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Unmanned Aircraft System (UAS)

Training and Procedures Manual

2025

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# **Purpose**

This manual for Unmanned Aircraft System Aviation Training (hereinafter referred to as the TM) outlines, introduces, and provides the minimal requirements and procedures for all member UAS pilots, Visual Observers (VO's), Mission Payload Operators (MPO) and other ground crew members and in accordance with all regulatory approvals. It serves as a guideline for required elements in training curricula to satisfy requirements for flight of District-operated UAS. It also outlines the understanding and expectations for training to operate unmanned aircraft systems (UAS) in compliance with all Federal, State, Local, and District requirements.

The topics covered in this manual include the knowledge, skills, and abilities requisite for safe flight as determined by a UAS Coordinator. All Pilots-in-Command (PICs), VOs, and MPOs must meet the requirements contained in this manual before taking part in UAS operations and before approval from a qualified instructor. Each District training plan should be reviewed and updated annually or as needed. The training elements, ground instruction and flight instruction will be developed and conducted by qualified personnel. Under certain circumstances, a separate formal training course, deemed acceptable to the program, may be employed to satisfy requirements, and be conducted using outside personnel and resources.

This manual is not intended to be all inclusive but is instead a supplement to the Code of Federal Regulations (CFR), FAA Regulations, and State and local laws as well as the approved exemption to conduct Unmanned Aircraft Systems (UAS) operations allowed by special authority for certain UAS. Title 49 U.S.C. § 44807, and 14 C.F.R. Part 11.

# **Objectives**

The TM’s primary objective is to ensure that all flight UAS crew members obtain and maintain the certification, qualification and proficiency needed to effectively perform their responsibilities. The outcome of this successful training program is the cultivation and maintenance of professional staff within each program that allows them to meet safteyl requirements and support the growth and development of the safe UAS operations. Additionally, it is intended to ensure safe and effective UAS aviation training that meeti all regulatory, and organizational requirements. The ultimate goal of any training program is to produce pilots and other crewmembers fully trained and qualified to handle any task set forth and within reason staying within the guidelines set forth by their program and the Federal Aviation Administration (FAA).

# **Authority**

All UAS flight operations conducted by Program employees are subject to the policies and procedures included in the program TM. Should the policies and procedures set forth here differ from those included in the UAS User’s Manual, staff should note these discrepancies and follow the guidelines and procedures within the UAS User Manual (except when the FOM presents a higher level of safety such as maximum flight speed, altitude, or flight in populated environments).

Conflict between this manual and applicable Federal or State Regulations, program approvals and operational specifications is unintentional. Should a conflict be discovered, the regulation, approvals, or operational specifications will take precedence, and the UAS Coordinator will be notified immediately.

In addition, each crew member will be provided a copy of an approved Flight Operations Manual (FOM). This TM and the FOM are intended to be complimentary guidelines for the safe operation of each UAS mission.

# **Distribution & Revisions**

The TM will be made available to all personnel involved in flight operations, their management and should be available for all operations. A copy must be kept with the operator crew as part of an “operations kit” in either digital or hardcopy. The original TM copy will be kept and maintained by the UAS Coordinator.

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

# **Safety**

*Safety is the mission.* The policies and procedures in the FOM, and its companion regulatory documents, are primarily designed to enhance safety. Deviations from these policies and procedures should onlybe made in extraordinary circumstances and when prior approval, when possible, is obtained from the UAS Coordinator. Other violations of these procedures may result in permanent removal from the worksite and/or termination. Our safety mission is met by:

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

# **Qualifications**

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

* FAA certified flight instructor (when a UAS flight instructor designation becomes available)
* UAS experience
* Experience in type
* Training in simulators if possible
* Previous UAS instructor qualifications
* Knowledge of the Program’s mission and Operational Activities
* Demonstrated performance.

The QIP must possess all required qualifications for UAS training including, currently, a Remote Pilot in Command (RPIC) License. The QIP must also meet flight review requirements specified in 14 C.F.R. 61.56 for the UAS being considered. These requirements include a minimum ten (10) hours of mission flights and one (1) hour of flight training and aeronautical knowledge review:

* A review of the current general operating and flight rules of 14 C.F.R. part 107 and additional waivers
* A review of the current regulatory requirements for UAS Operations.
* The QIP will have the following duties regarding training of PICs, VOs, and MPOs:
* Conducting and Evaluating Initial Training Qualification Flights
* Evaluating proficiency check flights for PICs
* Maintaining all training and flight records for each UAS PIC
* Assisting the UAS Coordinator to maintain all flight and maintenance records for each Aircraft, Remote Controller, and battery on which they train.
* Maintaining an on-going knowledge of, and relationship with, the FAA and other authorities to understand additional regulatory requirements as they develop.
* Determining if the PIC is qualified to operate and under what conditions.

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

# **Safety Equipment**

UAS flight crew personnel shall be required to wear minimal Personal Protective Equipment (PPE) during flight operations. This equipment should include class II safety vests, hard hats (optional), and eye protection(optional) at a minimum. Certain missions will require the use of chemical resistant work/hiking boots and cut resistant gloves.

Other safety equipment for the flight crews: two-way radios or cell phones, First Aid kit (required), fire extinguisher (optional).

# **Training**

### **Pilot in Command (PIC)**

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

### **Visual Observer (VO)**

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

* Knowledge to recognize and overcome visual illusions
* Understand physiological conditions which may degrade night vision
* Understand the Safety Plan
* 14 CFR Part 107 Regulations
* Understand all terms and provisions of UAS waivers
* Understand VO responsibilities

# **Recurrent Training**

Each PIC must complete an annual review and refresher class every 12 months to ensure proficiency in the UAS as well as aeronautical knowledge relevant to the operation and mission tasking. The re-currency training date shall be based upon the last day of the month in which the proficiency flight is accomplished. The recurrent training requirements will be determined by the QIP with guidance from 14 CFR applicable Parts and documented in the PIC records. At a minimum, the recurrent training will include an aeronautical knowledge exam along with a “simulated mission” currency flight administered by the QIP. Recurrent training will be documented and kept in the PIC’s file. Topics that should be included in the proficiency flight are:

* Knowledge requirements of 14 CFR § 137.19(e)(1)
* Flight Planning
* Mission Briefing
* Preflight Preparation and procedures
* Ground Procedures
* Site Surveying
* Crew Responsibilites
* UAS Launch and General Operating Procedures
* Normal Performance and Emergency Maneuvers
* Hovering procedures
* Application procedures
* Lost-Link Procedures
* Multi-UAS Procedures
* Hazmat Handling and Storage
* Nigh Operation Procedures
* Post-Landing Procedures
* Mission Debrief

# **Training Records**

The UAS Coordinator should ensure that a training record is prepared and maintained for each UAS PIC and ground crew member assigned. The training record will be updated yearly, periodically reviewed and securely stored in an appropriate location accessible by the PIC and any QIP. A training record form will be used to document all training and evaluation flights.

# **Flight Training and Evaluations**

Initial training will provide the knowledge, skills, and abilities to fly approved UAS in the National Airspace System (NAS) in a manner consistent with the latest Federal, State, and Local regulatory environment, as well as the program’s policies and application procedures.

Only after a careful evaluation by the UAS Coordinator demonstrating a basic set of knowledge and skills will an individual be declared a PIC and allowed to accept operations. It must be noted that all elements of the flight crew – PIC, VO and MPO – require different training and that training in one area does not denote qualification in another. Qualifications for each position will be tracked and managed by UAS Coordinator and ideally each member of the flight crew should be able to take over for the other, which is why VOs should be trained as pilots as well.

Conducting standardized evaluations is the principal means of assessing operational readiness and crewmember proficiency. It is the principal method of establishing and maintaining the safest possible UAS operation. The purpose of an evaluation is to determine the initial and continued mission qualification of all assigned crewmembers

This evaluation consists of a records review, a written or oral examination and a flight evaluation that is administered by the UAS Coordinator or a designated representative (QIP). The UAS Coordinator or a designated representative will complete the evaluation within 15 calendar days after the completion of initial training or within one month of the annual qualification date.

Program crewmembers must pass each evaluation element to acquire and maintain their qualification. The recurrent standardized evaluation must be completed from one month prior to one month after the initial qualification date.

The terms, "without error," "correctly", "minor deviation", and "incorrectly" apply to all training/evaluation elements. Many standards are common to several elements. Individual instructor techniques are not standards, nor are they used as grading elements. Unless otherwise specified in the training/evaluation elements, the common standards below apply:

* + - Perform crew coordination actions
    - Do not exceed UAS limitations
    - Utilize applicable Checklist
    - Utilize applicable terminology

Alternate or additional standards will be listed in individual tasks.

The evaluation examinations serve to measure a crewmember's UAS, FOM, and general aviation knowledge. These examinations validate the crewmembers' knowledge proficiency and readiness to safely perform UAS operations. The UAS Flight Evaluation consists of an oral exam and a complete flight mission.

# **Evaluation Process**

The value of any evaluation depends upon strict adherence to fundamental principles, clearly established criteria and standardization of performance. The method of evaluation must be based on uniform and standard objectives. Additionally, the evaluation method must be consistent with the program's mission and adhere to the FOM and FAA regulations. Moreover, the evaluation must be conducted in a manner that is purpose oriented. A thorough understanding of the purpose of the evaluation, and cooperation by all participants is necessary to fulfill the evaluation objectives. The emphasis is on all of the participants, not just the examinee.

The evaluation must produce specific findings to identify performance errors, misunderstandings, or additional training needs. General comments do not always provide the direction and guidance essential for improvement. The evaluation must pinpoint both strengths and weaknesses. Evaluations are dynamic activities. Therefore, every possible event or occurrence cannot be anticipated. If situations arise that are not covered by this guidance, the use of sound judgment is expected so that the evaluation event may be continued in the most logical and safe manner. Such circumstances shall be recorded.

# **No-Notice Evaluations (Spot Checks)**

The QIP will establish a "No-Notice" evaluation program to monitor crewmember proficiency, safety and effectiveness. Evaluations may consist of flight, oral, or written examinations or any combination of these as deemed necessary by the QIP. Annotation to the training record and reporting notifications and any corrective actions will also be monitored and recorded.

# **Grading Criteria**

*Oral Evaluation:* The examinee must demonstrate a working knowledge and understanding of the subject areas presented. The UAS Coordinator will assess the examinee's knowledge during the oral evaluation.

*Flight Mission Evaluation:* Performance standards are based on a basic or simple mission scenario. Grading is based on meeting the minimum standards of the required evaluation elements. Optional elements may be evaluated based upon the mission demands and proficiency of the crew member. Failure to meet acceptable standards for optional elements will not constitute a failure but will be recorded for focused refresher training as deemed necessary by the UAS Coordinator.

The evaluation sequence consists of the four phases given below. The UAS Coordinator will determine the amount of time devoted to each phase. When the examinee is a QIP, the evaluation procedure will require the UAS Coordinator to reverse the roles with the examinee. When the evaluator uses this technique, the examinee must understand how the role-reversal will be conducted and when it will be in effect.

Phase 1- Records Review and Briefing: The UAS Coordinator will complete a thorough review of the examinee's records to verify that the examinee meets all criteria for initial or recurrent qualification. The UAS Coordinator will discuss the purpose of the evaluation, explain the evaluation procedure, and review the standards and criteria to be used.

*Note: If the examinee is a QIP, he or she will be evaluated on established policies and procedures and the ability to effectively convey and evaluate the teaching concepts and topics in an effective manner. The examinee must demonstrate a working knowledge of the disciplines, standards, and mission tasks he or she will be instructing/evaluating. The examinee must also demonstrate an ability to determine when a pilot or ground crew member has not performed to a satisfactory level.*

Phase 2-Oral examination: The examinee must have a working knowledge and understanding of all applicable topics in the respective subject areas below. At a minimum, the evaluator will select two topics from each subject area. An instructor must also demonstrate the ability to instruct and evaluate any curriculum element:

* Applicable Federal Aviation Regulations
* National Airspace System Classifications with related weather and visibility requirements
* Standard Operating Procedures and Policies (FOM)
* UAS Operational Publications (i.e. Flight Operators Manual, Maintenance Manuals)
* Daily Flight/Mission logs, Maintenance logs
* UAS System Familiarity, Operating limitations and restrictions. Topics areas may include:
* Battery Handling, Charging Storage
* Airspeed limits
* Environmental Restrictions
* Other limitations
* Ground Control Station functions
* UAS antenna and telemetry issues
* UAS Emergency Procedures / malfunction recognition and analysis. Topics areas may include:
  + Emergency terms and their definitions
  + Electrical System Malfunctions
  + Loss of Control Link
  + Loss of Sensor Signal
  + Loss of Communications

Phase 3-Flight Evaluation, if required, the following areas will be evaluated:

* Mission Planning
* Mission Briefing
* Proper use of checklist
* Preflight Procedures
* Takeoff Procedures
* Mission Management with Crew Coordination
* Before landing and After-landing Procedures
* Post-Flight Procedures
* Mission Record Keeping

Phase 4-Evaluation Debriefing. Upon completing the Evaluation, the UAS Coordinator will discuss the overall event and point out examinee's strengths and weaknesses and provide specific recommendations for improvement of a knowledge or skill area. The UAS Coordinator will declare the examinee has successfully passed or failed the evaluation. In the case of failures, the UAS Coordinator must discuss and document any area not performed to standards in the training record. The UAS Coordinator will complete the evaluation form and ensure that the examinee reviews and initials it.

*Note.* The UAS Coordinator must *inform the examinee of any restrictions, limitations, or revocations that is recommended to the PIC following an unsatisfactory evaluation. Further disposition concerning follow-up action following such event will be the responsibility of the PIC.*

# **Evaluation Form**

A standardized Evaluation Form will be used to permanently record all crewmember evaluations. It is also used to record any change in crewmember status or other significant events. All evaluation forms shall be retained in the crewmembers training record.

*Note. Involvement in any accident or incident and the results of any post-accident evaluation (if given) must be recorded in the crewmembers training record.*

# **Failure To Meet Requirements**

When VO, MPO and other ground crew member training requirements are not met, the PIC and the UAS Coordinator will investigate the existing circumstances concerning the disposition and status of the crewmember. The PIC will take one of the following actions:

* Authorize the crewmember to complete remedial training within 30-days and participate in a recheck.
* Authorize the crewmember to take an immediate recheck.
* Remove the crewmember from performing any UAS flight operations duties.

# **Removal Of Crew Member**

Removal for a Training deficiency: Any crewmember who has their designation removed for a training deficiency shall not be permitted or scheduled to conduct any flight operations.

Removal for other than a training deficiency: Any crewmember who has their designation removed for anything other than a training deficiency must be interviewed by the PIC to determine desirability/suitability to continue in the program's UAS program. If they are deemed suitable for continuation in the flight program, they will have to undergo the complete initial training and qualification evaluation to get their designation reinstated.

# **Requirements To Perform Maintenance Functional Checks**

The PIC is authorized to designate other pilots or crew members to perform maintenance function checks (ground/airborne). Candidates to perform maintenance functions are to be selected from experienced crewmembers who are current, qualified and designated. The crew members assigned to perform post-maintenance checks will demonstrate proficiency in all maintenance functional checks (ground/airborne) according to appropriate maintenance standards and programmatic policy.

# **Training Risk Management**

Challenging, realistic training conducted to demanding standards is the cornerstone of the Program’s safety plan and its continued reliability to satisfy customer demands. The potential for accidents can increase as training realism or training demands increase. It is therefore the responsibility of the PIC and the UAS Coordinator to ensure that the limits of training and evaluation events do not cross an unacceptable risk threshold. Accomplishing the training and evaluation objective must be weighed against protecting crew members and any UAS assets involved.

An accident or incident during a training or evaluation event essentially impacts not only the UAS and those directly affected but also seriously jeopardizes the program's reputation for safe and reliable operations and can create serious operational and financial burdens that may drain precious resources.

Risk management is a tool that employees shall use to make smart risk decisions in all aspects of program operations. It permits trainers and trainees to execute more realistic training without ignoring or overlooking increasing risk levels. Risk management is a method of getting the job done by identifying those training and evaluation events or elements that present an elevated or unacceptable risk and taking action to eliminate, reduce, or control that risk or cancel the element altogether. Risk management thereby becomes a fully integrated part of every training, evaluation and mission planning and execution event.

Risk management is not complex, technical, or difficult. It is a simple awareness tool to promote a more informed decision-making process. It permits instructors, pilots, and crew members to think through any mission to discover hazards that pose risks and examine mission demands against those risks. All employees are expected to employ and exercise the risk management concepts outlined below to further support the safety goals of the the UAS program.

# **Risk Management Process**

Step 1- Identify Hazards: Identify the hazards that may impact an operational sequence and list them chronologically. This process will help detect specific risks associated with all training or evaluation elements. Safety can be built into an operation by first seeing the operation in its entirety. Operations invariably can be broken down into a series of phases, each with special characteristics and considerations. Operations have a time factor, a beginning to ending series of events in which the timing of events is often as significant as the events themselves. This operations analysis is a useful tool in quickly defining the flow and time sequence of events in an operation.

Step 2 - Assess Risks: Determine the magnitude of risks by estimating the probability and severity the hazards represent in order to quantify the risk they represent to the successful mission outcome. Assess each event hazard and determine whether it is routine and make an initial risk assessment. Ensure that standards for routine events are adequate to provide an acceptable level of risk.

Step 3 - Make risk decisions and develop risk controls (or mitigations): Make risk acceptance decisions by balancing risk benefits against risk assessments. Eliminate unnecessary risks. Reduce the magnitude of mission risks by applying appropriate controls. Controls range from hazard awareness to detailed operational procedures. Focus on high hazard events not covered by a good set of standards.

Step 4 - Implement Controls: Integrate specific controls into training and evaluation planning, the FOM, and training performance standards.

Step 5 - Supervise. Determine the effectiveness of the controls: The PIC and the UAS Coordinator must enforce controls through a robust standardization program. This is the key to continued operational safety and loss control.

# **Sample UAS Pilot / Crewmember Qualification Evaluations:**

* Element Name
* Conduct Crew Mission Brief
* Plan Visual Flight Rules Flight
* Perform Exterior Inspection Procedures
* Perform Engine Start/System Check
* Perform Radio Communication Procedures
* Perform Take-off and Landing
* Perform Manual (ATTI) Flight Mode
* Perform Power Management Procedures
* Perform Automatic Flight Mode
* React to System Emergency
* Perform Payload Operational Checks
* Perform Emergency Procedures
* React to Inadvertent Instrument Conditions
* Operate the Optical Sensors Payload(s)
* Perform Mission Planning Procedures
* Perform After Landing Procedures

# **Training Evaluation Elements (Not All Inclusive)**

**Perform Mission Planning**

*Criteria:*

1. Obtain and analyze weather briefings to determine that weather and environmental conditions are adequate to complete the mission
2. Perform VFR Sectional Chart and area photography review. Ensure that all known hazards are identified. Determine if the Pilot, Visual Observer, Mission Payload Operator and aircraft are capable of completing the assigned mission.
3. Determine the size, scope and boundaries of the operating area and determine entry and exit points, flight obstacles/obstructions.
4. Determine whether the flight can be performed under VFR conditions within the altitude and area boundary limits. (Ref applicable FAA regulations, local regulations and FOM.
5. Determine battery requirements and limitations
6. Complete mission paperwork per the FOM. Perform mission risk management assessment per the FOM.
7. Record mission data.
8. Contact ATC for coordination (as necessary).

*Performance:*

1. The PIC will ensure that crew members are current and qualified, and that the aircraft is equipped to accomplish the assigned mission. The PIC may direct other crew members to complete some portions of the mission planning.
2. The PIC will obtain current and forecasted weather information from appropriate weather sources. After ensuring that the flight can be completed under VFR, check VFR sectional chart and other appropriate sources for any restrictions that may apply to the operations area. Determine the magnetic heading, approximate ground speed, and estimated time for each segment. Compute total flight time. Review aircraft maintenance logbook for any outstanding write-ups that may affect mission accomplishment. Complete the mission planning paperwork.

## **Conduct a Crew Mission Brief**

*Criteria:*

1. The PIC will participate in the mission approval process.
2. The PIC will be briefed and will acknowledge full understanding of mission objectives and responsibilities.
3. The PIC will brief the assigned crew per the FOM with emphasis on safety
4. The PIC will require the crew members to acknowledge that they fully understand the assignment of duties and responsibilities.

*Performance:*

1. The PIC has overall responsibility for the crew mission briefing. The PIC may direct the other crew members to perform all or part of the crew briefing.
2. The PIC will ensure all aircraft systems, mission, and safety information is correct.

*Note. An essential element of the mission briefing is the post-mission review that follows every mission's conclusion.*

1. The crew members being briefed will ask the PIC any question concerning the briefed mission and acknowledge their duties, and responsibilities. Lessons learned from previous debriefings should be recorded and addressed as applicable during the crew briefing as well as time and location of the post-mission debrief upon completion of mission.
2. The PIC will brief the mission using an approved crew mission briefing checklist.

### Sample UAS mission briefing checklist:

* Date/Time/Location
* Mission Objectives
* Operational Area / Altitude
* Weather
* Expected Flight Duration and Number of Mission Sorties
* Battery Management
* Crew Duties, Communications, Coordination
* Aircraft and Sensor Package
* Authorization Paperwork
* ATC Notifications/Coordination
* Safety Considerations/Risk Management
* Emergency Plans
* Operational Contingencies / Customer Notifications

**Perform Preflight / Exterior Inspection**

*Criteria:*

1. Without error, the PIC will perform exterior preflight inspections according to UAS manual requirements and checklist.
2. The PIC will correctly enter and verify the appropriate information in Daily Flight Log.
3. The PIC and crew members will correctly perform crew coordination actions

*Performance:*

1. The PIC will ensure that proper exterior preflight inspections are accomplished using an appropriate checklist.

## 

## **Perform Payload Operational Checks**

*Criteria:*

1. PIC will perform operational checks on all installed payloads and ensure they are mission ready.

*Performance:*

1. PIC will perform operational checks as necessary to determine whether the installed payloads are operating properly. The PIC will determine the effects of any payload discrepancies against the needs of the mission. The PIC will record the mission readiness of the payloads when the checks are completed and record any discrepancies in the established maintenance log.

## **Perform Radio Communication Procedures**

*Criteria:*

1. The PIC and crew members will check, set and operate radios as required.
2. The PIC will establish and maintain visual and/or radio contact with the required VO and/or air traffic control (ATC) facility.
3. The PIC or designated crew member will operate all internal/external communication systems and mission equipment.
4. Perform visual and two-way radio failure procedures per the FOM.
5. The PIC and crew members will adjust system radios to the proper frequencies.
6. When communicating with ATC facilities, the PIC will use the correct radio communication procedures and phraseology according to Federal Aviation Regulations (FAR) and the Aeronautical Information Manual (AIM),
7. The PIC and crew members will acknowledge each radio communication, if used by using the correct aircraft call sign.

*Performance:*

1. The PIC will assure all crew members are on the proper radio frequencies per mission requirements during the crew briefing and will indicate which crew member will establish and maintain primary communications. However, if crew members monitor two frequencies simultaneously, they will keep each other informed of any actions or communications conducted on their respective frequency.
2. Crew members should monitor radios and establish initial contact. In case of two-way radio failure during a mission, the PIC will designate a crew member to troubleshoot the appropriate equipment and announce results.
3. The crew members will use standard radio communications procedures, phraseology, and terms.
4. When advised to change frequencies, the PIC and each assigned crew member will acknowledge the transmission before making the change. The assigned crew member will select the new frequency as soon as possible unless instructed to do so at a specific time, fix, or altitude.
5. Crew members will turn-on, self-test, and conduct operational checks of all internal and external communication systems. All crew members will employ the communications equipment as directed.
6. In case of two-way radio failure, each crew member will attempt to reestablish communications by using alternate frequencies and radios. If unsuccessful, execute lost communication procedures.

## **Perform Take-off**

*Criteria:*

1. The PIC will configure aircraft for takeoff UAS recommended procedures.
2. Without error, the PIC will perform takeoff checks and procedures UAS Operators Manual, FOM, and Check List.
3. Without error, the PIC will complete take-off UAS Operators Manual, FOM, and Check List.
4. Without error, the PIC will complete the post take-off checks and procedures UAS Operators Manual, FOM, and Check List.

*Performance:*

* 1. The PIC will select the appropriate takeoff heading based on weather and wind conditions. The PIC will remain focused on clearing the aircraft and obstacle avoidance and will monitor system indications for abort parameters.
  2. The VO will remain focused primarily on clearing the aircraft and provide adequate warning of obstacles or intruding aircraft.
  3. The PIC will announce intention to takeoff to crew members and complete all take-off checks and procedures in accordance with FOM and the checklist.
  4. All crew members will use standard "challenge and response" communication during completion of take-off checks, and post take-off checks.
  5. If aircraft exceeds any of the parameters listed in the UAS Operators Manual, the PIC will perform a takeoff abort.
  6. The PIC will perform post-takeoff procedures as per UAS Operators Manual/check list.

## **Perform Flight in Manual Mode**

*Criteria:*

1. Upon entry into manual mode ensure aircraft maintains proper altitude and airspeed.
2. Adjust airspeed to meet time-on-target (TOT) requirements in accordance with job requirements, while staying within the operating parameters.
3. Adjust altitude commands to meet mission requirements.
4. Adjust airspeed and heading for winds. Maintain heading to stay in approved airspace boundaries.
5. Ensure aircraft maintains airspeed and altitude within parameters of the aircraft operating limits.
6. The PIC and crew members will correctly perform crew coordination actions.

*Performance:*

1. The PIC's focus will be on the maintaining VLOS contact with the aircraft at all times and ensure the aircraft is responding as commanded.
2. Determine heading. From the current aircraft location and appropriate map display, determine the correct magnetic heading to the next checkpoint/target corrected for wind.
3. From the current aircraft position, the PIC will estimate the aircraft altitude then initiate a climb or descent on the controller and monitor battery voltage as well as altitude, airspeed and rate of climb indicators for proper response.
4. The PIC will monitor ground course and adjust flight parameters as necessary to remain within the mission boundaries to accomplish the mission.

## **Perform Flight Utilizing Automatic Flight Modes**

*Criteria:*

1. Without error, the PIC will complete portions of the mission utilizing automatic navigation modes as described in the UAS Operators Manual and Check List.
2. Without error, the PIC will engage and verify the aircraft enters the selected flight mode.
3. Without error, verify airspeed, heading, and altitude are correctly set for mission.
4. Correctly perform crew coordination actions.

*Performance:*

1. The PIC will announce all flight mode changes to the crew members and verify that the aircraft enters the selected flight mode by monitoring the flight mode on the controller.
2. The PIC will load a mission to the aircraft as required. Verify waypoints, airspeed and altitude are appropriate for the mission and not exceed system limitations. The PIC will select automatic flight mode on the controller and verify. The PIC can override the airspeed and altitude and control each parameter via inputs to the controller programming.

## **Perform Take-off and Landing Abort**

*Criteria:*

1. Without error, the PIC will complete the takeoff or before landing check as appropriate according to Operators Manual or Check List.
2. Monitor safe flight parameters to determine when to initiate an abort on takeoff or landing.
3. Announce abort (takeoff or landing as appropriate).
4. Without error perform aircraft takeoff/landing checklist.
5. Correctly perform crew coordination actions.

*Performance:*

1. During takeoff or landing, should any crew member notice a safety of flight issue, they will announce abort, at which time the PIC will initiate the abort immediately.
   1. Takeoff abort: The PIC will take immediate action to terminate the launch or initiate an immediate recovery.
   2. Landing abort: Prior to touchdown, the PIC will take immediate action to climb the aircraft to a safe operating altitude and verify that the aircraft is climbing and heading to the return to home waypoint.
2. After determining the circumstances that necessitated the abort, the PIC will take control of the aircraft in manual mode and commence another landing attempt.

## **Perform Emergency Procedures**

*Criteria:*

1. Without error, the PIC will execute procedures and checks per the UAS Operators Manual and Emergency Check List.
2. The PIC will correctly determine any malfunctions and apply corrective action/troubleshooting procedures to return the aircraft to a safe operating mode.
3. Correctly perform crew coordination actions.

*Performance:*

1. The PIC will announce the status of the aircraft to all crew members and execute appropriate emergency procedures.

## **React to Inadvertent Instrument or Meteorological Condition**

*Criteria:*

1. All crew members shall conduct weather and aircraft scans continuously.
2. The PIC will maneuver the aircraft as needed to avoid or maneuver out of obstructions. Climb, descend or turn as required, and/or briefed.
3. The PIC or designated crew member will request ATC assistance; acknowledge and record the appropriate information.
4. If unable to maintain instrument control or experiencing sudden decline in weather, then immediately initiate recovery procedures and land.

*Performance:*

1. The PIC, upon determining that Visual Line of Sight with the aircraft is lost, will proceed as follows:
   * 1. Maneuver UAS out of the area as required by commanding a heading change, descent, or climb (if necessary to avoid known obstacles), or a "Return to Home" command.
2. If communications with ATC are necessary, The PIC or designated crew member will maintain the required communications with ATC, and record ATC information as received when required.