DEPARTMENT OF THE ARMY
UNITED STATES MILITARY ACADEMY
West Point, NY 10996

STANDARD OPERATING PROCEDURE (SOP)
NUMBER: 385-95
Origin Date: 28 SEP 2017, Revised: 12 OCT 2023

SAFE OPERATIONS OF ORGANIC UNITED STATES MILITARY ACADEMY SMALL UNMANNED AERIAL SYSTEMS (SUAS) STANDARD OPERATING PROCEDURE

1. GENERAL

1.1. Purpose: This Standard Operating Procedure (SOP) establishes safe operating procedures and assigns responsibilities for the operation of organic United States Military Academy (USMA) Small Unmanned Aerial Systems (SUAS) for academic purposes.

1.2. Description of Operation: SUAS operations at USMA include vehicle design and modifications, sensor design and integration, design of SUAS support equipment, development of autonomous behaviors to include multi-UAS flight, operations research, operation of SUAS in support of courses, including Geographical Information Systems, and cadet/student competitions.

1.3. Applicability: This SOP applies to all government and contractor personnel who are actively involved in SUAS operations for USMA cadet educational and research activities. sUAS are defined as vehicles with takeoff weight less than or equal to 30 lbs. This SOP applies to operations within the local area defined in Appendix B, and outside the local area in addition to other requirements that may be required by the host organization. External agencies and organizations who obtain authorization to operate SUAS at West Point are not subject to this SOP. System safety management responsibilities for this SOP are defined in the System Safety Management Plan [1].

2. ROLES AND RESPONSIBILITIES

2.1. **Director of Academic Flight Program (DAFP)**: The Dean of the Academic Board will appoint the Director of Academic Flight Program. Among other responsibilities, the DAFP is responsible for oversight of all SUAS academic activities at USMA and managing the procedures set for in this SOP. The Director shall be an O-6 or government civilian equivalent or higher with an Aviation and/or Flight Test background. The DAFP is responsible for:

2.1.1. Ensuring USMA SUAS operations are safe and legal.

2.1.2. Chairing the Safety Review Board (SRB) per the System Safety Management Plan [1].

2.1.3. Maintaining familiarization material and records.

2.1.4. Airworthiness Releases.
2.1.5. Approving Test Plans and Composite Risk Management (CRM) assessment.
2.1.6. Publishing updates to this SOP as required.

2.2. **Deputy Director of Academic Flight Program**: The DAFP may appoint a Deputy to assist with his/her responsibilities.

2.3. **2ND AVN**: A sUAS POC will be appointed at 2nd AVN. 2nd AVN is responsible for:
2.3.1. Day to day approval of local SUAS operations.
2.3.2. Ensuring mission personnel have been briefed on critical information which may affect their mission for local operations.
2.3.3. The airspace is coordinated, deconflicted, and appropriate for the operation.
2.3.4. Supervisors of any appropriate operations at USMA have been notified.

2.4. **Program Manager (PM)**: each SUAS program within the academic departments shall have a PM who is the overall proponent for that SUAS usage case at USMA. Examples of SUAS PMs are faculty advisors of cadet projects that utilize SUAS, instructors or course directors of courses that utilize SUAS, or faculty members who are doing their own research (perhaps with a partnering agency) using SUAS. This person cannot be a cadet. The PM is responsible for:
2.4.1. The overall safe and effective use of the SUAS (to include storage and transportation).
2.4.2. Adherence to the USMA SUAS SOP and AWR by all members of their team.
2.4.3. The design and development of the SUAS (if applicable).
2.4.4. The purchase, requisition, or fabrication of SUAS (if applicable).
2.4.5. The integration or configuration of new hardware with existing SUAS (if applicable).
2.4.6. Managing the SUAS budget to include sustainment considerations.

2.5. **UAS Test Director (TD)**: a TD will be assigned per project by its PM, or may be the PM. This person cannot be a cadet. The TD is responsible for:
2.5.1. Developing the Test Plan to promote safety and effectiveness of the flight program.
2.5.2. Coordinating approval of the Test Plan and CRM assessment through the DAFP.
2.5.3. Coordinating flight activities with 2ND AVN and/or the appropriate range.

2.6. **Officer in Charge (OIC):** The OIC may be the TD or is appointed by the TD. This person cannot be a cadet. The OIC is responsible for:
   2.6.1. Supervising flight activities on site
   2.6.2. Executing actions in the Test Plan in accordance with this SOP
   2.6.3. Providing the Safety Brief to all mission participants
   2.6.4. Maintaining contact with Range Control during the mission or appointing a safety observer to maintain contact with Range Control if serving as Flight Operator.
   2.6.5. Completing OIC familiarization as described in this SOP.

2.7. **Flight Operator(s):** A Flight Operator may be the TD, the OIC, or can be a cadet. An operator is responsible for:
   2.7.1. Operating one or more SUAS using different interfaces (ex: RC Controller, Ground Control Station …) and in different modes (ex: manual, autonomous…).
   2.7.2. Completing operator familiarization for the modes of operation to be employed as described in this SOP. Familiarization is not required for modes not intended to be used.

2.8. **Safety Observer(s):** A Safety Observer can be a cadet and is responsible for assisting the OIC or Flight Operator(s) under certain circumstances described in this SOP. Observers will receive familiarization with the required tasks prior to operations.

2.9. All mission participants shall read and understand this SOP.

2.10. All participants and observers are responsible to immediately report any unsafe conditions or actions to the OIC.

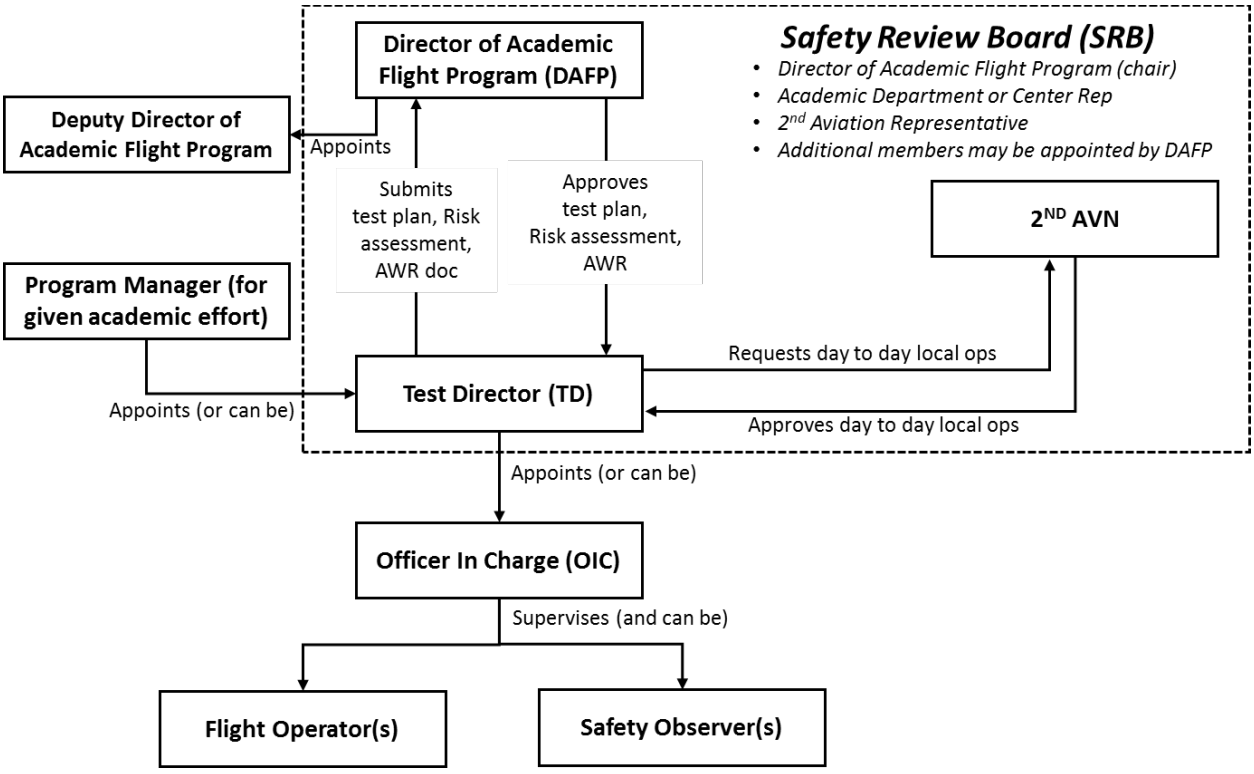

Figure 1. Organizational Chart of SUAS Operations Roles and Responsibilities

3. FLIGHT OPERATIONS PLANNING AND RISK MANAGEMENT

3.1. **Test Plan**: The Test Director shall develop a Test Plan for each flight program. The intent is to provide a concise description of objectives and activities to be performed. A proposed outline format for the Test Plan is available in Appendix C. The TD will coordinate approval of the Test Plan through the DAFP and may submit the document for coordination with ranges. Updates to the Test Plan can be implemented using concise amendments submitted to the DAFP.

3.2. **Risk Management**: The Test Director shall develop a Composite Risk Management (CRM) assessment IAW the SSMP for each SUAS Test Plan prior to flight. The TD will document hazards and control procedures using the form shown in Appendix D. The TD will submit this form, typically along with the Test Plan, to the DAFP for approval. The DAFP will chair a Safety Review Board (SRB) as described the USMA SUAS System Safety Management Plan (SSMP) [1]. The process maximizes the use of safe practices through independent skilled perspectives and ensures the risk is adequately categorized, mitigated, documented, and accepted at the appropriate level. The DAFP manages risk to people and property. However, many programs deal with UASs that are of low cost, low reliability, or of high technical risk where damaged or destroyed aircraft can be expected or in some cases desired by program goals. Therefore, Program Managers may determine the

impact to their programs of a damaged or destroyed UAS and should be permitted to accept that risk

3.3. **Proper Use.** The SRB shall review the Test Plan to ensure that the usage cases fall within the provisions of the Proper Use of DoD UAS pertaining to Secretary of Defense Policy Memorandum 15-002, dated 17 Feb 2015 and the Guidance for Procedures for the Operation and Procurement of Unmanned Aircraft Systems to Implement Section 848 of the National Defense Authorization Act for Fiscal Year 2020 dated 08 Sep 2021. In particular, the SRB will ensure that the proposed UAS operations will not conduct surveillance on U.S. persons and that all procedures reflect cybersecurity mitigation strategies outlined in Appendix K.

4. AIRWORTHINESS

4.1. **General:** AR 70-62 (Para 2-1.a) states all SUAS flight vehicles at USMA must receive an Airworthiness Release (AWR) [2]. The TD will provide information included in Appendix E to the DAFP to obtain an AWR. The Airworthiness Authority may seek additional information prior to issuing the AWR. If USMA is delegated a Limited Airworthiness Authority from the Army's airworthiness authority, the USMA Delegated Authority will use the process defined in Appendix J to determine airworthiness.

4.2. **Airworthiness Bounds:** To expedite issuance of an AWR, SUAS vehicles will be adhere to the USMA SUAS Bounded Operating Restrictions referenced in [3]. If a project desires to operate a vehicle outside the bounds of this document, additional coordination with Aviation Engineering Directorate will be required to obtain the required AWR.

4.3. **Airworthiness Documentation**. A copy of each flight vehicle AWR shall be maintained by both the DAFP and the Test Director of the project. The Test Director, OIC and Flight Operator(s) of a given SUAS project must read and abide by the AWR and remain within any limitations set forth in the AWR. In the event that the AWR is locally authored, the TD, OIC, and Flight Operators must read and abide by the AWR specific to their project.

5. FAMILIARIZATION REQUIREMENTS:

5.1. **General**: The DAFP will maintain familiarization material and records for the positions below. Familiarization elements are detailed in Appendix F. The DAFP may designate local subject matter experts capable of guiding applicable types of familiarization. The TD will define how personnel will obtain familiarization in the test plan and will ensure personnel for a flight event have obtained it and are proficient.

5.2. **OIC Familiarization**: The OIC will become familiar with principles of effective and safe mission coordination and supervision during flight activities. This involves:

5.2.1. General SUAS operations familiarization in applicable principles of SUAS operations, procedures, mission planning, and the operating environment. This will be refreshed annually.

5.2.2. New SUAS system orientation to provide a good understanding of systems, limitations, and control modes. This will be issued once per new system.

5.2.3. Any additional requirements imposed by a specific range or host organization (i.e. operations on USMA ranges require the OIC to receive OIC / Range Safety Officer (RSO) training from Range Control.)

5.3. **Flight Operator Familiarization:** Operators will become familiar with the safe operation of the mission SUAS in the control mode(s) intended to be used, within the established operating areas. This involves:

5.3.1. General SUAS operations familiarization in basic applicable principles of SUAS operations, procedures, mission planning, and the operating environment. This will be refreshed annually.

5.3.2. New SUAS system orientation to provide a thorough understanding of systems, limitations, and control modes. This will be issued once per new system.

5.3.3. Manual & Stabilized Flight Control: consists of low level attitude and performance control using a RC controller and visual feedback. Familiarization can be accomplished with an RC flight simulator, or through supervised flights. If an operator does not intend to operate in this mode, no familiarization is required.

5.3.4. Autonomous Control: includes basic waypoint and altitude control as well as higher level autonomous behaviors (path planning, multi-UAV control) using a Ground Control Station (GCS) application, with moving map and telemetry feedback. Familiarization can be accomplished with a software simulator, or through supervised flights. If an operator does not intend to operate in these types of modes, no familiarization is required.

5.3.5. Any additional requirements imposed by a specific range or host organization (there are no additional requirements for local operations).

5.4. **Documentation**. The DAFP shall maintain a database to track the familiarization of OICs and Flight Operators. OICs and Flight Operators shall report updates to the DAFP.

6. FLIGHT OPERATION CONTROLS, LIMITATIONS, AND SPECIAL PROVISIONS

6.1. Mission Preparation Controls and Limitations:

6.1.1. Every flight must be associated with an approved Test Plan and CRM Assessment, conducted by trained and current personnel, and the aircraft must have a valid AWR on file.

6.1.2. The TD must coordinate every flight activity directly with 2ND AVN and the range to be used IAW local SOP.
6.1.3. The TD must coordinate operations through the appropriate range or facility Spectrum Manager. Operations within unlicensed frequency bands within FCC approved radiated power limits typically do not require further approval when operating within the local area. The OIC will ensure proper frequency deconfliction within the bounds of the approval with any other activities occurring on range at time of operation.
6.1.4. Prior to performing any operations, the OIC will brief the mission participants and observers on the proposed operations (Appendix H). The hazards and mitigations documented in the AWR and/or Test Plan will be discussed.
6.1.5. A preflight check of the UAS system will be performed prior to each mission. Checks include, but are not limited to: airframe, controls, powertrain, battery, gear, payload operation, integrity of attaching hardware, datalinks, avionics, failsafe protocols, GCS, RC controller, flight plan, crew readiness, site readiness.

6.2. Operational Controls and Limitations:
6.2.1. SUAS covered in this SOP will be ≤ 30lbs.
6.2.2. SUAS flight operations will be restricted to areas where risk to people and property are minimized.
6.2.3. SUAS flight operations will be designed to ensure the aircraft remains within the lateral and vertical boundaries of the approved operating area, and well within range of the primary command and control link.
6.2.4. UAS flights shall not be flown over personnel not involved with the mission.
6.2.5. Failsafe Protocols will be implemented to ensure the aircraft remains within the boundaries of the approved operating area, and will be verified prior to flight. The following Failsafe Protocols will be implemented:
a. Loss of Link protocol will be implemented on all flights.
b. Loss of GPS protocol will be implemented on all flights where the UAS is not being visually tracked by an operator or observer dedicated to that UAS.
c. Geofence will be implemented on all flights where the UAS is not being visually tracked by an operator or observer dedicated to that UAS.
6.2.6. Flights beyond visual range may be authorized under the following conditions:
a. In accordance with the approved Test Plan
b. When operating in Restricted Airspace.
c. With approval from the range or airspace administrator.
d. Only after activation and verification of Loss of Link, Loss of GPS, and Geofence safety protocols.
6.2.7. Multi-UAS operations
a. Multi-UAS operations may be conducted when in accordance with the approved Test Plan, and or airspace administrated approval.

b. When multiple UAS are operating simultaneously, each UAS will be assigned a primary operator with final responsibility for that UAS. In this situation, the OIC may not serve as primary operator to a vehicle in order to maintain broader situational awareness.
c. Multiple UAS may be assigned to one primary operator if one of the following conditions is met:
    - All UAS are implemented with active Loss of Link, Loss of GPS, and Geofence failsafe protocols.
    - Each UAS is assigned a dedicated Safety Observer with direct line of communication to the primary operator, and the UAS remains within visual range of that observer.
d. Proper buildup operations must be performed to responsibly verify procedures, systems, and operator comfort prior to executing flights with large numbers of UAS.

6.3. Operations in the National Airspace System (NAS)

6.3.1. Operations in the NAS covered in this SOP will be limited to those applicable to the FAA Certificate of Authorization (COA) via Notification process [6].

6.3.2. These operations will be further limited as follows, as a deliberate additional safety measure, to align with the following provisions of FAA 14 CFR Part 107 [7].
a. Flight altitude limited to ≤400 ft Above Ground Level (AGL)
b. Flight speed limited to ≤100mph (87kts)
c. Minimum weather of 3 statute mile (sm) visibility, ≥500ft below clouds or ≥2000ft horizontally from the cloud
d. Flight within Visual Line of Sight (VLOS) of primary operator.
e. Daylight operations only. Night operations prohibited. Operations during civil twilight require the UAS to be equipped with anti-collision lights visible for at least 3 statute miles.

6.3.3. These operations will retain the ability to operate multiple UAS per operator, so long as the provisions in this SOP are maintained.

6.3.4. Operations in the NAS beyond the scope addressed in this section will be address via a separate SOP developed for that operation coordinated with the DAFP.

6.4. Indoor & Containment Structure SUAS Operations

6.4.1. Flight operations in containment structures (indoor, netted areas, etc.) approved locations will follow the provisions listed described in this SOP with the following modifications:
a. No coordination is required with 2ND AVN.
b. The acting OIC may be a Cadet. However, in this situation, approval must be granted for each operation by the TD according to DAFP and Department guidance, or the DAFP.

c. OIC and Operator familiarization may exclude elements pertaining to outdoor flight. Those elements will be required per this SOP if the individuals then plan to take part in outdoor operations.
d. SUAS will be limited to electrically powered aircraft weighing 20lbs for vertical take-off and landing (VTOL) SUAS, and 5lbs for other types of electrically powered SUAS.
e. All personnel in the flight environment will be participants receiving the OIC safety brief.
f. All personnel within the containment structure, during operations will be protected such that any kinetic energy created by the UAS shall not exceed the protection provided by adequate PPE and/or protective barrier. The TD will verify adequacy of this protection.
g. The TD will verify that the containment structure is capable of containing the aircraft during all normal and emergency operational phases, as well as debris ejected from the aircraft for any reason (e.g. thrown rotor blade, tip weight, propeller, turbine disk, etc.) If the containment structure is not capable of containing ejected debris, the TD will define a Safety Standoff Distance (SSD) or additional protective barrier to be employed during operation.
h. The TD shall verify that the containment structure has a method to control ingress and egress of personnel during operations.

6.5. Micro-UAS Operations

6.5.1. Micro-UAS in this SOP are defined as SUAS weighing ≤0.55 lbs.

6.5.2. Operations of Micro-UAS in approved locations, within VLOS of the primary operator, and limited to a single UAS per operator, will follow the provisions listed described in this SOP with the following modifications:
a. The Test Plan and CRM Assessment elements of mission coordination can be reduced to a concise email to the DAFP describing the operation.
b. The acting OIC may be a Cadet. However, in this situation, approval must be granted for each operation by the TD according to DAFP and Department guidance, or the DAFP.
c. Flight operators are exempt from familiarization requirements.

6.5.3. Operations of Micro-UAS in approved locations, beyond VLOS of the primary operator, or involving multiple UAS per operator will follow all provisions in this SOP.

7. EMERGENCY RESPONSE

7.1. A pre-accident plan will be included in all Test Plans.

7.2. Standard operations of the UAS may involve gliding flight recovery, or flight termination within the operating area. Nominal Multi-UAS operations may result in mid-air collisions between UAS within the operating area. These operations may cause components to break. These events do not constitute reportable mishaps. Reportable mishaps include flight outside of approved

airspace, and SUAS operations leading to injury to personnel or to damage to property not involved with the program.

7.3. In the event of a UAS mishap, vehicle accident, or injury, the following steps will be taken:
  7.3.1. Stop the mission.
  7.3.2. Collect the following information: Type of UAS, Model, type of assistance needed, location of accident, type and severity of injuries, names of injured, date and time, personnel and property involved in accident, ammunition/explosives/ HAZMAT/fire involved, owning unit.
  7.3.3. Apply the following precautions: keep others away for their own safety, render first aid, secure and control accident site, advise personnel help is on the way, do not answer media questions (refer to Public Affairs Officer), remain at accident site until relieved by either range control personnel if operating in a military range, by law enforcement personnel if in a public space, or by the owner if operating with an agreement over private space.
  7.3.4. Contact range control and DAFP.

7.4. In the event of unexpected vehicle behavior, the following steps will be taken:
  7.4.1. If the UAS flies to the Lost Link rally point, all personnel must remain clear of that area while communications are being re-established.
  7.4.2. If the UAS has terminated, personnel should recover the vehicle. The UAS should only be approached if there are no hazards in the area.
  7.4.3. If the UAS leaves the designated operating area, the OIC will stop the mission, and notify Range Control immediately.

APPENDIX A - REFERENCES

1. Guidance for Procedures for the Operation and Procurement of Unmanned Aircraft Systems to Implement Section 848 of the National Defense Authorization Act for Fiscal Year 2020

2. USMA Organic SUAS System Safety Management Plan, 1 MAR 2018.

3. Army Regulation 70-62 (AR 70-62), Airworthiness Qualification, 11 May 2016.

4. USMA SUAS Bounded Operating Restrictions, 1 MAR 2018.

5. CJCSI 3255.01, Joint Unmanned Aircraft Systems Minimum Training Standards, 4 September 2012.

6. Policy Memorandum 15-002, Guidance for the Domestic Use of Unmanned Aircraft Systems, 17 February 2015.

7. FAA and DOD Memorandum of Agreement Concerning the Operation of Department of Defense Unmanned Aircraft Systems in the National Airspace System, 16 September 2013.

8. Title 14, Code of Federal Regulation (CFR) Part 107, Small Unmanned Aircraft Systems, FAA, 29 August 2016.

9. Department of the Army Form 7566 (DA FORM 7566), April 2005, Composite Risk Management Worksheet.

10. FAA-G-8082-22, Remote Pilot – Small Unmanned Aircraft Systems Study Guide, 1 August 2016.

11. US Army Aviation Engineering Directorate (AED) Application for Airworthiness Qualification Level (AQL) 3 Airworthiness Release (AWR), Revision 11, 7 JAN 2014.

12. USAFA UAS Center Operating Instruction, 4 MAY 2016.

13. Deputy Secretary of Defense Memorandum, “Unmanned Aerial Systems Cybersecurity Vulnerabilities”, May 23, 2018.

14. Jacques, D. “AFIT Risk Mitigating Procedures to Protect Sensitive Information in the Operation of COTS SUAS Using Pixhawk/Pixhawk 2 Autopilot Systems”. 8 June 2018.

APPENDIX B – LOCAL OPERATING AREA

Figure B.1 shows Restricted Airspace R-5206 with vertical boundaries of SFC to 5000ft MSL. Most operations will take place within the boundaries of Range 11 which provides a 600 m x 400 m operating area. However, extended operations beyond Range 11, within R-5206 can be coordinated through range control. Requests to operate at this location will follow the provisions of this SOP, and will involve additional coordination with the Range RFMSS scheduling officer more than two weeks ahead of a mission, and submitting the Test Plan or separate CONOP to the Range Manager. The OIC requires a special range brief, renewed annually.

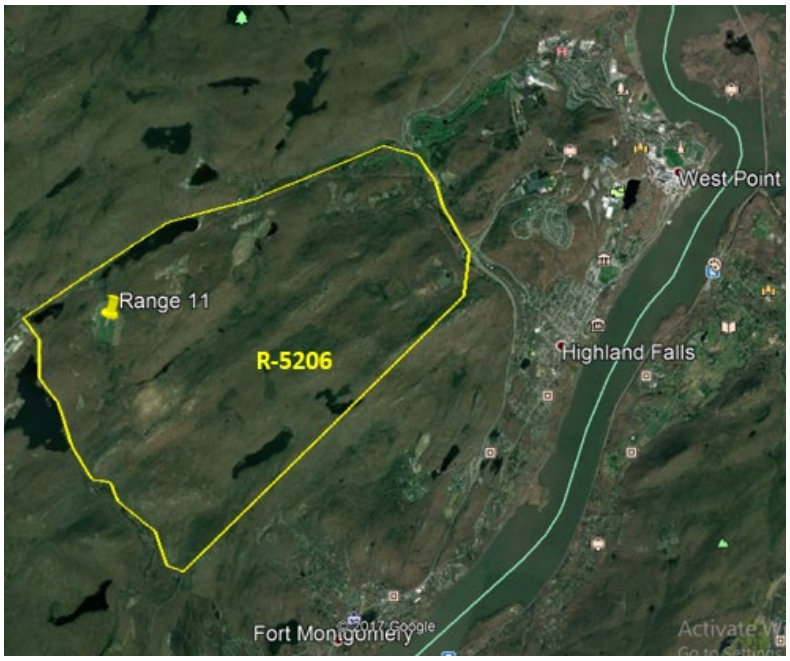

Figure B.1. Range 11 and Restricted Airspace R-5206

Figure B.2 shows the areas outside R-5206 that have been coordinated for sUAS with the FAA. These will be the primary operations areas. However, extended operations beyond these boundaries can be coordinated with more advanced notice, but will remain within the bounds of the West Point Military Installation. All these activities are conducted in Class G airspace through a FAA authorization coordinated by the DAFP via the online CAPS system. These activities must all follow the provisions in the SOP.

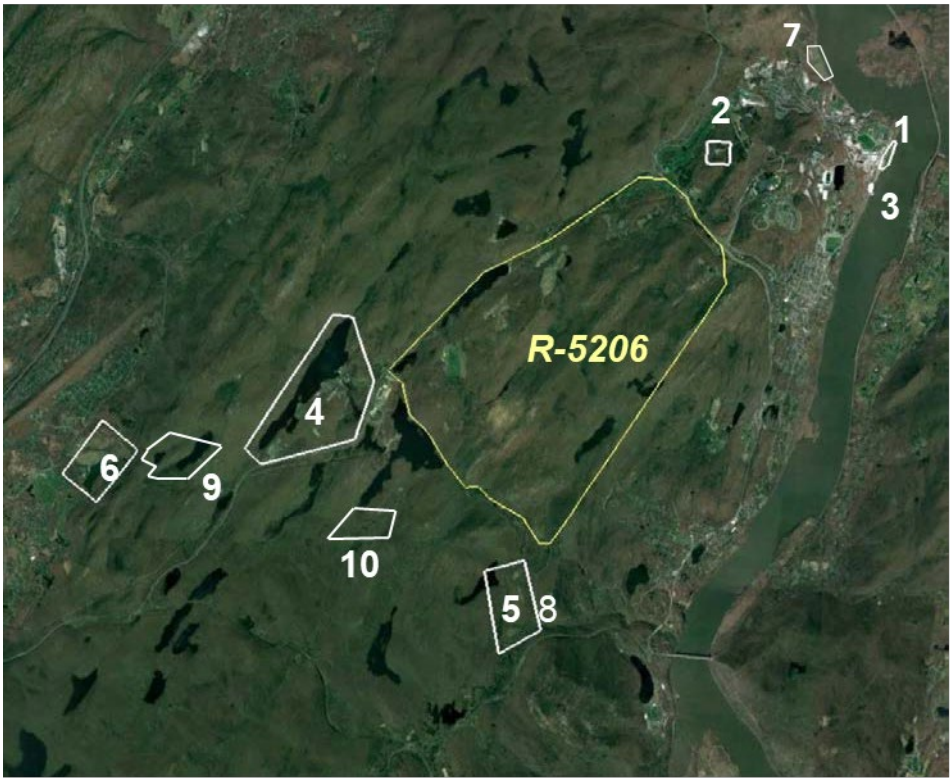

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Figure B.2. Operations Areas West Point Military Installation

Table 1: sUAS Operating Areas

Area	Name	Status
1	River Court	Authorized
2	Paintball	Authorized
3	Train Station	Authorized
4	Buckner	Authorized
5	Camp Shea	Authorized
6	Lake Frederick	Authorized
7	Target Hill Fields	Authorized
8	Ranges 15 & 16	Authorized
9	MOUT Sites P&R	Authorized
10	MOUT Site T	Authorized

APPENDIX C – TEST PLAN OUTLINE

1. **Introduction:** Describe program background, sponsor, short overview of test (who, what, where, when)

2. **Test Objectives:** List bulleted objective statements. Examples:
    - Demonstrate / Evaluate XX technology
    - Measure / Determine / Characterize XX event
    - Collect XX data
    - Support XX operation

3. **System Description:** Describe UAS system specifications, control modes, frequencies

    3.1. Control Safety Protocols (ex: loss of control, loss of link, loss of GPS, Geofence)

4. **Test Procedures:** Describe operating area and overall flight profile(s)/procedure(s).

5. **Test Personnel:** Type / number of personnel needed, and how will they get trained

A. Pre-Accident Plan

B. Include any additional information required by a specific range in Appendix B. Create additional appendices if needed.

APPENDIX D - SYSTEM SAFETY RISK ASSESSMENT

System Safety Risk Assessments (SSRA) for this program will be documented using DA FORM 7566, Composite Risk Management Worksheet shown below [8].

COMPOSITE RISK MANAGEMENT WORKSHEET

For use of this form, see FM 100-14, the proponent agency is TRADOC

1. MSN/TASK	2a. DTG BEGIN	2b. DTG END	3. DATE PREPARED *(YYYYMMDD)*

4. PREPARED BY		
a. LAST NAME	b. RANK	c. POSITION

5. SUBTASK	6. HAZARDS	7. INITIAL RISK LEVEL	8. CONTROLS	9. RESIDUAL RISK LEVEL	10. HOW TO IMPLEMENT	11. HOW TO SUPERVISE (WHO)	12. WAS CONTROL EFFEC-TIVE?

Additional space for entries in Items 5 through is provided on Page 2.

13. OVERALL RISK LEVEL AFTER CONTROLS ARE IMPLEMENTED *(Check one)*

☐ LOW ☐ MODERATE ☐ HIGH ☐ EXTREMELY HIGH

a. LAST NAME	b. RANK	c. DUTY POSITION	d. SIGNATURE

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APPENDIX E – AIRWORTHINESS RELEASE DOCUMENTATION (1/2)

Photo / Image of Aircraft: xxx

Aircraft Description: xxx

Make / Model: xxx

Weight, Max Gross: xxx

Method of determining suitable weight and balance configuration: xxx

Length: xxx

Wingspan: xxx

Rotor span: xxx

Maximum Level Flight Speed (specify Reported or Estimated): xxx

Primary Structure Materials: xxx

Control Mode(s): xxx

Failsafe System(s): xxx

Launch Method/System Type. xxx

Landing Method/System Type: xxx

APPENDIX E – AIRWORTHINESS RELEASE DOCUMENTATION (2/2)

Component	Supplier	Model	Description
Autopilot/Mission Computer			
Software VDD & Revision Number			
Payload(s)			
GPS Receiver and Antenna			
Motor			
Motor ESC			
Battery			
Propeller			
Data Link Radio and Antenna			
GCS Software			
GCS Hardware			
RC Controller			

_____(initials) AWR Authority conducts Technical Interchange Meeting and article inspection

AWR Authority Comments / Additional Limitations:

AWR (granted / disapproved) **_____**

Date: _____

Signature Block

APPENDIX F – USMA SUAS FAMILIARIZATION

1. **General:** Table F1 lists the different types of familiarization events applicable to the Officer in Charge (OIC) and Flight Operator(s). The intent is for the OIC to be familiar with principles of effective and safe mission coordination and supervision during flight activities, and for the flight operators to be familiar with safe operation of the mission SUAS in the control mode(s) intended to be used, within the established operating areas. Familiarization elements are listed below, and are consistent with References [4] and [9].

Table F1. SUAS Familiarization Elements

	Officer in Charge (OIC)	Flight Operator
General SUAS operations	1 session - yearly	1 session – yearly
New SUAS System Orientation	1 time per new system	1 time per new system
Range Specific Training	As required by range	As required by range
Manual & Stabilized Flight Control	N/A	As required
Autonomous Control	N/A	As required

2. General SUAS operations familiarization, conducted yearly in a single session, and includes:
    - Review of this SOP, Composite Risk Management (CRM), and Bounded Operating Restrictions
    - Weather considerations for SUAS flight
    - Restricted Airspace and Class G airspace considerations for SUAS flight
    - SUAS Aeronautical Decision Making and Physiological Factors
    - Typical Emergency Procedures
    - General hazard mitigation: battery usage, mission planning, ground operations

3. New SUAS System Orientation: conducted once for each new system on the elements listed below.
    - Applicable aviation principles and aircraft performance and limitation
    - System overview: configuration, datalinks, control modes
    - Failsafe protocols and verification
    - Use of flight checklists

4. Range or Host Specific additional training: conducted as required by that entity:
    - USMA ranges require the OIC to receive yearly OIC / Range Safety Officer (RSO) training from Range Control.

5. Manual & Stabilized Flight Control:
    5.1. Consists of low level attitude and performance control using a RC controller and visual feedback. Familiarization with this type of control can be accomplished with:
    - RC Flight Simulator software with representative aircraft model
    - Supervised flights of a representative or the actual SUAS (with possible use of buddy box)

    5.2. The level of flight control familiarization per aircraft category shall enable an operator to demonstrate the following maneuvers:
    - For Fixed Wing Aircraft
        a. Takeoff and climb
        b. Left, Right, and Figure Eight loiter patterns
        c. Stall and Recovery
        d. Emergency Procedures (Talk Through)
        e. Approach (Upwind & Crosswind)
        f. Landing & Go Around

    - For Rotary Wing Aircraft (or VTOL)
        a. Takeoff and low level hover
        b. Vertical/Lateral Box Pattern
        c. 90 deg yaw (Left or Right) Vertical/Lateral Box Pattern
        d. Unusual Attitude Recovery
        e. Emergency Procedures (Talk Through)
        f. Landing

6. Autonomous Control:
    6.1. Includes basic waypoint and altitude control as well as higher level autonomous behaviors (path planning, multi-UAV control) using a Ground Control Station (GCS) application, with moving map and telemetry feedback. Familiarization with this type of control can be accomplished with:
    - Software simulator with representative mode of control
    - Supervised flight operation of a representative or the actual SUAS

    6.2. The level of control mode familiarization shall enable an operator to demonstrate a tailored flight profile as well as emergency procedures (demo or talk through).

APPENDIX H – PRE-MISSION BRIEF CHECKLIST

1. Summary of previous day's test execution (if applicable)
2. Test objectives
3. Planned Activities
4. Mission profiles (what, where, altitude)
5. Airspace limits: vertical, lateral operating area, lateral containment
6. Weather
7. System Readiness
8. Go / No Go Criteria
9. Roles: OIC, Operators, Observers, Non Participants
10. Communications: voice comms, datalinks
11. Emergency Procedures
12. Hazards and Risk Management Review
13. Terrain and obstructions
14. Additional Safety and Environmental concerns (Personnel: bugs, sun, hydration, first aid, buddy system)
15. Range rules
16. Other Activities on Range (related, not related)
17. Review Proper Use Considerations (no overflight of nonparticipants and no surveillance of U.S. persons).
18. Questions?

APPENDIX I – GENERAL FLOW FOR SUAS CADET CAPSTONE PROJECTS

PHASE	PROCEDURES	DOCUMENTATION
Preliminary (Jul – Sep) * once per program	• PM Identifies need for SUAS • PM appoints TD • TD develops Test Plan • TD conducts Composite Risk Management (CRM) • TD submits Test Plan and CRM worksheet to DAFP • DAFP convenes SRB • DAFP approved/declines Test Plan & CRM, using SRB feedback	• Test Plan (App C) • Composite Risk Management (CRM) worksheet (DA Form 7566)
Intermediate (Oct – Mar) * once per program	• PM oversees purchase or development/fabrication of SUAS <u>Once aircraft is on hand:</u> • TD fills out AWR request • DAFP reviews AWR request • DAFP and TD conduct joint inspection / Tech Interchange Meeting (TIM) • DAFP approves or declines to provide AWR	• AWR request (App E)
Pre-flight (ready to fly) * week(s)/day before day of testing)	• OIC confirms familiarization of Flight Operators <u>If flying outside R-5206 (USMA Range)</u> • TD Coordinates with 2nd Avn for COA <u>If flying in R-5206 (USMA Range)</u> • TD Coordinates with Range Control (>2 weeks prior) <u>If flying off USMA</u> • TD Coordinates with owning org. range/airspace manager	• Situationally dependent
Flight (ready to fly) * on day of each flight event (i.e. day of testing)	• OIC confirms validity of CRM • OIC conducts pre-mission brief • OIC and Flight Operators conduct SUAS flights IAW Bounded AWR, platform AWR, SOP • Post-flight: OIC logs flight iterations	• Pre-mission Brief Checklist (App H)

APPENDIX J – USMA AIRWORTHINESS DETERMINATION PROCESS

This Appendix describes the process USMA will employ to determine airworthiness if it is delegated a Limited Airworthiness Authority from the Army's airworthiness authority. The scope of operations considered in this process will be limited to the USMA SUAS Bounded Operating Restrictions [3], and follow principles of this SOP and the SSMP [1].

Airworthiness assessment consists of overall hazard risk identification, mitigation, categorization, and acceptance for an operation. Risk will be managed to people and property, and its level will be correlated to the proposed operational restrictions, area of operation, and usage of the SUAS. Risk level of every flight program will be assessed through the Safety Review Board process as described in the SSMP [1]. In recognition that many programs involve low cost SUAS not designed to accepted engineering standards and/or do not possess adequate engineering data to determine their compliance with acceptance standards, programs may determine the impact to their program of a damaged or destroyed UAS is acceptable [2,11,12]. Only operations with LOW risk of hazard to personnel and property will be considered for an Airworthiness Release.

Because the airworthiness evaluation is made in place of a traditional airworthiness process, its considerations encompass all safety aspects of operating the UAS including, but not limited to, who the operator is, where it is operated, and how it is operated [11]. These elements are documented in the Test Plan (Appendix C), Composite Risk Management worksheet (Appendix D), and Airworthiness Release documentation (Appendix E), submitted by the Test Director. The DAFP may request a Technical Interchange Meeting (TIM) with the program to supplement the assessment. If an operation is found airworthy, the DAFP will sign the Airworthiness Release documentation (Appendix E), and append any additional restrictions in writing. The three documents described will then be filed as the locally issued AWR documentation, and attached with this SOP, SSMP [1], and Bounded Operating Restriction [3].

After an AWR is awarded, major modifications must be re-evaluated. A major modification is defined as any configuration change / alteration that implements a capability change, and/or expanded mission usage, or would result in a change in hazard associated with the operation.

The aviator's *5P Checklist* is adapted as listed in Table J1 to help evaluate airworthiness aspects of the operation in line with this SOP. The method of evaluation of each element can be specified based on engineering and safety judgement from the DAFP and the SRB.

Table J1. 5P Checklist to Help Evaluate Airworthiness

ELEMENT	DOCUMENTED IN
The **P**lan: Describes basic elements of the operation	
Purpose and objectives of operation	Test Plan
Launch and recovery Plan	Test Plan
Flight profile description	Test Plan
Emergency planning	Test Plan, CRM
Build-up approach in level of complexity	Test Plan, + As Req.
The **P**lace: Describes both the airspace and ground location at and surrounding the event.	
Airspace type (Restricted vs NAS)	Test Plan
Airspace coordination process (Range or FAA)	Test Plan, + As Req.
Airspace safety (other air traffic, airfields, airspaces)	Test Plan, + As Req.
Ground location access, safety, security	Test Plan, + As Req.
The **P**ilot: Describes the plan to ensure OICs and Flight Operators have appropriate familiarization	
General USMA Operations	DAFP records
UAS system specific knowledge	DAFP records
range specific knowledge	DAFP records
Proficiency in intended flight control modes	DAFP records
The **P**lane: Describes the aircraft design and configuration	
Aerodynamics	AWR Doc Photo, + As Req.
Structures	AWR Doc Photo, + As Req.
Stability and Control	AWR Doc Photo, + As Req.
Size, Weight, Balance, Power	AWR Doc
Propulsion	AWR Doc
Performance	AWR Doc
Avionics Systems	AWR Doc
Payload Systems	AWR Doc
Operator manual guidance and limits (if available)	As Req. / As Available
Maintenance practices (if available)	As Req. / As Available
Operational history & lessons learned (if available)	As Req. / As Available
The **P**rogramming: Describes GNC and failsafes	
Guidance, Navigation, Control Architecture	AWR Doc
Safety protocols	AWR Doc, Test Plan, CRM
Mission specific parameter programing & preflight	Test Plan or As Req.

APPENDIX K – CYBERSECURITY RISK MITIGATION PROCEDURES

This Appendix describes the process USMA will employ to mitigate cybersecurity vulnerabilities associated with the use of Commercial-Off-The-Shelf (COTS) UAS and UAS components, based on requirements outlined in Section 817 of the FY2023 National Defense Authorization Act (NDAA) and Section 848 of the FY2020 NDAA that prohibits the purchase and operation of Commercial sUAS from covered nations. Concerns with these vulnerabilities were expressed in a Deputy Secretary of Defense Memorandum in May 2018 [2] and clarified in an additional policy [1].

These procedures will be briefed as part the annual General sUAS Familiarization provided to all USMA academic SUAS operators and OICs. Adherence to these procedures will be addressed in each project Test Plan and as a line item in each Composite Risk Management Worksheet, both submitted to the Director of Academic Flight Program for approval. These procedures are based on a technical information exchange with the Army Cyber Institute, and practices and recommendations from other DoD components [3-4]. The Dean of the Academic Board is the approval authority for the procurement and operation of COTS sUAS in accordance with a memorandum delegating the approval authority from the Department of the Army. Prior to approval, the following steps will be taken.

1. The Test Director will review all public information regarding the manufacturer of the system in question to ensure that they do not have ties to a covered nation.
2. The Test Director will review all public information regarding the manufacturer of the critical components in question to ensure that they do not have ties to a covered nation.
3. The Test Director will initial a checklist that accompanies a request for COTS approval verifying that they have completed these reviews.
4. The DAFP will review the findings from the Test Director and audit the findings.
5. The DAFP will endorse the request for COTS approval prior to submitting the request to the Dean of the Academic Board.
6. Once approved, the information will be shared with all academic sUAS users to encourage users to utilize systems that have been vetted.
7. When requirements and funding allows, users are encouraged to utilize systems on the Blue sUAS list to further mitigate cybersecurity concerns.

Three important concepts are fundamental to cybersecurity for all SUAS research conducted by USMA:

1. 100% of this research is non-sensitive in nature and in data.
2. No UAS activities are ever conducted in sensitive locations.
3. All UAS and Ground Control Station devices are stand-alone devices without any Personal Identification Information (PII) or sensitive data (For Official Use Only) and never connect to DOD-networks.

In addition, the procedures described earlier in this SOP include safety protocols which ensure containment of the UAS to the test area which mitigates physical access to the

unit by non-participants. They also ensure no surveillance data is collected on non-participants. Furthermore, the supply chain in which UAS are acquired by USMA are non-sensitive.

The vast majority of UAS operations are conducted on USMA property. This includes the River Courts which is commonly seen and viewed by tourists and sit in open view along the Hudson River, and Range 11 which is a remote training site that is wooded and largely featureless. All activities conducted at West Point are publicly releasable. For academic SUAS activities conducted at West Point, the following procedures will be followed:

1. Ground Control Stations (GCS) will consist of standalone computers, tablets, or mobile devices only. These devices will:
    a. Be dedicated to the project.
    b. Not be personally owned devices and will not contain PII nor FOUO information.
    c. Never connect to a DoD network.
    d. Have cameras and microphones disabled in software, and embedded web cams taped over as added precaution.
    e. Be wiped in accordance with DoD data erasure processes at completion of project use.
2. Autopilots and integrated onboard sensors will only be connected to GCS devices and will never connect to DoD networks.
3. Flight data may be moved from a GCS device to another computer after being scanned for malware by a DoD approved scanning program.
4. Test teams will maintain accountability of SUAS assets and make all reasonable efforts possible to recover all units prior to leaving a test site.
5. SUAS cameras will be covered when not in use for research. When in use, the SUAS will be operated in such a way to avoid direct imagery of personnel. Imagery will be taken from behind or directly overhead while the personnel wear headgear that obscure the individual.
6. Upon completion of testing, flight data will be cleared from the ground station computer and any flight components. It is not necessary to purge autopilot settings from that unit, and copies of the autopilot parameter file may be stored on the ground station computer.
7. Prior to procurement and operation of any COTS sUAS, the test director will make all reasonable efforts to ensure that no critical components of the system are manufactured in a covered foreign country. The definition of critical components and covered foreign country are in references [1-2].

For academic SUAS activities conducted off West Point property, for which public release of data is authorized prior to operations, the same procedures will be followed.

For academic SUAS activities conducted off West Point property, for which public release of data is not available prior to operations, the following procedures will be employed in addition to those listed above (Note: the nature of the operation, the data

collected, the location, and flight profiles will all be confirmed to be non-sensitive prior to operations in all cases):

8. The GCS device will remain disconnected from all networks during operation.

In the event that a project needs to be conducted in an area that is not considered a benign environment, or to support an effort that is not unclassified in nature, additional mitigation measures must be put in place. As soon as either of these conditions are identified, the test director will consult with the DAFP and add cybersecurity mitigation measures to the test plan, in accordance with the cybersecurity mitigation matrix provided by the office of the Assistant Secretary of the Army – Acquisition, Logistics, and Technology (ASA-ALT). A copy of the most recent mitigation matrix will be stored on the UAS working group sharepoint page at all times.

REFERENCES

1. Guidance for Procedures for the Operation and Procurement of Unmanned Aircraft Systems to Implement Section 848 of the National Defense Authorization Act for Fiscal Year 2020

2. Deputy Secretary of Defense Memorandum, “Unmanned Aerial Systems Cybersecurity Vulnerabilities”, May 23, 2018.

3. Jacques, D. “AFIT Risk Mitigating Procedures to Protect Sensitive Information in the Operation of COTS SUAS Using Pixhawk/Pixhawk 2 Autopilot Systems”. 8 June 2018.

4. Beal R., Flack D. “Project RIZER – Update & Summary”. 8 March 2018.

5. Section 817 of the FY2023 National Defense Authorization Act (NDAA)

6. Section 848 of the FY2020 NDAA