Carnegie Mellon University Environmental Health & Safety FIRE | LAB | WORK	**Environmental Health and Safety** **Uncrewed Aircraft Systems (UAS) / Drone Program**
Date of Issuance: 10/25/22	**Revision Date:**
Revision Number: Initial	**Prepared by:** UAS/Drone Committee and Environmental Health and Safety

1. Purpose

Uncrewed Aircraft Systems (UAS), including aircraft commonly known as drones, are used at Carnegie Mellon University (CMU) in a variety of ways related to academics, research, business and recreation. CMU has developed this UAS/Drone Program to ensure compliance with applicable laws, mitigate safety risks and protect the security and privacy of the CMU community.

2. Scope

This UAS/Drone Program is developed in accordance with Federal Aviation Administration (FAA) rules. UAS/Drone flights intended to occur within, on or above university property are included in the scope of this Program. UAS/Drone that are over 55 lbs are not included in the scope of this program, must instead adhere to the applicable FAA rules, and contact drones@andrew.cmu.edu for additional assistance.

The information herein sets forth procedures for faculty, staff, students, and approved vendors acting on behalf of the university to assist in the successful completion of the FAA and CMU registration process, FAA Pilot requirements, UAS/Drone Flight Approval Request Form, and minimum training requirements. Also included are steps for registering an individuals indoor flight space.

UAS/Drone operators should also be familiar with the guidance found within the EHS Lithium-Ion Battery Safety – Guideline.

3. Responsible Parties

a. Approved Vendors

i. Comply with applicable FAA laws, rules, and regulations.
ii. Adhere to any limits prescribed by this Program to protect the safety, privacy and other rights and interests of the university and the surrounding population when operating a UAS/Drone.

b. CMU Faculty, Staff, and Students

i. Comply with applicable FAA laws, rules, and regulations.
ii. Register all CMU owned UAS/Drone through the UAS Portal, regardless of the intended indoor or outdoor use.

iii. Adhere to any limits prescribed by this Program to protect the safety, privacy, and other rights and interests of the university and the surrounding population when operating a UAS/Drone.
iv. Manage approved vendors who request to fly UAS/Drone on behalf of the university through the UAS/Drone flight operating request and approval process found through the UAS Portal.

c. **CMU Flight Club**
   i. Provide subject matter expertise and assist with creating and updating CMU-Sponsored UAS/Drone training.

d. **Environmental Health and Safety**
   i. Manage flight approval request reviews, to include notifying relevant parties (University Police, Facilities Management and Campus Services [FMCS], space owners, etc.) of approved flights.
   ii. Manage and update the UAS/Drone Program.
   iii. Register new CMU UAS/Drones with the FAA as needed.
   iv. Create and maintain CMU-sponsored UAS/Drone training and training records within SciShield.
   v. Lead UAS/Drone incident investigations and track incident data and trends.
   vi. Support the UAS/Drone Committee.
   vii. Maintain the UAS/Drone web page.
   viii. Maintain a list of approved indoor flight spaces through SciShield.

e. **Insurance Services and Office of General Counsel**
   i. Maintain insurance coverage for CMU registered UAS/Drone.
   ii. Verify that sufficient insurance coverage is maintained by UAS/Drone Pilots for UAS/Drone not registered to CMU.

f. **Supervising UAS/Drone Pilot**
   i. Supervise those who have not yet completed CMU UAS/Drone training, but who are operating UAS/Drone while conducting training flights or operations.
   ii. Remain present and actively engaged during UAS/Drone flight.

g. **UAS/Drone Committee**
   i. Provide subject matter expertise on UAS/Drone Program and operations.
   ii. Collaborate in the development and maintenance of the UAS/Drone Program.
   iii. Assist as needed in the UAS/Drone incident investigation process and, if applicable, reporting accidents and incidents to the FAA or the National Transportation Safety Board (NTSB).
   iv. Participate in UAS/Drone committee meetings as needed.
   v. Consult with other university offices or departments as necessary.

h. **UAS/Drone Pilot**
   i. Adhere to all FAA regulations and any applicable state or local requirements.
   ii. Operate UAS/Drone in accordance with this Program.
   iii. Complete all required training.
   iv. Report all incidents to EHS via drones@andrew.cmu.edu in a timely manner.

i. **University Police**
   i. Assist in deterring unauthorized UAS/Drone Flights.

4. Definitions

a. **Approved Vendors**
An entity, contractor, or individual not employed by CMU who is authorized by the UAS/Drone Committee to conduct a UAS/Drone flight on or above University Property.

b. **SciShield**
Enterprise safety, compliance and training software used by EHS.

c. **CMU-Sponsored Training**
UAS/Drone operation and safety training which is created, managed, and provided by CMU.

d. **Emergency**
An urgent, sudden, and serious event or an unforeseen change in circumstances that necessitates immediate action to remedy harm or avert imminent danger to life, health, or property.

e. **Federal Aviation Administration (FAA)**
FAA is the entity which governs the use of UAS/Drone, provides rules and regulations on UAS/Drone, including requirements associated with UAS/Drone registration and UAS/Drone Pilot licensing requirements.

f. **Remote Pilot Certificate**
Certificate issued under Title 14 of the Code of Federal Regulations (14 C.F.R.) which authorizes an individual to serve as Pilot-in-Command of a civil UAS/Drone operation.

g. **Supervising UAS/Drone Pilot**
UAS/Drone Pilot who has obtained a Remote Pilot Certificate and is current with CMU-Sponsored Training. Supervise those who have not yet completed CMU drone training, but who are operating UAS/Drone while conducting training flights or operations.

h. **Uncrewed Aircraft Systems (UAS/Drone)**
Aircraft weighing less than 55 pounds operating without the possibility of direct human intervention from within or on the aircraft. Aircraft and its associated elements (including communication links and the components that control the small Uncrewed aircraft) that are required for the safe and efficient operation of the Uncrewed aircraft in the National Airspace System.

i. **UAS/Drone Committee**
A committee appointed by the Associate Vice President of Enterprise Risk Management consisting of faculty and staff representatives from the schools and departments interested in the safe operation of UAS/Drone on University Property.

j. **UAS/Drone Portal**
A software platform accessed through the EHS UAS/Drone web page. This platform houses the various UAS/Drone forms described within this program which includes, UAS/Drone Registration, Indoor Flight Space, and Flight Operations.

k. **Unauthorized UAS/Drone Flight**
Any UAS/Drone flight conducted on or above University Property without permission from the UAS/Drone Committee or that has not completed all requirements of this Program.

l. **University Property**
Buildings or grounds owned or leased by the University including, but not limited to, buildings or grounds in which students reside.

m. **Visual Observer**
Responsible for assisting the UAS/Drone Pilot with scanning the airspace around where the UAS/Drone is operating for any potential collision hazard, and with maintaining awareness of the position of the UAS/Drone through direct visual observation. If used, Visual Observers must be able to maintain communication with the UAS/Drone Pilot throughout the UAS/Drone Flight.

5. Training

Training applies to CMU faculty, staff, and students who operate or plan to operate UAS/Drone on University Property.

a. UAS/Drone Pilots conducting flight operations shall have the following trainings before conducting unsupervised UAS/Drone flights:
   i. FAA Remote Pilot Certificate as noted in the FAA's Small UAS/Drone Rule for outdoor flights (Part 107) (this training is not required when operating the UAS/Drone indoors).
   ii. FAA Trust Training for flights occurring indoors.
   iii. CMU-Sponsored Training regardless of the flight location.

b. CMU-Sponsored Training shall be completed annually through SciSheld.

c. CMU-Sponsored Training shall be updated to reflect any FAA rule changes.

d. FAA Remote Pilot Certificate shall be obtained, including completion of recurrent training at least every 24 months.

e. Training flights that involve a UAS/Drone Pilot who has not completed, or is in the process of completing, one of the training options listed in section 5.1 must be supervised by a Supervising UAS/Drone Pilot.

6. UAS/Drone CMU Registration Process

The UAS/Drone CMU registration form is intended for registering UAS/Drone purchased with CMU funding and is then owned by the university. This registration process ensures the CMU owned UAS/Drones are registered through the FAA under the CMU UAS/Drone account. The UAS/Drone owner should complete the registration process.

a. New UAS/Drone Registration form
   i. The owner of the UAS/Drone shall complete the registration form found on the UAS/Drone Portal: New UAS Registration.
   ii. Information required within the form can be found in Appendix A.
   iii. Once the form is complete, it will be submitted to EHS who will:
      1. Verify insurance coverage,

2. Assign a CMU Drone ID, and
3. Register the UAS/Drone with the FAA.
    - UAS/Drone weighing 250 grams or more must register with the FAA. The FAA registration number (and Academy of Model Aeronautics number, if applicable) must be clearly marked on the exterior of the drone.
    - The operation of UAS/Drone outside of the United States may be subject to different licensing and registration requirements; it is the responsibility of the owner/pilot to comply with those requirements.

iv. The owner and any identified contacts will then receive the:
1. FAA registration number,
2. CMU Drone ID number,
3. Summary of FAA labeling requirements, and
4. Procedures for reporting changes or the retirement of the UAS/Drone.

b. UAS/Drone Registration Change Form
The UAS/Drone Change Form notifies EHS of changes to the UAS/Drone. EHS reviews the changes to ensure Insurance Coverage and make appropriate updates to the FAA Registration.
i. To notify EHS of a change to the UAS/Drone vehicle visit the UAS/Drone Portal and use the Request a Change to a UAS Registration form.

c. UAS/Drone Retirement Form
The UAS/Drone Retirement Form notifies the university that a UAS/Drone has been sold, destroyed, or retired.
i. From the UAS/Drone Portal select Retire a UAS/Drone Registration form, select the UAS/Drone that is going to be retired and indicate why this is occuring (i.e. being sold, destroyed, donated, etc.)
ii. EHS removes the FAA registration and assists the owner with the safe disposal, if needed.
iii. Complete form will be distributed to affiliated parties, i.e. contacts, insurance, etc.

7. Flight Operations/Requests

To ensure the safety of UAS/Drone operations and the CMU community, the UAS/Drone Pilot must complete a Flight Operation Request prior to operating a UAS/Drone over University Property, and a Flight Operation Closure Form once the flight has been completed.

Based on the intended flight, FAA authorization may be required if the flight will occur in controlled airspace. To determine if the intended flight location is within controlled airspace, reference the FAA Airspace Restrictions or the CMU UAS/Drone webpage for more information. If it is determined that special authorization or waiver is needed from the FAA, the Office of General Counsel must be contacted for counsel prior to initiating the request.

If changes to the approved flight request occur, the UAS/Drone Pilot will need to complete the Flight Operation Change Form. In addition, if an approved flight is canceled, a Cancellation Form needs to be completed.

a. Flight Operation Request

The Flight Operation Request form, found on the UAS/Drone Portal is completed by the staff, faculty, or student who requests to fly a UAS/Drone over University Property. The form is submitted to EHS who will verify the UAS/Drone registration, Pilot training, insurance coverage, and applicable contracts. The flight operations request will be routed to the space owners and the committee for comments and feedback.

i. Requests must be submitted at least **2 business days** in advance of any flight to allow time for the review and approval process. Form questions and required information can be found in Appendix B.

b. UAS/Drone Flight

i. Operate UAS/Drone in accordance with applicable FAA regulations, training, or supervisor instruction, and in a manner that protects public safety, the right to privacy, civil rights, and civil liberties.

ii. UAS/Drone Pilot must maintain proof of approved CMU Flight Request Form during flight operations. Proof of flight approval may be digital or printed.

iii. UAS/Drone pre-flight checklist is strongly recommended to be completed prior to UAS/Drone flight. Pre-flight checklist items can be found in Appendix C.

iv. An optional In-flight checklist can also be found in Appendix C for use during flight operations.

v. Any flight resulting in injury or property damage shall be reported immediately to drones@andrew.cmu.edu.

c. Post Flight Operation Survey

The post flight operation survey is completed after the flight is completed and reviewed by EHS.

i. A Post Flight Operation Survey can be found on the UAS/Drone Portal and should be completed within **5 business days** of the last flight.

ii. A Post Flight Operation Survey must include any significant or unexpected events that occurred during UAS/Drone operations and the Pre-flight checklist.

iii. An optional Post-Flight checklist can be found in Appendix C for use during the completion of a flight.

iv. If the Post Flight Operation Survey is not completed within 5 business days of the last flight, the survey will automatically be closed out.

d. Flight Operation Change

The Request a Change to a Flight Operation form allows the requester to alter a previously approved flight plan. EHS reviews the requested changes, gets the additional approvals, and updates the original flight requests as needed.

e. Flight Operations Cancellation

The Cancel a Flight Operation form allows the requester to cancel an approved flight. EHS reviews the request and notifies space owners and other members of the cancellation.

f. Privacy

i. A UAS/Drone must not be used to monitor or record activities where there is a reasonable expectation of privacy. A UAS/Drone must not be used for unapproved recordings of any campus events or performances, or for any unlawful purpose.

8. Indoor Spaces

Indoor UAS/Drone flights on University Property shall only be conducted in approved spaces. Space owners of indoor flight spaces shall complete a New Indoor Flight Space request for initial approval to the UAS/Drone Committee. Changes to an existing indoor flight space, and retirement of an indoor flight space shall be summitted by completing the affiliated forms on the UAS/Drone Portal. New and approved indoor flight spaces shall be inspected to ensure minimum requirements are met. EHS shall track approved indoor flight spaces.

a. New Indoor Flight Space
   i. Initiate a request by completing the New Indoor Flight Space form which will request the following information:
      1. Space owner name.
      2. Building name and space number of the space to be used.
      3. Any inability of the space to satisfy the list of indoor fight space requirements found in Appendix D.
      4. Any safety equipment or procedures utilized in the space not listed in Appendix C.
   ii. Completed indoor flight space requests will be routed to EHS at which point EHS will inspect the space prior to approval.
   iii. Approved indoor flight spaces shall be inspected annually by EHS to ensure the requirements found in Appendix D are able to be maintained.

b. Changes to an Existing Space
   i. Report any physical changes, or changes of a space owner of an approved indoor flight space by completing the Change an Indoor Flight Space form. After submitting the form, EHS will review and make updates within SciShield.
   ii. Based on the reported changes, EHS will determine if a follow up space inspection is required.

c. Retirement of an Approved Indoor Flight Space
   i. Report any plans to retire an existing approved indoor flight space as soon as possible by completing the Retire and Indoor Flight Space form found on the UAS/Drone Portal.
   ii. EHS will update the space listing accordingly.

d. EHS shall maintain a list of approved indoor flight spaces using SciShield.

e. Prior to flying a UAS/Drone within an approved indoor flight space, space owners shall verify
   i. UAS/Drone owned by CMU have been registered in accordance with Section 6.
   ii. UAS/Drone operators have completed training requirements listed in Section 5.
   iii. UAS/Drone operators are reminded that a UAS/Drone must not be used to monitor or record activities where there is a reasonable expectation of privacy. A UAS/Drone must not be used

for unapproved recordings of any campus events or performances, or for any unlawful purpose.

iv. Any incidents and injuries are reported in accordance with Section 9.

9. Incidents and Injuries

a. Any incident that results in injury or property damage must be reported to the University immediately by emailing drones@andrew.cmu.edu.

b. Any incident or injury that is considered an emergency must be reported to University Police immediately. Damages and/or injuries occurring to University property or individuals will be the responsibility of the UAS/Drone operator.

c. Any incident resulting in serious injury, loss of consciousness, or property damage greater than $500 must be reported to the FAA within 10 calendar days.
   i. The UAS/Drone Pilot will collaborate with EHS to submit a report to the FAA.
   ii. The incident information will also be communicated to the UAS/Drone Committee.

10. Program Violations

University faculty, staff, and students operating UAS/Drone in an unsanctioned, reckless, unsafe, or irresponsible manner, in violation of federal law, or in violation of this Program, will be subject to actions in accordance with applicable university policies.

Non-University users operating UAS/Drone in an unsanctioned, reckless, unsafe, or irresponsible manner, in violation of federal law, or in violation of this program, may be subject to criminal or civil actions.

11. References

a. FAA UAS/DRONE Webpage: https://www.faa.gov/UAS/Drone/

b. Remote Pilot Certificate Information: https://www.faa.gov/UAS/Drone/commercial_operators/become_a_drone_pilot/

c. FAA Part 107 Summary: https://www.faa.gov/UAS/Drone/media/Part_107_Summary.pdf

d. City of Pittsburgh Regulation: https://pittsburgh.legistar.com/LegislationDetail.aspx?ID=2471542&GUID=CE412BC6-C074-4249-BEEC-EAB2EAC508F2&FullText=1

e. CMU UAS/Drone Operations Manual: https://www.cmu.edu/ogc/training/restricted_access/cmu_unmanned_aerial_system_operations_manual.pdf

12. Revisions

Date	Documented Changes	Initials

Appendix A – UAS/Drone CMU Registration Process

1. UAS/Drone Registration

1.1. Name and Email
1.2. Organization or Department Affiliation
1.3. UAS/Drone Name (nickname given by owning department)
1.4. Purchase: Commercially, Modified, or Custom built
1.5. Take Off Weight
1.6. Remote ID Capabilities
1.7. Photo Capabilities
1.8. Recording Capabilities
1.9. Estimated Value
1.10. PAS Number
1.11. Upload a Picture
1.12. Owners – Primary Contact and Secondary Contact
1.13. Oracle String for FAA Registration
1.14. Acknowledgments and any Additional Comments

2. Request a Change to a UAS Registration

2.1. Select the UAS/Drone Registration that needs updated
2.2. Update any of the following information:
  2.2.1. Take Off Weight
  2.2.2. Remote ID Capabilities
  2.2.3. Photo Capabilities
  2.2.4. Recording Capabilities
  2.2.5. PAS Number
  2.2.6. Estimated Value
2.3. Owners – Primary Contact and Secondary Contact
2.4. Oracle String
2.5. Any Other Changed Information

3. Retire a UAS/Drone Registration

3.1. Select the UAS/Drone Registration that should be retired
3.2. Provide Reasoning for the Retirement
3.3. Any Other Information

Appendix B - Flight Operation Request

1. **Request Approval for a Flight Operation**
    - 1.1. Name
    - 1.2. Organization or Department Affiliation
    - 1.3. Flight Name
    - 1.4. Purpose of Flight and Description
    - 1.5. Aerial Photography or Videography
    - 1.6. Payload Description
    - 1.7. Flight Details
        - 1.7.1. Time Period
        - 1.7.2. Flight Date
        - 1.7.3. Take Off Site
        - 1.7.4. Flight Plan
        - 1.7.5. Flight Parameters
    - 1.8. UAS Owner
        - 1.8.1. CMU Owned – Select the Registered Drone
        - 1.8.2. Other – Provide detailed UAS/Drone Details
    - 1.9. Pilot in Command
    - 1.10. Pilot Affiliation
    - 1.11. UAS Operation
    - 1.12. Flight Type
    - 1.13. Pilot is Compensated – If yes provide additional details
    - 1.14. Pilot in Command Supervisor
    - 1.15. Plan for Pedestrian Safety
    - 1.16. Plan for Ensuring Building and Structural Safety
    - 1.17. Conditions for a Flight Cancellation
    - 1.18. Visual Observers
    - 1.19. Additional Crew Members
    - 1.20. Acknowledgements and Additional Comments
2. **Request a Change to a Flight Operation**
    - 2.1. Select an Approved Flight Operation
    - 2.2. Describe the Changes
    - 2.3. Acknowledge and Additional Comments
3. **Cancel a Flight Operation**
    - 3.1. Select an Approved Flight Operation
    - 3.2. Describe reason for Cancellation
    - 3.3. Acknowledge and Additional Comments

Appendix C – Flight Checklists

Pre-Flight Checklist

Hull and Propellers

- ☐ All hull screws are securely fastened to the body of the UAS/Drone.
- ☐ All propellers are securely fastened to the motors.
- ☐ Transmitters and accompanying wires are securely fastened to the hull.
- ☐ Camera(s), gimbal(s), and accompanying wires are securely fastened to the hull.
- ☐ There are no loose parts, wires, screws, or extremities that can fall from the UAS/Drone.

Safety Checks

- ☐ The operator performed a visual review of the area of operation.
- ☐ The operator is aware of aerial obstructions (i.e., poles, structures, utility wires, trees).
- ☐ The operator clearly marked a take-off/landing zone and an emergency landing zone.
- ☐ The operator has clearly announced that a UAS/Drone is preparing for flight.
- ☐ The operator has ensured no nonparticipating persons or large animals are near the take-off/landing and emergency landing zones.
- ☐ Weather permits the safe operation of the UAS/Drone.

Power to System

- ☐ The battery being placed into the UAS/Drone has a full capacity charge.
- ☐ The batteries inside the RC controller have a sufficient charge.
- ☐ There is a spare UAS/Drone battery with a full charge.
- ☐ There are spare batteries for the RC controller with a full charge.
- ☐ The UAS/Drone battery is securely fastened within the UAS/Drone hull.
- ☐ The UAS/Drone powers up completely indicating a normal audible chime of operability.
- ☐ All lights on the UAS/Drone are operating normally.

RC/WIFI

- ☐ There is a steady connection between the RC controller and the UAS/Drone.
- ☐ The UAS/Drone is responding accurately and efficiently to RC commands.
- ☐ RC Controller is set to appropriate control mode.
- ☐ Onboard computers are connected and functional.
- ☐ Data logging if any is activated.

Satellite Connectivity

- ☐ UAS/Drone is indicating full satellite/GPS connectivity.
- ☐ UAS/Drone has set the “home” location to include altitude and speed.
- ☐ Following take-off, UAS/DRONE successfully completes a 10-second unassisted hover in Position Hold mode.

Miscellaneous

- ☐ Firmware versions are correct on the UAS/Drone and transmitter.
- ☐ The onboard computers have correct versions of code compiled and tested.
- ☐ The flight log is updated.

In-Flight Checklist

Safety Checks

- ☐ Be aware of orientation and maintain full control.
- ☐ Fly no higher than the maximum specified within FAA regulations.
- ☐ The operator is aware of aerial obstructions (i.e., poles, structures, utility wires, trees).
- ☐ The operator has ensured no nonparticipating persons or large animals are near the flying zone, if so announce landing.
- ☐ Weather permits the safe operation of the UAS/Drone (i.e., little to no wind, no precipitation).

Power to System

- ☐ Battery in the UAS/Drone has more than the charge required to safely fly back and land to the home point.
- ☐ The batteries inside the RC controller have a sufficient charge.

RC/WIFI

- ☐ There is a steady connection between the RC controller and the UAS/Drone.
- ☐ The UAS/Drone is responding accurately and efficiently to RC commands.

Satellite Connectivity

- ☐ UAS/Drone is indicating full satellite/GPS connectivity.

Post-Flight Checklist

Hull and Propellers

- ☐ All hull screws are securely fastened to the body of the UAS/Drone.
- ☐ All propellers are securely fastened to the motors.
- ☐ Transmitters and accompanying wires are securely fastened to the hull.
- ☐ Camera(s), gimbal(s), and accompanying wires are securely fastened to the hull.
- ☐ There are no loose parts, wires, screws, or extremities that can fall from the UAS/Drone.

Onboard Computer

- ☐ Computers have connectivity.
- ☐ Data logging if any is turned off and downloaded to computers.
- ☐ Computers have been properly shutdown.
- ☐ Flight time is logged in logbook.

Power to System

- ☐ Power to UAS/Drone is turned off.
- ☐ Batteries within safe discharge/storage voltage:
- ☐ Minimum 3.00 volts per cell for flight batteries.
- ☐ Approximately 3.85 volts per cell for spare batteries.
- ☐ Batteries removed and stored properly.
- ☐ Motor and Speed-controller temperatures are normal.
- ☐ Battery temperature is normal.

Miscellaneous

- ☐ The flight log is updated.

Appendix D – Indoor Flight Space Requirements

1. Netting system that can prevent damage to the space, the building equipment within the space and the space occupants.

2. Area outside of a netting system where UAS/Drone Pilots can operate. This should prevent the area inside of the netting system from being occupied while UAS/Drone are in operation. This area should be located and configured so that UAS/Drone Pilots are able to maintain visual contact with UAS/Drone during operation.

3. Runaway battery station to allow for safe disposal of runaway batteries.

4. Appropriate fire extinguisher or sprinkler system within the space.