and Certification of Small Unmanned Aircraft”.

Chapters: (Compulsory)

1. Personnel Roles, Responsibilities, and Qualifications
2. Equipment Selection, Purchase, and Maintenance
3. Flight Operations and Deployment
4. Data Collection and Retention
5. Definitions

Attachments and Reporting Forms: (Non-Compulsory Information)

- A. UAS Program Planning
- B. Equipment and Maintenance
- C. Insurance Recommendations
- D. Operational Application Guideline - General
- E. Operational Application Guideline - Firefighting
- F. Operational Application Guideline - Search and Rescue
- G. Operational Application Guideline - Hazardous Materials Response
- H. MABAS UAS Program Budget Tool
- I. Reporting Forms
 - I.1. MABAS In-Service Report
 - I.2. MABAS Post-Flight Report
 - I.3. MABAS Deviation Report
 - I.4. MABAS Accident Report

Mutual Aid Box Alarm Systems

Unmanned Aircraft Systems Program (UAS)

Personnel Roles, Responsibilities and Qualifications

OVERVIEW

This document contains the definitions, qualification standards, and training requirements for personnel acting as crewmembers and administrators in the MABAS UAS Program.

ADMINISTRATIVE PERSONNEL

Administrative personnel perform support functions such as program reporting, asset coordination, and provide general guidance to crewmembers. Administrative personnel do not act in the capacity of flight crewmembers. The following personnel shall be considered administrative personnel, arranged in order of descending command chain.

A. UAS Section Chief

The UAS Section Chief is the person that manages the MABAS UAS Program readiness and compliance at the MABAS-Illinois level.

Duties include:

1. Maintaining the crewmember roster and supporting training logs for any persons eligible to act as crewmembers on a MABAS UAS operation.
2. Maintaining any MABAS-wide special authorization or waiver by the FAA.
3. Acting as a single point of contact with the FAA.
4. Updating, promulgating, and enforcing the MABAS UAS procedure and guideline.

B. UAS Division Supervisor

The UAS Division Supervisor is the person that manages the MABAS UAS Program readiness and regulatory compliance at the MABAS division level.

Duties include:

1. Maintaining the crewmember roster and supporting training logs, for any persons eligible to act as crewmembers on a MABAS UAS operation for the division to which they are assigned.
2. Establishing and maintaining divisional FAA authorizations or waivers.
3. Ensuring all operations conducted are in accordance with the MABAS UAS procedure and guideline.
4. Responsible for maintaining divisional UAS airworthiness to include maintenance logs.
5. Reporting pertinent crewmember and response information to the UAS Section Chief, and acting under the guidance of the UAS Section Chief.

C. Agency UAS Coordinator

The Agency UAS Coordinator is the person that manages the MABAS UAS Program readiness and regulatory compliance at the departmental level (if applicable).

Duties include:

1. Maintaining the crewmember roster and supporting training logs for any persons eligible to act as crewmembers on a MABAS UAS operation.
2. Establishing and maintaining localized FAA authorizations or waivers.
3. Ensuring all operations conducted are in accordance with the MABAS UAS guideline.

4. Responsible for maintaining departmental owned UAS airworthiness to include maintenance logs.
5. Reporting pertinent crewmember and response information to the Division (X) UAS Team Leader and acting under his guidance.

OPERATIONS PERSONNEL

Operations personnel are personnel that act in an operational on-scene role to support the UAS operation, but who do not act in the capacity of a flight crewmember. Operations personnel are responsible for logistics, implementation of technology, tactics, and information required to support the flight crew in the successful completion of the operation.

A. UAS Tactical Group Supervisor (UAS Coordinator)

The UAS Tactical Group Supervisor (UAS Coordinator) is an operations role that manages deconfliction of multiple air assets during operations that require the response of multiple UAS.

Duties include:

1. Interfacing between local Incident Command and responding air assets.
2. Coordinating local air operations.
3. Establishing Temporary Flight Restrictions (TFRs), authorizing, controlling, and separating air operations within the TFRs.
4. Establishing and maintaining safe landing sites on the fire ground or incident scene.
5. This crewmember may be assigned the duties of the Incident Air Tactical Group Supervisor and/or the Air Operations Branch Director.
 - a. When acting as Air Tactical Group Supervisor and/or the Air Operations Branch Director, he is responsible for controlling and separating manned air traffic as well as receiving any necessary pre-flight authorizations.
 - b. Coordinating with the FAA Special Operations Support Center on-scene when required.

B. UAS Technical Specialist

The UAS Technical Specialist is a data logistics role that provides technical support to the UAS team, acts to interface information between flight crew and Incident Command (IC), and may be responsible for assisting the flight crew in the management of communications systems and off-aircraft data recording and relay equipment.

Duties include:

1. Ensures that off-aircraft data recording and streaming equipment is operational at pre-flight, in-flight, and post-flight to achieve the mission objectives.
2. Responsible for radiofrequency coordination between Incident Command (IC), UAS Tactical Group Supervisor and flight crew.
3. Performs preflight and post-flight safety and security checks of onboard data gathering and streaming equipment.
4. Communicates safety, hazards, needs, and concerns relating to data gathering and streaming equipment to the flight crew.
5. Maintains the flow of streamed data while the aircraft is in flight.
6. Coordinates between Incident Command (IC) and flight crew to ensure pertinent data is captured.
7. Assists Incident Command (IC) in extracting actionable insights from live data.
8. Ensures that backup recording devices are operational before launch.
9. Checks data recorded, creates backup copy, and forwards original to designated operations and planning authorities.
10. Ensure well-documented chain of custody of information gathered from the aircraft.

FLIGHT CREW

Flight crewmembers are any personnel who perform duty operating the UAS during flight time ^[1]. The Remote Pilot in Command (RPIC) is the only required crewmember for the operation of the UAS. However, it is strongly recommended that divisions and agencies include additional flight crew to promote safety and efficacy of operations. Flight crews operating under the MABAS UAS Program report directly to their Commanding Administrator.

A. Remote Pilot in Command (RPIC)

The person that has been found to be properly qualified to exercise the privileges of Remote Pilot, and is directly responsible for the operation of the small unmanned aircraft, if operating a public aircraft as determined by the AHJ ^{[2], [3]}.

Duties include:

1. Operation of the UAS in accordance with applicable regulations under 14 CFR § 107.19 and 14 CFR § 91.3.
2. Directly responsible for, and is the final authority as to, the operation of that aircraft.
3. Conducting pre-flight, in-flight, and post-flight procedures.
4. Maintaining safety of flight operations.
5. Acting in accordance with any MABAS authorization or waiver.

B. Payload Operator (PO)

The crewmember responsible for manipulating sensor and non-sensor payloads, gathering and interpreting requisite inflight data, and transmitting the insights gathered from that data to the Incident Commander (IC). The Payload Operator may assist the Remote Pilot in Command (RPIC) in navigation and situational awareness (when requested by the RPIC).

Duties include:

1. Operation of sensor and non-sensor payloads.
2. Gathering and interpreting inflight data.
3. Communication of pertinent information to Incident Commander (IC).
4. Safeguards releasable payloads operations.
5. Ensuring the UAS is within weight and balance limitations.

C. Visual Observer (VO)

A crewmember who assists the Remote Pilot in Command (RPIC) in hazard detection, air traffic and collision avoidance, and fulfills the duties of the crewmember described in 14 CFR § 107.33 – Visual Observer ^[4].

Duties include:

1. Scanning the area to detect air traffic hazards, collisions, or unauthorized persons.
2. Assisting the Remote Pilot in Command (RPIC) with situational awareness.

QUALIFIED NON-CREWMEMBER (QNC)

Any person operating on the incident scene with awareness level training to operate effectively around the UAS flight crew. See the United States Code, 49 U.S.C § 40125: Qualifications for public aircraft status, for more information ^[5].

CREW TRAINING, QUALIFICATIONS AND PREREQUISITES

A. UAS Awareness

Awareness level training shall be completed by all deployable qualified non-crewmembers to operate around the UAS flight crew in the vicinity of UAS assets deployment and any command staff.

Minimum Qualification for:

- Qualified non-crewmember

Prerequisites:

- None

Privileges upon Completion:

- Deploy with UAS assets

B. UAS Operations

Operations level training shall be completed by all operational personnel conducting non-flying crewmember duties during the UAS operation.

Minimum Qualification for:

- Visual Observer
- Payload Operator

Prerequisites:

- Successful completion of UAS Awareness
- Successful completion of Basic Operations Firefighter

Privileges upon Completion:

- Deploy on the UAS team as a sensor operator, payload operator, or visual observer.

C. UAS Technician I

UAS Technician I is the minimum qualification for generalist UAS remote pilots to act as Remote Pilot in Command (RPIC) during a MABAS deployment.

Minimum Qualification for:

- UAS Remote Pilot in Command (RPIC)
- UAS Chief Pilot (UAS Coordinator)

Prerequisites:

- Successful completion of UAS Operations
- Successful completion of advanced Technician Firefighter
- Ten (10) hours total flight time as a non-flying crewmember (PO, VO)

NOTE: While not a prerequisite for UAS Technician I, each RPIC must hold a current Part 107 Remote Pilot Certificate before deployment.

Privileges upon Completion (with current Remote Pilot Certificate):

- Lead the UAS team as Remote Pilot in Command (RPC)
- Directly manipulate the flight controls of the UAS

D. UAS Technician II

UAS Technician II is a UAS Remote Pilot in Command (RPC) with extensive operational and management experience to deconflict multiple UAS operations and the requisite knowledge and experience to be eligible for various endorsements.

Minimum Qualification for:

- Interstate Deployment
- MABAS UAS Team Membership
- UAS Division Supervisor
- UAS Tactical Group Supervisor
- UAS Technical Specialist

NOTE: It is strongly recommended that the UAS Technical Specialist maintain at minimum operations level proficiency in the specialty to which the UAS team will be deployed. For example, it is recommended a UAS Technical Specialist deploying with a UAS team to a HAZMAT incident have completed at least HAZMAT Operations.

Prerequisites:

- Successful completion of UAS Technician I
- Twenty-five (25) hours logged acting as Remote Pilot in Command
- Successful completion of Command and General Staff

Privileges upon Completion:

- Qualify for Interdivisional or Interstate MABAS UAS Teams
- Qualify for mission-specific endorsements
- Mutual aid deployment to incidents with an investigative intent

E. UAS Instructor Endorsement

The UAS Instructor Endorsement is a mission-specific qualification for Remote Pilots who have successfully completed UAS Technician II, and intend to provide flight and ground instruction to MABAS UAS crewmembers, as well as evaluate the performance and grade written and practical tests of MABAS UAS crewmembers to determine their eligibility for advanced qualifications.

Prerequisites:

- Successful completion of UAS Technician II
- One hundred (100) hours flight time as Remote Pilot in Command (RPIC)
- One or more of the following:
 - Fire Instructor II ^[6]
 - FAA Basic Ground Instructor (or higher) ^[7]
 - FAA Sport Pilot Certificate (or higher)

Privileges upon Completion:

- Conduct ground and flight training for MABAS UAS crewmembers
- Administer and grade written and practical tests for MABAS UAS crewmembers
- Administer qualifications to MABAS UAS crewmembers

References:

- [1] 14 CFR § 1.1 - General definitions. Electronic Code of Federal Regulations. Retrieve from ecfr.gov.
- [2] 14 CFR § 107.19 - Remote Pilot in Command. Electronic Code of Federal Regulations. Retrieve from ecfr.gov.
- [3] 14 CFR § 91.3 - General Operating and Flight Rules. Electronic Code of Federal Regulations. Retrieve from ecfr.gov.
- [4] 14 CFR § 107.33 - Visual Observer. Electronic Code of Federal Regulations. Retrieve from ecfr.gov.
- [5] 49 U.S.C § 40125: Qualifications for public aircraft status. The United States Code. Retrieve from law.cornell.edu.
- [6] Program of Institution Course Syllabus. Instructor II. PDF. IFSI. Retrieve from fsi.illinois.edu.
- [7] Chapter 159 Issuance of Ground Instructor Certificate and added ratings. Retrieve from fsims.faa.gov.

Mutual Aid Box Alarm Systems

Unmanned Aircraft Systems Program (UAS)

Equipment Selection, Purchase, and Maintenance

OVERVIEW

This document contains the recommended UAS and support equipment as well as maintenance guidelines for a MABAS UAS Program. Having a standard set of equipment is critical for successful operations during multi-day incidents by insuring interoperability between agencies and divisions. This guidance will focus on rotor-wing aircraft.

UAS EQUIPMENT GUIDANCE

This guidance is specific to any type of team that will perform public safety functions at an event or incident. The goal of this guidance is to standardize the equipment used to make mutual aid requests more efficient through component interoperability. This guidance is based on technical capabilities and interoperability of the specified equipment.

A. General mission aircraft

General mission aircraft are meant to meet the needs of most missions. These missions typically involve collecting, visualizing and processing data. These aircraft will typically be owned and operated by local agencies, divisions and at the state level. The types of missions they are ideal for are:

- Overwatch
- Mapping / Pre-planning
- Search / Recon

Key features of this aircraft will include:

- Redundant batteries
- Multiple sensor configurations
 - Dual sensors
 - Thermal, visual, zoom, etc.
- Collision avoidance
- Warm and cold weather operations
- Wet weather operations

See Attachment B Equipment and Maintenance, for recommended configuration and support equipment information. In the Unmanned Aircraft Systems Program (UAS) Policy.

B. Lightweight / indoor / training aircraft

Lightweight / indoor / training aircraft are meant to be used for training purposes and for providing initial data during an incident. Their small size allows for easy storage and transportation. They can be used in limited indoor scenarios, but not confined spaces. Their fixed sensors are not ideal for night flights unless the scene is very well lit. These aircrafts will be typically owned and maintained at local, divisional and state agencies. They are ideal for the following missions:

- Overwatch
- Mapping / Pre-planning
- Search / Recon

See Attachment B Equipment and Maintenance, for recommended configuration and support equipment information. In the *Unmanned Aircraft Systems Program (UAS) Policy*.

C. Heavy lift aircraft

Heavy light aircraft are intended for delivering payloads to a victim, suspect or public safety personnel. In general, they should be able to lift a minimum of ten pounds (10lbs.) and have a dedicated payload release system. Typically, these aircraft will be owned and maintained at the divisional and state level and be at least available regionally to other agencies. These aircraft are suited for any incident type requiring payload deliveries such as water rescue, USAR, etc. Key features of these aircraft include:

- Lift more than ten pounds (10lbs.)
- Dedicated payload release system

See Attachment B Equipment and Maintenance, for recommended configuration and support equipment information. In the *Unmanned Aircraft Systems Program (UAS) Policy*.

UAS PURCHASING

Selecting a vendor is a critical component to an UAS program. It is recommended that requirements beyond the core equipment specifications include:

1. Continuous operations

It is important to ensure that the aircraft and support equipment (controller, tablet, anti-collision lights, etc.) can support continuous operations. Below are recommended continuous operational time frames that should be anticipated for UAS teams:

- Local Agency Teams – four (4) hours
- Divisional Teams – twelve (12) hours
- State Teams – twenty-four (24) hours

2. Support

- Cases, landing pads, etc.

3. Equipment delivery

With any new piece of equipment, it is recommended that a vendor perform an onsite installation of equipment to ensure the proper use of the equipment.

4. Technical service plan / support for equipment

- Distribution of manufacturer communications.
- Routine service inspections and component replacements.

5. Replacement plan in the event of equipment failure (not such a warranty).

UAS MAINTENANCE

Maintenance is a must to sustain a healthy UAS program. It should include routine as well as post incident and event maintenance. All components of the aircraft including the batteries and support should be part of an UAS maintenance program.

A. Manufacturer routine maintenance

1. Should be performed based on manufacturer recommendations.
2. A checklist should be developed based on manufacturer maintenance steps.
 - Name of maintenance person
 - Date
 - Any deficiencies
 - Readiness status

B. Weekly maintenance

1. UAS physical inspection for damage or defects including props, and payloads.
2. Battery inspections and readiness.
 - Charge is necessary
3. Firmware checks.
4. Inspect support equipment.
5. Wipe down / clean if necessary.
6. A checklist should be developed based on manufacturer maintenance steps.
7. Name of maintenance person.
 - Name of maintenance person
 - Date
 - Any deficiencies
 - Readiness status

C. Post event / incident maintenance

1. Check for physical damage to UAS, payloads and props.
2. If used in HazMat, must be appropriately decontaminated according to the manufacturer prescribed limitations of the aircraft before returning to service. If decontamination can not be performed and verified, the UAS should be removed from service indefinitely.
 - If flown in corrosive environment, consider permanently taking aircraft out of service.
3. Charge batteries as necessary.

D. Battery charging cycles

1. Batteries should always follow manufacture recommended maintenance practices.
2. See Attachment B Equipment and Maintenance for guidance on keeping batteries in a mission ready state of charge. In the *Unmanned Aircraft Systems Program (UAS) Policy*.

Mutual Aid Box Alarm Systems

Unmanned Aircraft Systems Program (UAS)

Flight Operations and Deployment

OVERVIEW

This policy presents the standard operating procedures for flight operations and deployment to be conducted by all agencies that operate small Unmanned Aerial Systems (sUAS) under the MABAS-Illinois Public COA. The procedures set forth in this policy must be adhered under the MABAS-Illinois Public COA. Operational guidance and best practices referenced here will be documented in a separate attachment.

SCOPE

This policy is broken down into four procedural parts to address all aspects of a deployment, from pre-flight to post-flight procedures. The four procedural parts are as follows: In service, pre-flight, flight operations, post-flight. Further operational guidance may be provided in addendums or attachments to this document.

A. IN-SERVICE INSPECTION

1. Description

All in service UAS and support equipment shall be kept in an airworthy and deployable state at all times to ensure expedient deployment. The following procedures shall be followed after each deployment so that all UAS and support equipment remain airworthy and ready. This inspection is expected to take an experienced Pilot in Command (PIC) no greater than forty-five (45) minutes to complete.

2. Responsibility of performance

If returning from an operation the Remote Pilot in Command (RPIC) assigned to the previous operation shall be responsible for ensuring the following procedure is conducted before the aircraft is approved to be placed in service. If the equipment is being placed in service from being out of service or is newly acquired, the UAS Coordinator or their designee, shall be responsible for ensuring the following procedure is conducted before the aircraft is approved to be placed in service.

- a. Nothing in this policy shall prevent other qualified flight crew or operations personnel in assisting in these tasks, at the sole discretion of the Remote Pilot in Command (RPIC) or UAS Coordinator.

3. Period of performance

The Remote Pilot in Command (RPIC) shall ensure the in-service inspection is completed before the aircraft is placed in service if any of the following conditions are met:

- a. The aircraft is returned from a deployment or training, regardless if it was flown.
- b. The sterile seal on the aircraft's case is missing, broken or damaged.
- c. The aircraft receive routine service or upgrades.
- d. Seven (7) days have passed from the time of last inspection.

4. Inspection procedures

- a. Records review

The Remote Pilot in Command (RPIC) shall inspect the UAS records to verify the following:

- Aircraft registration current.
- No abnormal operating conditions or previous damage reported
- No recalls, directives, safety bulletins, or warnings from the UAS manufacturer.
- Consumable parts (including but not limited to props and batteries) within manufacturer's specified interval.

NOTE: If any of the above items are found to be deficient, the aircraft shall immediately be grounded and removed from service until the deficient items are corrected.

b. Visual inspection

The Remote Pilot in Command (RPIC) shall inspect the UAS components to verify the following. No cracking, chipping, bending, punctures, heat damage, or any unusual wear, other than cosmetic blemishes on superficial components present on any of the following items:

- UAS airframe
- UAS powertrain (confirm motors spin smoothly, freely and silently by hand).
- Payloads
- Flight control station
- Rotors and aerodynamic components
- Batteries
- Aircraft is clean and free of contamination

NOTE: If any of the above items are found to be deficient, the aircraft shall immediately be grounded and removed from service until the deficient items are corrected in accordance with manufacturers guidance.

c. Software and firmware inspection

The Remote Pilot in Command (RPIC) shall inspect the UAS software and firmware to verify the following:

- Aircraft firmware is up to date on all components per manufacturer's directives.
- Flight control station firmware is up to date per manufacturer's directives.
- Supporting ground control software is up to date per manufacturer's directives.

NOTE: If any of the above items are found to be deficient, the aircraft shall be updated to the requisite firmware and software versions before returning to service.

d. Battery charging

The Remote Pilot in Command (RPIC) shall inspect the UAS batteries and verify the following:

- Batteries are charged and maintained in accordance with manufacturer's guidance.
- Fuel management indications (voltage, current capacity) is calibrated, functional and correct.
- Batteries are maintained at a state of charge to facilitate immediate deployment.

NOTE: If any of the above items are found to be deficient, the batteries shall be charged, cycled, calibrated and or maintained according to the manufacturer's guidance before returning to service.

e. UAS test flight

If the inspections above indicate no evidence of material deficiency of the UAS, the Remote Pilot in Command (RPIC) shall conduct a brief test flight, consisting of the following to verify the functionality of the UAS.

- Prepare the UAS for flight as recommended by the manufacturer in a location free of environmental hazards.
- Ensure any applicable geo-fencing unlocks are properly applied to the UAS.
- Ensure proper operation of sensors and payloads through all ranges of motion.
- Ensure proper recording of data from each sensor or payload with recording capability.
- If equipped, verify that the UAS has established a GPS connection in excess of eight (8) satellites. Watch for rapid or unexplained loss of GPS link.
- Verify that the aircraft telemetry does not indicate any warnings or abnormal conditions. If warnings are present, follow manufacture's recommendations.

- Start the motors and confirm no abnormal sounds (such as grinding, scraping, clunking, or rapid pulsations) can be heard.
 - Takeoff and hover at a suitable altitude to verify UAS controllability, low enough to make an immediate emergency landing if necessary (approx. 10-15' AGL).
 - Ascertain all primary flight controls (throttle, pitch, roll, yaw,) perform as expected. Carefully observe the UAS for unexpected movements.
 - If UAS is equipped with return to home feature, validate its functionality consistent with manufacturer specifications.
 - If UAS is equipped with flight mode switch, ensure proper operation of sUAS in each flight mode.
- f. Tamper indicating seal
- After the aircraft has been deemed airworthy by the Remote Pilot in Command (RPIC) and placed in service, a tamper indicating sealing device shall be affixed around one or more latches on the UAS flight case to prevent tampering before flight.
 - If the seal is found to be missing, broken or damaged, the UAS shall be assumed unserviceable, and the inspection must be performed again to return the aircraft to service.
 - Batteries may be stored separately from the sealed case, if necessary, to maintain a deployable state of charge.
- g. In-service report
- Filing of the return to service report shall be performed by any MABAS Remote Pilot in Command (RPIC) responsible for returning a MABAS owned aircraft to service. While not compulsory for non-MABAS owned aircraft, it is highly recommended that agencies document return-to-service inspections to limit liability.
- The in- service report shall be completed and signed by the Remote Pilot in Command (RPIC) returning a MABAS owned aircraft to service.
 - Completed in-service reports for the previous ninety (90) days shall be kept with the aircraft and other supporting documentation (registration certificate), and be immediately accessible at all times the UAS is in operation.
 - The agency or division to which the UAS is assigned may file or digitize any in-service report older than ninety (90) days.
 - It is the responsibility of the division or agency to which the MABAS asset is assigned to maintain all in-service records for twelve (12) months.
 - Reports older than eighteen (18) months may be destroyed at the agency's or division's discretion.

B. PRE-FLIGHT PROCEDURES

The following procedures have been developed to ensure proposed UAS operations can be conducted safely and effectively and that UAS flight crews are adequately. Pre-flight procedures shall be performed in advance of each flight operation, regardless of the nature of the operation. The pre-flight procedures consist of both pre-flight planning and operations.

Pre-flight planning

1. Description

Pre-flight planning should be performed in advance of any flight, regardless of type, to ensure the flight crew is familiar with all available information concerning that flight, and has developed strategies necessary to tackle any expected or unforeseen hazards.

2. Responsibility of performance

The Remote Pilot in Command (RPIC) shall be solely and completely responsible for ensuring the following procedure is conducted before flight.

- a. Nothing in this policy shall prevent other qualified flight crew or operations personnel in assisting in these tasks, at the sole discretion of the Remote Pilot in Command (RPIC).

3. Period of performance

The Remote Pilot in Command (RPIC) shall ensure this procedure is completed in advance of any flight operation before the UAS asset is deployed.

4. Pre-flight planning procedure

a. Ensure mission feasibility

The Remote Pilot in Command (RPIC) shall ensure that the requested operation is a good candidate for UAS deployment, can be completed safely and legally, and that the operation occurs in an official capacity, in accordance with the policies and procedures of the AHJ.

- If a policy or procedure of the AHJ is found to appreciably and irreconcilably conflict with the provisions required by this document, or any provision of any FAA authorization or waiver granted to MABAS or the AHJ, the flight crew shall abide by the procedures described herein, or the applicable FAA waiver or authorization and the procedures described therein.

b. Assign crewmembers

The Remote Pilot in Command (RPIC) shall ensure all flight crewmembers meet the training and currency requirements needed to exercise the duties of their crew position assignment.

c. Check airspace (local hazards)

The RPIC Remote Pilot in Command (RPIC) shall become familiar with the local airspace of the intended operation and ensure any authorization required to operate within the airspace in which the flight will take place is obtained. Additionally, the Remote Pilot in Command (RPIC) shall quantify any physical hazards effecting UAS operations in the vicinity. The Remote Pilot in Command (RPIC) should verify the following:

- Class of airspace flight will occur in.
- Configuration of closest airport.
- Contact number, tower or CTAF frequency for closest airport.
- Any TFRs current or expected for the operating area.
- Identify potential terrestrial hazards to flight.
- Identify potential safe areas for takeoff and landing.

d. Check weather

The Remote Pilot in Command (RPIC) shall ensure that the current and predicted weather in the vicinity of the proposed UAS operation is above legal VFR minimums and does not pose a hazard to the intended operation. The Remote Pilot in Command (RPIC) shall retrieve this information from an approved aviation weather source, and should pay special attention to the following:

- Cloud conditions
- Surface visibility
- Wind direction and speed
- Temperature / dewpoint
- Density altitude
- Precipitation
- AIRMETs, SIGMETs, and other advisories.

e. File NOTAM, SGI or TFR. (If applicable.)

- **NOTAM:** If necessary, due to the nature of the intended flight, weather conditions, airspace or stipulation in any COA or waiver, the Remote Pilot in Command (RPIC) shall file a Notice to Airmen (NOTAM) with flight service as soon as is practicable before the commencement of the operation.
- **SGI:** If flight operations in the direct support of active emergency response operations require relief from a federal aviation regulation, COA provision, or occur in an active TFR, the Remote Pilot in Command (RPIC) shall file a Special Governmental Interest Addendum (SGI) with the FAA System Operations Security Center before flight.

- TFR: If the Remote Pilot in Command (RPIC) has reason to believe that due to the nature of the intended operation, an undue hazard exists to any and all aircraft in the vicinity (other than the UAS) the Remote Pilot in Command (RPIC) may file a Temporary Flight Restriction (TFR) with the FAA System Operations Security Center before flight.
- f. Coordinate with other air assets. (If applicable.)
- If the nature of the intended operation requires or expects the presence of cooperative air assets (manned or unmanned) other than the UAS, the Remote Pilot in Command (RPIC) shall coordinate with the Pilot in Command (PIC) of each responding air asset to review the flight plan of each aircraft. The Pilot(s) in Command of all responding air assets shall reach a consensus on risk mitigation, traffic deconfliction, and emergency procedures before flight.
- g. Assess flight risk
- Once familiar with all available information pertaining to the intended flight, the Remote Pilot in Command (RPIC) shall assess the risk posed by the intended operation, and shall determine if the risk posed by deploying the UAS asset is acceptable given the circumstances and nature of deployment. The Remote Pilot in Command (RPIC) should use an applicable and standardized Flight Risk Assessment Tool (FRAT) to objectively quantify this assessment.
- h. Briefing flight crew
- Once familiar with all available information pertaining to the intended flight and acceptable risk, the RPIC shall brief the flight crew on the information pertaining to the flight, as required by the flight crew to ensure the safe and effective performance of their duties. The Remote Pilot in Command (RPIC) shall brief the flight crew on implementing any risk mitigations identified in the risk assessment. If multiple flights are to be taking place simultaneously, this briefing shall be done with all RPICs involved and performed by the UAS Coordinator/Lead RPIC.
- The mission briefing shall include:
- Airspace authorization.
 - Altitudes to be flown.
 - Mission overview, including handoff procedures.
 - Frequencies to be used, both for aircraft and verbal radio communications.
 - Flight time, including reserve fuel or battery requirements.
 - Contingency procedures, including lost link, divert, and flight termination.
 - Hazards unique to the flight being flown.
 - Protocol to prevent in-flight conflict.

Pre-Flight Operations

1. Description

Pre-flight operations should be performed in advance of any flight, regardless of type, to mitigate potential local hazards immediately before the flight, confirm that all UAS equipment is functional and airworthy, ensure the flight crew is in position and has been briefed, and verify that mission objectives can be met.

2. Responsibility of performance

The Remote Pilot in Command (RPIC) shall be solely and completely responsible for ensuring the following procedure is conducted immediately before flight.

- a. Nothing in this policy shall prevent other qualified flight crew or operations personnel in assisting in these tasks, at the sole discretion of the Remote Pilot in Command (RPIC).

3. Period of performance

The Remote Pilot in Command (RPIC) shall ensure this procedure is completed in advance of any flight operation, and should be completed when the UAS arrives on scene, shortly before takeoff.

4. Pre-flight operations procedure: (Scene arrival.)

- a. Coordinate with Incident Command to determine the following:
 - Determine the cold-zone and warm-zone landing and take-off areas.
 - Determine UAS operating area.
 - Determine mission objectives and the impact to overall flight operations.

- b. Pre-flight inspection of the UAS
 - The Remote Pilot in Command (RPIC) shall perform a complete preflight inspection of the UAS, as specified by the UAS manufacturer to ensure the UAS is in a condition for safe operation.
 - If the UAS manufacturer does not specify a preflight inspection, the Remote Pilot in Command (RPIC) should use the inspection procedures described in sections (B) and (E) of this chapter.
- c. Establish takeoff and landing areas
 - Upon arrival, the Remote Pilot in Command (RPIC) shall establish areas to be reserved for takeoff and landing of the UAS.
 - These areas shall be clearly demarcated and visible by all persons in the vicinity of the flight operation.
 - The Remote Pilot in Command (RPIC) shall establish one or more locations, separate from normal operating areas for landing in the event of an emergency.
- d. Validate risk assessment
 - The Remote Pilot in Command (RPIC) shall reassess the operational risk posed by the intended flight, accounting for any changes in weather, air traffic, airspace, environmental conditions, and incident activity.
 - The Remote Pilot in Command (RPIC) should use an applicable and standardized Flight Risk Assessment Tool (FRAT) to objectively quantify this assessment.
 - The Remote Pilot in Command (RPIC) shall take action to mitigate identified risk, and discontinue the flight if significant hazards to flight cannot be remedied.
 - The Remote Pilot in Command (RPIC) shall ensure that all implemented actions do not create new hazards to the operation.
- e. Operation briefing
 - The Remote Pilot in Command (RPIC) shall ensure that each UAS crewmember is adequately briefed on any and all available information pertaining to the flight and mission as well as their respective responsibilities. At a minimum, the briefing should consist of the following.
 - Mission objective, strategy and tactics.
 - Operational environment (airspace, weather, traffic, terrestrial hazards).
 - Identified hazards and remedies.
 - Special procedures for compliance.
 - Any special operating circumstances.
 - Roles, responsibilities and expectations of each crewmember.
 - All briefings shall be conducted with sufficient prior notice to ensure that all crewmembers are adequately informed before flight.
 - All crewmembers assigned to the UAS team shall receive a mission briefing prior to assuming their position.
- f. Routine debriefing
 - After mission completion, crew changeover, or landing, the flight crew shall debrief to identify and provide solutions to any hazards encountered before the next flight begins. A post-flight briefing should consist of at least the following:
 - Hazards encountered during flight and necessary mitigations.
 - Progress of mission in comparison to objectives.
 - Strategy and tactics necessary to meet objectives.
 - Any changes in operational strategy or tactics for next flight.

C. FLIGHT OPERATIONS, OPERATING LIMITATIONS (DAY)

1. Description

The following section describes the operating procedures and limitations of the UAS during flight, to ensure the safe, effective and lawful operation of the UAS during daylight. For the purposes of this section, daylight is the period between morning civil twilight, and evening civil twilight, as defined in 14 CFR § 1.1.

2. Responsibility of performance

The Remote Pilot in Command (RPIC) shall be solely and completely responsible for ensuring the UAS operates safely, and remains within all operating limitations during flight.

- a. Nothing in this policy shall prevent other qualified flight crew or operations personnel in assisting in these tasks, at the sole discretion of the RPIC.

3. Period of performance

The Remote Pilot in command shall ensure that the UAS is within its operating limitations at all times during flight.

4. Operating procedure

a. Startup, takeoff and landing

- When the Remote Pilot in Command (RPIC) is prepared to start the motors of the UAS, the RPI shall ensure that all persons are clear of the takeoff and landing areas and shall announce his/her intention to start the motors; e.g. "**Clear Prop!**" (or similar).
- When the Remote Pilot in Command (RPIC) is prepared to take off and begin initial climb, the RPIC shall ensure that all persons are clear of the takeoff and landing areas and shall announce his/her intention to take off; e.g. "**Taking Off!**" (or similar).
- When the Remote Pilot in Command (RPIC) is prepared to descend to land, the RPIC shall ensure that all persons are clear of the takeoff and landing areas and shall announce his/her intention to land; e.g. "**Landing!**" (or similar).

b. Sterile cockpit

At all times during the UAS operation, no crewmember shall engage in any operation, conversation, activity or duty unnecessary for or unrelated to the safe operation of the UAS.

c. Transfer of flight controls

During operation, it may become necessary to transfer the flight controls to another qualified remote pilot. If the Remote Pilot in Command (RPIC) determines the flight controls should be transferred, the following procedure shall be followed:

- RPIC arranges and briefs the recipient of the flight controls.
- RPIC confirms intentions to transfer flight controls to crewmember; e.g. "**You have the controls**".
- Crewmember confirms positive transfer of flight controls; e.g. "**I have the controls**".
- RPIC confirms positive transfer of the controls; e.g. "**You have the controls**".

NOTE: The transfer of flight controls does not relieve the RPIC of authority over and responsibility for the operation of the UAS, unless the controls are transferred to a qualified remote pilot, and the transfer of authority is briefed in advance.

5. Operation of Multiple UAS

a. UAS Tactical Group Supervisor

When operating more than one UAS on any incident, a UAS Tactical Group Supervisor shall coordinate between flight crews.

b. Requisite training

All flight crewmembers assigned to perform duties on a multiple UAS operation shall have received applicable practical and didactic training on the operation of multiple UAS.

- This training shall be documented by the sponsoring agency and;
- This training shall be conducted in other than congested areas, well clear of residential structures, moving vehicles, nonparticipating persons, and watercraft.

c. Marking of aircraft

Each UAS, ground control station or flight controls should have applicable markings as a means to distinguish the UAS from others at the incident scene.

d. Unique lighting of aircraft

Each UAS shall utilize lighting of an individual color to identify the individual aircraft controlled by each flight crew.

- This lighting shall be used day or night, and shall be designed to be visible from at least three (3) statute miles by the flight crew.
- The intensity of this lighting may be reduced in the interest of safety because of operating conditions.
- This lighting is intended solely for visual reference by the flight crew, and may not comply with the requirements of anti-collision lighting described in section (D) (4) (c) of this chapter.

e. Separate crewmembers

A separate Remote Pilot in Command (RPIC) shall be used for each operating UAS.

- If the UAS operation requires or utilizes a Visual Observer (VO) or Payload Operator (PO), each UAS shall use a separate Visual Observer and Payload Operator.

f. Separation protocol

After conducting a pre-flight briefing as described in section (B) (4) (h) of this chapter, the Remote Pilot in Command (RPIC) shall ensure a suitable protocol is established to prevent conflict between aircraft during the following:

- Launch, takeoff, or initial climb.
- Enroute flight.
- Landing and recovery.
- Lost link, return to home, or emergency procedures.
- Loss of GPS or autopilot.
- Engine or drivetrain failure.

6. Operating limitations

a. Maximum altitude

The maximum altitude for UAS operations shall be four hundred feet (400ft) Above Ground Level (AGL). If within four hundred feet (400ft) laterally of a structure, up to four hundred feet (400ft) above the structure's uppermost point.

b. Airspace

The UAS shall operate only within Class G airspace unless expressly authorized.

c. Weather

No UAS operations shall occur when the in-flight visibility is less than three (3) statute miles, closer than five hundred feet (500ft) to the base of any cloud, or closer than two thousand feet (2000ft) horizontally to a cloud.

d. Simultaneous operation

No person shall act as a remote Pilot in Command (PIC) or Visual Observer (VO) for more than one unmanned aircraft at one time unless otherwise expressly authorized by a COA, waiver, or SGI addendum.

e. Operations from moving vehicles

No operations from a moving vehicle or watercraft unless the operation is over a sparsely populated area and the Pilot in Command (PIC) and Visual Observer (VO) are co-located (if used).

- Operations from a moving aircraft are prohibited.

f. Medical condition

No person shall manipulate the flight controls of a small unmanned aircraft (sUAS) system or act as a remote Pilot in Command (PIC), Visual Observer (VO), or direct participant in the operation of the sUAS, if he or she has a physical or mental condition that would interfere with safe operations.

g. Visual Line of Sight (VLOS)

With vision that is unaided by any device other than corrective lenses, the Remote Pilot in Command (RPIC) and Visual Observer (VO) shall be able to see the UAS during its entire flight in order to (if one is used):

- Know the unmanned aircraft's location.
- Determine the unmanned aircraft's attitude, altitude, and direction of flight.
- Observe the airspace for other air traffic or hazards.
- Determine that the unmanned aircraft does not endanger life or property.

NOTE: Flight instrumentation may be used to augment situational awareness, but may not be used to extend the operating area beyond the flight crew's line of sight.

h. Operations over nonparticipants

Except when necessary to safeguard human life, the UAS shall never operate directly over persons or moving vehicles, other than qualified non-crewmembers as defined the United States Code, 49 U.S.C. § 40125: Qualifications for public aircraft status.

- If the UAS must operate in the vicinity of nonparticipating persons or moving vehicles, it is the responsibility of the Remote Pilot in Command (RPIC) to ensure that in the case of a powerplant failure, the UAS shall not endanger the safety of persons or moving vehicles below.
- For those operations where it is necessary to operate over persons, in order to safeguard human life, the Remote Pilot in Command (RPIC) shall not operate any lower or in closer proximity to human beings than is necessary to accomplish the operation.
- UAS with non-redundant powertrains (e.g. quadrotors) that will routinely operate over or in the vicinity of persons should be equipped with an automatically activated ballistic airframe parachute or similar device to limit hazards in the event of a failure.

i. Tethered operations

Tethered operations (if conducted) shall adhere to the Obstruction Marking and Lighting Requirements of FAA Advisory Circulator No:70/7460-1L. Standards for marking and lighting obstructions that have been deemed to be a hazard to navigable airspace.

j. Hazardous operation

No person shall operate a small unmanned aircraft system in a careless or reckless manner that could reasonably be suspected of endangering life or property.

k. Emergency deviation

In an in-flight emergency requiring immediate action, the Remote Pilot in Command (RPIC) may deviate from any provision of this policy, FAA regulation, provision or authorization to the extent necessary to meet that emergency.

- After a necessary emergency deviation, the RPIC shall submit within twenty-four (24) hours a completed MABAS Deviation Report Form.

l. Right of way

The UAS shall yield the right of way to all manned aircraft, airborne vehicles, launch, and reentry vehicles, except:

- When the other aircraft is participating in the operation and has been briefed in accordance with section (B) (4) (f) of this chapter.

- When the UAS flight crew is able to establish and maintain communications with the other aircraft and has coordinated adequate separation.
 - For the purposes of this chapter, yielding the right of way means that the small unmanned aircraft must give way to the aircraft or vehicle and may not pass over, under, or ahead of it unless well clear.

D. FLIGHT OPERATIONS, OPERATING LIMITATIONS (NIGHT)

1. Description

The following section describes the operating procedures and limitations of the UAS during flight, to ensure the safe, effective and lawful operation of the UAS during night. For the purposes of this section, night is the period between evening civil twilight, and morning civil twilight, as defined in 14 CFR § 1.1.

2. Responsibility of performance

The Remote Pilot in Command (RPIC) shall be solely and completely responsible for ensuring the UAS operates safely, and remains within all operating limitations during night flight.

- a. Nothing in this policy shall prevent other qualified flight crew or operations personnel in assisting in these tasks, at the sole discretion of the RPIC.

3. Period of performance

The Remote Pilot in Command (RPIC) shall ensure that the UAS is within its operating limitations at all times during night flight.

4. Operating Procedure

The operating procedure for UAS operations that occur at night shall be identical to those conducted during day, with the following exceptions:

a. Requisite training

All flight crew members shall have completed requisite training to recognize and overcome visual illusions caused by darkness, and understand physiological conditions which may degrade night vision.

b. Visual Observer (VO)

All operations at night shall use one or more visual observers.

c. Anti-Collision Lighting

The UAS must be equipped with anti-collision lighting visible from a distance of no less than three (3) statute miles. The intensity of the anti-collision lighting may be reduced if, because of operating conditions, it would be in the interest of safety to do so.

- Additionally, in order to comply with 14 C.F.R. § 91.209, the aircraft must have position lighting that enables determination of location altitude, and direction of flight.

d. Site Illumination

The area of operation must be sufficiently illuminated before flight to allow both the Remote Pilot in Command (RPIC) and Visual Observer (VO) to identify people or obstacles on the ground.

- (Add unless preplanned.)

E. POST FLIGHT OPERATIONS

1. Description

The following section describes the logging and reporting procedure that is expected to be completed after each flight occurring under the MABAS COA.

2. Responsibility of performance

The Remote Pilot in Command (RPIC) shall be solely and completely responsible for ensuring the requisite reporting is completed after flight.

- a. Nothing in this policy shall prevent other qualified flight crew or operations personnel in assisting in these tasks, at the sole discretion of the Remote Pilot in Command (RPIC).

3. Period of performance

The Remote Pilot in Command (RPIC) shall ensure that the following reports are completed no later than seventy-two (72) hours after the completion of the flight.

4. Required reporting

- a. Post-flight report
 - Shall be filed by the Remote Pilot in Command (RPIC) after any flight operation in response to a terrestrial emergency as part of a MABAS deployment.
 - May be filed after routine operations that are conducted under Part 107 of the Federal Aviation Regulations.
 - Submit to UAS Section Chief within seventy-two (72) hours.
- b. Accident report shall be filed to the UAS Section Chief within twelve (12) hours in the event of:
 - Serious or life-threatening injury to any person.
 - Major airframe damage to the UAS or third (3rd) party property.
- c. Deviation report shall be filed with the UAS section Chief within twenty-four (24) hours in the event of:
 - An in-flight deviation from any applicable federal aviation regulation, provision granted in the MABAS COA, or MABAS UAS Policy, including, but not limited to, the following:
 - Deviation from an air traffic control clearance or procedure.
 - Deviation from altitude or operating limitations.
 - Automated and inadvertent activation of a failsafe procedure (return-to-home, auto-land).
 - Deviation from weather minimums.
 - Necessary deviation to meet the needs of an inflight emergency.

F. EMERGENCY PROCEDURES

1. Description

The following section describes the logging and reporting procedure that is expected to be completed after each flight occurring under the MABAS COA.

2. Responsibility of performance

The Remote Pilot in Command (RPIC) shall be solely and completely responsible for ensuring the requisite emergency procedures are conducted to reduce risk to persons or property in the event of an inflight emergency.

3. Period of performance

The Remote Pilot in Command (RPIC) shall ensure that the following procedures are implemented immediately in the event of an inflight emergency.

4. Procedure

- a. Manufacturer's specified procedure

For the purposes of this section, any procedure designed or intended by the manufacturer of the aircraft and specified in the Pilot's Operating Handbook shall be used as the primary method to respond to any inflight emergency.

 - If no such procedure is specified, the Remote Pilot in Command (RPIC) shall use the procedures described below.
- b. Lost link procedure

If the UAS experiences loss or substantial interference of the Command and Control (C2) datalink that appreciably effects the primary flight controls for greater than three (3) seconds, the following failsafe procedure should be executed:

 - An automated return-to home procedure shall be executed at an altitude which ensures no conflict with obstacles, aircraft or terrain, or;
 - An automated direct-landing procedure shall be executed in the event that conflict with obstacles, aircraft or terrain cannot be ruled out.

c. Loss of VLOS

If the Remote Pilot in Command (RPIC) and/or Visual Observer (VO), are unable to maintain visual contact with the UAS, the following procedure shall be followed in order to attempt to regain visual contact:

- The RPIC shall immediately arrest all linear motion of the UAS and return to a hover.
- The RPIC shall climb to the established minimum obstacle clearance altitude established prior to flight.
- The RPIC shall activate any anti-collision or position lighting aboard the aircraft.
- The RPIC and VO, if used shall establish situational awareness with reference to the instrumentation, and a visual scan of the surrounding airspace and terrestrial hazards.
- The RPIC shall maneuver the aircraft to within VLOS of the RPIC and VO (if a VO is used).
- If VLOS cannot be regained in a reasonable period of time after conducting this procedure, the RPIC shall execute the lost-link procedure.

d. Failure of avionics

If a non-flight-critical avionics component, (including, but not limited to, a magnetometer, GPS receiver, optical flow position sensor, or sonar altimeter) fails during flight, the following procedure shall be conducted:

- The RPIC shall immediately disable any mode of flight automation reliant on the failed component, and return the UAS to a mode of flight not reliant on the failed component (eg: Disable GPS position hold in the event of a GPS failure).
- The RPIC shall ensure that the failure is isolated to non-critical components, and;
- The RPIC may elect to continue the flight if the RPIC has reason to believe the failure is isolated to non-flight critical components, and the RPIC is able to maintain safe and effective primary control authority over the UAS.
- In all other instances, the RPIC shall immediately discontinue the flight and remove the UAS from service pending inspection.

e. Powertrain failure

In the event of a substantial powertrain failure, any rotorcraft of a non-redundant drivetrain configuration (such as a quadrotor) will not be able to maintain controlled flight. Thus, it is the primary objective of the flight crew to ensure the failed UAS will not cause a hazard to persons or property on terrain contact.

- For UAS with a redundant powertrain configuration (such as rotorcraft consisting of 6 rotors or greater) the Remote Pilot in Command (RPIC) shall land the UAS immediately, as soon as is safely practicable.
- For UAS equipped with a ballistic airframe parachute, the parachute shall be deployed immediately upon failure of any flight-critical component.
- For all other UAS, the Remote Pilot in Command (RPIC) shall maneuver the UAS during the decent such that the impact shall not cause undue hazard to persons or property on the surface, and;
- The flight crew should immediately attempt to locate the UAS, assess the scene for injuries, and render first aid as necessary.
 - In the event of damage to the UAS, injury to persons, or damage to third (3rd) party property, a report shall be filed as described in section (E) (4) (b) of this chapter.

f. Emergency deviation

The Remote Pilot in Command (RPIC) may deviate from any federal aviation regulation, COA or waiver provision, departmental or MABAS policy to the extent necessary to meet the needs of an emergency, and/or mitigate hazards to other aircraft, or persons and property on the ground.

- This deviation shall be reported as described in section (E) (4) (c) of this chapter.

Mutual Aid Box Alarm Systems

Unmanned Aircraft Systems Program (UAS)

Data Collection and Retention

OVERVIEW

This document provides the operating procedure for how UAS-generated data is collected, retained, and transmitted during MABAS deployments, as well as ownership and usage rights of said data. This procedure is critical to maintaining the uncompromised utility of any data that will be used in an incident investigation, criminal, or civil proceeding.

SCOPE

This document provides procedures to be followed during all phases of the deployment, including preflight, inflight and post flight data capture, recovery, streaming, transmission and storage.

A. DATA COLLECTION: PRE-FLIGHT PROCEDURE

1. Description

This procedure ensures that all data recording mediums are formatted and prepared for use before deployment, and that all data transmission systems (if used) are operational and provide intended utility.

2. Responsibility of performance

The UAS Technical Specialist assigned to the UAS flight crew shall be responsible for ensuring this procedure is completed in its entirety.

- a. Nothing in this policy shall prevent any qualified crewmember from assisting the UAS Technical Specialist in the completion of his/her duties at the sole discretion of the UAS Technical Specialist.

3. Period of performance

The UAS Technical Specialist shall ensure that the strategy of data acquisition is feasible, that applicable payloads are fitted and functional, and that in-flight data recording media are properly maintained and prepared before the UAS is deployed.

4. Procedure

- a. Storage medium formatted

The UAS Technical Specialist shall ensure the data storage medium aboard the UAS is adequately formatted and cleared of any data unrelated to the current mission.

- It is recommended that the flight crew install an unused recording medium before operation.
- It is the sole responsibility of the UAS Technical Specialist to properly maintain the chain of custody of any previously recorded data.

- b. Incident Command (IC) coordination

The UAS Technical Specialist shall coordinate with Incident Commander (IC) to understand all available information pertaining to the needs of the IC and AHJ in gathering data during the incident. This should include the following:

- What data is needed of the incident from the UAS now, and in the future?
- How does the IC and or AHJ intend to use the data now, and in the future?
- To whom, if anyone, must the data be available to live, other than the flight crew?
- Does the AHJ have any policies, ordinances, local or state laws that effect the utility of the data, or limit the capture thereof?

From this information, the UAS Technical Specialist shall develop a strategy to ensure the data captured by the UAS flight crew is of suitable utility to the IC and AHJ. The UAS Technical Specialist shall confirm that this strategy is reasonably achievable with given crew, and available resources.

c. UAS sensor payloads operational

The UAS Technical Specialist shall ensure that all UAS sensor payloads are suitable and operational as necessary to meet the needs of the intended operation.

d. Data transmission system operational

The UAS Technical Specialist shall ensure that any external transmission system, if used (other than those necessary to the UAS for command and control purposes) is operational.

- In addition, the UAS Technical Specialist shall ensure the data transmitted externally from the UAS is effectively relayed to the personnel identified by Incident Commander (IC), and;
- The UAS Technical Specialist shall ensure the security of the data transmission system is adequate for the needs of the mission, and would not expose any information deemed privileged, confidential, classified, or sensitive by the AHJ, and;
- The UAS Technical Specialist shall ensure the intended transmission of the flight data does not violate any policy, ordinance, local, state, or federal rule, law, regulation, or precedent pertaining to the capture of digital data from a UAS.

e. Flight crew briefing

The UAS Technical Specialist shall brief the flight crew on the intended strategy to capture any requisite data, and shall ensure that said strategy can reasonably be achieved by the flight crew with the resources available.

B. DATA COLLECTION: INFLIGHT PROCEDURE

1. Description

This procedure ensures that data is adequately captured and transmitted while the UAS is in flight.

2. Responsibility of performance

The UAS Technical Specialist assigned to the UAS flight crew shall be responsible for ensuring this procedure is completed in its entirety.

- a. Nothing in this policy shall prevent any qualified crewmember from assisting the UAS Technical Specialist in the completion of his/her duties at the sole discretion of the UAS Technical Specialist.

3. Period of performance

The UAS Technical Specialist shall ensure that all applicable flight data is properly recorded and or transmitted in accordance with the developed strategy for the flight.

C. DATA COLLECTION: POSTFLIGHT PROCEDURE

1. Description

This procedure ensures that all data recorded during the flight maintains an uninterrupted chain of custody to the IC, or authorized representative of the AHJ.

2. Responsibility of performance

The UAS Technical Specialist assigned to the UAS flight crew shall be responsible for ensuring this procedure is completed in its entirety.

- a. Nothing in this policy shall prevent any qualified crewmember from assisting the UAS technical specialist in the completion of his/her duties at the sole discretion of the UAS Technical Specialist.

3. Period of performance

The UAS Technical Specialist shall ensure that the following procedure is conducted immediately upon UAS mission completion or termination.

4. Procedure

a. System shutdown

The UAS Technical Specialist shall ensure all applicable data recording devices have ceased recording and streaming equipment has been taken offline.

b. Incident Commander (IC) debrief

The UAS Technical Specialist shall debrief the Incident Commander (IC) on what data was captured during the flight, what is visible and identifiable in that data, and how it is stored.

c. Transfer of data custody

The UAS Technical Specialist shall transfer the data using the original equipment and software on which the data was recorded, directly to the Incident Commander (IC) or representative from the AHJ.

- The collected data shall not be uploaded to any intermediary device, before transfer to the custody of the AHJ.
- This transfer of custody should be logged by both the responding agency and the AHJ, in the manner consistent with the policies of the responding agency and the AHJ respectively.
- This transfer shall not violate any data custody policy, or procedure of the AHJ.
- The responding agency may seek reimbursement from the AHJ for an amount not to exceed the fair market value of the recording medium, if the data recorded is transferred directly to the AHJ.

Mutual Aid Box Alarm Systems

Unmanned Aircraft Systems Program (UAS)

Definitions

OVERVIEW

This document contains the definitions used throughout the MABAS UAS Guideline.

MABAS OFFICIAL DEFINITIONS

Approved

Acceptable to the authority having jurisdiction.

Authority Having Jurisdiction (AHJ)

An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, installation, or procedures.

Shall

Indicates a mandatory requirement.

Should

Indicates a recommendation or that which is advised but not required.

Standard

A MABAS Standard, the main text of which contains only mandatory provisions using the word “shall” to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Non-mandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase “standards development process” or “standards development activities,” the term “standards” includes all NFPA Standards, including codes, standards, recommended practices, and guides.

GENERAL DEFINITIONS

Air Operations Branch Director

The Air Operations Branch Director (AOBD), a NIMS defined role, reports to the Operations Section Chief and is primarily responsible for preparing the air operations portion of the IAP, for implementing its strategic aspects, and for providing logistical support to aircraft operating on the incident.

Air Tactical Group Supervisor

The Air Tactical Group Supervisor aka “Air Boss”, a NIMS defined role, is an administrative non-crewmember that manages deconfliction of multiple air assets during operations that require the response of multiple UAS and/or manned air assets on the incident scene. This role is typically needed during type III and above incidents where multiple manned and unmanned aircraft will be operating in the same airspace. The Air Tactical Group Supervisor’s duties include:

- Interfacing between local Incident Command and responding air assets.
- Controlling and separating local air operations.
- Establishing Temporary Flight Restrictions (TFRs), authorizing, controlling and separating air operations.
- Coordinating with the FAA Special Operations Support Center on-scene when required.
- Establishing and maintaining safe landing sites on the fire ground or incident scene.

Airworthiness

The measure, or state, of an aircraft’s suitability for safe and predictable flight.

Anti-Collision Lights

Are a set of lights required on every aircraft to improve visibility to others. Typically, white or red in color. More can be found in FAA Advisory Circular AC 20-30B. For UAS, they are to be used from sunset to sunrise.

Aviation Terminology

Any terminology used to describe the operation of aircraft, duties of aircrew, duties of aircraft operators, and scope and interpretation of federal aviation regulations may be found in 14 CFR § 1.1 or Section 2 of the *Aeronautical Information Manual*.

Azimuth

The horizontal angle or direction of a compass bearing.

Battery Charging Cycle

One complete cycle through which a battery is completely depleted, then returned to a full state of charge.

Bingo Fuel

The minimum fuel or battery charge quantity remaining, to allow the Remote Pilot in Command (RPIC) to return the aircraft to land safely at the primary flight operations area given the present atmospheric conditions. Bingo Fuel is treated as a determinant factor to immediately terminate the mission and return to the landing area for refueling/recharging.

NOTE: Bingo Fuel should not be confused with Reserve Fuel, which is the minimum amount of fuel required to make a controllable landing anywhere.

Certificate of Authorization

COA is an authorization issued by the FAA to authorize a specific type of aircraft activity not otherwise supported by regulation.

Civil Operations

UAS operations that are not explicitly defined as recreational or public aircraft operations. It should be noted that it is not necessary to define a flight operation as a public aircraft operation for utilizing a UAS at an incident or event.

Controlled Flight into Terrain (CFIT)

An accident in which an airworthy aircraft, under pilot control, is unintentionally flown into the ground, a mountain, a body of water or an obstacle, frequently due to loss of situational awareness by the pilot in command.

Crew Readiness

The availability and readiness of the Flight Crew to deploy for sUAS operations given their knowledge and completion of pre-flight duties. (PQU.)

Data Acquisition

The collection of information from sUAS for the purpose of fulfilling the mission objectives and goals in accordance with the mission plan. (PQU.)

Decontamination (Decon)

The process by which an item is sanitized of hazardous compounds prior to returning to service.

Flight Crew

Personnel assigned to perform duty directly pertaining to the operation of the sUAS during flight time.

Ground Sampling Distance (GSD)

The Ground Sampling Distance is the effective resolution of a photogrammetric map or model, measured in centimeters per pixel. For instance, in an orthomosaic map with a resolution of 2cm/px one pixel would equal 2 centimeters, or $\frac{3}{4}$ of an inch.

Hasty Search

A search pattern intended to allow rapid coverage of the search area gathering clues or information that may be used to refine later search stages.

Incident Commander (IC)

The individual responsible for all incident activities, including the development of strategies and tactics and the ordering and the release of resources. The IC has overall authority and responsibility for conducting incident operations and is responsible for the management of all incident operations at the incident site. [FEMA — ICS Glossary, 2008].

Maximum Takeoff Weight (MTOW)

The maximum weight at which the aircraft is safely able to takeoff under standard conditions, as specified by the manufacturer.

Minimum Obstacle Clearance Altitude (MOCA)

The minimum altitude at which a UAS is guaranteed freedom of movement above all obstacles in a given vicinity.

Nadir

The lowest point in a spherical coordinate system, directly below the observer. A UAS's camera position is said to be Nadir when it is focused directly at the ground, with the lens parallel to the earth's surface.

Notice To The Airmen (NOTAM)

A notice filed with the FAA to alert aircraft pilots of potential hazards along a flight route or at a location that could affect the safety of the flight.

Nonparticipating Person(s)

Any person(s) other than flight crew, and qualified non-crewmembers.

Operational Deployment

The deployment of a sUAS operation shall be considered an additional segment of an operation or an operation of its own.

Operational Risk Assessment

The evaluation of the relative danger of sUAS operations when taking into consideration mission objectives and goals, sUAS, professional qualifications of the RPIC and visual observer, operational readiness of the crew, weather conditions, environmental conditions, and regulatory requirements, and unforeseen hazards and operating conditions. This practice is to be used primarily for justifying approval for additional waiver or authorizations from the FAA. Reference ASTM F3178 – 16 Standard Practice for Operational Risk Assessment of Small Unmanned Aircraft Systems (sUAS).

Orthomosaic

An aerial photograph or image constructed of multiple photographs geometrically corrected ("orthorectified") such that the scale is uniform. The resultant photo has the same lack of distortion as a map. Unlike an uncorrected aerial photograph, an orthophotograph can be used to measure true distances, because it is an accurate representation of the Earth's surface, having been adjusted for topography, lens distortion, and camera tilt.

Overwatch

A flight mission where an aircraft hovers or orbits around a point of interest to give an overview of an incident or scene. Typically, this mission provides a different perspective for incident command so that they may make more informed decisions.

Payload Drop

The release of an item or package from sUAS for the purpose of fulfilling the mission objectives and goals in accordance with the mission plan. (PQU)

Payload Operator

The crewmember responsible for securing and manipulating payloads (sensor or non-sensor), gathering and interpreting requisite inflight data, and transmitting the insights gathered from that data to the IC. The sensor operator may, when requested by the RPIC, assist the RPIC in navigation and situational awareness.

Photogrammetry

The science of extracting accurate measurements from photographs.

Public Aircraft

"Public aircraft" and "Public aircraft operator" are any aircraft, and aircraft operates described by 49 U.S.C. § 40125 - U.S. Code Title 49.

Public Aircraft Operations (PAO)

Public aircraft operations shall only refer to operations described by 49 U.S.C. § 40125 - U.S. Code Title 49. It should be noted that the use of UAS at an incident or event does not require defining the mission as a Public Aircraft Operation.

Public Blanket COA

A certificate of authorization granted by the FAA that allows public aircraft operations of a UAS over a wide or nonspecific area. These COAs typically only allow flights in Class G airspace and not within certain radii of airports, heliports, and seaplane bases.

Public Jurisdictional COA

A certificate of authorization granted by the FAA that allows public aircraft operations of a UAS within a defined geographic area. Typically, these COAs are used in more complex airspace such as near tower-controlled airports and have more stringent requirements.

Public Safety Entity

Any entity involved with public safety that has a mission to protect life, property, or the environment or any combination of these.

Public Safety Personnel

Any individual involved with public safety that has a mission to protect life, property, or the environment or any combination of these. (PQU)

Qualified Non-Crewmember

Is any person as defined by statute, 49 USC § 40125 (3) (B).

Remote Pilot in Command (RPIC)

The person that has been found to be properly qualified to exercise the privileges of Remote Pilot in Command and is directly responsible for the operation of the small unmanned aircraft, pursuant to 14 CFR § 107.19 or 14 CFR § 91.3 if operating a Public Aircraft as determined by the AHJ. (PQU)

Resources

The equipment, personnel, and facilities required for the sUAS operations provided by the public safety department. (PQU).

- Development of UAS Concept of Operations (Conops).
- Evaluation of UAS hardware.
- Procedure to determine acceptability of proposed risk.

Reserve Fuel

The minimum amount of fuel or battery charge remaining to allow the UAS to make a controlled landing anywhere.

Small Unmanned Aircraft

An unmanned aircraft weighing less than 55 lb. (25 kg) maximum takeoff weight [14 CFR Part 107, 2016].

Small Unmanned Aircraft Systems (sUAS)

A small unmanned aircraft and its associated elements (including communication links and the components that control the small unmanned aircraft) that are required for the safe and efficient operation of the small unmanned aircraft in the national airspace system [14 CFR Part 107, 2016].

Special Government Interest Addendum (SGI)

Formally known as an Emergency COA, is a type of Certificate of Authorization that is granted to allow immediate ability to conduct non-standard operations that would normally be subject to a waiver or authorization process. For more information see FAA Order # JO 7200.23A.

State of Charge (SOC)

The approximate percentage of energy contained within a battery at any given point in time, compared to its maximum potential.

sUAS Operations

The use of any sUAS for the purpose of training, certification or testing, or for protection life, property or the environment.

sUAS Program

The elements (administrative, operational, qualifications and training, safety, and maintenance) that are required within the structure of a public safety entity in order to support sUAS operations that are safe, efficient, and feasible.

Sustainable Life Cycle

A determination made by a public safety entity in relation to the ability of sUAS manufacturer, system provider, or both to supply replacement parts, critical maintenance, system updates, upgrades, as well as the availability of training, certification and support and other applicable components critical to ensuring continuous sUAS operations that are interoperable with associated agencies.

System Operation Support Center

An office of the Federal Aviation Administration (FAA) responsible for the approval or denial of Special Governmental Interest Addendum authorizations. Public agencies making a Special Governmental Interest Addendum request must contact the System Operations Support Center to do so.

Unmanned Aircraft

An aircraft operated without the possibility of direct human intervention from within or on the aircraft. [14 CFR Part 107, 2016].

UAS Tactical Group Supervisor

The UAS Tactical Group Supervisor is an operations non-crewmember that manages coordination and deconfliction of multiple air assets during operations that require the response of multiple UAS, or UAS and manned air assets on the incident scene. This role coordinates missions with Air Operations. UAS Tactical Group Supervisor duties include:

- Interfacing between local incident command and UAS teams.
- Coordinating activities with Air Operations.
- Reports to the Air Tactical Group Supervisor or Air Operations Branch Director, if present.
- This role may perform tasks assigned to an Air Tactical Group Supervisor or Air Operations Branch Director in their absence.
- Coordinating with the FAA Special Operations Support Center on-scene when required.
- Establishing and maintaining safe landing sites on the fire ground or incident scene.
- Coordinating and deconflicting operations with unmanned aircraft assets.
- This role is equivalent to the NWCG UAS Module Leader.

UAS Coordinator

The UAS Coordinator is an administrative non-crewmember that manages program readiness and regulatory compliance at the Departmental level if applicable. Duties include:

- Maintaining the crewmember roster and supporting training logs for any persons eligible to act as crewmembers on a MABAS UAS operation.
- Establishing and maintaining localized FAA authorizations/waivers.
- Ensuring all operations conducted are in accordance with the MABAS UAS Guideline.
- Maintaining departmental owned UAS airworthiness, including maintenance logs.
- Reporting pertinent crewmember and response information to the UAS Division Branch Chief and acting under the guidance of the UAS Division Branch Chief.

UAS Division Branch Chief

The UAS Division Branch Chief is an administrative non-crewmember that manages program readiness and regulatory compliance at the MABAS Division or Departmental levels. Duties include:

- Maintaining the crewmember roster and supporting training logs for any persons eligible to act as crewmembers on a MABAS UAS operation.
- Establishing and maintaining localized FAA authorizations/waivers.
- Ensuring all operations conducted are in accordance with the MABAS UAS Guideline.
- Maintaining divisional or departmental owned UAS airworthiness.
- Reporting pertinent crewmember and response information to the UAS Section Chief.

UAS Section Chief

The UAS Section Chief is an administrative non-crewmember that manages the MABAS UAS Program, including readiness and compliance at the MABAS-Illinois level. Duties include:

- Maintaining the crewmember roster and supporting training logs for any persons eligible to act as crewmembers on a MABAS UAS operation.
- Maintaining any MABAS-wide special authorization or waiver from the FAA.
- Acting as a single point of contact with the FAA.
- Updating, disseminating, and enforcing the MABAS UAS Guideline.

Visual Line of Sight

Visual Line of Sight is determined by the ability of the average human eye to resolve a distant object with or without corrective lenses.

Visual Observer (VO)

A person who assists the Remote Pilot in Command (RPIC) and the person manipulating the flight controls of the small UAS (if that person is other than the RPIC) and fulfills the duties of the crewmember described in 14 CFR § 107.33.

WX

An Abbreviation for Weather

Zulu Time

Universal Coordinated Time (UTC) or Greenwich Mean Time (GMT) a universal time zone used in aviation weather forecasting.

Mutual Aid Box Alarm Systems

Unmanned Aircraft Systems Program (UAS)

UAS Program Planning

OVERVIEW

This document provides information required for MABAS Divisions and member agencies to plan and implement safe, legal and effective UAS operations. MABAS has identified that the primary cause of UAS program failures is the lack of planning. This in turn lead to agencies procuring equipment or training incompatible with the mission, or omitting requisite equipment or training. The following document intends to provide guidance agencies should follow when researching or establishing UAS programs in the fire service.

A. IDENTIFY OPERATIONAL NEEDS

The first step when conducting research to implement a UAS program is to understand the needs of the sponsoring agency as well as any other agencies, divisions or municipalities that may request the UAS to respond via mutual aid. The following areas should be taken into consideration by the implementing authorities having jurisdiction (AHJ).

1. Geography, population, and weather

The population density and geographic area for which the AHJ is responsible should be a primary factor of consideration for how the UAS program should be specified, and what types of UAS responses may be called for.

For example:

- An agency with an extensive rail network in their jurisdiction should consider developing a UAS program able to assist with derailments and associated HAZMAT incidents.
- An agency in an urban area near a Level 1 or Level 2 trauma center should expect medical helicopter traffic regardless of class of airspace and should consider coordinating with helicopter services in advance by means of standardized operating procedures, and memoranda of understanding.
- An agency in an area that receives extensive precipitation and condensing moisture during long periods of the year should consider launching their UAS program with an aircraft that is ingress protected.

2. Frequent deployments

The deployments to which the AHJ expects to be directed should be a primary indication of how the UAS program should be initially specified.

For example:

- An agency who expects to receive frequent water rescue calls should consider a UAS with effective payload capability to carry and release a personal flotation device, and requisite crew training so as to operate the UAS with external loading.
- An agency who expects to use the UAS to support post-control efforts on structure or wildland fires should consider a UAS with thermal imaging capabilities, and the requisite crewmember training so to operate and interpret thermal payloads.
- An agency that intends to provide mutual aid support to law enforcement should train flight crew.

3. Airspace

The overlying airspace of the AHJ's local and mutual aid response area (if applicable) should also influence the procedures and training required for safe and effective deployment.

For example:

- An agency In MABAS division 1, 3, 8, 9, 10, 21, 24, 28, or 48 should consider pre-arranging authorization with local Air Traffic Control (ATC) facilities for the controlled airports in their response area and have requisite authorizations in place before deployment.

- An agency with uncontrolled airports in its response area should consider equipping the UAS team with airband radios and the requisite training for the flight crew or Tactical Group Supervisor to separate air traffic without the support of Air Traffic Control (ATC). Consider an aircraft with a system similar to DJI AirSense which gives instant real-time positioning alerts on nearby manned aircraft.
- An agency who intends to respond by mutual aid should ensure any airspace authorization, waiver or COA extends beyond their municipality boundaries to include mutual aid areas.

4. Mutual aid availability and capability

Finally, each agency choosing to build a mutual-aid capable drone program should consider whether they intend to deploy assets from their program, in whole or in part, to support nearby agencies via mutual aid. This decision should be determined by the level of need and capability.

For example:

- Neighboring agencies with UAS programs who expect to deploy on mutual aid assignments together should consider standardizing on aircraft platform, training, and SOPs.
- Agencies who intend to deploy beyond the local scale, whether as part of a MABAS or FEMA team should ensure their program is compliant with the requirements of MABAS or FEMA team membership.
- Agencies that are early adopters of UAS technology in their region should expect to receive UAS mutual aid requests from neighboring agencies.

B. COST JUSTIFICATION AND BUDGETARY CALCULATIONS

Protecting firefighters from unnecessary exposure to harm is the primary cost justification for a UAS program. Budgetary calculations should take into account the operating cost of personnel and equipment as well as unforeseen liabilities like injuries, damage to equipment, and workman's compensation claims. The speed and efficiency with which an agency can respond to an incident have a direct relationship with the reduction of fixed costs and potential liabilities. Less time on scene means less payroll and overtime and less wear on equipment. Reduced direct, physical involvement in the incident means equally reduced liability of injury and loss. Additionally, the improved situational awareness provided to an incident commander by a drone allows the incident commander to allocate resources in the manner most efficient to meet the needs of the emergency, reducing unnecessary material expenditure.

An injury report published by NFPA in 2017 ("U.S. Firefighter Injuries in 2016"), indicates that on average 1% of a department's personnel will sustain an injury that will require around 3 weeks of recovery per year ^[1]. The National Fire Incident Reporting System (2016) statistics indicate that between 2012 and 2014 over 43% of recorded firefighter injuries were of moderate severity which included at least some degree of lost time, including overtime costs incurred to cover the injured individual ^[2]. Full reports are available online. In addition, opportunity costs, lost productivity, workman's comp, administrative functions and medical costs are incurred by the agency. The actionable intelligence provided by an effective drone program empowers safety officers to make more informed decisions to ensure the safety of personnel, and achieve objectives efficiently.

1. Startup costs

When developing a UAS program, there are some factors that need to be calculated including both fixed costs and development time.

a. Research time

On average, agencies should expect to spend between 80 and 120 man-hours conducting the necessary preliminary research to specify the scope of their drone program and beginning budget. This estimate of hours includes preliminary administrative tasks such as requesting competitive quotes for equipment and training. MABAS expects this time investment to decrease significantly as drone adoption becomes more mainstream and industry best practices are adopted.

b. Policy writing

Agencies that choose not to adopt the MABAS UAS Policy, or agencies that choose to operate beyond the MABAS UAS Policy, should expect to spend additional time defining and documenting the policies for their internal program. Typically, defining policies and guidelines, incorporating local, state, and federal policies and regulations may require up to an additional 120 man-hours of effort. MABAS strongly recommends that MABAS member agencies adopt

the MABAS UAS Policy to eliminate this development burden and promote interoperability between agencies implementing program.

2. Initial equipment cost

Agencies implementing drone programs should estimate initial equipment expenditures to range from \$8,000 to \$75,000. The upper limit of this range takes into account agencies who intend to operate multiple airframes of different capabilities, maintain redundant capacity with multiple aircraft, and dedicate a support vehicle to the UAS program. However, the majority of operational needs of an average agency can generally be met by an aircraft package including UAS, support equipment, payloads and accessories with an approximate cost of \$30,000 to \$35,000. Training costs will also be incurred, and it will be more than likely to include internal and external costs. The external costs over time will go down as fire service members over time will be able to train others. Typically, agencies can expect to spend around \$1,200 to \$1,500 per pilot on initial training, plus potential additional costs for position backfill that will depend on agency needs and available resources.

3. Program recurring costs

Once a UAS program is established, it will require recurrent training, equipment maintenance and replacement. These costs should be accounted for in the UAS program operating budget. Typically, attrition rates for roles within an organization are roughly 6% to 7% annually. This means that 6% to 7% of the initial funds spent on training would need to be budgeted. Also, as skills develop and become standardized, agencies may want to train their UAS teams in specialties such as UAS response to Search and Rescue, UAS response to HazMat, and others.

Additionally, all UAS equipment will require routine maintenance to remain in a deployable configuration. Typically, an agency should allocate 10% to 15% of their initial equipment cost for maintenance, as well as budget for equipment replacements. The average UAS has a lifespan (dependent on nature of use) of approximately 5 years. Thus, it is recommended that agencies allocate approximately 20% of their equipment cost per year to prepare for the eventuality of airframe replacement.

4. Amortized costs

Determining the value and understanding the return on investment that a tool provides will be different for each agency. This variance will be based on agency size, available resources, types of responses, number of annual responses, and local hazards.

The included MABAS UAS program budget calculator allows an agency to project the expense of making the UAS available for a particular incident, over the expected lifespan of the UAS, based on their fixed implementation costs and number of yearly expected deployments.

5. Examples of determining the value of a UAS Program

Understanding the value is one of the critical factors in starting any kind of program. With a UAS Program, there are a number of startup costs associated with equipment purchases and initial training. Additionally, there are recurring maintenance and training costs. Determining how a UAS program will allow an agency to operate more safely and efficiently are they key components to understanding the program's value.

For the examples below, we use a highly conservative estimate of \$300 per incident based on real-world examples.

▪ **Example # 1** (Suburban Wildland Fire)

This fire covered over 43 acres of 10ft cat-tails. The inability to maintain situational awareness based on the density of the foliage made allocating resources difficult. Incident command had predicted, extinguishment would take up to 4 hours with 3 agencies and roughly 15 personnel on site. Utilizing the UAS, the actual incident only took about 2 hours with the 15 personnel. Accounting only for personnel costs utilizing the UAS saved \$675, not including wear and tear on equipment and vehicles as well as the potential for injuries in an uneven, rough terrain.

▪ **Example # 2** (Law Enforcement Mutual Aid, Barricaded Subject)

In this scenario, over 20 fire personnel were on scene for support purposes. Managing the incident, there were approximately 125 law enforcement personnel including about 40 from Special Tactics teams. The incident was predicted to require at least 18 hours of on scene time utilizing a UAS.

The actual incident was concluded in 12 hours, a 33% decrease in time from the initial estimate. In this scenario, the UAS was used to deliver a cell phone to the armed and barricaded suspect which allowed negotiators to arrange a peaceful surrender. With the 6 hours of savings in time multiplied by the approximately 150 personnel on scene, the estimated cost savings was well in excess of \$20,000. The drone assisted in preventing injuries to the suspect, personnel on scene, and the community. For some UAS programs, this one incident alone may justify a 4-year expenditure.

- **Example # 3 (Large Downtown Structure Fire)**

This scene covered a large structure fire in a dense downtown area. The fire caused extensive damage, rendering even adjacent buildings unsafe to enter. This was determined to be an arson fire. With the size and scale of this fire, almost every department in the city government was involved. The Fire Department deployed a drone during firefighting operations to aid the Incident Commander with situational awareness. The drone was also deployed after the incident to document the scene and map the city block. The orthomosaic map and 3D model were used by investigators to document the scene. The 3D model was also used create a virtual tour, which allowed officers from the Police Department, Building Department, Public Works, Finance Department, Mayor's Office, and City Council, to safely assess the scene. Information was spread more rapidly, services were restored more expediently and exposure to hazards were minimized.

The day after the incident, the drone was used again with the fire investigation unit to enter the unstable structure and document the area of origin without undue risk to personnel. Currently, the documents, maps, and photos are being used by prosecutors with hopes of bringing the arsonist to justice.

6. Potential sources of funding

Drones are an emerging technology and adoption in the fire service is just beginning; as a result, many agencies have not made allowances in their general operating budget for the UAS Program and may have difficulty justifying an increase in budget without the tangible track record of success of an operational drone program. While MABAS strongly recommends that all member agencies interested in utilizing UAS assets budget accordingly, agencies that do not have a UAS Program in the budget can find resources to fund equipment acquisition and training through other sources. Below is a general, though not an exhaustive list of funding sources MABAS members have found to be useful. MABAS recommends prospective grant recipients familiarize themselves with the grant requirements before application.

Related information:

- Foreign Fire Tax (2% Fund)
- Fire Grants Help (Fire Rescue 1). *Search for Grants*. Retrieve from firegrantshelp.com
- EMS Grants Help. Retrieve from emsgrantshelp.com
- FEMA: *Assistance to Firefighters Grants Programs*. Retrieve from fema.gov
- Fire Grants. Retrieve from firegrants.info
- Firehouse Subs Public Safety Foundation. Retrieve from grants.firehousesubs.com
- Firefighters Support Foundation. Retrieve from ffsupport.org
- First Responder Grants. Retrieve from firstrespondergrants.com
- Urban Areas Security Initiative (UASI) Program. Retrieve from homelandsecuritygrants.info
- Walmart Community Grant Program. Retrieve from walmart.org
- Port Security Grants

C. CREW TRAINING AND CURRENCY

The specific requirements for training crewmembers may be found in *MABAS UAS Policy*, Chapter B Crewmember Roles and Responsibilities.

1. Initial training required

- Operations personnel who will be tasked with the role of UAS crewmember on a MABAS deployment shall have completed requisite training for their position to which they will be tasked, as specified in the *MABAS UAS Policy*, Attachment B Crewmember Roles and Responsibilities.

- Operations personnel who will not be tasked with the role of MABAS UAS crewmember on a MABAS deployment may receive initial training as specified by the AHJ or agency responsible for the UAS program.
- Regardless of operation, compliance structure, or MABAS affiliation operations personnel acting in the capacity of Remote Pilot in Command shall hold a current Part 107 Remote Pilot Certificate, and shall have received an applicable course and practical training to exercise the authority associated in any situation the Remote Pilot in Command is reasonably expected to encounter.

2. MABAS team requirements

It is the eventual goal of MABAS to assemble statewide and interstate deployable FEMA compliant UAS teams to provide statewide response capabilities to regions unable to support the establishment of local UAS programs. To maintain team status and membership, crewmembers shall obtain and maintain the training qualifications specified for team membership. These specifications will be distributed as teams are established.

3. Sources of compatible training

MABAS recommends agencies preparing to launch UAS programs carefully research the training vendors before selecting a source. MABAS UAS crewmembers will be expected to fly in situations and environments significantly beyond the capability of most civilian drone pilots. As such, MABAS expects that UAS crewmembers receive more specialized training from vendors with expertise in public safety.

Training vendor should meet the following guideline:

- Vendor should be intimately familiar with the MABAS UAS program, and associated compliance strategies.
- Vendor should provide a student-instructor ratio no greater than 1-6 during flight training to provide the most practical experience possible.
- Vendor should maintain a local presence and availability for recurrent training and service if necessary
- Vendor should be, or maintain an affiliation with a college, university, or public safety academy.
- Vendor should offer a public-safety focused curriculum, or track.
- Vendor's instructors tasked to train MABAS crewmembers should have comparable experience to the UAS Instructor Endorsement described in Chapter B, Crewmember Roles and Responsibilities (MABAS UAS Policy).

4. Maintenance of currency

Once initial training is completed, MABAS member agencies should prepare to maintain the proficiency of UAS operations personnel.

a. Yearly practical test

Agencies implementing UAS programs should consider instituting a yearly practical test for each crewmember to be tasked with the role of Remote Pilot in Command during a UAS operation. This practical test should be recorded and graded, against a criterion referenced standard to assess and document the performance of each pilot, and determine if additional recurrent training is needed.

b. Currency minimums (organized training)

In addition to the yearly practical test, agencies implementing UAS programs should ensure that each crewmember qualified to serve as Remote Pilot log at least 5 hours acting as Remote Pilot in Command every 90 days during dedicated training sessions.

D. EQUIPMENT ACQUISITION

Determining the right equipment must take into account a number of variables. Below is a list of the more common items for consideration, but it is not exhaustive.

- Types of incidents that a UAS would be utilized for.
- Types of UAS neighboring agencies are using (to support mutual aid interoperability).

- Initial UAS costs, including sensors and payloads.
- Manufacture support/warranty.
- Support equipment.
 - Transport vehicle (existing or new)
 - Aviation radio
 - Battery chargers
 - Inverter / generator
 - landing pad
 - Spare parts (propellers, screws, etc.)
 - Anti-collision lights

Cost is one of the most prominent factors for an agency acquiring new equipment. Agencies should consider not only the initial expenses but also recurring maintenance and equipment replacement. On average, an industrial UAS should have a life expectancy of 5 years, depending on severity of service. Accounting for an agency's startup cost, it should plan to budget 20% of the aircraft cost annually for equipment replacement and maintenance.

A key factor in determining equipment needs is interoperability with other UAS teams. Standardizing equipment helps to ensure that another agency responding to a mutual aid request can support continuous operations (by having interchangeable components such as batteries, air frames, sensors and controllers). Recommended equipment configurations may be found in the UAS equipment guide attachment.

E. FAA COMPLIANCE

Agencies that intend to implement a UAS Program should familiarize themselves with the federal aviation regulations pertinent for their intended operations, and their responsibility for compliance. Agencies may choose to launch their own drone programs, but access to MABAS UAS resources including insurance and regulatory support will only be granted to agencies that are compliant with MABAS's UAS policy.

1. Overview of the MABAS COA

MABAS-IL is currently in the process of finalizing a Certificate of Authorization (COA) with the Federal Aviation Administration to authorize specialized MABAS UAS responses anywhere within the state and beyond under a unified command and compliance structure once approved. This Certificate of Authorization (COA) is an agreement between the Federal Aviation Administration (FAA) and MABAS-Illinois, it allows MABAS Illinois to authorize any MABAS Agencies' pilots and aircrafts that meet the training and airworthiness requirements specified in the Certificate of Authorization (COA) to conduct UAS operations without the requirement of oversight or compliance management by the AHJ. The MABAS COA is designed to provide maximum flexibility and interoperability to UAS flight crews operating on MABAS deployments anywhere in the state.

NOTE: Statewide and interstate deployable MABAS UAS teams will be required to operate under the MABAS COA and MABAS UAS Policy.

To utilize the MABAS COA, the following criteria shall be met:

- Intended operation
 - Shall be a governmental function, as defined by the *United States Code*, 49 U.S.C § 40125: Qualifications for public aircraft status ^[3].

NOTE: Not all functions conducted by a MABAS member agency qualify as "governmental functions" per statute. In *FAA Advisory Circular (ACs)*, 00-1.1B - Public Aircraft Operations ^[4].

- Shall be in support of a MABAS mobilization or approved on a case-by-case basis by the UAS Section Chief.

- Flight crew
 - Shall meet minimum crew roles as defined in the MABAS COA.
 - Shall meet minimum training and certification levels for crewmember position as defined in the MABAS COA.
 - Shall not be a contractor or commercial flight service provider under contract with the AHJ. In FAA Advisory Circular (ACs), 00-1.1B – Public Aircraft Operations, section 9.
- Aircraft
 - Shall be a make and model approved for use under the MABAS COA.
 - Shall be maintained in accordance with manufacturers maintenance schedule or directives.

2. Agency compliance

Agencies implementing drone programs to conduct operations independently of MABAS may choose to develop their own methodology of compliance with federal aviation regulations. It is strongly recommended that agencies that intend to build localized drone programs do so in an interoperable manner with the MABAS UAS Program, even if they do not frequently intend to use MABAS resources or compliance protocols. Agencies that do not meet the requirements outlined in the MABAS UAS Policy may be ineligible to participate in MABAS deployments.

Agencies implementing UAS programs have two options for localized or agency specific compliance:

a. Civil operations under 14 CFR Part 107

Often cited as the quickest and most expedient method for authorization, UAS pilots who hold a Remote Pilot's Certificate can legally operate under that Part 107 regulations during the day, in reasonably good weather and visibility, and in uncontrolled airspace. Originally designed for commercial operations, Part 107 does not distinguish or apply scrutiny to type and nature of mission. For specialized operations, such as flying at night, in controlled airspace near a major airport, flying over people or moving vehicles, or flying beyond the pilot's line of sight, individual waivers are available. More information on the Part 107 regulations can be found in FAA Advisory Circular (ACs), 107-2 – Small Unmanned Aircraft Systems (sUAS) ^[5].

- Part 107 Pros
 - Not mission specific.
 - May not require any additional paperwork.
 - No FAA reporting burden.
 - Fly any drone you want, less than 55lbs.
 - Well understood regulatory program with extensive caselaw and support.
- Part 107 Cons
 - Restrictive operating rules (can't fly at night, beyond line of sight, over persons or vehicles, etc. without a waiver).
 - Must request authorization to fly in controlled airspace.
 - No exceptions for public safety mission types.

b. Public operations under a certificate of authorization pursuant by The Office of the Law Revision Counsel United States House of Representative.

See the United States Code, 49 U.S.C § 40125: Qualifications for public aircraft status, for more information ^[3].

The Public Certificate of Authorization process (Public COA) was designed by the Federal Aviation Administration (FAA) to support both manned and unmanned public aircraft operations and provides agencies a great deal of flexibility in justifying special operating circumstances.

To begin the Public COA process:

- 1) Your agency first needs to be declared in conformity with the statutes governing public operation of aircraft. This declaration should be provided to the Federal Aviation Administration (FAA) by the appropriate attorney (city, village, county, state attorney general).

- 2) Once approved, you'll be authorized to write your COA request. In this request, you'll be expected to demonstrate your operating, training, inspection, maintenance, emergency and other procedures, as well as make a safety case based on the procedures you develop.

For many exigent operations, Public COA provides the greatest amount of operational freedom. These include allowances to overfly persons, fly at night, request Temporary Flight Restrictions (TFRs) for manned and unmanned traffic, and call the FAA's System Operations Support Center (SOSC) in Washington, DC, for immediate amendments to the COA for emergency circumstances (see SGI Addendum, section C).

It is worth noting that the Public COA may only be used for "governmental operations" which may preclude certain non-exigent operations such as preplanning, and demonstrations for the public. MABAS recommends working with your agency's attorney to determine what if any operations that you intend to conduct fall outside of the bounds of "governmental functions" for missions undertaken using your agencies COA.

- Public COA Pros
 - Much greater flexibility than Part 107.
 - More access to controlled airspace.
 - Night operations approved by default.
 - Overflight of people approved by default.
- Public COA Cons
 - Limit to "governmental operations" pursuant to 49 U.S.C §40125: Qualifications for public aircraft status.
 - Monthly reporting requirements.
 - Greater upfront program development burden.

3. Special Governmental Interest Addendum (SGI Process, Formerly E COA)

The Special Governmental Interest (SGI) Addendum (formerly Emergency Certificate of Authorization) is a process by which the Federal Aviation Administration (FAA) may provide emergency authorization on a case-by-case basis to allow public safety agencies to operate UAS assets expediently in situations that would normally require a lengthy waiver or COA addendum process. Agencies should use the Special Governmental Interest (SGI) addendum process for emergency needs, where unforeseen circumstances require the UAS to be operated outside the bounds of the federal aviation regulations, or current authorizations. Agencies should be aware that the Special Governmental Interest (SGI) addendum is granted at the discretion of the FAA System Operations Support Center based on the specifics of the intended mission, and associated interest of safety of the NAS and the general public.

Example circumstances for SGI authorization:

- Emergency access to controlled airspace for overwatch on an active structure fire.
- Emergency need to operate over nonparticipating persons during search and rescue operations.
- Emergency need to operate in decreased visibility during water rescue operations
- Emergency need to access an area covered by a Temporary Flight Restrictions (TFR).
- Emergency need to establish a Temporary Flight Restrictions (TFR).to prevent incursion by nonparticipating aircraft.

The complete, step-by-step process of requesting a Special Governmental Interest (SGI) addendum may be found in the Air Traffic Organization Policy. MABAS member agencies or flight crews requesting a Special Governmental Interest (SGI) addendum should familiarize themselves with JO7200.23 before requesting.

See Air Traffic Organization Policy (UAS), Order JO 7200.23, section 7, for more information ^[6].

F. COMMUNITY AWARENESS AND ENGAGEMENT

Historically, drones have been met with skepticism from the public. The rapid emergence of this technology has led to privacy and safety concerns from many. It is incumbent on the public safety agencies adopting this technology to actively work to allay the concerns of their communities through education, transparency, and the active promotion of the safe, responsible and ethical use of drone technology.

Agencies can inform and engage the community by sharing the successes of the drone program through:

1. Official Department Social Media Accounts.
2. Official Fire Department press releases to the media.
3. Public Service Announcements to inform the general public about safe drone use.
4. Community demonstrations and presentations during planned events.
5. Other events when the department has a presence in the community.
 - Job Fairs
 - Fire Station Open Houses
 - Neighborhood Meetings / Block Parties
 - Fire Safety Presentations

As an emerging technology, drones inspire attention from local media. Agencies can take advantage of increased media attention by inviting media outlets to a demonstration of the capabilities of the drone program and describing its successes and intent. This full transparency allows the agency to alleviate the concerns of the community, promote the usefulness of the program, and out its direct impact on the safety and wellbeing of the community.

In addition to educating the community, it's vital to ensure all members of the department are educated on the value drones can provide in public safety. While not all department members will be active flight crew, all should understand the practical deployment considerations of the UAS relevant safety procedures. MABAS strongly recommends all department personnel complete at least awareness level training so as to be adequately informed about, and advocate for, the use of UAS by public safety agencies.

References:

- [1] Hylton Haynes. (2017). U.S. Firefighter Injuries in 2016. National Fire Protection Association (NFPA). Retrieve from NFPA.org.
- [2] Fire-Related Firefighter Injuries Reported (2012-2014). PDF. FEMA. Retrieve from usfa.fema.gov.
- [3] 49 U.S.C § 40125: Qualifications for public aircraft status. The United States Code. Retrieve from uscode.house.gov.
- [4] FAA Advisory Circular (ACs). 00-1.1B - Public Aircraft Operations. PDF. Retrieve from faa.gov.
- [5] FAA Advisory Circular (ACs). 107-2 - Small Unmanned Aircraft Systems (sUAS). PDF. Retrieve from faa.gov.
- [6] Air Traffic Organization Policy (UAS). Order JO 7200.23, section 7. PDF. Retrieve from faa.gov.

Mutual Aid Box Alarm Systems

B

Unmanned Aircraft Systems Program (UAS)

Equipment Selection Recommendations and Maintenance Guidance

OVERVIEW

This document contains the UAS and support equipment recommendations for local and divisional UAS teams as well as guidance on keeping aircraft and support equipment in a mission ready state. This document is meant to be used as a guideline, as your agency or division needs may vary. However, these guidelines help responding agencies interop with each other.

RECOMMENDED UAS EQUIPEMENT SPECIFICATIONS

This document contains the UAS and support equipment recommendations for local and divisional UAS teams as well as guidance on keeping aircraft and support equipment in a mission ready state. This document is meant to be used as a guideline, as your agency or division needs may vary. However, these guidelines help responding agencies interop with each other.

A. Recommended general aircraft specification

- 2x DJI M210 Quadcopter (Includes aircraft body, remote controller, CrystalSky Monitor, props, 2 sets of batteries and charger.
 - The M200 can be purchased in lieu of the M210 as most components are interchangeable. (**Note:** Monitor will have to be purchase separately.)
- 4 sets of High Capacity TB55 batteries
(**Note:** For 24/7 operability, 6 sets of batteries, 3 chargers and AC power are required.)
- DJI XT2 (640x512 30hz 13mm Radiometric with visual image overlay)
- DJI Z30 30x optical zoom camera
- DJI X4S camera
- 2 sets of extra props
- 3 charging hubs with power adapters
- Hard case
- Strobe light system for night operations

B. Recommended heavy lift aircraft specification

- 2x DJI M600 Hexcopter (Includes: aircraft body, remote controller, one set of TB47s batteries)
- 4 sets of high capacity TB48S batteries (24)
(**Note:** For 24/7 operability, 6 sets of batteries, 3 chargers and AC power are required.)
- DJI XT2 (640x512 30hz 13mm Radiometric with visual image overlay)
- DJI Z30 30x optical zoom camera
- 1 set of extra props
- 2 charging TB48 charging hubs
- M600 channel 3xpansion
- PWM controlled drop release system
- Hard case
- CrystalSky Monitor with 3 batteries and Mavic Crystal Sky mount
- Strobe light system for night operations

C. Recommended lightweight / indoor / training aircraft specification

- 2x DJI Mavic 2 Enterprise (Dual) Quadcopter (Includes: aircraft body and remote controller)
- 4 additional batteries
(**Note:** For 24/7 operability, 6 sets of batteries, 3 chargers and AC power are required.)
- Prop guards
- Prop cages
- 1 set of extra props
- 3 chargers
- Hard case
- CrystalSky 5.5" or 7.8" Monitor with 3 batteries and Mavic Crystal Sky mount.
- Strobe light system for night operations

Example UAS support equipment:

The UAS will need support equipment such as generators, transport vehicles, monitors, etc.

- Dedicated transport vehicle
 - Preferably 4x4 SUV
- Division or regional command van
 - Typical command van configuration
 - Should support HDMI input for viewing
- Amimon Connex HD transmitter and receiver kit. 1600ft line of sight range
- 8 x 32 GB Sandisk Extreme Pro MicroSD Cards
- High-end laptop computer
 - 1 TB hard drive
 - 32GB of memory
 - Best processors available
 - Optionally Pix4d mapping software -may be a divisional or regional aAsset
- 17" field monitor with case
- Landing pad
- High vis vests for crew
- Caution tape and cones for defining landing and take-off zone
- Red lensed flash lights

MAINTENANCE GUIDANCE

A. Battery readiness

Below is recommended guidance to keep DJI batteries mission ready (unless otherwise specified by the manufacture):

- DJI Batteries should not all be charged 100% all the time. This reduces the life of the battery. Instead only 1/3 of batteries should be fully charged at all times.
- Other DJI batteries should be between full and 1/2 power due to smart discharge cycles.
- During weekly maintenance charge the lowest battery.
- If possible, use the lowest batteries for training purposes and charge them to 100%. This helps cycle batteries and keeps the most fully charged batteries ready for deployment.
- During deployment, start charging batteries below 85% once on scene. This will allow for continuous operations while increasing battery life.

For example, if you had 8 batteries and did not fly for four weeks this would be the charging cycle:

- Week one, fully charge batteries 1 & 2.
- Week two, fully charge batteries 3 & 4.
 - 1) Batteries 1 & 2 will start to discharge based on DJI battery design and will probably be at 85%.
- Week three, charge batteries 5 & 6.
 - 1) Batteries 1 & 2 will start to discharge based on DJI battery design and will probably be at 70%.
 - 2) Batteries 3 & 4 will start to discharge based on DJI battery design and will probably be at 85%.
- Week four, fully charge batteries 7 & 8.
 - 1) Batteries 1 & 2 will start to discharge based on DJI battery design and will probably be at 55%.
 - 2) Batteries 3 & 4 will start to discharge based on DJI battery design and will probably be at 70%.
 - 3) Batteries 5 & 6 will start to discharge based on DJI battery design and will probably be at 85%.
- Week five, repeat the cycle starting with batteries 1 & 2.
- Week six, hold a training.
 - 1) The lowest batteries should be 3 & 4, so use those first.
 - 2) Then use 5 & 6 and so on.
 - 3) Still just fully charge 3 & 4.

Mutual Aid Box Alarm Systems

Unmanned Aircraft Systems Program (UAS)

Insurance Recommendations

OVERVIEW

This document provides information as to which UAS assets shall be covered by insurance policies owned and maintained by MABAS, as well as makes recommendations as to how agencies and divisions onboarding UAS programs should insure themselves.

1. WHAT INSURANCE SHOULD AN AGENCY CONSIDER?

General Liability

General liability insurance protects the agency against liability claims in the event of an aircraft accident causing tangible damage to persons or property. Minimum limits of \$1 million are common in the UAS industry.

NOTE: While some specialized policies and intergovernmental risk pools may include coverage for UAS operations, do not assume that your agency's blanket policy includes general liability coverage. Traditionally, many blanket policies include an "aviation exclusion" that prevents the insured from using any aircraft manned or UAS. This is changing with the increased adoption of UAS technology. Check with your insurance provider to confirm.

Professional Liability

For agencies that conduct and manage internal training, Professional Liability insurance, (sometimes referred to as "errors and omissions" insurance protects the agency against claims of inadequate or improper training of the UAS flight crew. FAA and NTSB statistics indicate greater than 80% of aviation accidents are caused by human error, thus agencies who conduct their own training may be at risk of such claims in the event of an accident.

Hull Damage (Comprehensive Coverage)

Hull Insurance, also called "Comprehensive Coverage" protects the aircraft against both damages related to accidents, as well as other damage from storage and transport. Self-insuring for hull damage is generally advisable for most aircraft unless the manufacturer offers a competitively priced extended warranty with comparable coverage.

2. DOES MABAS PROVIDE INSURANCE?

Yes, MABAS-IL provides insurance for MABAS purchased and owned assets. The MABAS-IL internal insurance policy lists assets that are owned by MABAS-IL and used lawfully and in accordance with MABAS Policy by member agencies on MABAS-IL deployments.

3. WHAT MABAS WILL NOT COVER:

MABAS' Insurance Policy is intended to cover MABAS owned assets during MABAS operations. The following are examples of situations or circumstances in which MABAS would not extend coverage to an aircraft:

- UAS NOT owned by MABAS.
- UAS NOT used for a MABAS deployment.
- UAS used unlawfully, in a negligent manner or in a manner not pursuant to the MABAS UAS Guideline or Policy.

Mutual Aid Box Alarm Systems

Unmanned Aircraft Systems Program (UAS)

UAS Operational Application Guidelines - General

PURPOSE

The purpose of this document is to provide general guidelines on operating a UAS at an incident or event. These guidelines shall coincide with the MABAS-IL UAS Flight Operations and Deployment Policy and shall not supersede the AHJ. The document will be broken down into various tasks. A specific operation may use one or many of these tasks.

SCOPE

The document will offer non-compulsory guidance to facilitate the safe and successful completion of a number of objectives, goals, and tasks instrumental to an effective deployment of UAS assets. Many of these tasks may need to be completed over a series of flights, dependent on the nature of the incident and number of units responding.

FLIGHT OPERATIONS AREA

The following is list of guidelines that should be utilized when establishing the area of operation. The flight operations area should be specifically reserved for the UAS operation and supporting personnel, vehicles and equipment. The takeoff and landing area should be a smaller subdivision of the flight operations area, reserved only for launch and landing of the UAS, as well as routine ground handling operations.

Flight operations area guidelines

- The flight operations areas should be clearly marked when practicable to prevent the entry of nonparticipating persons.
- The ideal flight operations area should be as large is as practicable, but at minimum should be a quadrangle measuring 2,500 square feet (50ft x 50ft).
- If possible, all vehicles and ground support equipment should be kept to one side of the flight operations area, while the other side contains the landing and takeoff zone.
- All persons in the flight operations area should readback announcements or instructions by any flight crew member to ensure they have been communicated effectively.

Takeoff and landing area guidelines

- The landing and takeoff area should be a minimum of 20ft by 20ft and 10ft away from any vehicle or other obstruction.
- The landing and takeoff zone should be unobstructed vertically.
- After sunset, use red scene lighting for the takeoff and landing area, whenever practicable.
- Establish at least one emergency landing zone in an area that will not create additional hazards.

TAKEOFF

The following is a list of guidelines that should be used when taking off.

1. Any crewmember should verbally declare their entry to the takeoff and landing area by announcing "*entering the active*" to all in the flight operations area.
2. When placing the aircraft in the takeoff zone, the aircraft's heading should be aligned with the wind direction. (e.g. wind out of 360°, aircraft should face north.)
3. Crewmembers should verbally declare when they power on the aircraft by announcing "*power*" to all in the flight operations area.

4. While any person is approaching the UAS, while its under power, the Remote Pilot in Command (RPIC) should hold the controls so as to avoid any inadvertent manipulation of the UAS.
5. The Remote Pilot in Command (RPIC) should announce when starting the rotation of the aircraft rotors by stating “*Clear Prop*” to all in the flight operations area.
6. The RPIC should announce when the UAS aircraft is taking off by stating “*taking off*” to all in the flight operations area.
7. Before taking off, the Remote Pilot in Command (RPIC) should position themselves behind the aircraft so that both the pilot and aircraft are pointing in the same direction.
8. Depending on the flight characteristics of the aircraft, during windy conditions, the Remote Pilot in Command (RPIC) may need to apply appropriate wind correction inputs
9. During takeoff, the Remote Pilot in Command (RPIC) should hover the aircraft at a practical altitude to ensure flight controls are functional before climbing out. While hovering, perform a flight controls check to make sure the aircraft is performing as expected before starting your flight mission. This should include:
 - Climb and descend
 - Pitch forward and backwards
 - Roll left and roll right
 - Yaw left and yaw right
 - If equipped, the Remote Pilot in Command (RPIC) should test the GPS lock by disabling position hold momentarily to let the aircraft drift a few feet then re-enabling position hold to ensure the GPS is providing input to the flight controller.

AVIATION RADIO COMMUNICATION PROCEDURES

All aviation radio communications follow a standardized protocol that will be expected by nonparticipating pilots and ATC. It is strongly recommended that MABAS flight crews become familiar with, and use the communication phraseology and techniques that are specified in the Aeronautical Information Manual, Chapter 4, Section 2 when communicating on any VHF Airband frequency.

MINIMUM OBSTACLES CLEARANCE ALTITUDE (MOCA)

Before the start of any mission, the minimum obstacle clearance altitude (MOCA) should be determined. This is the minimum altitude required to safely traverse between any two points in a defined area of operation with adequate clearance from terrestrial obstructions. Utilize the following steps to determine the MOCA:

NOTE: This procedure will only provide a reliable and repeatable MOCA altitude when a visual sensor zoomed to 1x is used. DO NOT attempt this procedure with the live feed from a thermal, multispectral or other payload.

1. Orient the camera gimbal level with the horizon (90-degree between nadir and zenith).
2. If the camera is equipped with a zoomable lens, ensure the lens is set to 1x zoom.
3. Identify the obstacle that appears the tallest in the flight operations area.
4. Set the heading of the aircraft such that the obstacle appears in the center of the camera feed horizontally.
5. From the landing and takeoff zone, ascend vertically until the obstacle crosses the astronomical horizon. (The astronomical horizon is the point at which the ground and sky appear to meet in the distance.)
6. Once this altitude is achieved, scan the live view for any other obstructions protruding above the horizon.
 - If an obstruction is seen, continue to ascend until that obstruction is just below the center of the live view.
7. Perform eight 45-degree yaws to the right. As you make each yaw, stop and scan the live view.
 - If an obstruction is seen protruding above the horizon, continue to ascend until that obstruction is just below the center of the live view.

8. Once a full 360-degree scan has been performed add 20ft to the drone's AGL altitude. This value will be your minimum obstacle clearance altitude (MOCA).
9. Document the MOCA value and if the aircraft is equipped with a return to home feature, set the return to home altitude no lower than the MOCA altitude.

The determination of the MOCA altitude for a particular location can be done before an incident or event as part of a UAS pre-planning exercise for the particular area the UAS will be operating in. Use extreme caution in congested areas, as the construction or modification of towers, buildings, antennas and aerial cables may cause MOCA to change over time.

TRAVERSING BETWEEN POINTS

Typically, most mission objectives will not be in the immediate area of the flight operations area and will require traversing from the takeoff area, to the objective and back multiple times throughout the deployment. When traversing between two points that are not in proximity, the Remote Pilot in Command (RPIC) should:

1. Fly the UAS no lower than the applicable MOCA altitude between the origin and destination.
2. Determine safe flight corridors. These corridors should have minimal obstructions and ground hazards such as ground personnel in the area or structures to allow ample room for the UAS to make an emergency or precautionary landing if necessary. Exercise caution to avoid transient overflight of nonparticipating persons and moving vehicles and vessels. Avoid loitering over structures and infrastructure longer than necessary to complete the needs of the mission. This may also mean that transit to the mission area may not be in a straight line from the flight operations area due to hazards on the ground.
3. Exercise caution to avoid any smoke, gas clouds, or convection currents which may pose a hazard to the operation of the UAS or interrupt the line of sight of the Remote Pilot in Command (RPIC).

OVERWATCH

The majority of UAS missions will involve providing data to enhance the situational awareness of the incident or event. This will frequently involve the following methodology.

Stationary hover (Loiter)

The stationary hover is where an aircraft hovers or loiters in a particular spot for an extended period of time. This may be useful when monitoring ground activities at an incident or event. The following guidelines should be followed while performing the stationary hover maneuver.

- The Remote Pilot in Command (RPIC) shall maintain VLOS at all times.
- Roughly every 10 minutes add gentle input to each primary flight control (yaw, roll, pitch, throttle) to make sure the aircraft is responding appropriately.
- The Remote Pilot in Command (RPIC) may descend below the minimum obstacle clearance altitude (MOCA), if it is safe, necessary, and in the best interest of the mission objective. However, the Remote Pilot in Command (RPIC) should return to the minimum obstacle clearance altitude (MOCA) as soon as practicable, and before moving the aircraft to another point.

Point of interest

The point of interest maneuver has similar intent to the stationary hover but provides a continual 360-degree view of the incident or event. The maneuver is performed by flying the aircraft in a slow circle while focusing the camera or sensor on an intended point of interest. The following guidelines should be observed while flying this maneuver:

- Do not fly below the MOCA altitude unless the RPIC has confirmed that the lower altitude and flight path is clear of any obstructions. This should only be conducted by a pilot who has sufficient knowledge and skill to make this assessment accurately.
- The Remote Pilot in Command (RPIC) may fly the POI maneuver aircraft manually or utilize an automated point of interest flight mode if the aircraft is equipped with it. It is strongly recommended that flights below the minimum obstacle clearance altitude (MOCA) be flown manually.

- The Remote Pilot in Command (RPIC) shall ensure no portion of the Point of Interest path extends beyond VLOS.
- On termination of the Point of Interest flight maneuver, return the aircraft to the minimum obstacle clearance altitude (MOCA).

LANDING

When landing the aircraft under the following conditions, the following guidelines should be adhered to:

1. Verbally declare your intent to return to base and land the aircraft by declaring “*returning to base*” and state your altitude to others in the flight operations area.
 - The UAS should always return to the takeoff and landing area with sufficient battery charge remaining to loiter or divert in the event the landing area is obstructed or congested. Sufficient charge remaining should provide the aircraft with 5 minutes of reserve power once the landing area is reached, at the minimum obstacle clearance altitude (MOCA).
 - If the aircraft’s fuel or battery level is at the minimum amount required to return home without engaging the failsafe, verbally declare “*(aircraft call sign/designator) returning to base*”, bingo fuel and state your altitude. All other landing and takeoff operations should be ceased, and the landing zone cleared for the incoming aircraft.
 - If the aircraft requires an emergency landing, the Remote Pilot in Command (RPIC) should verbally declare “*UAS (aircraft call sign / designator) declaring an emergency, returning to base*” and state your altitude, general location and direction of flight. All other landing and take-off operations should be stopped, and the landing zone cleared for the incoming aircraft.
 - If, due to the nature of the emergency the Remote Pilot in Command (RPIC) cannot safely return the aircraft to landing area, the Remote Pilot in Command (RPIC) should make an immediate descent and landing wherever is safe and practical.
2. When the aircraft is just outside the flight operations area, hover and hold the aircraft at the minimum obstacle clearance altitude (MOCA) determine that the landing zone is clear of obstructions and personnel, then verbally declare “*landing*” to everyone in the flight operations area. Then land the aircraft when safe to do so.
3. If an aircraft receives landing priority due to fuel exhaustion or other emergency, other aircraft or flight crew should immediately clear the landing area to allow the distressed UAS to land without delay.
4. Once the aircraft is on the ground, the Remote Pilot in Command (RPIC) should stop the rotors and verbally declare “*landed and disarmed*”.
5. When retrieving the aircraft, the Remote Pilot in Command (RPIC) or crew member should verbally declare “*retrieving the aircraft*”.

RELAYING INFORMATION TO INCIDENT COMMAND

One of the most critical functions a UAS can provide is real-time situational awareness to command during an incident. The following guidelines should be utilized to relay data and communicate with incident command.

- First, determine from incident command the need for live data, and what pertinent decisions will be made based on information captured by the UAS.
- Next, design a strategy by which the flight captures the pertinent data required by the incident commander.
- If possible, designate someone who has completed requisite training and has sufficient experience to assume the role of UAS Technical Specialist to maintain a single point of contact between incident command and the UAS team. This will prevent any unnecessary distractions for crewmembers, improve situational awareness and maintain an effective command structure. Provide a method independent of the Remote Pilot in Command (RPIC) or sensor operator’s instrumentation for incident command to view the data from the UAS in real time. (Reference equipment recommendations.)

DATA HANDLING

The following guidelines should be observed while handling the data from a UAS. These guidelines will not supersede AHJ policies, or any state local or federal law, policy, ordinance or directive.

- Each SD card should either be marked on the card or logged when it is inserted into an aircraft to indicate the sensor and aircraft in which the card was used.
- When retrieving the SD card, it should be logged and put into a case that can clearly identify which card slot it is stored in. The slot should be logged as well.

ORHTOMOSAIC MAPPING

Creating orthomosaic maps is valuable for pre-planning, situational awareness, surveying damage, and coordinating response efforts.

- To create an orthomosaic map, the UAS team will need access to software designed specifically for photogrammetry. Simple image editors will not suffice.
- All imagery should be collected with a minimum 75% overlap in the X and Y axis. In areas with high uniformity between images (dense vegetation, concrete, water) the overlap should be increased.
- Pilots should use a flight automation application designed for photogrammetry to eliminate human-introduced inconsistency.

Mutual Aid Box Alarm Systems

Unmanned Aircraft Systems Program (UAS)

UAS Operational Application Guidelines - Firefighting

PURPOSE

The purpose of this document is to provide guidelines on operating a UAS at a structure or wildland fire incident. These guidelines shall coincide with the MABAS-IL UAS Flight Operations and Deployment Policy and Operational Application Guidelines – General document, and shall not supersede the AHJ. The document will be broken down into various tasks. A specific operation may use one or many of these tasks.

SCOPE

The document will offer non-compulsory guidance to facilitate the safe and successful completion of a number of objectives in the safe and effective deployment of UAS assets. Many of these tasks may need to be completed over a series of flights, dependent on the nature of the incident and number of units responding.

OPERATIONAL TASKS

There are three common tasks that can be performed at a structure or wildland fire: situational awareness, payload delivery or evidence collection. The following sections highlight proven techniques for situational awareness and payload delivery operational tasks.

Situational awareness

At a structure fire the primary purpose of a UAS should be to enhance fireground safety and provide information to command. The following are a list of non-compulsory proven practices for providing situational awareness at a fire incident:

1. Setup an emergency landing area in the warm zone so as not to contaminate the cold zone.
2. Have the ability to stream the remote pilots live view and telemetry to incident command / safety officer. (This prevents having Incident Command (IC) / safety looking over your shoulder.)
3. If no specific direction is given by Incident Command (IC), provide situational awareness on the Charlie side of the structure / incident.
 - Keep the gimbal at a 45-degree angle from the ground, if possible.
 - If needed, increase altitude to ensure safe operations.
 - Maintain a distance of at least 1.5 times the width of the structure. To determine the current distance, the structure should take about 75% of the UAS live stream view.
 - Adjust the position of the aircraft, to keep it out of smoke and away from the heat and convection of the fire.
 - If possible, keep the aircraft, closest to the upwind side of the structure.
4. If roof operations are being performed, it is ideal to use a thermal camera to monitor the conditions of the roof.
 - Advise operations or Incident Command (IC) on the safe cooler locations on the roof.
 - Advise Incident Command (IC) if roof rafters in the thermal image are visible.
 - If the roof rafters' temperature matches the rest of the roof, advise Incident Command (IC) that the roof rafters are becoming compromised.

Payload delivery

Specific types of heavy lift, UAS can be used to bring tools to areas that are difficult to get to (or at). A risk assessment should be performed to evaluate the benefits of performing this task as there are many more risks that have to be taken into consideration. Next, are some non-compulsory guidelines that should be taken into account for delivering payloads with a UAS.

1. Ensure the aircraft and flight crew are capable of safely flying with the payload.
 - Ensure the payload and aircraft does not exceed the maximum takeoff weight.
 - Ensure that no payload is mounted to the UAS in a manner that would cause the UAS CG to fall outside the CG range limits imposed by the manufacturer.
 - When practicable, the aircraft should be equipped with a payload release mechanism that requires two-factor triggering (one input to arm, another input to release).
2. If the payload is attached to slung-load mechanism (as opposed to a hard mount) it is imperative to prevent positive feedback oscillations of the load by maintaining the load as close to the equilibrium position during flight as is practicable.
3. Insure the RPIC can maintain line of sight with the aircraft, payload and any receiving personnel.

Evidence collection

The following procedures are in line with NFPA 921 and should be followed as much as possible when collecting data for an investigation.

- Shoot an 18 percent gray card.
- Document and log location, date, or situational information.
- Log SD cards that are used.
- Keep used and unused SD cards separate.
- Never format a SD Card on the scene to ensure data is not accidentally erased.
- Always format the SD card before returning an SD card to service.
- Do not combine multiple incidents on one SD card. Complete each fire scene, remove the SD from the aircraft and log it before leaving the scene.
- Ensure chain of custody is documented.

Mutual Aid Box Alarm Systems

Unmanned Aircraft Systems Program (UAS)

UAS Operational Application Guidelines – Search and Rescue

PURPOSE

This document shall provide guidelines on operating a UAS at a search and rescue incident. These guidelines shall coincide with the MABAS-IL UAS Flight Operations and Deployment Policy and Operational Application Guidelines – General document, and shall not supersede the AHJ. The document will be broken down into various tasks. A specific operation may use one or many of these tasks.

SCOPE

The document will offer non-compulsory guidance to facilitate the safe and successful completion of a number of objectives in the safe and effective deployment of UAS assets. Many of these tasks may need to be completed over a series of flights, dependent on the nature of the incident and number of units responding.

OPERATIONAL TASKS

For search and rescue, the general objective of the UAS is to collect data over a wide area to search for clues of the victim's whereabouts. Generally, there are two ways UAS can be utilized for search and rescue: to deliver first aid devices or to perform search operations, each of which require appropriate risk assessment. The following sections discuss non-compulsory practices for each type of search method.

Hasty search

The hasty search is an ad-hoc search performed in a pre-defined area that is used to look for the victim or clues of their whereabouts. This search a free-flight search where the pilot looks for clues and documents what is found. This type of search is flown 2 to 3 times over the specified area for proper effectiveness.

1. Fly the aircraft at an altitude that balances reasonable ground coverage with resolution.
2. Record data when not taking images during the mission (takeoff and landing excluded). This video may be reviewed in real time or between flights by ground personnel to find clues as to the whereabouts of the victim that may have been missed by the pilot.
3. When the UAS is at a point of interest, collect still images.
 - Position the gimbal at a 60-degree angle from the ground and center the camera on the target.
 - The UAS may fly a point of interest pattern around the target while collecting still images.
 - If the location has many high contrast shadows, intentionally over exposing the image may help viewing into the shadowed areas.

Grid search (systematic sweep of a defined area)

A grid search is the most common search pattern used with UAS. Most UAS platforms have software that allows them to perform this type of pattern or supports a third-party solution to do. This type of search pattern has a high probability of detection with a UAS but collects a substantial amount of data. This type of search may have limited results in heavily wooded or urban areas. Below are guidelines for performing grid searches.

1. Use flight automation software to automate the flight path and data collection tasks, if possible.
2. Fly the aircraft as low as is safely practicable, at least 20'AGL above Minimum Obstacle Clearance Altitude (MOCA).
3. Images should have minimum 20% image overlap. Less overlap may prevent the images from being used in derivative data products (such as an orthostatic map, or other GIS information).

4. The camera should be positioned in a nadir position (90-degrees straight down) or, if the search area is urban, consists of dense foliage, has elevation changes, the camera may be positioned at 75-degrees to account for incidental object occlusion of the subject.
5. Generally, a wide-angle lens providing between 80 to 100 degrees of field of view is preferred.

Parallel route search (moving targets with a known course)

Parallel route search is a proven practice for aerial search operations designed to search for a moving target when the last known location and target are known. The parallel route search is flown by first following the last known course of the target and expanding the flight path in parallel lines outward from there. Pilots should exercise caution to ensure that the length of the route search does not extend beyond the pilot's visual line of sight. The following guidelines should be used by pilots intending to fly parallel route searches

1. Before takeoff, plot the last known location and course of the target.
2. If the targets course extends beyond the pilot's visual line of sight, divide the course into segments to be completed on multiple flights, or by different flight crews simultaneously. Additionally, Special Government Interest Addendum (SGI) may be available for flights beyond line of sight in exigent circumstances.
3. Fly the aircraft at an altitude that balances area coverage with ground sampling resolution.
4. Position the camera at a slightly oblique angle (approximately 75-degrees or 15-degrees above nadir).
5. Fly each succeeding parallel course with 30% visual overlap with the last course.

Expanding square search (when a last seen point is identified)

The expanding square search is a proven practice for aerial search operations designed to be used when a last scene or last known point of a victim is identified, but their current movements or whereabouts are unknown. The expanding square search should be conducted in phases by shifting the expanding square course in 45-degrees of azimuth if a detection is not obtained during each succeeding square course. The following guideline should be used by pilots flying an expanding square search.

1. Before takeoff plot the last known point of the target.
2. Fly the aircraft at an altitude that balances area coverage with ground sampling resolution.
3. Position the camera at a slightly oblique angle (approximately 75-degrees or 15-degrees above nadir) similar to the parallel route search pattern.
4. Fly the aircraft in an expanding square course, with the "top" of the camera feed facing the heading of the aircraft.
5. If the pattern is completed without detection of the victim, shift the course by 45-degrees of azimuth counter clockwise and begin the search from the start point again.

Mutual Aid Box Alarm Systems

G

Unmanned Aircraft Systems Program (UAS)

UAS Operational Application Guidelines – Hazardous Materials Response

PURPOSE

The purpose of this document is to provide guidelines on operating a UAS at a hazardous materials response incident. These guidelines shall coincide with the MABAS-IL UAS Flight Operations and Deployment Policy and Operational Application Guidelines – General document, and shall not supersede the AHJ. The document will be broken down into various tasks. A specific operation may use one or many of these tasks.

SCOPE

The document will offer non-compulsory guidance to facilitate the safe and successful completion of a number of objectives in the safe and effective deployment of UAS assets. Many of these tasks may need to be completed over a series of flights, dependent on the nature of the incident and number of units responding.

OPERATIONAL TASKS

At hazardous material response incidents, the primary focus of a UAS will be to collect data, so the Incident Command (IC) can identify and mitigate hazardous situations. The following is a list of guidelines that could be used during a hazardous materials response incident.

- Define landing zone in the warm zone.
- Designate the return to home point as the warm landing zone. This prevents contamination of the cold zone in the event of an auto return to home.
- Always wear proper PPE when entering the warm or hot zones.
- Decontaminate the aircraft in a method consistent with the present hazard, and the specifications/ingress protection of the aircraft.
- If any equipment enters the warm zone, it must be decontaminated before coming back into the cold zone. This includes batteries, controllers, aircraft, sensors, etc.
- Assume any aircraft flown into a warm or hot zone may be total loss due to hazmat exposure.
- Consider directly recording the live streamed data from any aircraft that may be flown into a hazardous environment, as recovering the footage directly may not be possible.
- When possible, maintain appropriate standoff distance in the cold zone by utilizing a zoomable sensor.

DECONTAMINATION TASKS

After a hazardous materials incident, it may be necessary to decontaminate the UAS and determine its airworthiness. The following guidelines should be followed:

- Consult with Hazmat Operations Team to understand decontamination procedures for the particular substance and whether the substance can have permanent effects on electronics or mechanical components.
- Place the aircraft in a sealed container with indicator tape for 24 hours to validate that the materials are no longer a hazard.
- Perform a full maintenance inspection of the aircraft when returning it to service. An aircraft may be taken out of service indefinitely due to contamination.
- Use extreme caution when returning an aircraft to service that may have come into contact with corrosives or oxidizers.

Mutual Aid Box Alarm Systems

Unmanned Aircraft Systems Program (UAS)

In-Service Report

OVERVIEW

This document gathers information required by the MABAS Illinois to ensure the safe and effective operation and function of MABAS owned UAS assets, and ensure that all UAS are airworthy and maintained in a manner that ensures their ability to be immediately available for deployment in the event of a callout.

SCOPE AND INTENT

This report was developed with the intention of documenting and ensuring that UAS assets are maintained in an airworthy and deployable manner, and to identify and mitigate potential maintenance issues that may effect asset and fleet readiness. While this document does not need to be routinely submitted to MABAS, return to service records may be requested to investigate the cause of an equipment malfunction of the UAS asset.

WHEN REPORTING IS REQUIRED

The Remote Pilot in Command of the UAS returning from deployment shall ensure this report is completed Immediately upon returning a MABAS Owned UAS asset to service after any deployment or use, regardless of whether the UAS has been flown during the deployment or use.

WHEN REPORTING IS RECOMMENDED, BUT NOT REQUIRED

Reporting is not required when returning any UAS to service that is not a wholly owned MABAS asset. However, MABAS strongly recommends that agencies operating divisionally or locally owned UAS file this report after each return-to-service inspection to document the airworthiness of their UAS assets, identify potential maintenance issues, and limit liability.

DIRECTIONS

1. Complete the following form immediately upon returning a UAS to service.
2. Maintain a copy of the completed form in the aircraft log.
3. After 90 days from the date of completion, this form may be removed from the log and stored digitally.
4. Retain a copy of this form (digital or hardcopy) for 12 months from the date of completion.

GENERAL INFORMATION

Date	Time	Aircraft Identifier
RPIC Name		Aircraft Registration Number
RPIC Certification Number		Division No.
Sponsoring Agency		Contact Phone

AIRCRAFT RECORDS INSPECTION

Verify the following:

	Yes	No
Aircraft Registration Current?	<input type="checkbox"/>	<input type="checkbox"/>
Any abnormal operating conditions or previous damage reported?	<input type="checkbox"/>	<input type="checkbox"/>
Any recalls, directives, safety bulletins, or warnings from the UAS manufacturer?	<input type="checkbox"/>	<input type="checkbox"/>
Consumable parts within manufacturer's specified interval?	<input type="checkbox"/>	<input type="checkbox"/>

Describe any deficiencies: (If applicable).

AIRCRAFT VISUAL INSPECTION

Verify no cracking, chipping, bending, punctures, heat damage, or any unusual wear, other than cosmetic blemishes on superficial components present on any of the following items:

	Yes	No
UAS airframe	<input type="checkbox"/>	<input type="checkbox"/>
UAS powertrain (verify smooth action of motors)	<input type="checkbox"/>	<input type="checkbox"/>
UAS payloads	<input type="checkbox"/>	<input type="checkbox"/>
Flight control station	<input type="checkbox"/>	<input type="checkbox"/>
Rotors/aerodynamic components	<input type="checkbox"/>	<input type="checkbox"/>
Batteries	<input type="checkbox"/>	<input type="checkbox"/>
Ancillary equipment necessary for operation (anti-collision lights and other accessories)	<input type="checkbox"/>	<input type="checkbox"/>
Aircraft is clean and free of contamination	<input type="checkbox"/>	<input type="checkbox"/>

UAS FIRMWARE / SOFTWARE INSPECTION

Verify the following:

	Yes	No
Aircraft firmware up to date?	<input type="checkbox"/>	<input type="checkbox"/>
Flight control station firmware up to date?	<input type="checkbox"/>	<input type="checkbox"/>
Battery firmware up to date?	<input type="checkbox"/>	<input type="checkbox"/>
Supporting ground control station firmware up to date?	<input type="checkbox"/>	<input type="checkbox"/>

Describe any deficiencies: (If applicable).

UAS FLIGHT TEST

Verify the following:

	Yes	No
Geo-fencing unlocks applied as required	<input type="checkbox"/>	<input type="checkbox"/>
Sensor payloads functional in all ranges of motion	<input type="checkbox"/>	<input type="checkbox"/>
Data recording and telemetry operable	<input type="checkbox"/>	<input type="checkbox"/>
No errors or warnings present on instruments	<input type="checkbox"/>	<input type="checkbox"/>
Motors spin freely, no unusual sounds	<input type="checkbox"/>	<input type="checkbox"/>
Flight controls free, consistent and correct	<input type="checkbox"/>	<input type="checkbox"/>
All flight modes functional, operate as expected	<input type="checkbox"/>	<input type="checkbox"/>
Automated emergency procedures function as expected	<input type="checkbox"/>	<input type="checkbox"/>

Describe any deficiencies: (If applicable).

RETURN TO SERVICE DETERMINATION

What steps should be taken to prevent this deviation from occurring in the future?

	Yes	No
Based on the above, is the aircraft in an airworthy and deployment ready condition?	<input type="checkbox"/>	<input type="checkbox"/>

If no, describe what corrective action must be taken to return the aircraft to an airworthy condition.

ATTESTATION

I the undersigned, as Pilot in Command of the aircraft during the aforementioned flight, have read and understand the above form, and verify the above information is true and correct to the best of my knowledge and ability. I understand that the above information may be submitted to the Federal Aviation Administration in the event of an investigation into the cause of any related incident or violation. I understand the intent of this report is to ensure MABAS UAS airworthiness MABAS UAS operations.

Print Name

Date

Signature

Mutual Aid Box Alarm Systems

Unmanned Aircraft Systems Program (UAS)

Post Flight Report

OVERVIEW

This document gathers information required by the Federal Aviation Administration (FAA) and MABAS Illinois on the normal use, deployment and operation of UAS assets under the privileges granted by the MABAS COA.

SCOPE AND INTENT

This report was developed with the intention of identifying and documenting normal use and operating information MABAS is required to submit to the FAA for operations that occur under the MABAS COA. MABAS will frequently review and utilize this data to research continuing improvements to the MABAS UAS Program.

WHEN FILING IS REQUIRED

After any flight operation in response to a terrestrial emergency as part of a MABAS deployment, including, but not limited to, flights in support of:

- Structure and Wildland Fire Responses
- Urban Search & Rescue Operations
- Water/Ice Rescue Operations
- Mutual Aid to Law Enforcement
- HAZMAT Operations

WHEN FILING IS RECOMMENDED, BUT NOT REQUIRED

During routine operations that are conducted under Part 107 of the Federal Aviation Regulations (Title 14, Chapter I, Subchapter F, Part 107), including, but not limited to, flights for the purposes of:

- Routine training or testing
- Preplanning
- Public demonstrations
- Mutual aid to Public Works
- Non-exigent accident reconstruction

DIRECTIONS

1. Complete the following form after the completion of the flight operation in its entirety.
2. Submit to UAS Division Chief within 72 hours.

GENERAL INFORMATION

Date	Division No.	Sponsoring Agency	
RPIC Name		Certificate Number	Dispatch Number
RPIC Contact Phone		Reason for Flight	Incident Number

ENVIROMENT

Please fill-in the following information as reported during the flight:

_____		_____	_____
Location (Municipality, Latitude – Longitude)		Wind Direction	Cloud Bases
_____	_____	_____	_____
Deployment Start Time (Local)	Deployment End Time (Local)	Wind Speed	Visibility

AIRCRAFT VISUAL INSPECTION

Please fill in the following information for the aircraft that was flown.

_____	_____
Aircraft Make	Aircraft Model
_____	_____
Registration Number	Aircraft Identifier

FLIGHT OPERATIONS

Number of Flights Conducted: _____ Total Flight Time _____ Equipment malfunction?
 Yes No

Describe any equipment failures or malfunctions: (If applicable).

ATTESTATION

I the undersigned, as Pilot in Command of the aircraft during the aforementioned flight, have read and understand the above form, and verify the above information is true and correct to the best of my knowledge and ability. I understand that the above information may be submitted to the Federal Aviation Administration in the event of an investigation into the cause of any related incident or violation. I understand the intent of this report is to be non-punitive, and is to identify and mitigate hazards during MABAS UAS operations.

Print Name

Date

Signature

Mutual Aid Box Alarm Systems

Unmanned Aircraft Systems Program (UAS)

Deviation Reporting Form

OVERVIEW

This document gathers information required by the Federal Aviation Administration (FAA) and MABAS-Illinois to investigate all in-flight deviations from the MABAS COA, MABAS UAS Policy, or applicable federal aviation regulations.

SCOPE AND INTENT

This report was developed with the intention of identifying, documenting, and mitigating deviations from the MABAS COA or MABAS UAS Policy during MABAS UAS operations. While the data provided in this report may be used by the Federal Aviation Administration in the event of an investigation, the intent of the following form is non-punitive. The data provided will be evaluated by MABAS to determine if changes to MABAS UAS policies, procedures, or the MABAS COA are warranted.

PUNITIE IMMUNITY

The information provided in this form shall not be used by MABAS in pursuing any punitive action against pilots who deviate from applicable federal aviation regulations, the MABAS COA, or the MABAS UAS Policy if the following form is filled out within 24 hours of the deviation, the report is true and correct to the best of the pilot's knowledge and ability, the report is submitted in a timely manner and one or more of the following conditions is met:

- The deviation is made in a reasonable effort to meet the needs of an emergency.
- The deviation does not result in undue hazard to persons or property.
- The deviation is made inadvertently and without premeditation, negligence, or intent.
- The deviation does not directly result in a reportable accident, injury to persons or damage to property.

NOTE: The MABAS deviation report does not constitute a report to the Aviation Safety Reporting System. While MABAS may not pursue punitive action, MABAS may require pilots to undergo further training to maintain deployment-ready status.

WHEN TO FILE

This document shall be filed in the event of an in-flight deviation from any applicable federal aviation regulation, provision granted in the MABAS COA, or MABAS UAS Policy, including, but not limited to, the following:

- Deviation from an air traffic control clearance or procedure.
- Deviation from altitude or operating limitations.
- Automated and inadvertent activation of a failsafe procedure (return-to-home, auto-land).
- Deviation from weather minimums.

WHEN NOT TO FILE

A deviation report shall not be filed for deviations from the federal aviation regulations or the MABAS COA that are authorized by the FAA Special Operations Support Center, or Deviations from the MABAS UAS Policy authorized by the UAS Operations Section Chief, including, but not limited to, the following:

- Flight into a Temporary Flight Restriction once a clearance is obtained.
- Flight over nonparticipating persons if conducted as specified in §H, (3) of the MABAS COA (Or otherwise specified in by 49 U.S.C. §40125 and Advisory Circular 00-1.1A (6)(i).
- Flights in the vicinity of participating manned aircraft assets.

DIRECTIONS

- 1. Complete the following form in its entirety.
- 2. Submit to the UAS Section Chief within 24 hours.

GENERAL INFORMATION

Date _____

RPIC Name _____

RPIC Certificate Number _____

Sponsoring Agency _____

Division No. _____

Dispatch Number _____

RPIC Contact Phone _____

ENVIROMENT

Please fill-in the following information as reported at the time the deviation took place:

Location _____

Wind Direction _____

Cloud Bases _____

Local Time _____

Wind Speed _____

Visibility _____

AIRCRAFT

Please fill-in the following information for the aircraft involved in the deviation:

Aircraft Make _____

Aircraft Model _____

Registration Number _____

Flight Mode at Time of Incident _____

Aircraft Damaged or Destroyed?

Yes No

Damage Caused to 3rd Party Property?

Yes No

DEVIATION INFORMATION

Type (Check one)	Regulation or Provision Title, and Number:	Necessary to meet the Needs of an Emergency?	
		Yes	No
<input type="checkbox"/> MABAS COA	_____	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> MABAS Policy	_____	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Federal Aviation Regulation	_____	<input type="checkbox"/>	<input type="checkbox"/>

Description of Deviation:

MITIGATION AND PREVENTION

What steps should be taken to prevent this deviation from occurring in the future?

By the flight crew:

By MABAS:

ATTESTATION

I the undersigned, as Pilot in Command of the aircraft involved in the aforementioned incident, have read and understand the above form, and verify the above information is true and correct to the best of my knowledge and ability. I understand that the above information may be submitted to the Federal Aviation Administration in the event of an investigation into the cause of the incident. I understand the intent of this report is to be non-punitive, and is to identify and mitigate further hazards during MABAS UAS operations.

Print Name

Date

Signature

Mutual Aid Box Alarm Systems

Unmanned Aircraft Systems Program (UAS)

Accident Reporting Form

OVERVIEW

This document gathers information required by the Federal Aviation Administration (FAA) and MABAS-Illinois to investigate all UAS accidents resulting in injuries to persons or damage to property. This report shall only be filed in the event of a UAS-related injury to any person or damage to the UAS airframe or 3rd party property as a result of operations.

SCOPE AND INTENT

This report was developed with the intention of identifying, documenting, and mitigating potential hazards and injury risks during MABAS UAS operations. While the data provided in this report may be used by the Federal Aviation Administration in the event of an investigation, the intent of the following form is to be non-punitive.

NOTE: This Accident report does not supersede or replace any reporting of accident or injury by the AHJ or sponsoring agency. UAS flight crews shall, when required by the AHJ complete all required reporting documentation on behalf of the AHJ. Any local injury reports filed after a UAS accident shall be noted in and attached to this form.

WHEN TO FILE

This document shall be filed in the event any of the following conditions are met as a result of a UAS accident or incident on a MABAS Response.

1. Serious or life-threatening injury to any person, (Reference 49 CFR. §830.2) including but not limited to:
 - Any life-threatening injury requiring immediate medical treatment.
 - Hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received.
 - A fracture of any bone (except simple fractures of fingers, toes, or nose).
 - Severe hemorrhages, nerve, muscle, or tendon damage.
 - Injuries involving any internal organ.
 - Injuries involving second- or third-degree burns, or any burns affecting more than 5 percent of the body surface.
2. Major airframe damage to the UAS or 3rd party property, including, but not limited to:
 - Total UAS airframe loss.
 - Substantial damage to the unmanned aircraft system where there is damage to the airframe, power plant, or onboard systems that must be repaired prior to further flight.
 - Damage to property other than the UAS.
 - A catastrophic inflight malfunction (such as an inflight fire).

WHEN NOT TO FILE

1. An accident report shall not be filed for small, superficial, or minor injuries that do not require substantial or immediate treatment.

Examples of exempt injuries:

- Minor lacerations, scrapes, cuts, or avulsions.
- Minor bruising, sprains or strains.
- Simple fractures of fingers, toes, or nose.
- Any injury not warranting immediate medical treatment.

2. An accident report shall not be filed for superficial or cosmetic damage that does not affect flight performance, for normal wear, or for non-flight-related damage to the UAS.

Examples of exempt UAS damage:

- Scratches or damage to paint and cosmetic surfaces or coatings.
- Normal wear of mechanical components.
- Damage caused during storage or transport.
- Component malfunction or failure during non-flight tests.

DIRECTIONS

1. Provide necessary medical treatment to injured persons.
2. Photographically document the following:
 - a. UAS impact site.
 - b. Undisturbed UAS airframe and debris.
 - c. Extent of injuries.
3. Notify the MABAS UAS Section Chief and IC.
4. Complete the following form in its entirety.
5. Submit to the UAS Section Chief and IC within 12 hours.
6. Recover, but **DO NOT DISPOSE** of or alter in any way, UAS wreckage or debris until instructed.

GENERAL INFORMATION

Date _____

RPIC Name

RPIC Certificate Number

Sponsoring Agency

Division No.

Dispatch Number

RPIC Contact Phone

ENVIROMENT

Please fill-in the following information as reported at the time the incident took place:

Location

Wind Direction

Cloud Bases

Local Time

Wind Speed

Visibility

AIRCRAFT

Please fill-in the following information for the aircraft involved in the incident:

Aircraft Make

Aircraft Model

Registration Number

Flight Mode at Time of Incident

Aircraft Damaged or Destroyed?

Yes No

Damage Caused to 3rd Party Property?

Yes No

Description of Damage to Aircraft:

Description of Damage to 3rd Party Property

INJURIES

Please fill-in following information for any serious injuries that occurred as a result of the incident:

Number of Persons Injured: _____

EMS Responded? Yes No

Injuries Serious or Life Threatening?

Yes No

EMS Report No.

Description of Injuries: Please describe any resulting injuries to the best of your ability.

IMAGES

Please attach and describe any relevant images of the accident scene. If no images are available, skip this step.

Image File Name: _____

Image Description: _____

Image File Name: _____

Image Description: _____

Image File Name: _____

Image Description: _____

Image File Name: _____

Image Description: _____

Image File Name: _____

Image Description: _____

ATTESTATION

I the undersigned, as Pilot in Command of the aircraft involved in the aforementioned incident, have read and understand the above form, and verify the above information is true and correct to the best of my knowledge and ability. I understand that the above information may be submitted to the Federal Aviation Administration in the event of an investigation into the cause of the incident. I understand the intent of this report is to be non-punitive, and is to identify and mitigate further hazards during MABAS UAS operations.

Print Name

Date

Signature