Keller Army Community Hospital

Project MARS
Standard Operating Procedure

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Chapter 1

General

1-1 Purpose

a. This SOP establishes the operational procedures and operator selection/training requirements necessary to ensure safe flight operations for KACH personnel within Project MARS. This SOP is designed to comply with all applicable FAA, DoD, and Army regulations, as well as KACH policies.

The Army is incorporating sUAS into the inventory. But currently there is not a clear description from the Army on how to handle development of UAS equipment not part of a POR. Project MARS in cooperation with USMA's RRC is endeavoring to develop, construct, and test a purpose built Group 1 UAS sUAS capable of autonomous MEDLOG delivery BVLOS. Project MARS personnel have developed this SOP to guide the safe use of all UAS used in conjunction with this Project.

1-2 Description of Operation

a. This SOP describes piloted and autonomous flight operations, maintenance and safety considerations, and personnel requirements related to the operation of multi-rotor sUAS within the Project MARS inventory.

Note: This SOP must be present in the operational area of use. A copy will also be maintained in the KACH Project MARS office.

1-3 Applicability

a. **Personnel** This SOP applies to all government and contractor personnel who are actively involved in air or ground operations related to Project MARS. Operational procedures described in this SOP will be used to maintain prudent, safe operating practices and to ensure that appropriate response actions are taken in the event of an emergency.

b. **Airworthiness** Airworthiness oversight of the Project MARS assets is documents via Level 3 AWR as issued by the Special Projects Team, UAS Division, SRD of RDECOM. This SOP is suborindate to the Level 3 AWR. Additionally, this SOP shall be subordinate to the SOP or regulations of the NAS controlled by teh FAA, restricted airspace, and any relevant agreements between the DoD and FAA where Project MARS is operating.

1-4 Proponent and Authority

a. **Proponent** The proponent for this SOP is the KACH Project OIC.

b. **Exception/Waiver Authority** The proponent may approve written exceptions/waivers to this SOP that are consistent with controlling law, regulation, and safety policy. The proponent may delegate approval authority in writing to the Project NCOIC.

c. **Limits to Proponent Authority** Any change that alters OPORD-controlled measures or authorities (for example, ACMs, altitude blocks, flight corridors/routes/boxes, TFB approval lanes, or delegated command authority) requires action by the USMA G-3 via FRAGO.

d. **Recommended Changes** Users submit recommended changes via email to the Project NCOIC or Project OIC; the Project OIC adjudicates and publishes approved updates.

e. **Precedence** In the event of a conflict between this SOP and controlling law, regulation, or policy, the controlling document takes precedence. The proponent will correct the SOP at the next revision.

Chapter 2

Roles and Responsibilities

The Roles and Responsibilities of personnel involved in both the performance and oversight of Project MARS operations are defined in this chapter.

2-1 Permanent / Appointed Positions

The positions listed below are permanent/appointed positions. Appointment to positions specific to this Project will be accomplished by MFR signed by the specified authority.

2-1.1 Hospital Commander

a.

2-1.2 Project MARS OIC

a. **Primary Role** A US Army Officer will be designated the Project MARS OIC. The OIC is responsible for oversight of the Project, and is empowered to make decisions regarding the planning, briefing, and execution of all flight operations. The OIC will be the principal advisor to the Hospital Commander regarding the Project.

b. **Responsibilities** The OIC's duties include, but are not limited to the following:

- Assure that an assessment of the operational area meets any requirement prescribed for that location in accordance with FAA and/or Army guidance and policy.
- All material hazards have been identified and eliminated or adequate mitigations have been implemented prior to flight operations.
- A risk determination for the material hazards has been made and all risks assessed and accepted at the appropriate level in a signed risk acceptance memorandum to be provided to SRD prior to flight operations.
- All operational hazards have been identified and eliminated or adequate mitigations have been implemented prior to flight operations.
- A risk determination for the operational area hazards has been made and all risks assessed and accepted at the appropriate level in a signed risk acceptance memorandum to be provided to SRD prior to flight operations.
- Supervision for all personnel involved in the mission.
- Ensuring all personnel supporting the operation are qualified for the role they are assigned, have been properly briefed and thoroughly understand their role in the mission.
- Logbooks are present and accurate prior to all flight operations.
- All system equipment is verified in proper working order during the preflight inspection and properly set-up.
- The mission data is recorded in the logbook.
- Ensures that all required communications with the other controlling agencies are established and maintained throughout the entire operation.
- A Mishap Action plan is in place prior to operations for each operational area with emergency notification procedures completed prior to flight.

- Conducts pre/post mission briefs with all personnel involved in the mission as prescribed within this SOP.

***c.* Appointment** The Project MARS OIC will be appointed by the Hospital Commander via MFR.

2-1.3 Project MARS NCOIC

***a.* Primary Role**

***b.* Additional Responsibilities**

***c.* Appointment** The Project MARS NCOIC will be appointed by the Hospital Commander via MFR.

2-1.4 Lead Operator

***a.* Primary Role** The Lead Operator is the Project MARS SME when it comes to flight operations., and will be EO qualified. The Lead operator helps the Project MARS OIC develop,implement, and manage the ATP. The Lead Operator will conduct IQT and namerefsec:qual-ao~~Crefsec:qual-ao~~[claude]. If sUAS Master Trainer Qualified, the Lead Operator will conduct namerefsec:qual-qp~~Crefsec:qual-qp~~[claude]; if not master qualified, the Lead Operator will assist with training of Project MARS personnel selected for QP training.

***b.* Additional Responsibilties** The Lead Operator will be responsible for maintaining the flight qualification training records for Project MARS personnel.

***c.* Appointment** The Project MARS Lead Operator will be appointed by the Project MARS OIC via MFR.

2-1.5 Project MARS Technical Lead

***a.* Primary Role** A government employee within KACH will be designated the Project MARS Technical Lead. This individual is responsible for the general configuration management and maintenance of the Project MARS fleet. The Technical Lead is responsible for managing all hardware and software configurations of the Project MARS fleet and certifying individual airframes for flight in accordance with the AWR issued by SRD. Communications related to safety of the airframe will be directed toward the Technical Lead.

***b.* Additional Responsibilities** The Project MARS Technical Lead is also responsible for training and approving maintenance technicians.

***c.* Appointment** The Project MARS Technical Lead will be appointed by the Project MARS OIC via MFR.

2-1.6 Maintenance Technician

***a.* Primary Role** Maintenance technicians are responsible for conducting all maintenance and delegated to them by the Project MARS Technical Lead, as well as any upkeep required to ensure the safe operation of Project MARS vehicles. Personnel will certify the use of each vehicle in the Project MARS based on completion of appropriate inspection(s).

***b.* Additional Responsibilities** Maintenance Technicians will be available on request to assist RPICs in setting up the Project MARS for flight and conducting the preflight inspection as necessary. In the event of an emergency, maintenance technicians will stand by for instructions from the Project MARS Project MARS NCOIC for directions related to recovery operations.

***c.* Appointment** Maintenance Technicians will be appointed by the Project MARS Technical Lead via MFR.

2-2 Situational Positions

The following positions are not permanent positions and are assigned on a per-flight basis.

2-2.1 Remote Pilot in Charge

a. A designated government employee is assigned as the RPIC for all flights. The RPIC is responsible for evaluating the situation and making timely decisions for the safe operation of the Project MARS aircraft at all times, even when the aircraft is following pre-programmed commands. The RPIC is the final authority as to the operation of the aircraft. The RPIC's duties include, but are not limited to:

(1) Pre-flight Prior to flight, the RPIC is responsible for:

- Confirming Flight authorization with Project MARS NCOIC.
- Confirming airworthiness certification of the aircraft to be flown, and conducting pre-flight inspection IAW Section 5-9.1.
- Receiving cargo and ensuring it is stowed in the payload securely and that it will not adversely affect the flight characteristics or controllability of the aircraft. (See Section 3-4.)
- Confirming that weather conditions are safe for flight.
- Confirming that a NOTAM is published, and there are no flight restrictions in place that would ground the flight.
- Ensuring all Crewmembers are properly briefed on operating conditions, contingency procedures, and emergency procedures.
- Making verbal connection with the Crewmember(s) on the arriving LZ and ensure they are staged and prepared to receive the aircraft BEFORE liftoff~~takeoff~~[claude].

(2) During Flight During flight, the RPIC is responsible for:

(i) **All Flights** The RPIC is responsible for complying with all procedures and restrictions outlined in this SOP, and any applicable COA. In the event of an emergency, the RPIC will maintain/regain control of the aircraft to the best of their ability and bring the aircraft to a safe LZ or the nearest SAA designated for that flight. The RPIC has final decision on when to land or ditch the aircraft, but may not violate /acfaa or Army regulations in an effort to "save" the aircraft.

(ii) **Manual Flight** During manual flight, the RPIC's primary task is to maintain control of the aircraft. Manual flights will usually be conducted in VLOS conditions, and the RPIC will ensure that they or the VO has unaided sight of the aircraft at all times.

(iii) **Autonomous Flight** During autonomous flight, the RPIC is responsible for monitoring the aircraft's telemetry at all times and must remain ready to directly intervene if necessary. The RPIC will maintain communication throughout the flight with the receiving Crewmember(s) to ensure everyone knows what the other Crewmembers are doing, and who is controlling the aircraft.

(3) Post-Flight After a flight, the RPIC is responsible for:

- Confirming that the aircraft has arrived safely to the receiving LZ and has been secured by receiving Crewmember(s).
- Reporting successful flight to Project MARS NCOIC, and filing any requisite flight logs or other paperwork associated with the flight.
- Reporting any issues, irregularities, malfunctions, or mishaps that occurred to the Lead Operator, Project MARS Technical Lead, and/or Project MARS NCOIC as appropriate.

b. **Qualification** Qualification requirements to serve as RPIC are laid out in Chapter 4 (**4)**. At a minimum, personnel service as an RPIC for autonomous flights will be certified to namerefsec:qual-ao~~Crefsec:qual-ao~~[claude] standards. To serve as RPIC during manual flight modes, personnel will be certified to namerefsec:qual-qp ~~Crefsec:qual-qp~~[claude] standards.

2-2.2 Crewmember

a.

b. **Qualification** At a minimum, all assigned crewmembers will have an AO qualification. Requirements for this qualification are laid out in crefch:certification~~Crefch:certification~~[claude].

2-2.3 Visual Observer

a.

b. **Qualification**

Chapter 3

Airframes & Supporting Systems

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labelsection:systemspecs~~labelsec:systemspecs~~claude

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Chapter 4

Aircrew Certification, Training & Currency

a. This chapter establishes the Aircrew Training Program (ATP) for Project MARS. Project MARS' primarily operates nonstandard, UASs with a non-tactical mission, and its qualification, evaluation, and currency requirements are defined in AR 95-1, Appendix D, Paragraph 10. The Project MARS ATP provides specific guidelines for executing sUAS aircrew training, and establishes crewmember qualification, refresher, mission, and continuation training and evaluation requirements.

b. The operator's manual is the governing authority for operation of the aircraft. If differences exist between the maneuver descriptions in the operators' manual and this chapter, then this chapter the governing authority for training and flight evaluation purposes only.

4-1 Aircrew Qualification Framework

a. The Project MARS aircrew qualification framework is a tiered system designed to ensure personnel possess the appropriate skills and knowledge for the missions they are assigned. Advancement through these tiers is based on a structured progression of training, demonstrated proficiency, and a comprehensive understanding of program procedures. This framework ensures that while all operators meet a baseline safety standard, those tasked with more complex or higher-risk missions have achieved a corresponding level of expertise.

b. The three levels of qualification are Autonomous Operator (AO) , Qualified Pilot (QP) , and Expert Operator (EO).

(1) Autonomous Operator An Autonomous Operator represents the entry-level qualification, trained specifically to oversee and manage pre-planned, routine autonomous missions under normal conditions.

(2) Qualified Pilot The next level, Qualified Pilot , builds upon that foundation by adding comprehensive manual flight proficiency. A QP is skilled in taking direct manual control of the aircraft, especially during off-nominal situations, confined area landings, or when deviating from an autonomous plan.

(3) Expert Operator The highest level of qualification is the Expert Operator , an individual with extensive experience who serves as an instructor, evaluator, and subject matter expert. EOs are responsible for conducting training, certifying other operators, and leading the development and validation flights for new routes and emergency procedures.

4-2 Requirements for All Aircrew Personnel

a. The following personnel may fly and/or operate Project MARS airframes. Personnel who –

(1) Are members of the Regular Army, USAR, ARNG, or Civilian employees of the U.S. Army or DHA.

(2) Have complied with the qualification, training, evaluation, and currency requirements of this SOP for the airframe to be flown and/or operated.

(3) Meet the medical standard as outlined in AR 40-501 (but are not required to maintain a class IV physical).

4-3 Autonomous Operator Qualification

***a.* Requirements** Autonomous Operator (AO) level is the most basic operator certification level, and consists of BUQ 1 and 2 certification completed via the SUASMAN website (or equivalent), plus 2 hours local training on the Project MARS airframe.

***b.* Role** This level qualifies the AO to operate Project MARS sUASs in autonomous mode only. AO qualified personnel will not conduct operations without the assignment of a supporting QP or EO.

***c.* Re-certification** In addition to the currency requirements listed below, Personnel trained to AO Level are required to re-certify with a currently qualified EO annually.

4-4 Qualified Pilot Qualification

***a.* Requirements** Qualified Pilot (QP) level is the intermediate level of qualification for Project MARS. In addition to the requirements of namerefsec:qual-ao~~Crefsec:qual-ao~~claude, QP qualification requires graduation from the sUAS Operator Course.

***b.* Role** A QP is skilled in taking direct manual control of the aircraft, especially during off-nominal situations, confined area landings, or when deviating from an autonomous plan. In addition to autonomous operations, the QP is authorized to conduct flights in manual flight modes, such a DT&E and training flights.

***c.* Re-certification** In addition to the currency requirements listed below, Personnel trained to QP Level are required to re-certify with the Lead Operator annually.

4-5 Expert Operator Qualification

***a.* Requirements** Expert Operator (EO) qualification is the highest level of qualification recognized by Project MARS. In addition to the requirements for namerefsec:qual-qp~~Crefsec:qual-qp~~claude, EO qualification requires Appointment Orders signed by the Project MARS OIC. While not a qualification requirement, attendance of the sUAS Master Trainer Course is strongly encouraged for EO, and they will be prioritized for attendance.

***b.* Role** As the highest trained operators within Project MARS, EOs will act as SMEs for sUAS operations as well as flight instructors and operator evaluators for all Project MARS personnel. The Lead Operator must be EO qualified.

***c.* Re-certification** In addition to the currency requirements listed below, Personnel trained to EO Level are required to re-certify with the Lead Operator annually.

4-6 Currency and Recurrency Requirements

***a.* Currency** Currency requirements for Project MARS operators are dependent on the operator's level of qualification.

(1) Frequency To be considered current, a Project MARS sUAS operator must:

(i) **Autonomous Operator (AO)** Every 60 consecutive days, perform one flight each to two different locations under autonomous conditions. Receive at least one autonomous mission launched from another LZ.

(ii) **Qualified Pilot (QP)** Every 30 consecutive days, perform a launch, recovery, and 15 minute piloted (i.e., non-autonomous) flight of a Project MARS sUAS (or compatible simulator). QPs will perform a live launch, recovery, and a 15-minute piloted flight of the sUAS every 150 consecutive days.

(iii) **Expert Operator (EO)** Currency requirements for EO are the same as those for QPs.

(2) Tracking Tracking actual flight time for a flying hour requirement is impractical and not required. Individual flight records folders are not required; however, documentation of flight operations (sorites) for the purpose of tracking currency is required. A qualified sortie is a launch, recovery, and autonomous flight for AO currency, and a launch, recovery, and piloted flight for QP or EO currency.

(3) Currency Lapse Project MARS operators whose currency has lapsed must complete a proficiency flight evaluation by the Lead Operator before conducting operations. Simulators may not be used to reestablish currency.

(4) Waivers Waivers to currency may only be granted by the Project MARS OIC.

(5) Similar UAS Currency in one Project MARS sUAS will satisfy requirement for all sUAS belonging to the Project MARS. Autonomous flights do not satisfy requirement for piloted flights.

Chapter 5

Flight Operations

This chapter establishes flight operations procedures for Project MARS sUAS operations conducted from KACH across the WP Garrison. Operations are conducted under both FAA Part 107 with COA and DoD/Army regulations. This chapter addresses both VLOS operations (used during development, testing, and training) and BVLOS operations (used during routine autonomous delivery missions).[claude]

5-1 Ground Operations

Ground operations encompass all activities required to prepare, launch, recover, and secure Project MARS sUAS and associated equipment.

5-1.1 Launch and Landing Zone Setup

a. **Primary Launch Site** The primary launch site for Project MARS operations is KACH. The designated LZ will be established in accordance with the approved COA and coordinated with hospital operations. The LZ will be:

- Clear of obstacles within a 15-meter radius of the launch/landing point
- Marked or cordoned to prevent unauthorized personnel entry during operations
- Positioned to provide adequate clearance for approach and departure routes
- Accessible for GCS setup with clear line of sight (for VLOS operations)

b. **Destination Landing Zones** Each destination LZ will be surveyed and approved prior to first use. Destination LZs serving USMA and USMAPS will be identified during route development and documented in mission planning materials. Each destination LZ will have:

- A designated point of contact for receiving operations
- Clearly defined boundaries and approach corridors
- Emergency contact information posted

5-1.2 Ground Control Station Setup

a. The GCS will be positioned to provide optimal telemetry reception and, for VLOS operations, direct line of sight to the LZ and initial flight path. The Remote Pilot in Charge will verify:[claude]

- GCS is powered and all telemetry links are established[claude]
- Antenna orientation is correct for the planned flight path[claude]
- All software applications are running and displaying current data[claude]
- Backup power is available for extended operations[claude]

5-1.3 Payload Handling

a. Medical supply payloads will be prepared and loaded in accordance with section 3-4 (/namerefsec:approvedcargo). Personnel handling payloads will:

- Verify payload weight does not exceed aircraft limits

- Ensure payload is properly secured and will not shift during flight
- Confirm payload does not interfere with aircraft sensors or control surfaces
- Document payload serial number and weight in the flight log

5-1.4 Site Security

a. During flight operations, the LZ and GCS location will be secured to prevent unauthorized access. At minimum, one crewmember will maintain situational awareness of the immediate area to identify and respond to ground hazards. For VLOS operations, Visual Observers will be positioned to maintain both aircraft observation and ground security awareness.

5-2 Flight Scheduling

All Project MARS flights require coordination with multiple agencies and must be scheduled in advance through the established process.[claude]

5-2.1 Weekly Scheduling Process

a. The Project MARS NCOIC will develop a weekly flight schedule and present it at the weekly leadership meeting for approval by the Project MARS OIC. The schedule will:

- Draft a preliminary schedule for two weeks out
- Set the flight schedule for the following week
- Identify required crew assignments and equipment for the following week
- Note any special coordination requirements

5-2.2 Required Coordination

a. Prior to flight operations, the following coordination will be completed:[claude]

(1) 2nd Aviation Detachment The Project MARS NCOIC will coordinate with 2nd Aviation Detachment for airspace deconfliction no later than three hours prior to flight. 2nd Aviation will be notified within 15 minutes of flight completion.[claude]

(2) USMA G3 The Project MARS NCOIC will consult with USMA G3 during weekly mission planning to ensure flight operations do not conflict with installation activities.[claude]

(3) FAA NOTAM A NOTAM will be published for all flight operations in accordance with COA requirements; no later than 24 hours prior to flight. The Remote Pilot in Charge will verify NOTAM publication prior to flight.

(4) WP DES The WP DES Duty Desk (845-938-3333) will be notified no later than 10 minutes prior to flight operations and within 15 minutes of flight completion.

5-3 Briefings and Risk Management

A structured briefing process ensures all personnel understand mission requirements, hazards, and contingency procedures.[claude]

5-3.1 Weekly Leadership Brief

a. The Project MARS NCOIC will conduct a weekly leadership briefing attended by the Project MARS OIC, Lead Operator, and other stakeholders as appropriate. The briefing will cover:

- Review of previous week's operations and any lessons learned
- Approval of the upcoming week's flight schedule
- Discussion of any new hazards or risk mitigations
- Equipment status and maintenance issues
- Training and qualification updates

5-3.2 Mission Brief

a. A mission brief will be conducted the day before scheduled flights. For VLOS developmental flights, the brief will be conducted by the Lead Operator or designated RPIC. The mission brief will include:[claude]

- Mission objectives and planned routes[claude]
- Weather forecast and go/no-go criteria[claude]
- Crew assignments and responsibilities[claude]
- Aircraft and equipment assignments[claude]
- Communication procedures and frequencies[claude]
- Emergency procedures and SAAs[claude]
- Known hazards and mitigations[claude]

5-3.3 Crew Brief

a. On the day of flight, the RPIC will conduct a crew brief immediately prior to operations. The crew brief will confirm:[claude]

- Current weather conditions meet minimums[claude]
- All crewmembers understand their roles[claude]
- Emergency procedures are understood[claude]
- Communication checks are complete[claude]
- Any changes from the mission brief[claude]

5-3.4 Composite Risk Management

a. CRM will be conducted in accordance with DA Pamphlet 385-30 using DA Form 7566. The Project MARS NCOIC will ensure a current CRM assessment exists for each flight profile. The CRM will:[claude]

- Identify hazards specific to the planned operation[claude]
- Assess initial risk levels[claude]
- Develop controls and mitigations[claude]
- Determine residual risk[claude]
- Obtain appropriate risk acceptance authority signature[claude]

b. The RAA for Project MARS operations is established in Chapter 7 (**7**). The RPIC will review the applicable CRM assessment prior to each flight and verify all controls remain in place.[claude]

5-4 Weather Considerations

Project MARS operations will comply with FAA Part 107 weather minimums unless more restrictive limits are specified in the applicable COA or this SOP.[claude]

5-4.1 Weather Minimums

a. The following weather minimums apply to all Project MARS flight operations:[claude]

- Visibility: 3 statute miles minimum[claude]
- Cloud clearance: 500 feet below clouds, 2000 feet horizontal from clouds[claude]
- Maximum altitude: 400 feet AGL[claude]
- Daylight operations only (civil twilight to civil twilight)[claude]

b. Operations during civil twilight require the sUAS to be equipped with anti-collision lights visible for at least 3 statute miles.[claude]

5-4.2 Go/No-Go Criteria

a. In addition to weather minimums, the following conditions constitute automatic no-go criteria:[claude]

- Sustained winds exceeding aircraft limitations[claude]
- Gusts exceeding aircraft limitations[claude]
- Precipitation (rain, snow, sleet)[claude]
- Lightning within 10 nautical miles[claude]
- Icing conditions[claude]
- WP FPCON at CHARLIE or DELTA[claude]

5-4.3 Weather Decision Authority

a. Weather decisions follow a tiered approval chain:[claude]

(1) The RPIC is responsible for evaluating current conditions and making the initial weather determination.[claude]

(2) The Project MARS NCOIC will approve weather-related go/no-go decisions for routine operations.[claude]

(3) The Project MARS OIC will provide final sign-off on weather decisions that involve marginal conditions or deviation from standard procedures.[claude]

5-4.4 Weather Hold Procedures

a. If weather conditions deteriorate during operations, the RPIC will:[claude]

- Immediately assess whether to continue, hold, or abort the mission[claude]
- For deteriorating but still acceptable conditions: continue with increased monitoring[claude]
- For marginal conditions: place the mission on weather hold and await improvement[claude]
- For conditions below minimums or approaching rapidly: execute immediate recovery or abort[claude]

b. Emergency weather procedures are detailed in section 7-3.5.[claude]

5-5 Crew Coordination

Effective crew coordination is essential for safe flight operations. Crew composition and responsibilities differ between VLOS developmental operations and BVLOS autonomous operations.[claude]

5-5.1 VLOS Operations Crew

a. VLOS operations typically involve 3-5 personnel for route assessment, development, and validation flights:[claude]

(1) Remote Pilot in Charge Responsible for overall flight safety and aircraft control. Maintains authority over all flight decisions.[claude]

(2) Visual Observer(s) Maintain visual contact with the aircraft and provide situational awareness to the RPIC. Multiple Visual Observers may be positioned along the route to maintain continuous visual contact.[claude]

(3) Ground Observers Additional personnel positioned along the route to observe aircraft performance, identify hazards, and validate route suitability. Ground observers will have direct communication with the RPIC.[claude]

5-5.2 BVLOS Operations Crew

a. BVLOS autonomous delivery operations require the following minimum crew:[claude]

(1) Launch RPIC Located at KACH, responsible for pre-flight, launch, and monitoring during transit. Maintains authority to abort the mission.[claude]

(2) Receiving Pilot Located at the destination LZ, responsible for receiving the aircraft and confirming safe landing. The receiving pilot will be at minimum AO qualified and in direct communication with the launch RPIC.[claude]

5-5.3 Communication Protocols

a. All crewmembers will maintain communication throughout flight operations using approved methods (radio, telephone, or other means as specified in the mission brief). Standard communication calls include:[claude]

- "Ready for launch" – RPIC confirms all pre-flight complete[claude]
- "Launching" – Aircraft is taking off[claude]
- "Aircraft in sight" – Visual Observer/Ground Observer confirms visual contact[claude]
- "Lost visual" – Visual Observer has lost sight of aircraft[claude]
- "Approaching [waypoint]" – Position report during autonomous flight[claude]
- "On final" – Aircraft on approach to LZ[claude]
- "Touchdown" – Aircraft has landed[claude]
- "Secured" – Aircraft is powered down and safe[claude]

5-5.4 Handoff Procedures

a. For BVLOS operations, control authority handoff between launch RPIC and receiving pilot will be conducted as follows:[claude]

- Launch RPIC maintains authority throughout transit[claude]
- When aircraft enters visual range of destination, receiving pilot confirms "Aircraft in sight"[claude]
- Launch RPIC may transfer landing authority to receiving pilot if situation requires[claude]
- Transfer of authority will be verbally confirmed by both pilots[claude]
- After landing, receiving pilot assumes responsibility for aircraft security[claude]

5-6 Types of Operations

Project MARS conducts several types of flight operations, each with distinct procedures and crew requirements.[claude]

5-6.1 Routine Scheduled Delivery

a. Routine scheduled delivery missions are BVLOS autonomous flights conducted on pre-validated routes. These missions:[claude]

- Follow routes that have been previously surveyed and approved during developmental testing[claude]
- Are scheduled through the weekly planning process[claude]
- Require minimum crew of launch RPIC and receiving pilot[claude]
- Follow pre-programmed flight paths with minimal deviation[claude]

b. **Procedures**

- Mission brief completed day prior[claude]
- Crew brief conducted morning of flight[claude]
- Pre-flight inspection and payload loading per section 5-9.1[claude]
- Launch per approved procedures[claude]
- RPIC monitors telemetry throughout transit[claude]
- Receiving pilot confirms approach and landing[claude]
- Post-flight documentation completed[claude]

5-6.2 On-Demand / Emergency Response Delivery

a. On-demand and emergency response delivery operations are not within the current scope of Project MARS. Procedures for these operations will be developed as the program matures and expands beyond the developmental phase.[claude]

5-6.3 Development, Testing, and Evaluation Flights

a. DT&E flights are conducted under VLOS conditions to survey routes, validate aircraft performance, and refine operational procedures. These flights:[claude]

- Are the primary flight type during the developmental phase[claude]
- Require full VLOS crew (3-5 personnel)[claude]
- Allow the RPIC flexibility to adapt within a few dozen meters of the planned route[claude]
- Generate data used to approve routes for future BVLOS operations[claude]

b. **Procedures**

- Route survey and hazard identification[claude]
- CRM assessment specific to test objectives[claude]
- Positioning of Visual Observers and ground observers along route[claude]
- Incremental testing (low altitude, then full profile)[claude]
- Documentation of route performance and any required modifications[claude]
- Post-flight debrief and data collection[claude]

5-6.4 Training Flights

a. Training flights are conducted to qualify and maintain currency for Project MARS operators. Training flights require increased supervision and are restricted to approved training areas.[claude]

b. All training flights will:[claude]

- Be supervised by a QP or higher qualified operator[claude]
- Be conducted in designated training areas with minimal risk to non-participants[claude]
- Follow the training requirements outlined in Chapter 4 (**4)**[claude]
- Be documented in the trainee's qualification record[claude]

c. Risk management for training flights is addressed in Chapter 7 (**7)**.[claude]

5-7 Air Corridor and Route Management

Routes and air corridors for Project MARS operations are developed, validated, and managed through a structured process to ensure safe and repeatable operations.[claude]

5-7.1 Route Development

a. New routes will be developed using the following process:[claude]

- Ground survey of proposed route to identify obstacles, hazards, and suitable LZs[claude]
- Identification of primary, alternate, and contingency routes for each destination[claude]
- Designation of SAAs along each route[claude]
- VLOS test flights to validate route suitability[claude]
- Documentation and approval of route for operational use[claude]

5-7.2 Primary, Alternate, and Contingency Routes

a. For each destination, the following routes will be established:[claude]

(1) Primary Route The preferred flight path under normal conditions. Selected for optimal efficiency while maintaining safety margins.[claude]

(2) Alternate Route An alternative flight path available when the primary route is unavailable (e.g., due to conflicting activities or temporary obstacles).[claude]

(3) Contingency Route A simplified route for use during degraded conditions or emergencies. Contingency routes prioritize safety and may include additional SAAs.[claude]

b. Routes will be identified in the weekly mission brief and loaded into the autonomous flight plan prior to each mission.[claude]

5-7.3 Safe Abort Areas

a. SAAs are pre-surveyed locations along each route where the aircraft can safely land in an emergency. Each route will have multiple SAAs spaced to ensure the aircraft can always reach one if required.[claude]

b. SAA locations will be:[claude]

- Programmed as rally points in the autonomous flight plan[claude]
- Clear of obstacles and away from populated areas[claude]
- Accessible for aircraft recovery[claude]
- Documented with coordinates and description[claude]

c. In the event of an anomaly requiring abort, the aircraft will navigate to the nearest SAA and land. Lost link procedures are configured to direct the aircraft to the nearest SAA.[claude]

5-7.4 Geofencing and Corridor Boundaries

a. All BVLOS flights will operate within defined corridor boundaries enforced by geofencing. The geofence will:[claude]

- Define lateral boundaries of the approved flight corridor[claude]
- Enforce altitude limits in accordance with the COA[claude]
- Trigger alerts if the aircraft approaches boundaries[claude]
- Initiate automatic abort procedures if boundaries are breached[claude]

b. For VLOS operations, the RPIC may adjust within a few dozen meters of the planned route as needed for safety or mission accomplishment, but will remain within the overall approved operating area.[claude]

5-8 Mission Planning and Approval Cycle

All Project MARS flight operations require planning and approval through the established cycle. Different types of operations require different levels of approval.[claude]

5-8.1 Approval Authority Matrix

a. The following table summarizes approval authorities for Project MARS operations:[claude]

Decision	Approval Authority	Consulted/Informed
Overall Operational Risk[claude]	Hospital Commander[claude]	_[claude]
Airspace Authorization[claude]	FAA via USAASA[claude]	_[claude]
Ground Operations Authority[claude]	WP Garrison Commander[claude]	SMC[claude]
Weekly Flight Schedule[claude]	Project MARS OIC[claude]	USMA G3, 2nd AVN[claude]
Weather Go/No-Go[claude]	Project MARS OIC[claude]	Project MARS NCOIC[claude]
Equipment Airworthiness[claude]	RPIC[claude]	Project MARS Technical Lead[claude]
Final Launch Authority[claude]	RPIC[claude]	Flight crew, WP DES[claude]

5-8.2 Weekly Planning Cycle

a. The weekly planning cycle proceeds as follows:[claude]

- **Week -2:** Project MARS NCOIC drafts preliminary schedule[claude]
- **Week -1:** Weekly leadership meeting reviews and approves schedule; Project MARS NCOIC coordinates with USMA G3 and 2nd AVN[claude]
- **Week -1:** NOTAMs submitted for publication[claude]
- **Day -1:** Mission brief conducted[claude]
- **Day 0:** Crew brief, pre-flight, and flight execution[claude]

5-8.3 Mission-Specific Approvals

a. Certain mission types require additional approvals:[claude]

- Flights over non-pre-established routes require USMA G3 coordination at least 5 working days prior[claude]
- Night operations or operations over people require SMC approval and additional FAA waivers[claude]

- Flights in areas requiring Range Facility Management System (RFMIS) reservation require DPTMS approval[claude]

5-9 Flight Procedures

This section establishes standardized procedures for all phases of flight. Personnel will follow these procedures unless deviation is required for safety of flight.[claude]

5-9.1 Pre-Flight Procedures

a. The following pre-flight procedures will be completed before every flight:[claude]

(1) Documentation Review The RPIC will verify:[claude]

- Current AWR on file for the aircraft[claude]
- NOTAM is published and active[claude]
- No Temporary Flight Restrictions (TFRs) or other airspace restrictions affect the flight[claude]
- CRM assessment is current and controls are in place[claude]

(2) Coordination Notifications The RPIC or designated crewmember will:[claude]

- Contact 2nd AVN for airspace deconfliction (NLT 3 hours prior)[claude]
- Notify WP DES (NLT 10 minutes prior)[claude]
- Confirm receiving crewmember is in position (if BVLOS)[claude]

(3) Aircraft Inspection The RPIC will inspect:[claude]

- Airframe integrity (no visible damage, all components secure)[claude]
- Propellers (no nicks, cracks, or damage)[claude]
- Battery charge and condition[claude]
- Control surfaces and motors (free movement, secure mounting)[claude]
- Sensors and cameras (clean and unobstructed)[claude]
- Payload attachment and security[claude]

(4) GCS Verification The RPIC will verify:[claude]

- Telemetry link established[claude]
- GPS signal acquired (sufficient satellites)[claude]
- Flight plan loaded correctly[claude]
- Geofence parameters set[claude]
- Failsafe protocols configured (RTH, lost link, low battery)[claude]
- SAAs programmed as rally points[claude]

(5) Crew Brief Conduct final crew brief per section 5-3.3.[claude]

5-9.2 Procedures During Flight

***a.* VLOS Flight Procedures**

(1) Launch Upon completion of pre-flight and crew brief:[claude]

- RPIC announces “Ready for launch” and confirms LZ is clear[claude]

- Visual Observers confirm ready status[claude]
- RPIC initiates launch sequence[claude]
- Aircraft climbs to designated altitude and holds for system check[claude]
- RPIC verifies all systems nominal, then proceeds with mission[claude]

(2) In-Flight Monitoring During flight, the RPIC will:[claude]

- Maintain awareness of aircraft position relative to planned route[claude]
- Monitor telemetry for any anomalies[claude]
- Respond to Visual Observer calls regarding aircraft position or hazards[claude]
- Make route adjustments as needed within approved parameters[claude]

(3) Contingency Actions If conditions warrant:[claude]

- For minor anomalies: continue with increased monitoring[claude]
- For degraded conditions: execute return to launch or nearest SAA[claude]
- For emergencies: follow procedures in Chapter 7 (**7)**[claude]

b. **BVLOS Flight Procedures**

(1) Launch Upon completion of pre-flight and crew brief:[claude]

- Launch RPIC confirms receiving pilot is in position and ready[claude]
- RPIC announces “Ready for launch” and confirms LZ is clear[claude]
- RPIC initiates autonomous launch sequence[claude]
- Aircraft climbs and proceeds on programmed route[claude]

(2) Transit Monitoring During autonomous transit:[claude]

- RPIC monitors telemetry continuously[claude]
- Position reports are called at designated waypoints[claude]
- Receiving pilot monitors for approaching aircraft[claude]

(3) Approach and Landing

- Receiving pilot confirms “Aircraft in sight” when visual contact established[claude]
- RPIC monitors approach via telemetry[claude]
- Aircraft executes autonomous landing[claude]
- Receiving pilot confirms “Touchdown” and “Secured”[claude]

(4) Abort Criteria The RPIC will abort the mission and direct the aircraft to the nearest SAA if:[claude]

- Telemetry indicates system anomaly[claude]
- Weather conditions deteriorate below minimums[claude]
- Lost link exceeds configured timeout[claude]
- Receiving pilot is unable to receive the aircraft[claude]
- Any crewmember calls “Knock it off”[claude]

5-9.3 Post-Flight Procedures

a. Following every flight, the following procedures will be completed:[claude]

(1) Aircraft Securing

- Power down aircraft per manufacturer procedures[claude]
- Remove and secure battery[claude]
- Conduct post-flight inspection for damage[claude]
- Secure payload and aircraft for transport/storage[claude]

(2) Notifications

- Notify 2nd AVN of flight completion (within 15 minutes)[claude]
- Notify WP DES of flight completion (within 15 minutes)[claude]
- Report mission status to Project MARS NCOIC[claude]

(3) Documentation

- Complete flight log entry[claude]
- Document any anomalies, discrepancies, or maintenance issues[claude]
- Download and archive telemetry data (if required)[claude]
- Update aircraft logbook[claude]

5-10 Data Management

Proper documentation of flight operations supports program analysis, safety reviews, and potential expansion to other installations.[claude]

5-10.1 Required Flight Logs

a. The following information will be recorded for every flight:[claude]

- Date and time of flight (takeoff and landing)[claude]
- Aircraft identification[claude]
- RPIC and crewmember names[claude]
- Mission type and route flown[claude]
- Payload description and weight[claude]
- Weather conditions[claude]
- Flight duration[claude]
- Any anomalies, deviations, or incidents[claude]

5-10.2 Recommended Telemetry Capture

a. The following telemetry data capture is recommended but not required:[claude]

- GPS track (position, altitude, speed)[claude]
- Battery voltage and current draw[claude]
- Motor performance data[claude]
- Link quality metrics[claude]

b. Telemetry data supports troubleshooting, route optimization, and program analysis for potential expansion.[claude]

5-10.3 Record Retention

a. Flight logs and associated documentation will be retained in accordance with Army record retention requirements. At minimum:[claude]

- Flight logs: retained for the duration of the program plus 3 years[claude]
- Aircraft logbooks: retained for the service life of the aircraft[claude]
- Incident/mishap reports: retained per DA Pamphlet 385-40[claude]

5-10.4 Incident Documentation

a. Any anomaly, incident, or mishap will be documented in addition to the standard flight log. Incident documentation will include:[claude]

- Detailed narrative of the event[claude]
- Contributing factors identified[claude]
- Actions taken in response[claude]
- Recommendations for prevention[claude]

b. Incident reporting requirements are detailed in section 7-4.[claude]

Chapter 6

Maintenance and Logistics

6-1 Maintenance Overview

6-2 Maintenance Schedule

6-3 Battery Management Protocol

6-4 Software and Firmware Update Procedures

6-5 Supply and Spare Parts Management

6-6 Maintenance Documentation

Chapter 7

Safety and Emergency Procedures

7-1 Risk Management

7-1.1 Controlling Doctrine Risk management for Project MARS is done in accordance with DA Pamphlet 385-30. Additionally, all Project MARS sUAS will have current AWRs in accordance with AR 70-62 prior to conducting flight operations.

7-1.2 Risk Acceptance Authority The overall RAA for Project MARS is the Hospital Commander. The Hospital Commander has delegated RAA to the Project MARS OIC for nonrecurring missions conducted under VLOS conditions. Because of the potential risk to non-participating personnel during BVLOS operations, the RAA for BVLOS operations is the SMC, or their delegate. The USMA Superintendent, as SMC has delegated this approval authority to the WP Garrison Commander.

7-1.3 Risk of Training Flights All Project MARS training flights are considered low risk since the aircraft must be operated within line of sight of the Remote Pilot in Charge or Visual Observer. Training flights are restricted to unpopulated areas where risk to people and property is minimal. During these flights, line of sight will be maintained between the aircraft and ground station at all times.

7-1.4 Risk of All Other Flights All Project MARS flights conducted other than for training must have a hazard analysis and a risk determination. Project MARS Personnel will obtain briefings from the Project MARS NCOIC and implement the proscribed mitigation measures in accordance with the risk determination prior to any flight operations. Briefings will be conducted by the RPIC.

7-2 General Emergency Procedures

***a.* Priorities** This SOP cannot anticipate every type of emergency that an operation may encounter. Any Emergency Procedure (EP) laid out in this chapter for specific emergencies can be equated to 'immediate action' techniques for a small arms weapons system. They do not replace critical thinking. Project MARS personnel will, at all times, prioritize the following criteria in order:

(1) Preservation of Life No stateside operation is so important that it is worth the loss of a single human life. At all times, Project MARS personnel will act to minimize the risk of injury/fatality to anyone, whether or not they are directly involved with the Operation.

(2) Preservation of Materiel While sUAS are considered consumable commodities, rather than durable property, they are non-trivial to replace and their safety should be prioritized when possible. In an emergency, Project MARS personnel will prioritize safeguarding non-Project MARS materiel ahead of sUAS equipment.

(3) Preservation of Mission The mission of Project MARS is to develop a safe, reliable, autonomous sUAS based resupply capability. However, no individual operation is so critical that its accomplishment overrides general safety procedures. In an emergency, Project MARS personnel will prioritize mission accomplishment only after ensuring that there is no further risk to personnel or materiel; if any doubt exist, the mission will be scrubbed.

***b.* Pilot Priorities** Loss of control of the aircraft remains the highest risk related to sUAS~~sUAS~~[claude] operations. The following priorities should be followed by operators during an in-flight emergency:

(1) Aviate When an aircraft is in the air, the top priority of the RPIC must always be to aviate. That means to maintain (or regain) manual control of the aircraft.

(2) Navigate After ensuring they have control of the aircraft, the RPIC must navigate the aircraft to the safest location possible in accordance with the mission parameters. RPIC's must keep in mind that while this may be either LZ, or SAA, if the aircraft is unable to reach any of those locations safely, the RPIC must use their best judgement to land the aircraft in the safest manner possible considering the above priorities.

(3) Communicate Once the RPIC has positive control of the aircraft they should communicate the issue appropriately as laid out in this SOP. This may be done simultaneous to the navigate step above, but should not take priority over safe navigation or operation of the aircraft.

7-3 Specific Emergency Procedures

The following specific EPs reflect the most common emergencies encountered by sUAS operators. These EPs should be followed to the extent that they align with the priorities listed in Section 7-2.

7-3.1 Lost Communication (Lost Link)

***a.* Situation** Lost Link refers to the loss of C2 between the GCS and the sUAS during flight. This includes primary and backup telemetry, command uplink, or video downlink loss beyond a pre-established threshold. Lost link may be temporary or permanent and can occur in both VLOS and BVLOS operations. All aircraft participating in Project MARS flights must be pre-programmed with an appropriate Lost Link procedure and contingency route.

***b.* Detection and Initial Assessment** Lost Link is detected when:

- The GCS indicates telemetry or control signal interruption (e.g., ”No RC Signal,” ”Lost Telemetry”).
- The aircraft ceases to respond to manual inputs.
- A pre-set timeout value (e.g., 3 seconds for control link, 10 seconds for telemetry) is exceeded without recovery.

In the event the RPIC has detected a lost link, they shall immediately verify the condition by confirming:

- Power and antenna integrity at the GCS.
- System status on secondary displays or via secondary control links (if available).
- Possible sources of local interference or terrain obstruction.
- Power and antenna integrity at the GCS.
- System status on secondary displays or via secondary control links (if available).
- Possible sources of local interference or terrain obstruction.

***c.* Priorities** During a loss of communication with the aircraft, the RPIC's priorities are as follows:

(1) Ensure safety of personnel, airspace users, and infrastructure.

(2) Prevent airspace incursion outside the authorized corridor.

(3) Recover the aircraft safely to a pre-designated Rally Point or RTH location.

(4) Maintain accountability of payloads.

(5) Comply with FAA, DoD, and KACH safety policies.

***d.* Immediate Actions (All Flights)** After confirming a lost link, the RPIC should take the following immediate actions:

(1) Attempt manual link recovery within 30 seconds.

(2) If unsuccessful, monitor aircraft telemetry (if still available) and watch for the aircraft to perform programmed Lost Link behavior such as:

(i) Autonomous RTH

(ii) Loiter-and-Land

(iii) Navigation along a pre-programmed contingency route

(3) If the RPIC is not QP qualified, or higher, they will immediately notify a QP qualified person.

(4) Notify the Lead Operator.

(5) If aircraft is non-responsive and on unsafe trajectory, initiate termination protocol.

(6) Log time, location, telemetry status, and any deviation from planned route.

***e.* Autonomous Flight Mode Specific Considerations** During autonomous flight, a lost link presents less immediate risk than during direct pilot control, because the aircraft continues on its pre-programmed route without needing active input from the RPIC. However, lost link is an abnormal condition that may reflect other system problems. RPICs holding only AO qualification may not be fully prepared to deal with this situation and should immediately contact a qualified QP for assistance.

***f.* Manual Flight Mode Specific Considerations** In piloted operations (manual flight), a lost link is a critical emergency because the operator loses all command capability over the aircraft. The RPIC must remain calm while attempting to reestablish the link, and be prepared to take immediate action if the aircraft's trajectory becomes unsafe. If link cannot be restored quickly, the RPIC should be ready to execute an emergency landing or flight termination to prevent the sUAS from causing harm.

***g.* Reporting and Documentation**

(1) Loss of Link is not, in itself, a reportable mishap. In the event of a loss of link, the RPIC will log the time, location, telemetry status, and any deviation from planned route on their flight log, and report it to the Project MARS NCOIC.

(2) If loss of link leads to a reportable mishap, the RPIC will follow the instructions listed in Section 7-4.

***h.* Maintenance and Return to Service**

(1) The RPIC will perform a thorough inspection of the aircraft and ground control system after any lost link event, focusing on the C2 link equipment (antennas, transceivers) for faults or damage.

(2) All relevant flight logs and telemetry data should be reviewed to determine the cause of the lost link (e.g., radio interference, hardware failure, software glitch).

(3) Any identified issues must be corrected and verified on the ground (such as conducting a range test to ensure the control link is reliable) before the next flight.

(4) If the root cause cannot be determined or fixed immediately, the aircraft will remain grounded until evaluated by Maintenance Technician or the Project MARS Technical Lead for further guidance.

7-3.2 GPS / Navigation Failure

***a.* Situation** GPS / Navigation Failure describes loss or severe degradation of onboard positioning data in primarily autonomous flight. When satellite signals, inertial sensors, or magnetometers become unreliable, the aircraft may revert to inertial dead reckoning, drift off the programmed track, or enter conservative failsafe behavior without human intervention. Operators must be prepared to monitor telemetry, switch to alternate navigation modes, and (if available) prompt the aircraft toward a safe loiter or landing using minimal manual inputs.

b. **Detection and Initial Assessment** GPS / Navigation failure is detected by signs such as:

- The GCS issues an alert of positioning or sensor failure (e.g., ”GPS signal lost” or an abnormal increase in position error).
- The navigation solution becomes erratic or blank (for instance, the map display no longer updates the UAS's position accurately).
- The UAS deviates from its planned course or has difficulty holding a fixed position (indicating it may have reverted to an attitude hold mode or dead-reckoning).
- The number of GPS satellites or the quality of the GPS signal (as shown on the GCS) falls below the minimum required for reliable navigation.
- The RPIC or VO observes the aircraft drifting or not following waypoint commands as expected.

If a navigation failure is suspected, the RPIC will cross-check the aircraft's sensor status (e.g., verify satellite count and compass functionality) and confirm whether the autopilot has switched to any backup mode. Quick verification of these signs will help determine if immediate manual control is required.

c. **Priorities** During a navigation failure, the priorities are:

(1) Ensure the aircraft remains under control (stabilize its attitude and prevent uncontrolled drift).

(2) Keep the UAS within the authorized airspace and away from any populated or high-risk areas, even if precise navigation is lost.

(3) Attempt to regain accurate navigation capability by switching to backup systems or manual flight, as necessary.

(4) Navigate (as much as possible) toward a safe location where the aircraft can loiter or land, rather than continuing on the intended route without guidance.

(5) Communicate the situation to the crew and any relevant authority, and prepare for a possible mission abort.

d. **Immediate Actions (All Flights)**

(1) Immediately attempt to stabilize the aircraft by switching to a flight mode that does not depend on GPS (e.g., Attitude hold or full manual mode).

(2) If the aircraft is beyond visual range and manual control inputs are not effective, command the UAS into a stable holding pattern or hover (if the autopilot accepts such a command) to stop it from wandering.

(3) Use any available navigational cues (such as the UAS's last known heading or visual landmarks from the camera feed) to guide the aircraft toward the nearest safe landing area.

(4) Avoid relying on erratic or inaccurate GPS data; instead, control the aircraft using attitude references and apply minimal control inputs to prevent over-correction or loss of stability.

(5) If position control cannot be regained and the aircraft is in danger of leaving the safe area, be prepared to activate the flight termination system or intentionally bring the aircraft down in a known safe area to prevent greater harm.

(6) If the RPIC is not QP qualified, immediately contact a QP for assistance in managing the situation.

(7) Notify the Lead Operator of the navigation failure and the actions being taken.

(8) Once the aircraft is under control or on the ground, record the time, location, and nature of the failure in the flight log, along with any corrective actions executed.

e. **BVLOS Specific Considerations** A loss of navigation capability during a BVLOS mission is critical because the RPIC cannot visually monitor the aircraft's position. The RPIC must rely on any remaining telemetry (such as inertial data or compass heading) and preplanned contingency behaviors. BVLOS operations should include predefined responses to navigation failure (e.g., an automatic hover or altitude hold). If these do not engage or are ineffective, the mission must be aborted immediately. Without reliable position data, a conservative approach—such as initiating an immediate descent and landing in a safe known area—is preferred to letting the aircraft continue on an unknown path.

f. **VLOS Specific Considerations** In VLOS operations, the crew can visually observe the UAS and notice if it begins to drift or stray from course. The RPIC should switch to manual flight mode at the first sign of GPS failure and use visual references to pilot the aircraft back. The VO can assist by providing information about the aircraft's position and movement relative to the intended path. Flying without GPS (Attitude mode) requires constant attention to wind drift; the RPIC should execute a prompt landing as soon as practicable once stable control is achieved. If the RPIC cannot maintain control even with visual cues, they should immediately choose a safe area and land or terminate the flight to prevent the UAS from flying away.

g. **Reporting and Documentation**

(1) GPS / Navigation Failure by itself (with a safe recovery) is not a reportable mishap outside Project MARS. The RPIC will document the event in the flight log, noting the time, location, and any suspected cause (e.g., interference or sensor failure), and inform the Project MARS NCOIC.

(2) If the navigation failure results in an unauthorized airspace deviation, loss of the aircraft, or any injury/damage, then it becomes a reportable incident. The RPIC will follow the mishap reporting procedures in Section 7-4 (e.g., notifying the chain of command and filing necessary reports).

h. **Maintenance and Return to Service**

(1) Following a navigation failure, maintenance personnel will examine the UAS's navigation systems (GPS receiver, compass, inertial unit) for any faults. Any sensor recalibration or replacement must be completed before the next flight.

(2) The Project MARS Technical Lead should coordinate a ground test where the aircraft's GPS functionality is checked in a controlled environment to ensure proper signal reception and accuracy.

(3) If the failure was due to external factors, this information will be recorded. Future missions will avoid those conditions or locations if possible, or additional controls will be implemented.

(4) The aircraft shall not be returned to operational status until the navigation system is verified to be functioning normally and any risk of recurrence has been mitigated.

i. **Situation** Uncommanded Flight (Flyaway) refers to autonomous aircraft motion that diverges from the programmed mission without human input. Control system anomalies, corrupt waypoints, sensor faults, or malicious interference can cause unexpected climbs, turns, or speed changes while automation remains engaged. Crew members must quickly recognize such abnormal behavior, check if the autopilot still responds to override commands, and be prepared to switch to manual control or trigger flight termination if the aircraft cannot be contained within the safe area.

j. **Detection and Initial Assessment** Flyaway conditions are recognized by:

- The aircraft deviating significantly from its programmed flight path or waypoints without any commanded reason.

- Lack of appropriate response to control inputs (the RPIC commands changes, but the aircraft continues its own maneuver), indicating the autopilot may not be obeying commands.
- Telemetry data showing anomalous behavior (e.g., sudden uncommanded changes in altitude, heading, or speed) that does not match the mission plan.
- The VO visually observes the UAS maneuvering erratically or departing the designated operating area.

Upon noticing these signs, the RPIC should immediately attempt a positive control check by issuing a direct command (such as a new loiter command or altitude change). If the aircraft does not respond, this confirms a flyaway condition requiring immediate intervention.

k. **Priorities** During a flyaway emergency, the RPIC's priorities are:

(1) Ensure the safety of any persons both in the air and on the ground by steering or forcing the errant aircraft away from populated or sensitive areas.

(2) Contain the aircraft within the designated operational airspace if possible; prevent it from entering uncontrolled or unauthorized airspace.

(3) Regain positive control of the aircraft (via manual override or other means) or reduce its energy (altitude/speed) to minimize potential damage if it must come down.

(4) Maintain situational awareness of the aircraft's trajectory and continuously evaluate potential impact points so warnings can be given or areas cleared if necessary.

(5) Prioritize retrieval of the aircraft and any attached payload once the situation is stabilized, but only after safety of life and property is assured.

(6) Comply with notification requirements (for example, inform ATC or local authorities if the aircraft departs the approved area or poses a wider hazard).

l. **Immediate Actions (All Flights)**

(1) Attempt to override the errant flight behavior by switching the UAS to a manual or emergency flight mode (e.g., toggle from autonomous to manual control).

(2) If the aircraft does not respond to control inputs, activate any available flight termination system or emergency recovery mechanism (such as a kill-switch to cut power or a parachute deployment, if equipped) to immediately stop the flyaway.

(3) If partial control is regained, stabilize the aircraft and command an immediate landing at the nearest safe location (do not attempt to continue the mission).

(4) Continue to monitor the aircraft's position via telemetry and visually (if possible), and be prepared for further contingencies if it approaches populated areas or leaves the operations area.

(5) If the RPIC is not QP qualified, they will immediately notify a QP-qualified team member of the situation and seek assistance.

(6) Communicate the emergency to all crew members~~crewmembers~~[claude] and, if applicable, to air traffic control or range control, especially if the UAS is leaving the intended operating area.

(7) Notify the Lead Operator as soon as practicable that a flyaway is in progress and report the actions being taken.

(8) After the aircraft has been recovered or comes to rest, record the last known flight path, approximate duration of the flyaway, and any control actions attempted in the flight log.

m. **BVLOS Specific Considerations** In a BVLOS scenario, a flyaway is especially dangerous because the aircraft can travel far beyond the visual range of the crew. BVLOS operations typically have engineered mitigations (like geo-fences and automatic flight termination triggers) to contain a flyaway. The RPIC must quickly determine if an onboard contingency (such as an automatic RTH or preset termination) has activated. If not, the RPIC should manually trigger flight termination or immediate landing as outlined in the mission's BVLOS emergency plan. The RPIC or another crew member will promptly notify ATC or any controlling agency that the UAS is no longer adhering to its clearance and provide the last known coordinates and altitude. Tracking the aircraft via any available means (radar, telemetry, visual observers along the route) is crucial; if telemetry is lost entirely, the crew should relay the last known position and heading to local authorities to aid in public safety and recovery efforts. BVLOS missions require this scenario to be pre-briefed, and often a dedicated "containment area" or procedure is in place to minimize risk if a flyaway occurs.

n. **VLOS Specific Considerations** During VLOS operations, the flight crew can visually track the aircraft if it begins to fly away, which aids in responding to the emergency. The VO will immediately alert the RPIC to the erratic behavior and keep the aircraft in sight. The RPIC may try repositioning themselves or the control antenna to improve the link quality, and if possible, even move (on foot or by vehicle) to follow the aircraft and maintain line-of-sight/communication. The crew should use visual orientation to gauge how the aircraft is moving; if it is heading toward people or property, they must warn those at risk (e.g., by shouting or using any available communication) and ensure the aircraft is brought down away from them. Visual contact also aids in locating the aircraft once it lands or crashes. Once the flyaway has ended, the crew will use their visual observations to assist in recovering the aircraft and analyzing the incident.

o. **Reporting and Documentation**

(1) Any uncommanded flyaway event is treated as a serious incident. The RPIC must report the flyaway to the Project MARS NCOIC as soon as possible after regaining control or after the aircraft is lost. Details such as the duration of loss of control, approximate flight path, and how/where the aircraft was recovered (or where it went missing) will be logged.

(2) A flyaway that results in the aircraft leaving the approved airspace, being lost, or causing damage or injury is a reportable mishap. In such cases, the RPIC will follow Section 7-4 procedures (e.g., immediate chain-of-command notification and formal reporting). If the flyaway was quickly contained with no damage, it will still be documented internally for safety review and future prevention.

p. **Maintenance and Return to Service**

(1) After a flyaway incident, the aircraft will not be returned to flight until a thorough investigation and remediation are completed. Maintenance and engineering personnel will analyze the flight logs and autopilot data to identify the root cause of the uncommanded flight (whether a software anomaly, sensor failure, control link issue, etc.). External support (such as contacting the autopilot manufacturer or consulting engineering experts) may be involved if needed.

(2) The UAS will undergo a full inspection. Any components suspected of contributing to the flyaway—such as faulty GPS units, flight controllers, or actuators—must be repaired or replaced. The airframe, propellers, and motors will also be checked for stress or damage resulting from any extreme maneuvers or a hard landing/termination.

(3) If a software or configuration error is identified, updates or corrections will be applied and tested in a controlled setting (e.g., a ground simulation or tethered flight) before attempting normal flight again. Similarly, if a hardware fault is found, the fix or new component will be verified.

(4) The aircraft must successfully pass a test flight (preferably under VLOS conditions) demonstrating normal operation and control responsiveness prior to being cleared for operational missions again.

(5) The Project MARS OIC will approve return to service only after reviewing the findings of the flyaway investigation and the corrective actions taken, ensuring confidence that the issue has been resolved.

7-3.3 Intrusion of Local Airspace

a. **Situation** Intrusion of Local Airspace occurs when an uncooperative aircraft enters the RWC volume around an autonomously flown sUAS. Unexpected manned or unmanned traffic may appear without prior coordination, penetrate the RWC volume from any direction, and present an immediate midair collision risk while automation remains engaged. Operators must watch for DAA or geofence alerts and issue prompt reroute or hold commands to increase separation from the intruder. They must also be prepared to assume manual control or execute termination protocols if the collision risk cannot be adequately mitigated.

b. **Detection and Initial Assessment** An intruding aircraft may be detected through:

- Visual observation by the VO or RPIC of an aircraft (manned or another drone) approaching or entering the operating area.
- Electronic alerts from DAA systems (e.g., ADS-B based traffic alerts or radar) indicating an aircraft in proximity to the UAS.
- Geofence breach warnings if the intruding aircraft triggers any virtual boundary alarms set around the operation.
- Notification from air traffic control or other pilots (e.g., a radio call about unexpected traffic in the vicinity).

Once an intruder is detected, the RPIC will immediately assess its relative position, altitude, and direction. This rapid assessment determines if an immediate avoidance maneuver is required (for example, descending or turning to increase separation).

c. **Priorities** In the event of an airspace intrusion by another aircraft:

(1) Yield right-of-way to the intruding aircraft to avoid collision, even if that means abandoning the mission route.

(2) Aviate (maintain safe separation): execute any necessary maneuvers to increase distance from the intruder while keeping the UAS under control.

(3) Navigate to safety: if needed, move the UAS to a predefined safe location or altitude (for example, descend to a minimum loiter altitude) to deconflict with the intruder.

(4) Communicate: alert the crew (“Traffic intrusion, taking evasive action”) and, if possible, broadcast on relevant aviation frequencies or inform ATC about the UAS’s evasive actions.

(5) Only after the intruding aircraft has cleared out and the airspace is confirmed safe should the mission resume or continue. Avoiding a mid-air conflict takes absolute precedence over mission objectives.

d. **Immediate Actions (All Flights)**

(1) Immediately perform an avoidance maneuver. In most cases, the safest initial action is to descend the UAS to a low altitude well below the intruder’s flight path, or land immediately if a safe landing spot is available.

(2) If descending alone is insufficient (for example, the intruder is a low-flying helicopter), execute a lateral maneuver to increase separation (e.g., move the UAS to a known safe hold area away from the intruder’s projected path).

(3) If equipped with a radio or other comms, broadcast the UAS operation’s status and location (e.g., “Unmanned aircraft at [location], descending due to traffic”) on common traffic advisory frequencies, or notify ATC, to warn the intruder pilot.

(4) Activate all available anti-collision measures: ensure the UAS's strobe/lighting is on (to maximize visibility) and position the UAS in a way that minimizes the risk (for example, orient it to move away from the intruder).

(5) If a collision appears imminent and avoidance maneuvers are not sufficient, initiate flight termination to eliminate the risk of mid-air collision. It is better to sacrifice the UAS than allow any chance of a mid-air collision with a manned aircraft.

(6) Once clear of the conflict, recover the UAS to a safe state (either resume the mission if authorized or land) and then communicate to the crew that the immediate airspace threat has passed.

e. **BVLOS Specific Considerations** In BVLOS operations, detecting intruding aircraft relies on technology and coordination with air traffic services since the crew cannot see the entire area. All BVLOS missions have predefined contingency plans for airspace intrusions. Upon receiving a DAA alert or notification from ATC of an approaching aircraft, the RPIC should immediately execute the planned avoidance maneuver (such as an immediate descent or turn to a safe heading) without waiting for visual confirmation. The RPIC must also notify ATC (or the controlling authority) that the UAS is deviating from its course due to conflicting traffic. Without visual contact, the RPIC should assume worst-case proximity and act conservatively—e.g., land or terminate the flight if unsure of sufficient separation. BVLOS crews maintain open communication with air traffic control during operations for this reason and should be prepared to report any off-nominal intrusions in real time.

f. **VLOS Specific Considerations** In VLOS operations, the VO and RPIC are actively scanning the sky for intruding aircraft. At the first sight or sound of another aircraft nearby, the VO will call it out (e.g., "Traffic above us, knock it off!"), and the RPIC will immediately respond by yielding: typically descending to a very low altitude or landing as quickly as possible. The crew practices these responses; for example, in training they simulate an intruder scenario where the RPIC must immediately drop to minimum altitude and hover until given the all-clear. The VO continues to monitor the intruder and provides updates ("intruder passing, still to our north") so the RPIC knows when it's safe. Once the intruding aircraft has gone and the VO confirms the airspace is clear, the RPIC can resume the mission. This visual see-and-avoid capability is the primary safety net in VLOS operations and is used decisively to prevent any close calls.

g. **Reporting and Documentation**

(1) An airspace intrusion that is resolved without incident is not an externally reportable mishap. However, the RPIC will document the encounter in the flight log, including the time of intrusion, type of intruding aircraft (if known), and the avoidance action taken. The Project MARS NCOIC should be informed during the post-flight debrief.

(2) If the intrusion resulted in a near mid-air collision situation or caused the UAS to deviate significantly from its cleared airspace, the Project MARS OIC may direct that a formal incident or hazard report be filed in accordance with aviation safety protocols. All available data (telemetry, any video) should be preserved for analysis.

(3) Lessons learned from the incident will be incorporated into future mission planning and briefs. For example, the team might establish a larger buffer or improve communication with local airfield managers if an intruder came from a known nearby airstrip.

h. **Maintenance and Return to Service**

(1) If the UAS performed an abrupt evasive maneuver (such as a sudden dive or climb) to avoid an intruder, it will undergo a post-flight inspection. Critical components (propellers, motors, airframe joints) will be checked for any signs of stress or damage. In particular, the battery and power system will be examined since rapid maneuvers can cause voltage sag or spikes.

(2) In the absence of any physical contact or collision, no special maintenance is typically required beyond this inspection. If no issues are found, the UAS can be returned to service for the next mission.

(3) Nonetheless, the maintenance team and operators will review whether the UAS's DAA systems functioned as intended. Any necessary adjustments (for example, tuning geofence parameters or updating firmware for traffic alerts) will be made before the next flight to enhance the system's response to potential intrusions.

7-3.4 Ground Risk Incursion

***a.* Situation** Ground Risk Incursion occurs when an unauthorized person, vehicle, animal, or other object unexpectedly enters the designated operational area (such as the takeoff/landing zone or a delivery drop zone) while the UAS is in flight. These incursions can happen with little or no warning, often during takeoff or landing phases, and pose a serious hazard because the UAS could collide with an uninvolved person or object on the ground. Even with perimeter security and clear announcements, bystanders or vehicles might inadvertently encroach on the flight area. In such an event, the crew must be ready to immediately alter the flight plan, pause or abort the mission, and prioritize ground safety over mission objectives.

***b.* Detection and Initial Assessment** Ground incursions are typically detected by:

- Visual observation by the RPIC, VO, or other crew members~~crewmembers~~[claude] of a person, vehicle, or animal entering the restricted operating area.
- Alerts or calls from support personnel (e.g., a team member positioned near a landing zone~~LZ~~[claude]) indicating that an unauthorized entry has occurred.
- Onboard camera feed showing an unexpected object or person in the vicinity of the UAS's intended flight path or landing point.

Once a ground incursion is noticed, the RPIC (or any crew member~~crewmember~~[claude]) should immediately assess the position and movement of the intruder relative to the UAS. Key considerations include whether the UAS is on approach to that area, how much time is available to react, and what evasive action will best protect both the person and the aircraft.

***c.* Priorities** In the event of a ground risk incursion:

(1) Protect human life on the ground above all else. Cease or modify any UAS operation that would put the intruding person or bystanders at risk.

(2) Aviate: maintain control of the UAS and avoid sudden, erratic maneuvers that could lead to loss of control. Be prepared, however, to execute an immediate evasive maneuver (such as an emergency climb or hover hold) to prevent the UAS from coming into contact with the intruder.

(3) Navigate: move or hold the aircraft in a safe location away from the intruder. For example, abort the landing and climb to a safe altitude to loiter until the ground area is clear, or divert to a predefined alternate landing site if necessary.

(4) Communicate: alert the crew by calling out the ground hazard (e.g., "Ground incursion, aborting landing!") so everyone is aware. If possible, have a team member or security personnel on the ground communicate with or intercept the intruding person to keep them safe and clear of the area.

(5) Once ground safety is re-established (the area is confirmed clear), only then consider resuming the mission or proceeding with landing. Mission continuation is secondary to preventing harm from ground hazards.

***d.* Immediate Actions (All Flights)**

(1) If the UAS is on final approach to land and a person or obstacle is spotted in the landing zone ~~LZ~~[claude], immediately execute a go-around or climb to a hover at a safe altitude. The landing should be aborted without hesitation.

(2) If a payload drop is imminent and the drop zone is compromised, cancel or delay the release. Do not drop any items until the ground area is verified clear.

(3) If the UAS is in the process of takeoff and an incursion occurs (for example, a vehicle crossing the takeoff path), abort the takeoff. If the aircraft is still on the ground, do not lift off~~take off~~[claude]; if it has just lifted, land it straight back down if able, or hover at a low safe altitude until the area is clear.

(4) Establish the aircraft in a safe holding pattern or hover away from the incursion point (e.g., hold at least 50 ft above and offset from the affected area) while monitoring the intruder's position.

(5) If crew members~~crewmembers~~[claude] are available, have one attempt to warn or guide the intruder away from the danger (shout, wave, or approach if it can be done safely) while the RPIC keeps the UAS clear.

(6) Consider utilizing an alternate landing zone~~LZ~~[claude] if one has been designated and it is known to be clear. This can shorten the time the UAS must remain airborne with low battery or other constraints.

(7) If the RPIC is not QP qualified, immediately inform a QP of the situation and follow any instructions given.

(8) Notify the Lead Operator that a ground hazard has occurred and that the operation is on hold or terminating.

(9) Maintain the holding pattern until the area is confirmed clear by visual inspection or communication from ground personnel. Once clear, the RPIC can resume the mission or land as appropriate.

(10) After the flight, document the incursion, including the time, duration, description of the intruder (person, vehicle, etc.), and the actions taken by the crew to resolve it.

e. **BVLOS Specific Considerations** In BVLOS operations, ground risk incursions at remote sites are mitigated by having local support personnel or observers whenever possible. If an unexpected person or vehicle is reported at a remote landing or drop site, the RPIC should immediately hold the UAS in a safe airborne position (e.g., circle or hover at a designated safe altitude) and await confirmation that the area is clear. BVLOS missions should include pre-briefed alternate landing sites along the route; if the primary site remains compromised, the RPIC can divert the UAS to an alternate location that has been deemed safe for landing. Communication with on-site personnel (via radio or phone) is critical: the RPIC must rely on them to evaluate and resolve the ground incursion since they have eyes on the situation. If no on-site personnel are present and a ground incursion is suspected (for example, detected via camera or other sensors), the default action is to abort the mission's landing or drop segment—either holding in the air or returning to base—rather than risking an unattended landing in a potentially unsafe area.

f. **VLOS Specific Considerations** In VLOS operations, the crew can directly see and often hear individuals or vehicles near the operation area. The VO should continuously scan not just the airspace but also the ground around the operating area for any encroachment. At the sight of a ground intruder, the VO will call it out (e.g., "Person in the landing zone!"), and the RPIC will immediately take evasive action (abort landing, climb and hold position). Because the crew is on site, they can also directly interact with the intruder: a team member can approach the individual (if it can be done safely) to inform them of the ongoing operation and keep them at a safe distance. The RPIC should keep the UAS high enough and away from the person until receiving a clear signal that the area is secured. Once the intruder is at a safe distance or removed, and the crew has verified the zone is clear, the RPIC may continue the operation or land the UAS. VLOS crews benefit from being on the scene—decisions and adjustments can be made rapidly based on actual visual conditions, which greatly aids in safely handling these situations. They should always prioritize a controlled hover or diversion over trying to rush a landing when any person is near the landing area.

g. **Reporting and Documentation**

(1) Ground incursions that do not result in any injury or damage are generally not reportable outside the unit. However, the RPIC will record the incident in the flight log and inform the Project MARS NCOIC during the debrief, especially if the incursion was a close call or caused an abort.

(2) If an unauthorized person came dangerously close to being struck, or if the UAS had to be intentionally brought down to avoid a person, the incident may be elevated to a formal safety incident report per the chain of command's protocols.

(3) Regardless of the outcome, the details of the event (who/what caused the incursion, where and when it happened, and why it was not prevented) should be analyzed by the team. Preventive measures—such as improved site security, additional signage, or extra observers—may be adopted to reduce the likelihood of similar incursions in the future.

***h.* Maintenance and Return to Service**

(1) If the incursion was managed without any physical contact or extreme maneuvers by the UAS, only standard post-flight checks are necessary. The aircraft can be turned around for the next operation once routine inspections (battery levels, motor health, airframe condition) are completed.

(2) If the UAS performed any abrupt or high-stress maneuvers to avoid a ground hazard (for example, a sudden full-throttle climb or rapid braking action), a targeted inspection is warranted. Crew should examine propellers for nicks, motor mounts for any shifts, and measure the battery temperature to ensure it wasn't overheated by a surge in current draw.

(3) Provided no anomalies are detected, the UAS can return to service immediately. If any wear or damage is observed (even if minor), maintenance will replace or repair the affected components. A brief functional test or test flight might be conducted if a repair was made, to ensure all systems function correctly before the next mission.

7-3.5 Unsafe Weather / Knock-it-Off

***a.* Situation** Unsafe Weather / "Knock-it-Off" refers to any situation where environmental conditions deteriorate beyond safe limits or any emergent hazard prompts an immediate cessation of the mission. Common weather triggers include thunderstorms (lightning), high winds or gusts exceeding the UAS's capability, heavy rain or snow, icing conditions, or sudden loss of visibility (fog). In such cases, any crew member may call "Knock it Off," which is a directive for all participants to halt the operation and focus on safety. Upon a "Knock it Off" call due to weather or other hazards, the RPIC must immediately prioritize securing the aircraft (aviate), navigating it out of danger (navigate), and communicating the situation (communicate) to the crew and any relevant authority. No mission objective is worth continuing flight into unsafe weather.

***b.* Detection and Initial Assessment** Indicators of unsafe weather or conditions requiring a "Knock it Off" include:

- Sudden onset of precipitation or lightning in the vicinity of the operation.
- Wind gusts or sustained winds that exceed mission limits or cause the UAS difficulty in maintaining position/track.
- Visibility dropping below required minimums (e.g., the RPIC/VO loses sight of the UAS due to fog, heavy rain, or dusk conditions beyond what was planned).
- Unforecast severe weather cells approaching on radar or visually (dark thunderclouds, dust storms, etc.).
- Any crew member's~~crewmember's~~[claude] judgment that conditions have become unsafe (this could include non-weather factors, such as another concurrent safety issue—when in doubt, they call "Knock it Off").

Upon noticing any of these signs, the crew should immediately compare the observed conditions to the mission's safety criteria. If any limit is exceeded or imminent (e.g., lightning within a predetermined radius, wind above threshold), a “Knock it Off” will be declared. The RPIC quickly evaluates the UAS’s current state (battery level, position relative to home or alternate landing sites) and decides on the safest immediate course of action (return to home, land immediately at current position, etc.).

***c.* Priorities** In an unsafe weather or “Knock-it-Off” situation:

(1) Preserve life and safety: ensure crew members~~crewmembers~~[claude] and bystanders are not put at risk by the operation (for example, cease flight before a lightning storm arrives, so no one has to handle electronics outside during lightning).

(2) Aviate: maintain control of the aircraft despite deteriorating conditions. This may involve slowing down, switching to a more stable flight mode, or temporarily climbing above turbulence.

(3) Navigate: immediately direct the aircraft toward the safest possible location (usually back toward the launch/recovery point or a known safe landing area) while avoiding known weather hazards (like storm cells or high winds over ridges).

(4) Communicate: clearly announce the abort (“Knock it Off - unsafe weather”) so that all crew acknowledge it. If applicable, inform any air traffic control or other agencies that the mission is terminating early due to weather.

(5) Safeguard equipment secondary to safety: while protecting the UAS and payload is desirable (e.g., avoiding rain damage by landing under cover), such concerns are secondary to a controlled landing. If needed, the UAS can be sacrificed to avoid greater harm (e.g., ditching it in a field if that means avoiding an out-of-control descent near people).

***d.* Immediate Actions (All Flights)**

(1) Immediately acknowledge the ”Knock it Off” call. The RPIC discontinues any mission task (such as waypoint following or payload operation) and takes direct control if not already in manual control.

(2) If the UAS is beyond the immediate vicinity, initiate an expeditious return-to-home (RTH) or navigate to the nearest safe landing area. Do not wait—begin the recovery while sufficient battery and options remain.

(3) If weather conditions are rapidly worsening (e.g., an approaching thunderstorm or sudden extreme winds), consider an immediate precautionary landing at the current location or a closer site rather than attempting to reach the original destination. A controlled landing in a safe open area is preferable to losing the aircraft in flight.

(4) In multi-UAS operations, deconflict the aircraft during the abort: for example, assign each UAS a specific loiter altitude or landing order to prevent them from interfering with each other as they all seek to land quickly.

(5) Adjust flight parameters for safety: reduce altitude (to get out of turbulent conditions aloft), reduce speed (to lessen wind stress), and avoid any aerobatic or aggressive maneuvers. If rain is present, fly the UAS as level as possible to keep water out of sensitive areas and be gentle on the controls to avoid water-induced instability.

(6) Ensure ground crew take appropriate actions: for instance, have someone ready with a dry landing pad or catch net if the ground is muddy, and have personnel move to safe positions (under shelter if lightning is in the area). No one should be holding antennas or standing on high ground during lightning risk.

(7) If the RPIC is not QP qualified and feels overwhelmed by the conditions, they should immediately ask a QP (if one is present) to take over or assist.

(8) Notify the Lead Operator that the flight is aborting due to weather and keep them updated on where and when you intend to land.

(9) Once the aircraft is on the ground, quickly secure it (motors off, power down) and move it to a safe area if the weather threat continues (e.g., get it out of the rain or away from an open field in lightning).

(10) After the situation is stabilized, record the weather conditions and timing (e.g., "mission aborted at 14:32 due to gust front arrival") in the flight log for documentation.

***e.* BVLOS Specific Considerations** In BVLOS missions, weather assessments rely heavily on forecasts, onboard sensors, and any available remote observers. BVLOS operations should not commence without acceptable weather forecasts for the entire route and duration, but unexpected weather can still arise. The RPIC should continuously monitor weather data like ground station readings (temperature, wind) and any telemetry from the aircraft (such as wind estimation or airspeed trends) for signs of degrading conditions. At the first hint of unsafe weather along the route or at a remote destination (e.g., the remote site reports high winds or the aircraft's battery is draining faster than normal due to cold), the RPIC should call "Knock it Off". The aircraft's autonomy may have a built-in weather abort: for instance, if wind exceeds a threshold, it might automatically RTH. The RPIC must be ready to manually command an abort if those systems don't trigger. BVLOS flights typically have contingency landing spots; the RPIC will choose the nearest one that keeps the aircraft and public safe. They will also communicate with any remote personnel (e.g., a field team at the destination) to let them know of the abort. If ATC or a flight following service is involved in the BVLOS mission, notify them of the early termination due to weather. Ultimately, because visual confirmation of conditions isn't possible, BVLOS pilots should be highly conservative regarding weather: if in doubt, get the aircraft on the ground.

***f.* VLOS Specific Considerations** In VLOS operations, the crew can directly observe weather conditions and feel their effects. The RPIC and VO should continuously monitor the sky for developing clouds, changes in wind (like dust picking up or trees swaying harder), and other signs like distant lightning or thunder. If any crew member voices concern about the weather, that alone can justify a "Knock it Off"—better to be safe and land than push it. Once "Knock it Off" is called, the RPIC should immediately bring the UAS back toward the home point. Since the aircraft is nearby, often a prompt landing can beat the arrival of the worst conditions. The crew should have a plan for sudden weather: for example, if rain starts, have a towel or case ready to cover the UAS once it's recovered; if lightning starts, everyone knows to not handle antenna masts and to get indoors after the UAS is secured. Because VLOS flights are usually shorter range, there's usually no need for alternate sites—returning to launch and landing quickly is typically feasible. The RPIC may perform a slightly expedited landing (faster descent than normal) to minimize time in adverse conditions, but must balance that against maintaining control. Practice in handling the UAS in wind and light rain (if allowable) can build confidence for the real scenario, but ultimately in VLOS operations the philosophy is: at the first sign of trouble, get it down.

***g.* Reporting and Documentation**

(1) Aborting a flight due to unsafe weather or a "Knock it Off" call is not considered a mishap; it is a prudent decision. The RPIC will note in the flight log that the mission was terminated early due to weather, including the specific cause (e.g., "terminated due to lightning within 5 NM" or "wind exceeded limit"). This entry helps the team in later analysis and in refining weather minimums or decision points.

(2) The Project MARS NCOIC should be informed of the abort as part of the normal flight operations reporting (so they are aware the mission did not complete as planned). This is generally for situational awareness; no external reporting is required when a mission is safely aborted without incident.

(3) If the weather event caused any damage (for example, the UAS was forced into a hard landing by a gust and got banged up, or equipment was damaged by weather exposure), then appropriate maintenance actions will be taken and, if necessary, an incident report may be generated per Project MARS guidelines. Otherwise, the abort is simply documented and the mission can be attempted again when conditions improve.

***h.* Maintenance and Return to Service**

(1) After an unsafe weather abort, the UAS should be inspected for any weather-related effects. If it flew through precipitation, it must be dried off and sensitive components (like electronics and vents) checked for moisture. Any water ingress should be addressed (drying, use of electronics-safe cleaner) before next use.

(2) If the aircraft experienced strong turbulence or wind stress, check all mechanical connections, propellers, and control surfaces for signs of stress (e.g., loose screws, hairline cracks). Also verify that the GPS and compass are still calibrated—severe magnetic disturbances (like nearby lightning) can sometimes upset sensors.

(3) The battery should be examined if heavy current draw was needed during the abort (high throttle to fight wind can heat the battery). Ensure the battery is cool, at a safe voltage, and undamaged. Recharge it slowly to balance cells if it was heavily taxed.

(4) Any components found to be adversely affected (water damage, loosening, etc.) must be repaired or replaced. Once maintenance is done, the UAS can be returned to service. If substantial repairs were needed, a brief test flight in benign conditions is recommended to ensure all systems function properly before the next mission.

7-3.6 Low Battery Emergency Landing

a. **Situation** Low Battery Emergency Landing is triggered when an autonomously flown aircraft forecasts insufficient power to complete the programmed mission safely. Accelerated discharge, cell imbalance, or temperature-induced capacity loss may reduce available endurance without human inputs to conserve energy. The automation may command aggressive power-saving modes, altitude reductions, or immediate descent; operators should supervise these transitions, select the nearest safe landing area, and provide minimal manual guidance only as needed to ensure a controlled touchdown before critical levels are reached.

b. **Detection and Initial Assessment** Low battery conditions are detected by:

- On-screen alerts from the GCS indicating the battery has reached predefined low or critical levels (for example, “Battery Low – 30%” and “Battery Critical – 15%” warnings).
- Autopilot behavior such as initiating an RTH or hovering in place because it calculates insufficient battery to continue the mission.
- Observable difficulty maintaining performance: for instance, the UAS might struggle to climb or hold altitude, signaling that battery voltage is dropping to a critical point.
- The RPIC noticing an abnormally rapid drop in battery percentage or voltage on the telemetry readout.

When a low battery warning occurs, the RPIC should immediately cross-check the remaining battery percentage and voltage against the distance/altitude of the UAS. They must quickly determine if the UAS can safely return to the planned recovery site or if an immediate landing at a closer location is required. Initial assessment includes factoring in wind (a strong headwind can drastically reduce range on low battery) and any available power reserve.

c. **Priorities** When facing a low battery emergency:

(1) Aviate: maintain stable flight and avoid panic inputs. Fly smoothly to conserve what power remains (rapid throttle changes or fighting the wind aggressively can accelerate battery drain).

(2) Navigate: head for the closest safe landing zone~~LZ~~[claude] immediately. This could be the launch point or a known emergency landing site – whichever the UAS can reach with the remaining battery. If the original LZ is too far, be prepared to land short in a safe open area rather than attempting to stretch the glide.

(3) Communicate: inform the crew (“Low battery – landing ASAP”) so ground personnel can prepare the landing area (clear people away, be ready to recover the aircraft). If operating in controlled airspace, advise ATC that you are performing an emergency landing due to low battery to let them know of the deviation.

(4) Preserve the aircraft if possible: it’s better to land under control with a few percent of battery left than to overfly and have the battery die mid-air. Do not continue any mission task—focus only on landing. Payload

jettison is generally not necessary unless dropping it would significantly increase safety and is part of an approved emergency procedure.

(5) Mission priority is suspended. The only goal is a safe landing before the battery is exhausted.

d. **Immediate Actions (All Flights)**

(1) Acknowledge the low battery alert and immediately terminate the mission segment. Command an immediate return-to-home~~RTH~~[claude] or navigate to the nearest safe landing site without delay.

(2) If possible, reduce power consumption: for example, if the UAS has adjustable speed, slow down to an efficient cruise (unless a strong headwind makes speed necessary). Turn off or minimize use of any unnecessary equipment (like additional lights or payload devices) to save power.

(3) Initiate a gentle, continuous descent toward the chosen landing area while you still have a safe power margin. Aim to have the aircraft on the ground while a small reserve (e.g., 10% battery) remains, rather than riding the battery down to 0%.

(4) Monitor the battery voltage as well as percentage; in cold or high-load situations, voltage can drop suddenly. If the voltage approaches the minimum safe level, prepare to land immediately, even if that means landing off-airfield in an open spot directly below.

(5) Be ready to assume manual control if the autopilot's low-battery behavior isn't optimal. Some systems will auto-land vertically when critical; if that auto-land is targeting an unsafe spot (water, trees), override it and steer the aircraft a short distance to a safer touchdown point.

(6) Communicate the emergency: announce to the team that an emergency landing is in progress due to low battery. Ensure the landing zone (or intended touchdown area) is clear of people and obstacles. If an alternate site is used, direct a team member (if available) to move to that location for recovery and security of the aircraft.

(7) Once the aircraft is on the ground, quickly deactivate the motors and power system. A critically low battery can sometimes swell or overheat; removing the battery from the aircraft (if feasible) and placing it in a safe, ventilated area is wise as a precaution.

e. **BVLOS Specific Considerations** In BVLOS missions, careful battery management is planned, but unforeseen factors (like an unexpected headwind or hovering longer than planned) can lead to a low battery situation. The RPIC should design the route with contingency landing points. At the first sign of insufficient battery to continue, the RPIC will divert the UAS to the closest predetermined landing site or a safe unplanned site if necessary. Because the aircraft is beyond sight, the RPIC must rely on telemetry to judge battery and distance. Modern autopilots often estimate if the battery is enough to get home; if the estimate shows negative margin, the RPIC must land immediately at the nearest safe location. BVLOS often involves notifying authorities of off-nominal landings (since you might land outside the original area): if time permits, inform ATC or any authority tracking the flight that you are putting the UAS down early due to low battery and give coordinates. BVLOS UASs sometimes have higher battery redundancy or reserve, but the principle remains: do not push the limits. Additionally, if the BVLOS mission has a remote crew at the landing site (e.g., to retrieve a package), communicate with them to expect an emergency landing and ensure the area is clear. Finally, after recovery, perform a quick check: a severely depleted battery can be a safety hazard (risk of fire), so treat it carefully during transport from a remote site.

f. **VLOS Specific Considerations** In VLOS operations, responding to a low battery is more straightforward due to close proximity and direct line-of-sight. At the first low battery warning, the RPIC should immediately head back to the launch point or a known safe landing area that's within sight. Because distances are short, an UAS under VLOS can usually be recovered quickly. The RPIC can also visually gauge how the aircraft is performing—if it's struggling against wind or slowing down, that's a sign to get it down sooner. If the battery becomes critical when the UAS is still a bit away, the RPIC may choose to land it in a safe open area within sight rather than risk it shutting off in mid-air. The VO can assist by guiding the RPIC to any nearby clearing if needed. VLOS drones often have some failsafe like auto-land at critical battery; the RPIC must be prepared to override if that auto-landing would occur in a suboptimal spot (for instance, over water or trees)—instead, command it to a better area or catch it (if it's a small drone and that technique is practiced). Because VLOS typically implies one is in a controlled environment (e.g., a test field), the main focus is simply executing the landing promptly and safely. The crew should practice low-battery drills (like sudden "battery low, land now" scenarios) so that in real cases their reactions are immediate.

g. **Reporting and Documentation**

(1) A low battery emergency landing, by itself, is not a reportable mishap externally as long as it concludes without damage or injury. The RPIC will note the event in the flight log, including the battery percentage/voltage at landing, the estimated remaining flight time or distance if available, and what actions were taken (e.g., "initiated RTH at 25%, landed with 8% remaining"). This helps evaluate whether procedures need adjustment (for example, maybe the initial warning threshold should be set higher).

(2) The Project MARS NCOIC should be informed that the mission was cut short due to low battery as part of the normal operational reporting. If the cause of the low battery condition was something avoidable (such as launching with an undercharged battery or unexpected payload weight), that will be addressed in crew debriefs.

(3) If the low battery situation resulted in a landing off the intended site or any unintended outcome (like a hard landing or minor damage), then internal incident reports will be filed accordingly. Such instances are also used as training case studies to improve energy management in future flights.

h. **Maintenance and Return to Service**

(1) After a low battery emergency, special attention must be given to the battery involved. If it was drained below its safe discharge level or if any cell readings were very low, that battery may be damaged or degraded. Maintenance will perform a capacity test and cell health check on the battery. It may be removed from service if it shows signs of puffing, imbalance, or significant capacity loss.

(2) Inspect the power system of the UAS as well. Sometimes a low battery incident might be caused or exacerbated by a failing component (for example, a motor drawing excessive current due to a bad bearing). Check motors, ESCs (electronic speed controllers), and wiring for any signs of overheating (discoloration, smell) that might indicate why power consumption was higher than expected.

(3) If the UAS performed an auto-land or was landed quickly in suboptimal conditions, examine the airframe for any stress. A rapid descent and landing might put more strain on the landing gear or fuselage; ensure nothing is cracked or bent.

(4) Address any issues found: replace any suspect motors or electronics, and certainly replace the battery if there is doubt about its reliability. Before returning to normal operations, it's advisable to do a short test flight with a fresh battery to confirm that the UAS is behaving normally and that the telemetry properly reflects battery levels.

(5) Going forward, consider adjusting mission plans or battery reserve thresholds if this event revealed that the prior margins were insufficient. The Project MARS OIC and maintenance officer may set a higher minimum battery reserve for future flights as a corrective measure.

7-4 Accident/Incident Reporting

a. Standard operations of the UAS may involve flight termination within the operating area. Nominal operations may result in mid-air collisions between Project MARS UAS within the operating area, which may cause components to break. These events do not constitute mishaps that are reportable outside the Project MARS chain of command. Reportable mishaps include:

(1) Flight outside approved airspace

(2) sUAS operations leading to injury

(3) sUAS operations leading to damage to property not involved with Project MARS.

b. In the event of a reportable mishap, crash, vehicle accident, or injury all Project MARS sUAS are immediately grounded until cleared by the Project MARS OIC via MFR.

c. **RPIC Responsibilities** In the event of a UAS mishap, vehicle accident, or injury, the following steps will be taken by the RPIC:

(1) Stop the mission.

(2) In the event of injury to personnel, or ongoing threat to life or property (e.g. fire), dial 911.

(3) Contact Project MARS NCOIC about incident; if unable to reach Project MARS NCOIC, escalate to Project MARS OIC. If unable to reach either the Project MARS NCOIC or Project MARS OIC and there are injuries, make contact with the Hospital Commander.

(4) Collect the following information:

(i) Type of UAS

(ii) Model of UAS

(iii) Type of Assistance Needed

(iv) Location of incident

(v) Type and severity of injuries

(vi) Names of injured

(vii) Date and time

(viii) Personnel and property involved in accident

(ix) Any additional hazards remaining (e.g., fire/hazmat/etc)

(5) Apply the following precautions:

(i) Keep others away for their own safety.

(ii) Render first aid.

(iii) Secure and control the accident site.

(iv) Advise personnel help is on the way.

(v) Remain at accident site until relieved either by Project MARS NCOIC or Project MARS OIC.

d. **Project NCOIC Responsibilities** Upon notification of a mishap, the Project MARS NCOIC will:

(1) Immediately move to the incident site to provide supervision.

(2) Notify Project MARS OIC of incident.

(3) Ensure all aircraft and crewmember flight records are secured.

(4) Recover the aircraft when safe.

(5) Be prepared to brief the Hospital Commander as requested.

(6) Provide resources and assistance to accident investigators as necessary.

e. **Project OIC Responsibilities** Upon notification of a mishap, the Project MARS OIC will:

(1) Notify the Hospital Commander as appropriate.

(2) Identify the nature of the mishap and appoint appropriate personnel to investigate. In the event of injury, damage to non-Project MARS material, and in other circumstances the OIC deems appropriate, the Project MARS OIC will recommend appointment of IO to the chain of command.

Chapter A

Regulatory Framework and References

This SOP was generated with the input of subject matter experts at KACH, USMA, SRD, USAASA, and the FAA. The following appendix lists the regulations, doctrine, and guidance used in the creation of this SOP along with a brief description of how each document was used.

A-1 FAA Regulations and Guidance

a. **Part 91**

b. **Part 107**

c. **Part 108 (Proposed)**

A-2 Joint FAA and DoD Regulations and Guidance

a. **Memorandum of Understanding (MOU) between DoD and FAA** The *Memorandum of Understanding Between the Department of Defense and Federal Aviation Administration for Unmanned Aircraft System Operations in the National Airspace System* (signed January–March 2019, Annex A to HQDA EXORD 228-24) establishes the framework for DoD UAS access to the NAS outside of Restricted, Warning, or Prohibited Areas. It supersedes the September 2013 MOA on the same subject.

(1) Key provisions drawn upon in this SOP include:

- **Airworthiness and Operator Qualification (§5.1–5.2):** All DoD UAS operating in the NAS must hold a Military Department airworthiness certification, and pilots/operators must be qualified and medically certified by the appropriate Military Department. These requirements informed the operator certification and medical standards in this SOP.
- **sUAS Access to Class G Airspace Without COA (§7):** DoD sUAS weighing 55 lbs or less may operate in Class G airspace under VMC (day/night) within visual line of sight, provided a NOTAM is published 24–72 hours in advance. This provision directly shapes the SOP's default operating conditions and NOTAM procedures.
- **Operations Near Non-DoD Airports (§8):** UAS operations in Class B, C, D, or surface-area Class E airspace require an FAA COA and ATC authorization. The SOP's airspace and coordination requirements reflect this constraint.
- **Night Operations (§9):** Night flight is permitted provided the UAS meets 14 CFR 91.209 lighting requirements and crews adapt to night conditions 30 minutes prior. The SOP's night operations procedures derive from this section.
- **Operations Over Populated Areas (§10):** Prohibited without appropriate airworthiness certification under DoD standards, informing the SOP's restrictions on flight over personnel and populated areas.
- **COA Process and Timelines (§6):** New COAs are processed within 60 business days; renewals within 30. COAs are valid for 24 months. These timelines guided the SOP's administrative planning and renewal schedules.

A-3 DoD and Army Regulations and Guidance

a. **SecDef Memo — Unleashing U.S. Military Drone Dominance** *Memorandum from the Secretary of Defense, "Unleashing U.S. Military Drone Dominance"* (10 July 2025, signed by the Secretary of Defense) directs the rapid proliferation of Group 1 and Group 2 sUAS across all DoD units. Issued in support of Executive Order 14307 ("Unleashing American Drone Dominance," 6 June 2025), it rescinds the 2021 DoD guidance implementing NDAA FY2020 §848 and the 2022 Blue sUAS exception-to-policy memorandum, replacing both with streamlined authorities and procurement directives.[claude]

(1) Key provisions relevant to this SOP include:[claude]

- **Delegated Authority to O-6 Commanders:** O-6 commanders or equivalents may grant authority to operate (ATO) and may procure, test, and train with small UAS compliant with statutory limitations. This authority may not be further delegated. This delegation informed the SOP's approval and command authority framework.[claude]
- **Blue List Compliance:** All UAS must comply with the Blue List maintained by the DIU (transferring to DCMA by January 2026), which catalogues DoD-approved UAS, components, and software. The SOP's procurement and vetting procedures align with Blue List requirements.[claude]
- **Cybersecurity — Closed-Loop Networks:** All small UAS must remain in closed-loop cyber networks, cordoned from DoD networks. This requirement reinforced the SOP's cybersecurity and data-handling provisions.[claude]
- **Airworthiness and Material Release Exemptions:** The Secretaries of the Military Departments shall determine airworthiness and material release requirements, exempting Group 1 and Group 2 UAS with few exceptions. This exemption shaped the SOP's streamlined airworthiness approach for small UAS.[claude]
- **Training Delegation:** Group 1–2 UAS operator training and qualifications are delegated to the Military Departments with minimal additional medical standards. DoD entities outside the Military Departments shall adhere to standards prescribed by the Secretary of the Army. This delegation underpins the SOP's operator certification and medical standards.[claude]
- **Covered Foreign Entity Restrictions:** The memo reaffirms NDAA FY2020 §848, FY2023 §817, and the American Security Drone Act (FY2024 §§1821–1825), permitting only limited procurement from covered foreign entities for research, training, testing, electronic warfare analysis, or counter-UAS development. These statutory constraints informed the SOP's procurement restrictions and cybersecurity risk-mitigation procedures.[claude]
- **Installation Commander Responsibilities:** Installation commanders will integrate drones against their unique installation restrictions, working with the FAA to remove inappropriate range restrictions and expand spectrum approval. This directive informed the SOP's airspace coordination and installation-specific operating area provisions.[claude]
- **Consumable Classification:** Group 1 and Group 2 UAS will be accounted for as consumable commodities, not durable property. This classification influenced the SOP's property accountability and logistics procedures.[claude]

b. **AR 95-1, Appendix D — Small Unmanned Aircraft System Utilization** *Army Regulation 95–1, Flight Regulations* (22 March 2018), Appendix D, establishes regulatory guidance for Group 1 sUAS (0.55–20 lbs) operated by personnel other than MOS-qualified unmanned aircraft operators. Appendix D is the primary Army regulatory authority governing sUAS training, qualification, currency, airspace usage, and crew requirements.[claude]

(1) Key provisions drawn upon in this SOP include:[claude]

- **Personnel Eligibility (§D–2):** Authorized sUAS operators include Regular Army, USAR, ARNG, and

Army civilian employees who meet qualification, training, evaluation, and currency requirements and the medical standard of AR 40–501 (without a Class IV physical). Government contractors require written authorization from the owning ACOM/ASCC/DRU/ARNG. These eligibility criteria informed the SOP's operator qualification requirements.[claude]

- **Training Program and Currency (§§D–3, D–4):** The sUAS ATP and currency requirements follow the appropriate MTL. Lapsed currency requires a PFE; simulators may not reestablish currency. These requirements informed the SOP's training and currency framework (subject to the D–10 exemption discussed below).[claude]
- **Airspace Usage (§D–7):** sUAS operations comply with paragraph 2–11 of AR 95–1 and applicable FAA orders. DoD sUAS weighing 0.55–20 lbs may operate in Class G airspace below 1,200 ft AGL within VLOS of the operator or a certified observer, provided the UAS remains more than 5 miles from any civil airport or heliport. NOTAM publication is required no later than 24 hours in advance for non-recurring operations; standing "blanket" NOTAMs are prohibited. These airspace provisions directly shaped the SOP's default operating conditions and NOTAM procedures.[claude]
- **Minimum Crew (§D–8):** The minimum crew is one qualified operator unless the operator's manual specifies otherwise. This requirement informed the SOP's minimum crew composition.[claude]
- **Certification of Operators and Master Trainers (§D–9):** Master Trainers designated by the first O–6 in the chain of command certify new operators at home station. Qualification courses are conducted at TRADOC-approved locations. These provisions informed the SOP's operator certification pathway (subject to the D–10 exemption discussed below).[claude]
- **Nonstandard sUAS with a Non-Tactical Mission (§D–10):** This paragraph is the foundational regulatory exemption for Project MARS. See discussion below.[claude]

(2) Paragraph D–10 Exemption Paragraph D–10 of AR 95–1 is the single most important regulatory provision enabling Project MARS. It provides that Group 1 UAS procured per Chapter 9 of AR 95–1 for non-tactical missions—explicitly including "research and academic activities within Army research laboratories, RDECOM, military academies"—are **exempt from the qualification, evaluation, and currency requirements** of the regulation. The owning organization retains responsibility for safe operations and compliance with applicable FAA circulars.[claude]

For Project MARS, this means:[claude]

- **Exemption from AR 95–1 operator qualification, evaluation, and currency:** USMA operators need not complete the TRADOC-approved sUAS operator qualification course, semi-annual proficiency and readiness tests (§D–5), or standard ATP currency requirements (§D–4). This exemption—reinforced by ALARACT 080/2024 and West Point Policy Memorandum MR-25-02 (§5.c)—is the basis for the SOP's locally developed operator certification framework.[claude]
- **Continued FAA compliance:** The exemption does not relieve USMA of FAA obligations. Operators must still hold an FAA Remote Pilot Certificate (14 CFR Part 107), register sUAS with the FAA, and comply with all applicable FAA airspace rules and waivers. The SOP's FAA compliance requirements derive from this continued obligation.[claude]
- **Safe operations responsibility:** USMA as the owning organization bears full responsibility for establishing and enforcing safe operating procedures—which is the central purpose of this SOP.[claude]

Figure A.1 reproduces Paragraph D–10 from AR 95–1 in its entirety.[claude]

***c.* AWR**

organic SUAS assets may appoint MTs as unit aircrew training managers.

d. MTs must be current, qualified, and mission qualified in the system in which they will be performing their duties.

D–10. Nonstandard small unmanned aircraft systems with a non-tactical mission

Group 1 UAS procured per chapter 9 of this regulation for non-tactical missions, for example, Corps of Engineers dam inspections, research and academic activities within Army research laboratories, RDECOM, military academies, or public affairs events, are exempt from the qualification, evaluation, and currency requirements of this regulation. Owning organization is responsible for safe operations and compliance with applicable FAA circulars.

AR 95–1 • 22 March 2018 65

Figure A.1: AR 95–1, Paragraph D–10: Nonstandard small unmanned aircraft systems with a non-tactical mission (22 March 2018).[claude]

A-4 Local Regulations and Guidance

***a.* Academic Flight Program**

***b.* USMA sUAS SOP (SOP 385-95)** The *Standard Operating Procedure for Safe Operations of Organic United States Military Academy Small Unmanned Aerial Systems (SUAS)* (SOP 385-95, originated 28 SEP 2017, revised 12 OCT 2023) is the primary predecessor document for this SOP. It governs all organic USMA sUAS operations for academic purposes, covering vehicles with a takeoff weight of 30 lbs or less.

(1) This SOP drew extensively from SOP 385-95 in the following areas:

- **Roles and Responsibilities (§2):** The organizational structure—DA FP, Deputy Director, 2nd AVN, Program Manager, Test Director, OIC, Flight Operator(s), and Safety Observer(s)—was adopted as the basis for the roles and responsibilities defined in this SOP. Key constraints (e.g., cadets may not serve as OIC for outdoor operations) were carried forward.
- **Flight Operations Planning and Risk Management (§3):** The requirement for an approved Test Plan, CRM assessment via DA Form 7566, and Safety Review Board approval informed this SOP's mission planning and risk management framework. The proper-use review ensuring compliance with SecDef Policy Memorandum 15-002 and Section 848 (NDAA FY2020) was also incorporated.
- **Airworthiness (§4):** The requirement for an Airworthiness Release per AR 70-62, the Bounded Operating Restrictions, and the locally delegated airworthiness determination process (Appendix J, adapted 5P Checklist) directly informed this SOP's airworthiness chapter.
- **Familiarization Requirements (§5):** The tiered familiarization framework—annual general sUAS operations training, per-system orientation, range-specific training, and mode-specific flight control proficiency (manual/stabilized and autonomous)—was adopted for operator certification in this SOP.
- **Flight Operation Controls, Limitations, and Special Provisions (§6):** Operational limits for NAS operations 400ft AGL, 100mph, 3sm visibility, VLOS, daylight-only with twilight lighting provisions) and failsafe protocol requirements (Loss of Link, Loss of GPS, Geofence) were carried into this SOP. Provisions for indoor/containment operations, micro-UAS operations (<0.55 lbs), multi-UAS operations, and beyond-visual-line-of-sight operations in restricted airspace were also adopted.
- **Emergency Response (§7):** The mishap response procedures—stop mission, collect information, render aid, secure the site, contact range control and DAFP—and the distinction between reportable and non-reportable mishaps were incorporated into this SOP's safety chapter.

- **Local Operating Area (Appendix B):** The definition of authorized operating areas (R-5206/Range 11 and ten FAA-coordinated Class G sites on the West Point Military Installation) informed the airspace and operating area provisions of this SOP.
- **Cybersecurity Risk Mitigation (Appendix K):** Procedures for vetting COTS sUAS against covered-nation restrictions (NDAA FY2020 §848, FY2023 §817), standalone GCS device requirements, and data handling protocols were adopted into this SOP's cybersecurity and procurement provisions.

c. **West Point Policy Memorandum MR-25-02** *West Point Policy Memorandum MR-25-02, Use of Small Unmanned Aircraft Systems (sUAS) on West Point Military Installation* (25 July 2025, signed by LTG Steven W. Gilland, Superintendent) establishes installation-wide policy for the management and use of nonofficial, non-tactical, and commercial sUAS on West Point. It rescinds USMA Policy MA-18-35 and applies to all personnel assigned, attached, residing, visiting, or under OPCON of West Point.

Key provisions drawn upon in this SOP include:

- **Senior Commander Approval (§5.a):** All sUAS use within West Point is prohibited without prior approval from the Senior Commander or designee, on a case-by-case or recurring basis. All sUAS must be on the approved Blue UAS Cleared Drone list per NDAA FY2020 §848 and FY2023 §817. This requirement directly informed the SOP's procurement and approval processes.
- **FPCON Restrictions (§5.b):** sUAS operations terminate immediately at FPCON Charlie or Delta and do not resume without Senior Mission Commander approval. This constraint was incorporated into the SOP's force protection provisions.
- **ALARACT 080/2024 Exemption (§5.c):** Academic and research activities at Military Academies are exempt from the qualification, evaluation, and currency requirements of AR 95-1, though West Point remains responsible for safe operations and FAA compliance. This exemption is a foundational authority for the SOP's operator certification framework.
- **Remote Pilot Certificate and FAA Compliance (§5.d–e):** Operators must hold an FAA Remote Pilot Certificate (Part 107 knowledge exam) and register sUAS with the FAA. West Point falls under controlled airspace requiring FAA authorization. These requirements were adopted into the SOP's operator certification and airspace chapters.
- **Operational Limitations (§5.f):** Cloud clearance (500 ft below, 2,000 ft horizontal), 3 sm minimum visibility, 400 ft AGL maximum altitude, VLOS requirement, yield right-of-way to manned aircraft, and prohibitions on night/over-people operations without Senior Mission Commander approval and FAA waivers. These limits directly shaped the SOP's flight operation controls.
- **Accident Reporting (§5.g):** All sUAS accidents involving property damage or injury require immediate notification to DES Duty Desk (845-938-3333), the USMA Safety Office, and chain of command for CCIR determination. This reporting chain was adopted into the SOP's emergency response procedures.
- **Flight Approval Process (§7):** The tiered coordination process—sUAS Planning Group (chaired by Deputy G3), USMA sUAS Flight Request Form, weekly Helo-Ops/Flight Schedule via 2nd AVN TASKORD, pre-/post-flight notifications to 2nd AVN and MP Duty Desk, and RFMIS reservations for training areas west of Route 9W—was incorporated into the SOP's flight request and coordination procedures.
- **Restricted Areas and PAO Coordination (§5.k–l):** Prohibitions on overflying formations, MEVAs, HRTs, CPRA, post housing, and access control points without Force Protection and PAO approval, plus requirements for PAO review of aerial photos/video, informed the SOP's imagery and restricted-area provisions.
- **Indoor/Containment Operations (§7.h):** Weight limits (20 lbs VTOL, 5 lbs other), participant-only flight environments, containment verification, Safety Standoff Distance, and ingress/egress control requirements were carried into the SOP's indoor operations provisions.

Chapter B

Checklists

B-1 Pre-Flight Checklist

B-2 Post-Flight Checklist

B-3 Emergency Procedures Checklist

Chapter C

Required Forms

C-1 Pre-Flight Inspection Form

C-2 Flight Log Form

C-3 Maintenance Log Form

C-4 Incident Report Form

Chapter D

West Point Airspace Approval

This appendix outlines the approved airspace for UAS operations under Project MARS at USMA. All operations must adhere to the specified airspace restrictions and guidelines to ensure safety and regulatory compliance.

D-1 Airspace Access Request

On 21 November 2025, KACH submitted a formal request to the U.S. Army Aeronautical Services Agency (USAASA) for authorization to operate Group 1 UAS in Class G airspace within the West Point Military Reservation (WPMR). The request outlined planned operations for four approved platforms (HAR-V, Parrot ANAFI, Skydio X2D, and FLIR SkyRaider R80D) conducting intermittent flights at or below 400 feet AGL during daylight hours only. The operational area encompasses approximately 24.81 square miles within the boundaries of the WPMR. All operations were planned to be conducted under VLOS conditions with qualified operators, published NOTAMs, and current AWRs for each platform. The complete airspace access request is provided in Figure D.1.

D-2 Airspace Access Approval

On 8 January 2026, USAASA granted authorization for Project MARS to operate sUAS within the approved airspace under reference number 2025-ESA-00668. The approval, signed by COL Ronald C. Smith, Commanding Officer of USAASA, authorizes operations from 9 January 2026 through 8 January 2028, unless rescinded by the Commander USAASA. The authorization specifies day-only operations at a maximum altitude of 400 feet AGL and requires the unit to publish NOTAMs not more than 72 hours in advance but not less than 24 hours prior to operations. The unit remains responsible for maintaining current AWRs, frequency authorization, and compliance with all DoD/FAA Memorandum of Understanding requirements. The complete airspace access approval is provided in Figure D.5.

DEPARTMENT OF THE ARMY
KELLER ARMY COMMUNITY HOSPITAL
900 WASHINGTON ROAD
WEST POINT, NEW YORK 10996-1197

MCUD 21 November 2025

MEMORANDUM THRU Department of the Army Representative (DAR), Federal Aviation Administration Eastern Service Center, ATTN: AJR-02, 1701 Columbia Ave., College Park, Georgia 30337

FOR Commander, US Army Aeronautical Services Agency (USAASA), ATTN: Airspace Branch, 9325 Gunston Rd., Suite N319, Ft. Belvoir, Virginia 22060-5582

SUBJECT: Request for Authorization to Operate Group 1 (20 pounds or less) Unmanned Aircraft System (UAS) in Class G / Uncontrolled airspace

1. References:

a. HQDA EXORD 228-24, Army Implementation of the Department of Defense (DoD) and Federal Aviation Administration (FAA) Memorandum of Understanding (MOU) for Unmanned Aircraft System (UAS) Operations in the National Airspace System (NAS), 212119Z Oct 24.

b. AR 95–1, Flight Regulations, 22 Mar 18.

c. AR 95–2, Air Traffic Control, Airfield/Heliport, and Airspace Operations, 31 Mar 16.

d. CJCSI 3255.01, Joint Unmanned Aircraft System Minimum Training Standards, 17 Jul 09; Ch 1, 21 Oct 11 – Directive Current as of 04 Sep 12.

e. Memorandum, Secretary of Defense, 10 Jul 25, subject: Unleashing U.S. Military Drone Dominance.

f. Notice to Air Mission (NOTAM), Flight Data Center (FDC) 0-5116, 20 Aug 20, Security: Special Security Instructions for Unmanned Aircraft Systems (UAS) Operations for Multiple Locations Nationwide, https://tfr.faa.gov/save_pages/detail_0_5116.html

g. FAA / DOD J-SOP for UAS-Specific SSI, Version 1.0, 06 Apr 17, and Addendum to the FAA / DOD J-SOP for UAS-Specific SSI.

2. Request to operate Group 1 Army UAS in Class G / Uncontrolled airspace as outlined in references a. through c. The following operational information is provided:

Figure D.1: VLOS Airspace Access Request (Page 1 of 4)

MCUD
SUBJECT: Request for Authorization to Operate Group 1 UAS in Class G / Uncontrolled airspace

a. Unit or Organization Name: Project MARS (Medical Autonomous Resupply System), Keller Army Community Hospital (KACH).

b. Type of UAS:

(1) HAR-V

(2) Parrot ANAFI MIL(DIU Blue List)

(3) Skydio X2D (DIU Blue List)

(4) FLIR SkyRaider R80D (DIU Blue List)

c. Total Weight of UAS with any payload(s):

(1) HAR-V - 5lbs

(2) Parrot ANAFI MIL(DIU Blue List) - 1.5 lbs

(3) Skydio X2D (DIU Blue List) - 5 lbs

(4) FLIR SkyRaider R80D - 11lbs

d. Geographical area of operations: see attached map in enclosure.

e. No access to civil or military controlled airspace (ex. Class D airspace) is required for this operation.

f. No access to private property is required for this mission.

g. Purpose of UAS Operation or Justification: KACH will conduct regular piloted flights within the West Point Military Reservation (WPMR) in order to develop flight corridors, airspace control measures, and deconfliction protocols with other tenant units. These flights will be conducted under VLOS conditions, using platforms with approved Air Worthiness Releases (AWRs). This operation is in support of a project to establish reliable autonomous sUAS based medical logistics delivery between KACH and the US Military Academy (USMA).

h. Planned / desired start and end date: 12/01/2025 - 30/09/2027.

i. Planned times of operations: Intermittent, 30-minute flights between sunrise - sunset.

2

Figure D.2: VLOS Airspace Access Request (Page 2 of 4)

MCUD
SUBJECT: Request for Authorization to Operate Group 1 UAS in Class G / Uncontrolled airspace

j. Planned operational altitude: At or below 400 ft. AGL.

k. Operational Risk has been assessed as LOW.

3. This UAS operation will not take off or land on private property.

4. AWRs for the HAR-V sUAS, Parrot ANAFI, Skydio X2, and FLIR Skyraider R80D are provided through USMA's Director of Academic Flight (DAFP) under authority delegated by the Systems Readiness Directorate (SRD). These AWRs are provided with the application for Certification of Waiver or Authorization (CoA).

5. All operators are qualified to operate UAS IAW AR 95-1. All operators will ensure the UAS remains within clear visual line of sight of the operator, or a certified observer in ready contact with the operator, to ensure separation from other aircraft.

6. All operators and observers will be medically qualified IAW current Army requirements (AR 40-501 and AR 95-1).

7. A Notice to Airmen (NOTAM) will be published to alert non-participating aircraft of the UAS operation. The NOTAM will be published not more than 72 hours in advance but not less than 24 hours prior to the operation.

8. Aircraft anti-collision lights will be on when engines are operating, except when conditions may cause a hazard to safety. Position lights will be on between official sunset and sunrise.

9. IAW Army Regulation 95-2, I understand that initial reports for all UAS accidents or incidents must be reported to the DAR, FAA Eastern Service Area within 24 hours. Contact the DAR Office for Report Format. This is in addition to reporting requirements prescribed by AR 95– 1, AR 385–10, DA Pam 385–40 and standing SIR / CCIR.

10. The unit's application has been entered in the FAA's CoA Application FAADroneZone (CADZ) at: https://faadronezone-access.faa.gov/#/ . A copy of this memorandum will be uploaded as a supporting document.

3

Figure D.3: VLOS Airspace Access Request (Page 3 of 4)

MCUD
SUBJECT: Request for Authorization to Operate Group 1 UAS in Class G / Uncontrolled airspace

11. The POC for this action is Project MARS NCOIC SFC Jamez White at (315) 774-8734 or james.r.white561.mil@health.mil.

Encl	SEAN J. HIPP
Enclosed Airspace Diagram	COL, MC
	Commander

Figure D.4: VLOS Airspace Access Request (Page 4 of 4)

DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY AERONAUTICAL SERVICES AGENCY
9325 GUNSTON ROAD, SUITE N319
FORT BELVOIR, VA 22060-5582

DAMO-AVA-ZA 8 January 2026

FOR: Keller Army Community Hospital, 900 Washington Rd, West Point, NY 10996-1197

SUBJECT: Keller Army Community Hospital, West Point, NY / Class G Airspace Access Approval (2025-ESA-00668)

1. The Memorandum of Understanding (MOU) between the Department of Defense (DoD) and the Federal Aviation Administration (FAA) dated 9 May 2019, streamlines the Airspace Access Approval process for DoD operations. As a result, this memorandum provides the authorization for the Keller Army Community Hospital to operate sUAS within the confines of your airspace access request. You are authorized to operate from 9 January 2026 – 8 January 2028 unless rescinded by the Commander USAASA.

2. Procedures outlined within your airspace access approval request and any local operating procedures serve as the operational guidance for HAR-V, Parrot Anafi, Skydio X2D, and FLIR SkyRaider R80D to operate from Keller Army Community Hospital to the West Point Military Reservation. The authority to operate will be in accordance with the Secretary of Defense memo" Unleashing U.S. Military Drone Dominance" dated July 10, 2025.

3. UAS operations will be conducted day only at a max altitude of 400 feet AGL.

4. The unit is responsible for publishing a NOTAM to alert non-participating aircraft not more than 72 hours in advance, but not less than 24 hours prior to the operation.

5. The unit is responsible for maintaining and operating within the limits of the current airworthiness release for flight in Class G airspace IAW DoD/FAA MOU.

6. Unit is responsible for frequency authorization for the operational airspace identified in the airspace access approval request.

7. In the event of an accident/incident, contact your Department of the Army Representative (DAR) and submit an accident/incident report within 24 hours.

8. If you have any questions please contact Mr. Barney Owens at (703) 806-4865 or email barney.c.owens.civ@army.mil, Mrs. Sydney Tutein at (703) 806-4863 or email sydney.e.tutein.civ@army.mil, or CW4 Michael Sirmans at (520) 706-7614 or email michael.d.sirmans.mil@army.mil.

RONALD C. SMITH
COL, AV
Commanding

Figure D.5: VLOS Airspace Access Approval

Chapter E

Approved UAS Characteristics

The following UAS have been approved for operations as part of Project MARS, as laid out in refch:airspace ~~Crefch:airspace~~[claude]. Configurations are subject to change based on mission requirements and technological advancements. Operators must ensure compliance with all relevant regulations and guidelines when utilizing these UASs.

E-1 Airframes approved for VLOS operations

E-2 Airframes approved for BVLOS operations

Glossary

Section I
Abbreviations

ACM Aircrew Member

ACOM Army Command

AGL Above Ground Level

AO Autonomous Operator

ARNG Army National Guard

ASCC Army Service Component Command

ATC Air Traffic Control

ATP Aircrew Training Program

AWR Air Worthiness Release

BUQ Basic UAS Qualification

BVLOS Beyond Visual Line-of-Sight

C2 Command and Control

COA Certificate of Authorization

CRM Composite Risk Management

DA FP Department of the Army Force Protection

DAA Detect and Avoid

DCMA Defense Contract Management Agency

DES Department of Emergency Services

DHA Defense Health Agency

DIU Defense Innovation Unit

DoD Department of Defense

DPTMS Directorate of Plans, Training, Mobilization, and Security

DRU Direct Reporting Unit

DT&E Developmental Test & Evaluation Flights

EO Expert Operator

EP Emergency Procedure

FAA Federal Aviation Administration

FPCON Force Protection Condition

FRAGO fragmentary order

G3 Assistant Chief of Staff, Operations

GCS Ground Control Station

GPS Global Positioning System

IO Investigating Officer

IQT Initial Qualification Training
KACH Keller Army Community Hospital
LZ Launching / Landing Zone
MARS Medical Autonomous Resupply System
MEDLOG Medical Logistics
MFR Memorandum for Record
MGTOW Max Gross Takeoff Weight
MOS Military Occupational Specialty
MTL Master Task List
NAS National Airpace System
NCOIC Non-Commissioned Officer in Charge
NDAA National Defense Authorization Act
NOTAM Notice to Airmen
OIC Officer in Charge
OPORD operation order
PFE Program, Fielding, and Equipping
POR Program of Record
QP Qualified Pilot
RAA Risk Acceptance Authority
RPIC Remote Pilot in Charge
RRC Robotics Research Center
RTH Return-to-Home
RWC Remain Well Clear
SAA Safe Abort Area
SMC Senior Mission Commander
SME Subject Matter Expert
SOP Standard Operating Procedure
SRD Systems Readiness Directorate
sUAS Small Unmanned Aircraft System
TFB Test-Flight Box
TFR Temporary Flight Restriction
TRADOC Training and Doctrine Command
UAS Unmanned Aircraft System
USAASA US Army Aeronautical Services Agency
USAR United States Army Reserve
USMA United States Military Academy
USMAPS United States Military Academy Prepatory School
VLOS Visual Line of Sight
VO Visual Observer

WP West Point

Section II
Terms

air corridor
A restricted air route of travel specified for use by friendly aircraft and established for the purpose of preventing friendly aircraft from being fired on by friendly forces.
Source: JP 3-52, DoD, 2014.

aircraft
A device that is used, or intended to be used, for flight.
Source: Pilot's Handbook of Aeronautical Knowledge, FAA, November 2023.

airframe
The fuselage, booms, nacelles, cowlings, fairings, airfoil surfaces (including rotors but excluding propellers and rotating airfoils of engines), and landing gear of an aircraft and their accessories and controls.
Source: 14 CFR Subsection 1.1, US Congress, September 2025.

automated
Operated by machines or computers without direct human control.
Source: Dictionary, Merriam-Webster, 2024.

Automatic Dependent Surveillance - Broadcast (ADS-B)
A function of an aircraft or vehicle that preiodically broadcasts its state vector (i.e., horizontal and vertical position, horizontal and vertical velocity) and other information.
Source: Pilot's Handbook of Aeronautical Knowledge, FAA, November 2023.

autonomous flight
The operation of a /acuas where a complex function makes decisions and performs actions without direct human input, enabled by a run-time assurance (RTA) architecture that safely bounds the flight behavior.
Source: ASTM F3269-17, ASTM International, 2017.

Beyond Visual Line of Sight (BVLOS)
The operation of a UAS beyond the visual capability of the flight crew members (i.e., remote pilot in command [RPIC], the person manipulating the controls, and visual observer [VO]), if used to see the aircraft with vision unaided by any device other than corrective lenses, spectacles, and contact lenses.
Source: Pilot/Controller Glossary, FAA, August 2025.

Certificate or Waiver of Authorization (CoA)
An FAA grant of approval for a specific flight operation or airspace authorization or waiver.
Source: Pilot/Controller Glossary, FAA, August 2025.

Class G airspace
Airspace that is uncontrolled, except when associated with a temporary control tower, and has not been designated as Class A, Class B, Class C, Class D, or Class E airspace.
Source: Pilot's Handbook of Aeronautical Knowledge, FAA, November 2023.

controlled airspace
An airspace of defined dimensions within which ATC service is provided to IFR and VFR flights in accordance with the airspace classification. It includes Class A, Class B, Class C, Class D, and Class E airspace.

Source: Pilot's Handbook of Aeronautical Knowledge, FAA, November 2023.

crewmember (UAS)
A person assigned to perform an operational duty. A UAS crewmember includes the remote pilot in command, the person manipulating the controls, and visual observers but may also include other persons as appropriate or required to ensure the safe operation of the UAS (e.g., sensor operator, ground control station operator).
Source: Pilot/Controller Glossary, FAA, August 2025.

DoD / FAA Memorandum of Understanding (MoU)
a /acmou between the /acdod and /acfaa that sets forth provisions that allow for increased /acdod /acuas use in the /acnas outside of restricted, warning, or prohibited areas. This /acmou defines many collaboration methods, and lists specific requirements that the /acdod and /acfaa must meet.
Source: /acmou between the /acdod and /acfaa for /uas in the /acnas, Jointly published, May 2019.

drone
See Unmanned Aircraft System (UAS).
Source: .

flight corridor
A defined three-dimensional airspace, of defined width, which has been set aside for flights along a particular route.
Source: ICAO Document 4444, International Civil Aviation Organization, 2016.

flight path
The line, course, or track along which an aircraft is flying or is intended to be flown.
Source: Pilot's Handbook of Aeronautical Knowledge, FAA, November 2023.

geo-fence
A virtual perimeter for a real-world geographic area that can be dynamically generated or correspond to a pre-set geographic boundary.
Source: ASTM F3002-14a, ASTM International, 2014.

Group (DoD UAS Classification)
The UAS group system establishes the foundation for joint UAS terminology. It provides a common reference to compare UAS. UAS are grouped based on the physical and performance characteristics of weight, operating altitude, and airspeed. UAS groups are determined without regard for payload, mission, command relationship, or Service. All UAS fall into one of five groups.
Source: AR 95-1, DA, March 2018.

Group 1 UAS
Typically hand-launched, self contained, portable systemsemployed for a small unit or base security. They are capable of providing “overthe hill” or “around the corner” reconnaissance and surveillance. They operatewithin visual range and are analogous to radio-controlled model airplanes ascovered in AC 91-57.30. Typically weigh less than 20lbs MGTOW.
Source: DoD UAS Airspace Integration Plan, 2004. 6

Group 2 UAS
Small to medium in size and usually support brigade and intelligence, surveillance, reconnaissance, and target acquisition requirements. They usually operate from unimproved areas and launched via catapult. Payloads may include a sensor ball with electro-optic / infrared(EO/IR) and laser range finder/designator (LRF/D) capability. They typically perform special purpose operations or routine operations within a specific set of restrictions. Typically weigh between 21lbs and 55lbs MGTOW.
Source: DoD UAS Airspace Integration Plan, 2004.

Group 3 UAS
Operate at medium altitudes with medium to long range and endurance. Their payloads may include a sensor ball with EO/IR, LRF/D,signal intelligence (SIGINT), communications relay, and chemical biological radiological nuclear explosive (CBRNE) detection. They usually operate from unimproved areas and may not require an improved runway. Typically weigh more than 55lbs, but less than 1320lbs MGTOW.
Source: DoD UAS Airspace Integration Plan, 2004.

Group 4 UAS
Relatively large UAS that operate at medium to high altitudes and have extended range and endurance. They normally require improved areas for launch and recovery, beyond line-of-sight (BLOS) communications, andhave stringent airspace operations requirements. Payloads may include EO/IR sensors, radars, lasers, communications relay, SIGINT, Automatic Identification System (AIS), and weapons. Typically weigh more than 1320lbs MGTOW.
Source: DoD UAS Airspace Integration Plan, 2004.

Group 5 UAS
Include the largest systems, operate at medium to high altitudes, and have the greatest range, endurance, and airspeed capabilities. They require improved areas for launch and recovery, BLOS communications, andthe most stringent airspace operations requirements. Group 5 UAS perform specialized missions such as broad area surveillance and penetrating attacks. Typically weigh more than 1320lbs MGTOW.
Source: DoD UAS Airspace Integration Plan, 2004.

manipulator of the controls
A person who operates the controls of an aircraft during flight time.
Source: AC 61-65H, Federal Aviation Administration, September 2018.

Maximum Gross Takeoff Weight (MGTOW)
The maximum allowable weight for takeoff, inclusive of airframe, fuel, and cargo.
Source: Pilot's Handbook of Aeronautical Knowledge, FAA, November 2023.

mean sea level
The average height of the surface of the sea at a particular location for all stages of the tide over a 19-year period.
Source: Pilot's Handbook of Aeronautical Knowledge, FAA, November 2023.

National Airspace System (NAS)
The common network of United States airspace—air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information; and manpower and material.
Source: Pilot's Handbook of Aeronautical Knowledge, FAA, November 2023.

National Security Unmanned Aircraft System Flight Restriction (NSUFR)
Temporary flight restrictions that prohibit UAS operations within specified distances of certain security sensitive facilities to address national security concerns.
Source: FAA UAS Data Exchange (LAANC), FAA, 2024.

Notice to Airmen (NOTAM)
A notice filed with an aviation authority to alert aircraft pilots of any hazards en route or at a specific location. The authority in turn provides means of disseminating relevant NOTAMs to pilots.
Source: Pilot's Handbook of Aeronautical Knowledge, FAA, November 2023.

Operations Over People (OOP)
Operations of small unmanned aircraft over people.
Source: Pilot/Controller Glossary, FAA, August 2025.

operator (UAS)
The owner and/or remote pilot of a UAS.

Source: Pilot/Controller Glossary, FAA, August 2025.

Part 107
The Federal Aviation Regulation that establishes requirements for the operation of small unmanned aircraft systems (sUAS) in the National Airspace System.

Source: 14 CFR Part 107, US Congress, August 2016.

Part 91
General operating and flight rules that apply to aircraft operations within the United States and its territories.

Source: 14 CFR Part 91, US Congress, April 2024.

pilot
The term “pilot” means an individual who has final authority and responsibility for the operation and safety of the flight or any other flight deck crew member.

Source: 14 CFR Subsection 44921, US Congress, October 2018.

Pilot in Command (PIC)
The pilot responsible for the operation and safety of an aircraft during flight time.

Source: Pilot/Controller Glossary, FAA, August 2025.

piloted
Flight of an unmanned aircraft that allows pilot intervention in the management of the flight path.

Source: ASTM F3269-17, ASTM International, 2017.

remote pilot
Pilot of a UAS who is not operating as a recreational flyer under 49 USC §44809, the Exception for Limited Recreational Operations of Unmanned Aircraft.

Source: Pilot/Controller Glossary, FAA, August 2025.

Remote Pilot In Command (RPIC)
The RPIC is directly responsible for and is the final authority as to the operation of the unmanned aircraft system.

Source: Pilot/Controller Glossary, FAA, August 2025.

Temporary Flight Restriction (TFR)
Restriction to flight imposed in order to: 1. Protect persons and property in the air or on the surface from an existing or imminent flight associated hazard; 2. Provide a safe environment for the operation of disaster relief aircraft; 3. Prevent an unsafe congestion of sightseeing aircraft above an incident; 4. Protect the President, Vice President, or other public figures; and, 5. Provide a safe environment for space agency operations. Pilots are expected to check appropriate NOTAMs during flight planning when conducting flight in an area where a temporary flight restriction is in effect.

Source: Pilot’s Handbook of Aeronautical Knowledge, FAA, November 2023.

uncontrolled airspace
Class G airspace that has not been designated as Class A, B, C, D, or E. It is airspace in which air traffic control has no authority or responsibility to control air traffic; however, pilots should remember there are VFR minimums which apply to this airspace.

Source: Pilot’s Handbook of Aeronautical Knowledge, FAA, November 2023.

Unmanned Aircraft (UA) / Unmanned Aerial Vehicle (UAV)
A device used or intended to be used for flight that has no onboard pilot. This device can be any type of airplane, helicopter, airship, or powered-lift aircraft. Unmanned free balloons, moored balloons, tethered aircraft, gliders,

and unmanned rockets are not considered to be a UA.

Source: Pilot/Controller Glossary, FAA, August 2025.

Unmanned Aircraft System (UAS)
An unmanned aircraft and its associated elements related to safe operations, which may include control stations (ground, ship, or air based), control links, support equipment, payloads, flight termination systems, and launch/recovery equipment. It consists of three elements: unmanned aircraft, control station, and data link

Source: Pilot/Controller Glossary, FAA, August 2025. , 65

Visual Line of Sight (VLOS)
Condition of operations wherein the operator maintains continuous, unaided visual contact with the unmanned aircraft

Source: Pilot/Controller Glossary, FAA, August 2025.

visual observer
A person who is designated by the remote pilot in command to assist the remote pilot in command and the person operating the flight controls of the small UAS (sUAS) to see and avoid other air traffic or objects aloft or on the ground.

Source: Pilot/Controller Glossary, FAA, August 2025.