University of Colorado Boulder
Unmanned Aircraft Systems
FIight Operations Manual

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Chapter 1. Introduction

1.1 Preface *

FAR 91, FSIMS 8900.1

The UAS Advisory Committee (UAC), which is charged with ensuring the users of the University's FAA approved assets are properly trained and qualified to operate safely was formally established in 2018 in conjunction with the approval of the CU Boulder UAS Policy. The UAC establishes and maintains policies, procedures, and training to ensure users understand the requirements to operate safely in the NAS, and within the complex limitations of the COAs and regulatory framework. The UAC is recognized by the Chancellor for this purpose. The UAC consists of the following personnel: Associate Vice Chancellor of Integrity, Safety and Compliance, Associate Vice Chancellor for Research-Integrity & Compliance, IRISS Representative, RECUV Representative, Director of Flight Operations, Risk Management Representative, CUFF Chairperson, CUPD Representative, Student Affairs Representative, and Student Representative. The daily functions of this committee will be delegated by the UAC to the Director of Flight Operations (DO). Prior to any UAS operations the DO approves each Pilot in Command (PIC), Instructor and Visual Observer (VO). Due to FAA requirements, groups or departments will not be approved as users, only individuals.

There are three FAA approved paths allowing the legal operations of unmanned aircraft in the national airspace system. These paths are: COAs, FAR Part 107, and Hobbyists as defined by H.R. 302. COAs are Certificates of Waiver or Authorizations granted by the FAA allowing specific users such as a public university to operate specific aircraft in specific locations. UCB has numerous COAs that are used for numerous aircraft and research missions. FAR Part 107 is a chapter of the Federal Aviation Regulations that grants permissions to individuals allowing them to fly small UAS below 400 feet above ground level over most of the United States. Hobbyists are individuals who are operating strictly for pleasure, not commercially, to operate UAS in accordance with the rules of community based organizations such as the Academy of Model Aeronautics. UCB Faculty, Staff, and Students have many specialized needs when it comes to operating UAS. In most cases operating under a UCB COA will be the preferred path. In some cases, Part 107 or the Hobby Exemption may be the most appropriate solution. We recommend all users consult with the DO in order to determine which path is best suited to that individuals need.

Drones weighing less than 0.55 pounds are exempt from FAA regulations regarding registration, however other FAA regulations may apply. UCB has policies regarding their operations over University property. These procedures are in chapter 6 of this manual. For these operations only the rules in chapter 6

of this manual apply.

This Flight Operations Manual (FOM) is required by the FAA to allow The University of Colorado Boulder (UCB) to "self-certify" UAS, flight-crew members, and for operations authorized by COAs. It includes instructions and information necessary for personnel involved with the operations of UCB aircraft to perform their duties and responsibilities with a high degree of safety.

Operations conducted according to this manual have been accepted or approved by the Director of Flight Operations as meeting FAA and University requirements for operations.

Each employee or student is required to be thoroughly familiar with the content of this manual as it pertains to his/her area of responsibility. This manual shall be accessible when performing assigned duties. Additionally, crewmembers are charged with having a good working knowledge of all regulations pertinent to the exercise of their responsibilities as crewmembers.

1.2 Authority *

FAR 91, COA

This manual applies to all UCB associated individuals who intend to fly UAS under the authority granted by UCB-owned COAs, Part 107 or the Hobby Exemption. It also applies to individuals operating toy drones over UCB property. Only UCB associated individuals are authorized to operate under the authority granted by any UCB COA.

Compliance with procedures in this manual are mandatory and must be followed by all Faculty, Students and Staff as well as all individuals who operate UAS from UCB property as applicable.

UCB employees, instructors and students who wish to operate in UCB-owned COAs are required to comply with all paragraphs of this manual except those solely pertaining to hobbyists.

UCB employees, instructors and students who wish to operate exclusively under FAA FAR Part 107, are required to comply only with paragraphs of this manual with an askerisk (*) after the title of the paragraph. This paragraph in no way relieves any person from the requirement to comply with FAR Part 107.

UCB employees, instructors and students who wish to operate exclusively under the Hobby Exemption must comply with chapter 7 of this manual if

they are operating as a member of a sanctioned UCB club, or if they are operating over UCB property.
UCB employees, instructors and students who wish to operate toy drones over UCB property must comply with Chapter 6 of this manual

In cases where a discrepancy exists between this manual and the Federal Aviation Regulations (FARs), including COAs, the FARs shall take precedence.

1.2.01 Reproduction *

This manual may be shared or reproduced outside of the University of Colorado Boulder.

1.2.1 Format

Small italic type below a paragraph header indicates the regulatory source where information contained in the paragraph originates.

1.2.11 Electronic Copy

An electronic copy of the most current revision of this manual shall be deemed as a legal copy for use.

1.2.2 Change Bars

A vertical line next to a paragraph or sentence indicates that a change has been made to that content in the last revision of the manual. A vertical line next to the page number indicates the entire page has changed since the last revision.

1.3 Definitions

FAR 1, COA

-Advisory Circular (AC): FAA document used to further define or illustrate a FAR or policy

-AGL: Reference to above ground level altitude

-Auxiliary Operator (AOP): Auxiliary Ground Station Operator (ie, follow-me)

-Auxiliary VO (AVO): Additional Visual Observer required for specific missions

-Cloud Ceiling: The lowest layer of clouds or obscuring phenemonon with 80 percent or greater coverage.

-COA: COA is an authorization issued by the Air Traffic Organization to a public operator for a specific UA activity

-Continuing Airworthiness: The decision that a proven UAS is in a condition acceptable for safe flight

-Crewmember: Any person acting as a PIC or VO for operations under a COA or FAR Part 107. A pilot flying under the hobby exemption, or a pilot operating a toy drone is not considered a crewmember for the purposes of this manual.

-UCB Flight Instructor (CFI): An individual approved by the DO to instruct and certify pilots and VOs in the operation of UCB UAS

-Day: Is defined as 30 minutes prior to official sunrise until 30 minutes after official sunset

-Director of Flight Operations (DO): Individual delegated by the UAC to set procedures for operations, training, standardization and airworthiness for the University of Colorado Boulder regarding UAS operations in accordance with FAA policies and procedures

-Duty Time: Time period beginning when a crewmember begins their daily work activities and ending when the work activities end for the day.

-Federal Aviation Regulation (FAR): Federal regulations pertaining to aircraft operations

-Flight Crew Lead (FCL): Flight Crew: Aircraft Maintenance, Setup, Take-down

-Flight Operations Coordinator (FOC): Coordinator of ground crew and regulatory obligations. PIC may, at times, fulfill this role

-Flight Operations Manual (FOM): The UCB-owned manual governing the operation of UAS by UCB personnel or over UCB property

-Flight Time: The time from when the aircraft becomes airborne under its own power until it comes to rest at the end of a flight. This time should be rounded to the nearest tenth of an hour for logging purposes.

-Hobbyist: A pilot flying as a hobbyist as defined by House Resolution (H.R.) 302 or other applicable federal laws

-Initial Airworthiness: The decision that a new UAS is safe to operate in the NAS

-IRISS: Integrated Remote and In-Situ Sensing Program

-Launch Crew Lead (LCL): Lead Launch Crew Setup/Takedown/Launch

-LZ: Landing Zone (Landing Site)

-May: is used in a permissive sense. It means the desire or method is not mandatory

-Mission Leader (ML): Highest Ranking team member on site. Typically, IRISS or RECUV Project PI and/or Faculty Member

-MSL: Reference to above mean sea level altitude

-National Airspace System (NAS): All airspace over the United States of America, this airspace is controlled and regulated by the Federal Aviation Administration

-NOTAMS: Notices to Airman required by the FAA to be filed in the national NOTAM system warning all airspace users of operations taking place which may influence the users' operations

-Pilot at the Controls Manual (PAC-M): Pilot with direct manual Control of the UA (Usually the PIC)

-Pilot at the Controls Operator (PAC-O): Pilot at Controls of Primary Ground Station

-Pilot in Command (PIC): FAA certified pilot in charge of all Flight Operations and Safety

- Public Aircraft: An aircraft owned, leased, or operated for or by a federal or state government, or a political subdivision of one of these governments, as defined by statute in 49 U.S.C. § 40102(a)(41)

-Quick Reference Handbook: UCB owned publication which contains Emergency, Abnormal and Normal procedures for operating a specific aircraft type. Not all aircraft have a QRH, most small commercially available UAS utilize their own electronic or written checklists, not a QRH.

-RECUV: Research and Engineering Center for Unmanned Vehicles
-Scout Observer Landing Site Coordinator (SCO): Scout Vehicle Observer, LZ scout

-Section 333 Exemption: FAA operating authority granted under section 333 of Public Law 112-95

-Toy Drone: Any UAS weighing less than .55 pounds. See chapter 6 for more information

-TFR: Temporary Flight Restriction issued by the FAA for safety of flight or national security reasons

-UA: Unmanned Aircraft, the airborne component of an unmanned aircraft system

-University of Colorado Boulder (UCB): The University of Colorado-Boulder campus and all persons and entities governed within

-Unmanned Aircraft System (UAS): Any unmanned aircraft, either heavier or lighter than air

-Video Support Aircraft PIC (VID): Lead of mission videography

-Video Support Aircraft Visual Observer (VVO): VO for Video Lead

-Visual Line of Sight Aircraft Operation:

(a) With vision that is unaided by any device other than corrective lenses, the remote pilot in command, the visual observer (if one is used), and the person manipulating the flight control of the small unmanned aircraft system must be able to see the unmanned aircraft throughout the entire flight in order to:

(1) Know the unmanned aircraft's location;

(2) Determine the unmanned aircraft's attitude, altitude, and direction of flight;

(3) Observe the airspace for other air traffic or hazards; and

(4) Determine that the unmanned aircraft does not endanger the life or property of another.

(b) Throughout the entire flight of the small unmanned aircraft, the ability described in paragraph (a) of this section must be exercised by either:

(1) The remote pilot in command and the person manipulating the flight controls of the small unmanned aircraft system; or

(2) A visual observer.

-Visual Meterological Conditions (VMC): Weather conditions greater than 3 statute miles visibility and a cloud ceiling equal to or greater than 1000' above ground level

-Visual Observer (VO): Primary Visual Observer (Lead)

1.4 Time Reference

All references to time, including dates, are based on Universal Time Coordinated (UTC) unless otherwise defined.

1.5 Gender Reference

Any references to persons in this manual are gender-neutral, i.e., statements herein apply equally to all persons.

1.6 Revision Control *

Control of this manual is the responsibility of the UAS Advisory Committee. No alterations, changes, or deviations are authorized without prior approval from the UAC. The DO is authorized to change or update any material in the appendices' of this manual without UAS Advisory Committee approval.

1.7 Change Indicators

A heavy vertical line (change bar) in the margin identifies changed, added, or deleted material.

Chapter 2. Operational Policies

2.1 General *

FAR 91, COA

University of Colorado Boulder flight operations are conducted in compliance with the applicable FARs, COAs, CU Policy, local regulations, and the procedures established in this manual. There shall be no deviations from applicable FARs or COAs unless an exemption or deviation is approved by the FAA. However, no policy or regulation shall be interpreted as a substitute for the exercise of sound judgment.

2.12 Safety *

Safety is the most important consideration in all UCB flight operations. The operating philosophy also supports the conclusion that safety is an essential ingredient to research and mission success. In the course of flight operations, several factors must be given due consideration by all flight crewmembers. The most important are: Safety and Legality.

The following items describe the key crewmember responsibilities as they relate to the primary responsibility – Safety:

• During times when various priorities of safety, legality, and reliability appear to be in conflict, it is the responsibility of all crewmembers in general, and the PIC in particular, to ensure that safety remains the primary focus.

• Any crewmember who observes a non-standard procedure that has not been explained shall immediately communicate this deviation to the other crew-members.

• Any uncertainty regarding the safety of an operation is to be questioned and satisfactorily resolved before that operation is conducted or continued.

• If a crewmember becomes aware of a significant operational conflict which causes concern, he must immediately inform the PIC.

• Whenever there are warning signs that situational awareness is inadequate or at risk, they must be communicated immediately so that corrective action may be taken.

• Every crewmember must address and resolve any doubts or confusion regarding what is happening, what a particular crewmember is to do, how that crewmember is to do it, or who is doing what.

2.13 Fatigue *

FAR 91, COA

It is the crewmember's responsibility to be properly rested for each flight operations event. However, if circumstances prevent this, no crewmember should feel pressured to work when not properly rested. A crewmember who is fatigued should immediately notify the PIC, and ML if applicable.

2.14 UAS Advisory Committee (UAC):

"Unmanned Aircraft System Advisory Committee" means the committee appointed by the Chancellor to:

a. establish and maintain this policy;
b. periodically review the UAS policy and associated procedures and recommendations of the DO; and
c. review UAS policy and procedure exceptions proposed by the DO.

The Committee is chaired by the Associate Vice Chancellor for Integrity, Safety and Compliance and may include the following representatives:

Associate Vice Chancellor for Integrity, Safety and Compliance

Associate Vice Chancellor for Research-Integrity & Compliance

IRISS Represenative

RECUV Represenative

Student Represenative

University Risk Management Represenative

CUUF Chairperson

Director of Flight Operations

Vice Chancellor for Infrastructure and Sustanability Represenative

Student Affairs Represenative

CUPD Represenative

2.17 Director of Flight Operations (DO)

The DO is delegated by the UAC to set procedures for operations, crew training and standardization, and airworthiness for the University of Colorado Boulder regarding UAS operations in accordance with FAA policies and procedures. The DO has final authority regarding these issues and will implement the policies desired by the UAC to the maximum extent practical while still adhering to all federal, state and local laws. The DO is will submit an annual report to the committee on flight activity, including any required reports that were submitted to the FAA or NTSB.

2.18 Safety Action Report (SAR) *

All Pilots or Visual Observers must submit this report to the DO within 24 hours of any accident/incident, as defined below. Only one report for each event is required. However, the Pilot and VO may both submit a separate SAR for the same event. The SAR is located in the appendix of this manual.

This report is used to document any unsafe events that occur while flying or preparing to fly an unmanned aircraft. In addition, this SAR will be used by the DO and the UAS Committee for consideration and possible investigation. The intent of this report is to learn and become safety as well as to assist in compliance with FAA, NTSB, and UCB reporting requirements.

- "Accident" or "incident" is defined as any:
    - Fatal injury, where the operation of a UAS results in a death occurring within 30 days of the accident/mishap
    - Physical injury
    - Total unmanned aircraft loss
    - Substantial damage to the unmanned aircraft system where there is damage to the airframe, power plant, or onboard systems that must be repaired prior to further flight
    - Damage to property, other than the unmanned aircraft.
    - Any incident/mishap that results in an unsafe/abnormal operation including but not limited to:
        - A malfunction or failure of the unmanned aircraft's on-board flight control system (including navigation)
        - A malfunction or failure of ground control station flight control hardware or software (other than loss of control link)
        - A power plant failure or malfunction
        - An in-flight fire

        - An aircraft collision
        - Any in-flight failure of the unmanned aircraft's electrical system requiring use of alternate or emergency power to complete the flight
    - A deviation from any provision contained in the COA
    - A deviation from an ATC clearance and/or Letter(s) of Agreement/Procedures
    - A lost control link event resulting in
        - (1) Fly-away, or
        - (2) Execution of a pre-planned/unplanned lost link procedure.
    - Loss of over $250.00 in equipment through damage or loss
    - Non-compliance with FAR or COA requirements
    - Any other event any crewmember deems worthy of a SAR

2.19 Responsibility and authority of the pilot in command *

FAR 91

(a) The pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft.

(b) In an in-flight emergency requiring immediate action, the pilot in command may deviate from any rule to the extent required to meet that emergency.

(c) Each pilot in command who deviates from a rule under paragraph (b) of this section shall, upon the request of the DO, send a written report of that deviation to the DO.

2.19.1 Minimum Crew Complement

COA, FSIMS 8900.1

The minimum flight crew that a UAS may be operated with is one PIC and one VO

2.2 Crew Duties *

FAR 91, COA, FSIMS 8900.1

-PIC: FAA or UCB Certified pilot in charge of all Flight Operations and Safety. The PIC has final and ultimate authority over all flight operations for which he is assigned. The PIC may delegate tasks as necessary to any crewmember in the interest of situational awareness or safety. **This is an FAA required position**.

-PAC-M: Pilot at Controls (Usually the PIC) Individual responsible for the safe manual control of the aircraft. The PAC-M is responsible for assuming manual control if the safety of flight in any autonomous mode is ever in doubt. The PAC-M is also responsible for launch and recovery of the aircraft if autonomous launch and recovery are not possible

-PAC-O: Pilot at Controls of Primary Ground Station, responsible for the setup and operation of all ground station equipment. Must maintain exceptional situational awareness and communicate with the PIC and or PAC-M effectively. Can be concurrently filled by the PIC

-AOP: Auxiliary Ground Station Operator, responsible for the setup and operation of all UAS mission specific flight or science support equipment on-board the UAS. Must maintain exceptional situational awareness and communicate with the PIC, PAC-O and or PAC-M effectively.

-VO: Primary Visual Observer responsible for the safe visual de-confliction of all hazards to flight. Must communicate effectively with the PIC, PAC-M and PAC-O. This is an FAA required position.

-ML: Mission Leader - Highest Ranking team member on site. Typically the Project PI and/or Faculty Member. Responsible for overall direction of the mission in coordination with the PIC. **In no case, during flight, may the ML override a decision made by the PIC regarding the operation of the aircraft.**

-FOC: Flight Operations Coordinator - Coordinator of ground crew and regulatory obligations. PIC may, at times, fulfill this role. Responsible for the coordination of all ground based activities including NOTAM issuance and other regulatory responsibilities if delegated from the PIC.

-FCL: Flight Crew Lead – Primarily responsible for the continuing airworthiness of the aircraft as delegated by the PIC. Duties also include aircraft maintenance, setup and take-down.

-LCL: Launch Crew Leader - responsible for launch equipment setup, takedown and assisting the PAC-M and PIC with launching the aircraft.

-VID: Lead of mission videography. PIC of videography platforms, must be certified by UCB or FAA standards as a PIC. Responsible for the gathering of in-flight video and photo data in a safe and effective manner without adversely impacting the research and science project being filmed.

-VVO: VO for Video Lead, Visual observer for the VID, FAA required position who must maintain exceptional situational awareness with the VID and the PIC/PAC-M

-SCO: Scout Vehicle Observer, LZ scout. Responsible for coordinating communications between the scout vehicle and other operators. Must use sound judgment to assist the PIC in choosing landing sites that are acceptable for the mission restrictions and aircraft/operator limitations in place.

2.21 Flight Times *

COA

No PIC or VO will operate a UAS more than 8 flight hours per calendar day. COA or CU Boulder specific limitations, which are more restrictive than those listed above are binding.

2.215 Duty Times *

All COA or CU Boulder duty times are binding

2.22 Preflight Action *

FAR 91

Each pilot must thoroughly pre-flight their aircraft before commencing flight operations and before each subsequent flight of the day. This pre-flight should be done in accordance with written or electronic checklists.

Each pilot in command shall, before beginning a flight, become familiar with all available information concerning that flight. This information must include:

1. Planned flight path to the maximum extent reasonable before beginning the flight
2. Any NOTAMS or TFR restrictions that may affect the flight
3. Any known traffic conflicts that may arise, for example the location and information pertaining to any airports along the planned or potential flight path
4. Any other deficiencies, personnel or mechanical which may affect the safety of flight

2.22.1 NOTAMS *

COA, FAR 91

The PIC is responsible to ensure that NOTAMS are issued for all flight activities in accordance with applicable COAs and FARs

2.23 Flight Plans *

COA, FAR 91, FSIMS 8900.1

The PIC is responsible for ensuring any necessary flight plans and or Air Traffic Control (ATC) facility coordination is completed before flight

2.24 Delegation of Authority *

FAR 91

The PIC may delegate their authority as they see fit in order to accomplish mission tasks so long as the delegation of their authority does not exceed FAA limitations on such. However, in no case is this delegation of authority deemed to be a relief of responsibility of that authority which the PIC always retains.

2.24.1 In Flight Crew Change *

If briefed among all crewmembers, PIC and VO roles may be switched mid-flight between any qualified crewmembers for any reason

2.25 Flight Currency *

COA, FAR 61

PICs will maintain currency on all UAS systems they operate. A minimum of three takeoffs and landings must be made on each UAS type every 90 days. If a pilot does not maintain currency they must accomplish three takeoffs and landings before operating the UAS as PIC. If a pilot fails to maintain currency, they must accomplish three takeoffs and landings under the direct supervision of a CFI in order to re-establish currency.

Pilots may be qualified on multiple similar aircraft types in a class of aircraft, for example, all commercially produced multirotors under 55 pounds. In this case, the PIC is still required to maintain currency on each specific aircraft type in the class they intend to operate.

Pilots must maintain a log of their flight currency that is available for FAA or management review at any time. The pilot's personal electronic logbook, issued by the DO, is the only acceptable means of compliance with this rule. Part 107 users and those using the Hobbyist Exemption do not need to log this information.

2.26 Stabilized Approaches *

Stabilized approaches to landing are essential to safe operations. Pilots will strive to be stable on final approach as early as operationally feasible. Limiting bank angles to 30 degrees or less in the approach and landing regime is required unless other requirements dictate steeper bank angles.

2.261 BVLOS Approaches *

During flights utilizing beyond visual line of sight permissions Pilots and VO's are required to maintain visual line of sight with the aircraft for takeoff, approach and landing.

2.27 Flight over Congested Areas *

FAR 91, COA

Flight over persons or congested areas should be avoided as much as possible.

The entire CU Boulder campus (Main Campus, East Campus, South Campus and Williams Villiage) is considered a congested area and is therefore prohibited unless specific written permission is granted by the UAC or DO.

2.28 Radio Communications*

Radio discipline is very important to ensure there is no confusion as to what is being said or who has received the message.

It is important to:

• Avoid “radio slang” terms. Always use standard phraseology and enunciate clearly at all times.

• Avoid causing congestion on the frequency by limiting any non-essential radio traffic so the VO, MC and PIC have adequate communication opportunities.

2.29 Sterile Operations *

No person may engage in nor may any pilot in command permit any conversation or other activity that could distract or interfere with a flight crewmember in the proper conduct of flight duties during a critical phase of flight. Critical phases of flight include all operations from when the UAS is placed in position for takeoff or launch until the aircraft comes to rest at the conclusion of flight.

2.21 Operation in the vicinity of Military Training Routes *

No person may operate a UAS within 5 nautical miles of the centerline, or closer than 100’ above or below the vertical limits of a published VR or IR military training route without coordinating with the DO for approval. The DO may desiginate, in writing, a representative to handle MTR coordination and approval in situations where it is deemed appropriate

2.3 Careless or Reckless Operations *

FAR 91

No crewmember may operate an aircraft on the ground or in flight in a careless or reckless manner so as to endanger equipment, life, or property of another.

2.31 Accident Investigation*

COA, FSIMS 8900

If the UAC deems it necessary the UAC Chair will convene a board to investigate an accident. For specific guidance, reference the following CU Boulder documents, located in the appendix of this manual:

1. CU Boulder UAS Accident Criteria and Protocols
2. PIC UAS Post Accident Checklist

2.32 See and Avoid Policy *

FAR 91, COA

When meteorological conditions permit, regardless of type of flight plan or whether or not under control of a radar facility, the PIC and/or VO is responsible to see and avoid other traffic, terrain or obstacles.

2.34 Extreme Maneuvers *

Extreme or acrobatic flight maneuvers are prohibited except in cases where the PIC deems them necessary for engineering or scientific research purposes. All maneuvers not necessary to safe and orderly flight shall be avoided. Normal flight operations should not require more than a 60° angle of bank or 45° pitch.

Except for an emergency, such as collision or terrain avoidance, no abnormal maneuvers shall be executed. Maneuvers required during flight training or maintenance/test flights are authorized.

2.35 Crew Briefings *

All flight briefings should identify known or potential threats to safety and develop specific strategies the crew will utilize to counter these threats in order to reduce the potential for error. Normal procedures should not be briefed. Threat awareness, error detection and correction shall be included in these three primary briefings that occur on every flight:

- Initial Crew Briefing
- Before Landing Briefing
- Post Flight Debriefing

2.36 Checklist Usage *

FAR 91

Crewmembers will utilize checklist procedures for all flight operations.

2.37 Aircraft Discrepancies

COA, FSIMS 8900.1

The PIC ensures that any discrepancy, which may affect the airworthiness of the aircraft, is entered in the maintenance logging system so that the appropriate maintenance action is accomplished before the next flight.

2.38 FAA Notices *

Any communication received from the FAA that could result in enforcement action against any UCB employee must be immediately forwarded to the Director of Operations or his representative.

2.4 Alcohol and Drug Use *

FAR 91

No crewmember may consume alcohol or any drug that could impair their ability to operate within 8 hours prior to any flight operation

The maximum allowable blood alcohol level while performing flight duties is .04%

Federal law prohibits marijuana use by crewmembers

2.41 Corrective Devices *

FAR 67, COA

Each Pilot and VO will ensure they wear any vision correction devices or hearing aids required at all times during flight operations

2.42 Crew Qualifications

COA

Each Pilot or VO must be trained in accordance with the Crew Training and Standardization section of this manual before they may operate a UCB UAS. This does not apply to individuals under the direct instruction of a CFI.

Each pilot is authorized to act as PIC only on certain UAS types. A list of UAS types each individual PIC is authorized to operate will be maintained in their training folder by the DO. Under no circumstances is a pilot allowed to operate as PIC on a UAS type not specifically listed in their training folder.

Unless otherwise noted VO's may operate as a VO all UCB-owned UAS types.

2.43 Medical Qualifications

COA, FAR 67, FSIMS 8900.1

Each Pilot, CFI or VO must possess one of the following before they can act as a PIC, VO or CFI:

-Driver's License issued by a US State or US Territory
-FAA issued First, Second or Third class medical certificate. (First and Second class medical certificates that have reverted to Third class are acceptable)
-Certificate showing the individual has 20/20 vision (corrected or uncorrected) and normal hearing in both ears issued by a medical professional licensed in the Unites States. Wardenberg Health Center can provide this certificate if needed.

The DO or his representative must keep documentation of each VO, CFI and PIC's compliance with this requirement in that individual's training folder. Crewmembers must report changes to their medical qualification within 48 hours.

2.43.1 Operations with a Known Medical Deficiency *

Any crewmember who has a known condition, which in their opinion could impair their ability to safely operate a UAS, shall immediately remove themselves from flight duty until the condition is resolved.

2.44 UAS aircraft flight manual, marking, and placard requirements. *

FAR 91, COA

No person may operate a UAS without complying with the operating limitations specified in the approved Flight Manual, markings, and placards, or as otherwise prescribed by the certificating authority

All UAS must be registered in accordance with current FAA requirements. The DO or his delegate will maintain a list of applicable UAS registered to UCB. Any PIC who is a CU Faculty, Staff or Student, must ensure their aircraft is legally

registered. If requested, the PIC must provide proof of registration of their aircraft to the DO within 24 hours.

All UAS must properly display proper registration in accordance with FAA rules.

2.45 Required Documentation *

All crewmembers are required to have a copy of the FOM available when they are conducting flight operations. A hard copy or electronic copy is acceptable.

All crewmembers are required to have a copy of all applicable COA's available when they are conducting flight operations. A hard copy or electronic copy is acceptable

Hobbyists must have their AMA card on their person while flying as a hobbyist over UCB property

Crewmembers and hobbyists must present their required documentation to law enforcement officials when asked.

2.46 Master Logbook

COA

All PICs must log every flight they make in the Master Flight Log Spreadsheet located on the Google Drive within 24 hours of flight completion.

The DO or his representative shall ensure the monthly COA reporting logs are compiled and submitted by the fifth business day of the following month

2.46.1 Individual Pilot/VO Logbooks

Each pilot and VO must log all flight activity in their individual logbook. Each pilot has a folder located on the Google Drive which is only viewable only by that individual, the DO and the FAA. This log is the official record of your flight time at UCB. This log will support your training record and provide the legal proof of your currency. Expect the DO and FAA to examine this log

If a UCB instructor has given you Dual instruction you should open the logbook so he can record the instruction given (This can be used for the Acronym list)

Logbook Entry Definitions:

PIC = Pilot in command time, this is the time where you served as the legal PIC for a flight. This time can only be logged after you are a qualified PIC

PAC-O = Time served as the PAC-O. This time can be completely separate from PIC time

PAC-M = Time served as the PAC-M. This time can be completely separate from PIC time

UAS Type = Type of UAS flown, e.g., TTwistor, Pix-Trainer, etc.

Location = The geographic location where the flight originated, for example Table Mountain, Hays KS, etc.

COA = The COA you were operating under, for example 2016-CSA-75-COA

Dual = The time where you were flying at the controls under the direct supervision of a CFI

VO = The time you were serving as the FAA required VO

Landings = The number of landings where you were the PAC

Instructor = The name of the instructor who gave you Dual time

A/C Reg. = The FAA registration number for the aircraft flown

2.47 Aircraft Ownership

All aircraft operated by UCB crewmembers in UCB COAs must be owned by UCB. A legally binding bailment agreement transferring ownership to UCB on a temporary basis is a satisfactory means of complying with this requirement. CU must have exclusive control of the UAS for the duration of the bailment, including responsibility for all flight operations. The minimum duration of a bailment agreement is 90 consecutive days. The bailment agreement cannot be shortned under any circumstances. CU personnel or affiliates must occupy all required crew positions during flight operations.

2.48 Dropping objects *

FAR 91

No pilot in command may allow any object to be dropped from that aircraft in flight that creates a hazard to persons or property. However, this section does not prohibit the dropping of any object if reasonable precautions are taken to avoid injury or damage to persons or property.

2.49 Notifications for Flight Operations*

All pilots must request written permission from the DO 48 hours in advance for all flights over UCB property. This allows time for coordination between appropriate authorities including CUPD, CUUF, and other parties who must be made aware of legitimate flight operations over campus. An email to the DO with the requested location and times for the flights is the preferred way to comply with this paragraph.

This paragraph applies to faculty, staff and students flying for official projects. This paragraph does not apply to hobbyists flying as part of a club or for pleasure. Flights for these purposes should refer to Chapter 7

2.5 CUUF Procedures

Approval for flight operations does not constitute approval from the organization responsible for management of the takeoff and landing location. CUUF procedures must be followed to obtain the necessary authorization for any UCB facility use.

2.51 Professional Photo Video Licensing

All operators who plan to obtain photo or video footage from a UAS operated under the authority granted by policies or procedures in this FOM must adhere to the:

THE UNIVERSITY OF COLORADO BOULDER MOTION PICTURE, VIDEO, TELEVISION AND PHOTOGRAPHY LOCATION AGREEMENT.

Contact:

University Strategic Relations
3100 Marine St, Rm. 505
Campus Box 584

Boulder, Colorado 80309-0584

for additional information.

2.6 English Language Proficiency

FAR 61

No person may act as a UCB PIC or VO unless that person meets the English language proficiency requirements of FAR part 61. If a person holding UCB PIC or VO privledges does not meet FAA English language proficiency requirements, the DO will suspend those privledges.

See FAA Advisory Circular (AC) AC 60-28A for information on FAA English language proficiency requirements.

2.7 Flights Near Residence Halls

Hobbyist – No hobbyist may operate a UAS within 200' of a residence hall

Toy Drones – Nobody may operate a drone weighing less than 0.55lbs within 200' of a residence hall

Research or Official CU Business – Flights within 200' of a residence hall must follow all campus resident notification procedures to ensure all residents are aware of the flight prior to commencement

2.8 Weather Requirements

No flights may be conducted when the lowest cloud ceiling is below 1000' AGL

No flights may be conducted when the prevailing visibility is less than 3 nautical miles

2.81 Cloud Clearance Requirements

No UAS will be operated at a distance from a cloud less than:

1. 1000' above a cloud
2. 2000' horizontal from a cloud
3. 500' below a cloud

Chapter 3. Crew Training and Standardization

3.1 Authority

COA, FSIMS 8900.1

UCB has the authority to train and certify our Pilot in Command and Visual Observer crewmembers as we determine appropriate. This authority is granted via our COAs in accordance with FAA order FSIMS 8900.1 UCB also retains the right to remove any individual from flight status if they fail to meet the minimum requirements for certification.

FAA COA Language:

- *The University of Colorado Boulder is authorized to conduct operations in accordance with the FSIMS 8900.1, Volume 16, Chapter 4, Section 1, Pilots, dated 5/17/16.*

- *The University of Colorado Boulder is authorized to conduct operations in accordance with the FSIMS 8900.1, Volume 16, Chapter 4, Section 4, Visual Observers and Other Personnel, dated 5/17/16.*

- *This change applies to all active and pending COAs.*

3.12 Delegation

The UAC has delegated the DO as the individual responsible for the training and certification of all UCB PICs, CFIs, and VOs. The DO has authority regarding all decisions pertaining to whether a UCB crewmember is qualified to act in that crew position for UCB. Any appeal of the DO's decision must be made to the UAC

3.13 Training Programs

FAR 67, FSIMS 8900.1, COA

The DO will maintain separate training programs for PIC, CFI and VO crewmembers. This training will meet all FAA and UAC prescribed requirements for such training curriculum.

3.14 Records

COA

The DO or his representative will maintain training records for all crewmembers. These records will be maintained for a period of three years after the last flight activity by the individual crewmember. An individual, if requested in writing to the DO or his representative with 48 hours' notice during regular business hours, may review their training record.

3.15 Initial PIC Requirements

3.15.1 Pilots who hold an FAA Private Pilot license or higher:

1. UCB PIC Short Course Curriculum
2. Practical Test

3.15.2 Pilots who do not hold an FAA Private Pilot license or higher or a FAA drone operator's license

1. UCB Initial PIC Curriculum
2. Practical Test

3.15.3 Pilots who hold a FAA drone operator license

1. UCB PIC Short Course Curriculum
2. Practical Test

3.16 Initial CFI Requirements

3.16.1 Pilots who hold an FAA Certified Flight Instructor License and who are current and qualified UCB PICs

1. Practical Test

3.16.2 UCB PICs who do not hold an FAA Certified Flight Instructor License

1. UCB Initial CFI Curriculum
2. Practical Test

3.17 Initial VO Requirements

3.17.1 Individuals who hold an FAA Private Pilot license or higher, FAA Drone Operators license, or an FAA Advanced or Basic Ground Instructor license

1. Practical Test

3.17.1 Individuals with no FAA Pilot or Ground Instructor license

1. UCB Initial VO Curriculum
2. Practical Test

3.18 Practical Test Requirements for PICs

-Verbal test on FAR's: 1, 61, 67, 91, 107, UCB FOM, and COAs
-Flight of a UCB UAS under the supervision of a UCB instructor showing competency in all aspects of operation from preflight through post flight. The CFI has the discretion to require a practical test for each make and model of UAS or may grant privileges for multiple similar UAS with a practical test for one type. For example, a successful practical test on a PIX Trainer could also grant PIC privileges for a Swift Trainer. The DO is final authority regarding which aircraft practical tests may count for PIC privileges on other UAS types.

3.19 Practical Test Requirements for CFIs

-Must show currency as a UCB PIC to the satisfaction of the DO
-Must be observed by the DO providing two hours of ground training and two hours of flight training to a PIC or VO candidate. During the practical test observation, the CFI candidate must demonstrate the capability to effectively instruct while maintaining safe operations, as well as the ability to judge the competency of the trainee to operate as a UCB PIC or VO.

3.20 Practical Test Requirements for VOs

-Verbal test on FARs: 1, 61, 67, 91, 107, UCB FOM, COAs
-Observation of the VO by a UCB CFI during flight operations showing competency in all VO operations

3.201 Practical Test Failures

-In the event of a practical test failure, the required retraining will be at the discretion of the DO

-A second attempt at a practical test will not be held on the same day as the previous failure

-In the event of a second or subsequent failure on the practical test the applicant may not be scheduled for a another attempt for at least thirty days after the second or subsequent failure

3.202 Training Recency

-Initial PIC trainees who are in the UCB Initial PIC Curriculum must complete their first flight training session no later than 60 days after completion of ground school. Failure to meet the 60 day deadline will require the student to re-accomplish ground school.

3.21 Flight Review

FAR 61, COA

A pilot may not act as PIC unless within the last 24 calendar months unless they have completed either a practical test for a PIC rating from UCB or have completed a flight review administered by a UCB CFI.

A flight review must contain at least the following:

> A minimum of 1 hour of flight training and 1 hour of ground training. The review must include:
> (1) A review of the current general operating and flight rules of part 91; and
> (2) A review of those maneuvers and procedures that, at the discretion of the person giving the review, are necessary for the pilot to demonstrate the safe exercise of UCB PIC privileges.

Completion of the UAS Recurrent Training Course available in Skillsoft fulfills the 1 hour ground training requirement of this paragraph.

Completion of a flight review will be noted in the individuals training folder and be maintained for a minimum of three years.

For the purposes of complying with this paragraph 24 months means: The last day of the 24th month following the qualifying event, not including the month the qualifying event occurred in.

Example: A PIC who completed their initial certification on 6 August 2019 would be qualified until September 30th 2021.

3.212 Flight Instructor Review

FAR 61, COA

An individual may not act as a CFI unless within the last 24 calendar months unless they have completed either a practical test for a CFI rating from UCB or have completed a flight instructor review administered by a UCB CFI.

A flight instructor review must contain at least the following:

> A minimum of 2 hours of flight training and 2 hours of ground training. The review must include:
> (1) A review of the current general operating and flight rules of part 91 and

> Part 61; and
> (2) A review of those maneuvers and procedures that, at the discretion of the person giving the review, are necessary for the instructor to demonstrate the safe exercise of UCB CFI privileges.

Completion of a flight instructor review will be noted in the individuals training folder and be maintained for a minimum of three years.

Individuals holding CFI privlidges on 1 August 2019 are grandfathered and will be due for a Flight Instructor Review no later than 31 August 2021

Chapter 4. Airworthiness

4.1 Authority

COA

UCB has been granted the authority to certify the airworthiness, both continuing and initial, of its UAS fleets by the FAA. This authority is granted via UCB COAs. Only UAS that are certified as airworthy via the procedures in this chapter can operate using UCB COAs or over UCB property.

4.12 Oversight

COA

The UAC had designated the DO as the individual responsible for the initial airworthiness certification of all UAS flown under UCB COAs and over UCB property. The DO will issue a signed letter for each non-commercially produced UAS found to be airworthy by CU. This letter will include any limitations or restrictions as appropriate. The DO reserves the right to require an initial airworthiness review for commercial UAS that have been modified from their stock configuration.

Continuing airworthiness is the responsibility of each individual PIC before operating their UAS.

4.13 Initial Airworthiness *

COA

-Non-commercial UAS: See 4.12

-Commercial UAS: PICs are responsible for ensuring the airworthiness of any commercial system they intend to operate. If any question of a system's airworthiness exists the PIC should contact the DO for assistance.

4.14 Continuing Airworthiness *

COA, FSIMS 8900.1

Continuing Airworthiness of both commercial and non-commercial UAS is the sole responsibility of the PIC operating the aircraft. In no circumstances is a non-airworthy UAS to be operated.

Any aircraft that has undergone major repair work must be subjected to a Functional Check Flight before it is returned to normal service. The content of the Functional Check Flight will be left up to the PIC, however the flight shall be conducted at a remote site, such as Table Mountain.

Chapter 5. Part 107 Operations

5.0 Applicability*

FAR 107

The UAC has authority over all UAS operations at UCB, compliance with this chapter is mandatory

All references to Part 107 in this chapter also refer to and are applicable to individuals operating under a FAA Section-333 Exemption.

5.1 Part 107 Operations not over UCB property*

FAR 107

UCB encourages personnel who want to fly UAS in conjunction with their work, studies or research to operate under FAR 107 if appropriate. CU has worked for over a decade to develop flight capabilities, many of which are unique in the field making it possible to do advanced research while operating complex UAS in the NAS. However, in many cases these capabilities do not need to be leveraged to satisfy mission requirements. FAR part 107 allows users access to vast amounts of airspace with relatively easy entry requirements. It is important to understand the varying liability issues between operations under COA's and FAR 107.

The UAC intends to minimally regulate how operators from UCB use the privileges granted under FAR part 107. However, in order to maintain clear delineation between part 107 users and individuals using UCB COAs the following procedures exist in order to preserve the critical research assets UCB has invested in COAs.

All UCB Faculty, Staff and Students who operate under Part 107 must be on the UCB Approved Part 107 Operators List before they fly. This list is in the appendix of this manual.

1. Any UCB employee, or student who plans to fly under FAR Part 107 must notify the DO of their intentions in writing at least 48 hours before their first flight. The DO will review the individual's qualifications and then either add the individual to the list of UCB-approved Part 107 operators or contact the individual regarding what steps are needed to allow them to be included on the UCB-approved Part 107 operators list. All UCB Part-107

operators must provide their FAA Drone Operators License number and the registration numbers for all their UAS to the DO. This information needs to be updated only if the license or registration number changes. The intent of this rule is to make differentiating a Part-107 operator from a COA user an expeditious manner, thereby protecting UCB COA access in case of enforcement action by the FAA against a Part-107 operator.

2. A Part-107 operator who is required to file an accident or incident report with the FAA or NTSB, resulting from their operations, shall submit a copy of that report to the DO within 24 hours.

5.2 Part 107 Operations over UCB property*

Anyone, whether they are associated with UCB or not, and who intends to fly over UCB property exclusively utilizing FAA authorization in the form of FAR Part 107, must obtain specific written authorization from the UAC or DO. These users are also required to follow all provisions of paragraph 5.1 of this manual. Contact the DO for the application required to fly over CU property as a Part 107 PIC.

5.3 Hobby Exemption Users*

UCB personnel or any other individuals who are operating under the hobby exemption, and who are not flying over UCB property are exempt from this chapter with the exception that **under no circumstances are any persons allowed to operate a UAS over UCB property without written approval from the UAC**. Hobby-exemption users may include UCB sponsored clubs or student organizations. See Chapter 7 of this manual.

Chapter 6. UAS Weighing Less than 0.55lb

6.1 Applicability

UAS weighing less than 0.55lb are commonly referred to as "Toy drones." These aircraft are not required to be registered by the FAA or CU, although other regulations may apply. UCB has rules regarding their use over UCB property. These procedures are contained in this chapter. Compliance with these rules is mandatory.

Users operating UAS weighing more than 0.55 pounds are not required to follow the rules in this chapter.

6.2 Operational Rules for UAS weighing less than 0.55lb

1. No flying over people not directly involved in the UAS operation
2. Line of sight flight only. First person view flight is strictly prohibited
3. No flying over 100-foot AGL
4. No flying at night unless the area is properly illuminated so the pilot can see the aircraft in all phases of flight with ambient light, no spotlight on the aircraft, or on-board lighting required.
5. No flying while under the influence
6. No flying in a manner that presents a risk to people or property
7. No flying that can be reasonably construed as invading another person's privacy
8. UCB and the CUPD has the sole discretion and authority to require termination of flights that are not consistent with these rules.
9. No flying indoors in UCB buildings unless specific permission has been granted by the DO and Building Proctor.
10. No flying that interferes with life safety operations
11. No flying over special events or PAC 12 events
12. No flying within 200' of a residence hall

Chapter 7. Hobbyist Pilots

7.1 Applicability

Hobbyist flights covered under this paragraph are flights from UCB property by any individual not for an official research, work related, or scholastic purpose sanctioned by UCB. All Registered Student Organization (RSO) activities (sanctioned or unsanctioned), individuals flying their personal UAS, or any other operation not specifically authorized by a COA or FAR part 107 fall under this chapter of the FOM. This chapter applies to UAS weighing .55 pounds or more, not toy drones. For toy drones see Chapter 6.

7.2 Academy of Model Aeronautics Membership

All pilots conducting hobbyist flights from UCB property must be current Academy of Model Aeronautics (AMA) members

7.3 AMA Safety Code

All pilots flying from UCB property as hobbyists must follow all AMA Safety Code and flying site guidelines and requirements

7.4 FAA Regulations

All pilots flying from UCB property must strictly follow all applicable FAA regulations

7.5 Registration

All pilots must register their AMA Number with the campus before they can request or be approved for hobbyist flight privileges at UCB

In order to register, pilots shall send a copy of their current AMA membership card to the Director of Flight Operations at directorofflightoperations@colorado.edu This registration will be valid until the following December 31st. On every January 1st, the list will be purged and all hobbyists must re-register using this procedure

7.6 Flight Areas

Flight approvals over the three UCB campuses for hobbyists are as follows:

Main Campus: Flights over the Main Campus are only approved for group activities, not for individuals. RSO's can apply for one time permits for club activities. Applications will be accepted by the UAS Advisory Committee no less than 30 days prior to the requested flight date. The application must contain the following items.

1. The date of the requested flight activity
2. The name and contact information of the representative of the RSO requesting the flight permission
3. Location of the activity
4. Plan to comply with AMA Safety Code and Flying Field Safety Guidelines during the event (Including plans to cordon off the required safety zones with the CUPD)
5. Name of each pilot who will be approved to fly during the event
6. Documentation showing compliance with CUUF procedures

East Campus: Flights over East Campus, with the exception of the flight zone clarified below, are prohibited due to safety and legal concerns resulting from to its proximity to Boulder Municipal Airport. The field just to the east of Potts Field is available for RSO's flying below 100 feet AGL. The map in figure 1 marks the boundaries of this field. In order to use this space, the RSO must submit an application containing:

1. The date(s) and time(s) of the requested flight activity
2. The name and contact information of the representative of the RSO requesting the flight permission
3. Plan to comply with AMA Safety Code and Flying Field Safety Guidelines during the event (Including plans to cordon off the required safety zones with the CUPD)
4. Name of each pilot who will be approved to fly during the event
5. Documentation showing compliance with CUUF procedures

Applications for RSO's to fly over East Campus require 5 days notice for approval. If the activity is approved the RSO will receive email notice of approval for the operation from the DO.

All pilots flying from this field must comply with all federal, state and local regulations in addition to any procedures required by the Boulder Municipal Airport Manager.

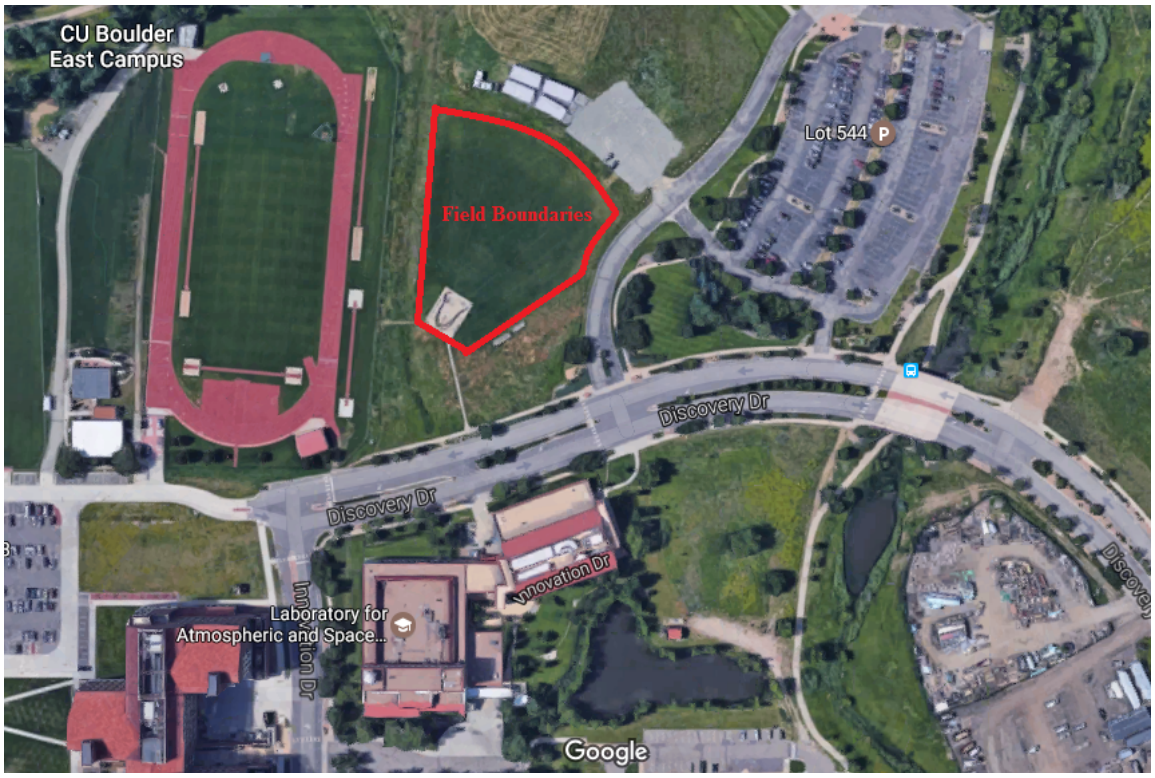

Figure 1: Boundaries of the East Campus hobbyist field. The field is located due North of LASP and due East of Potts Field.

South Boulder Campus: Flights over the South Boulder Campus will be approved for registered hobbyists on a case by case basis depending on site availability.

To request flight approval for these operations pilots shall email the DO at directorofflightoperartions@colorado.edu
48 hours prior to the requested flight activity so that appropriate coordination with the CUPD and other organizations can be accomplished. If the activity is approved the pilot will receive email approval for the operation from the DO.

Williams Villiage: Flights will be approved for registered hobbyists on a case by case basis depending on site availability and the ability to operate within applicable safety regulations.

To request flight approval for these operations pilots shall email the DO at directorofflightoperartions@colorado.edu. A minimum of 30 days before the requested activity. The email must include:

1. The date of the requested flight activity

2. The name and contact information of the person(s) requesting the flight permission
3. Location of the activity
4. Plan to comply with AMA Safety Code and Flying Field Safety Guidelines during the event (Including plans to cordon off the required safety zones with the CUPD)
5. Name of each pilot who will be approved to fly during the event
6. Documentation showing compliance with CUUF procedures

Chapter 8. Export Control

This chapter applies when a UAS is being exported outside the United States, or when a foreign national may have access to controlled technical data related to certain UAS.

8.1 Export Control Classification and Requirements

As a federally registered exporter and as a recipient of government contracts, the University must comply with all federal laws regarding the research use and export of controlled hardware, software and technology. These controls are in place to protect US national security; to prevent the proliferation of weapons of mass destruction; to further U.S. foreign policy including the support of international agreements, human rights and regional stability; and to maintain U.S. economic competitiveness. These export control regulations govern how information, technology, and commodities may be transmitted overseas to anyone, including U.S. citizens, or to foreign nationals located physically in the United States

UAS have the potential to use some of the most high-profile and highly controlled technologies. UAS and their associated systems are considered "dual-use" items: commodities that can be used for both military/strategic and commercial/civilian purposes. Almost all UAS are subject to some form of export control, even if the UAS is for research or non-commercial use. Different UAS capabilities will cause the hardware, software, and technical information associated with the UAS to be controlled by different government regulatory regimes.

8.2 Department of State Regulations (ITAR) and UAS Classification

The International Traffic in Arms Regulations (**ITAR**) have specific controls and regulations on both unarmed and armed *military* UAS. "Military" in this respect is a UAS that was designed to military or intelligence specifications, designed for a military application, or that may be classified or controlled for national security purposes. Items controlled under the ITAR are subject to strict restrictions on export to foreign countries and access by foreign nationals. Foreign nationals, even students, are not permitted to work on or have access to any ITAR controlled UAS (including all associated hardware, software, and technical data) without explicit authorization from the U.S. Government in the form of export licenses (see Chapter 8.4). The chart below details how specific capabilities are controlled under the ITAR's United States Munitions List (**USML**), but a final determination should be reached only after working with the CU-Boulder Office of Export Controls.

Classification Description	USML Category Number	Notes
Unarmed military UAVs	VIII(a)(5)	Considered "Significant Military Equipment"
ALL armed UAVs	VIII(a)(6)	No range for USML threshold listed, considered "Significant Military Equipment"
UAV flight control systems and vehicle management systems with *swarming* capability	VIII(h)(12)	*Swarming* – UAVs interact with each other to avoid collisions and stay together, or, if weaponized, coordinate targeting

8.3 Department of Commerce (EAR) Regulations and UAS Classification

The Export Administration Regulations (**EAR**) control the export of mostly commercial and "dual use" items. Many UAS used in research today fall under the commercial or dual use category. While not as restricted as items on the USML, many items and technology on the EAR's Commerce Control List (**CCL**) are potentially restricted to foreign nationals. The chart below outlines the primary UAS related categories on the CCL.

Classification Description	Export Control Classification Number	Notes
Nonmilitary UAVs or unmanned airships with maximum endurance greater than or equal to 30 minutes but less than 1 hour *and* designed to take-off and have stable controlled flight in wind gusts equal to or exceeding 46.3 km/h (25 knots)	9A012.a.1	UAS must meet both requirements (maximum endurance and stable controlled flight) to be classified as 9A012.a.1
Nonmilitary UAV with maximum endurance of 1 hour or greater	9A012.a.2	

Complete UAV with autonomous flight control	9A120.a.1	Only if not specified by 9A012
Complete UAV with capability of controlled-flight out of the direct vision range of human operator	9A120.a.2	Only if not specified by 9A012
Complete UAV with aerosol dispensing system	9A120.b.1	Must have capacity greater than 20 liters

8.4 Department of Treasury Office of Foreign Asset Controls (OFAC)

OFAC administers exports to and financial transactions with embargoed countries and specially designated nationals. As of April 2017, OFAC embargoed countries include Cuba, Iran, North Korea, Sudan and Syria. Any work with these countries will require review and special licensing.

8.5 Obtaining Export Control Licenses and other Authorizations

If the UAS project requires export (even temporary) of the UAS outside of the United States, or use of or access to the UAS by foreign nationals, the use must be reviewed by the UCB Office of Export Controls (OEC) (exportcontrols@colorado.edu, or 303-492-2427). The researcher will work with the OEC to determine the proper classification of the UAS and to ensure that the scope of the project is covered under a license or other form of authorization. The OEC will advise the PI, University Empowered Official, and the UAC if an export license is needed.

Researchers should note that OEC may need one to two weeks for OEC to make a classification determination; if a license is required, approval by the Federal agencies typically takes at least six weeks (and may take considerably longer). Please plan accordingly!

Chapter 9. Ground Safety

9.1 LIPO Battery Storage

Lithium Polymer (LIPO) batteries used by most UAS' are very energy dense and can create serious safety hazards unless strict handling, storage and charging procedures are followed.

On campus, storage, transport and charging of LIPO batteries must be conducted in accordance with all applicable campus guidelines. Of particular concern is the charging of LIPO batteries in housing areas. Refer to housing services for policies regarding charging of LIPO batteries in dormitories.

General Guidelines:

1. Batteries should be stored in LIPO approved fire-proof storage bags or fire-proof metal containers
2. Batteries should be stored at 50 percent capacity
3. Batteries should be charged only with appropriate LIPO capable battery chargers. Never charge a LIPO battery with a non-LIPO battery charger
4. Batteries should be monitored while charging
5. Damaged LIPO's should be immediately discarded in accordance with applicable battery disposal procedures.

Appendices

1. University of Colorado Boulder owned FAA Approved Active COAs
2. Acronym List
3. University of Colorado Boulder Unmanned Aircraft Safety Action Report
4. University of Colorado Boulder UAS Accident/Incident Criteria and Protocols
5. PIC UAS Post Accident Checklist

University of Colorado Boulder Owned FAA Approved Active COAs

For the full versions of these COAs please request a copy from the Director of Flight Operations.

FAA FORM 7711-1 UAS COA Attachment
Blanket Area- Public Agency sUAS COA
2018-WSA-1043-COA

Page 1 of 8

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

CERTIFICATE OF WAIVER OR AUTHORIZATION

ISSUED TO
University of Colorado Boulder — Part 91

ADDRESS
1111 Engineering Drive
Boulder CO, 80309
POC: Daniel Hesselius; daniel.hesselius@colorado.edu

This certificate is issued for the operations specifically described hereinafter. No person shall conduct any operation pursuant to the authority of this certificate except in accordance with the standard and special provisions contained in this certificate, and such other requirements of the Federal Aviation Regulations not specifically waived by this certificate.

OPERATIONS AUTHORIZED
Operation of small Unmanned Aircraft System (UAS) weighing less than 55 pounds and operating at speeds of less than 87 kts (100 mph) in Class G airspace at or below 400 feet Above Ground Level (AGL) for the purpose of public aircraft operations.

LIST OF WAIVED REGULATIONS BY SECTION AND TITLE
N/A

STANDARD PROVISIONS

1. A copy of the application made for this certificate shall be attached and become a part hereof.
2. This certificate shall be presented for inspection upon the request of any authorized representative of the Federal Aviation Administration, or of any State or municipal official charged with the duty of enforcing local laws or regulations.
3. The holder of this certificate shall be responsible for the strict observance of the terms and provisions contained herein
4. This certificate is nontransferable.

Note-This certificate constitutes a waiver of those Federal rules or regulations specifically referred to above. It does not constitute a waiver of any State law or local ordinance.

SPECIAL PROVISIONS

Special Provisions A and B, inclusive, are set forth on the reverse side hereof.

The certificate is effective from February 17, 2018 to February 16, 2020, inclusive, and is subject to cancellation at any time upon notice by the Administrator or his/her authorized representative.

BY DIRECTION OF THE ADMINISTRATOR

SHAWN MICHAEL KOZICA Digitally signed by SHAWN MICHAEL KOZICA Date: 2018.02.16 12:55:04 -08'00'

FAA Western Service Center (Region)

Shawn M Kozica (Signature)

February 16, 2018 (Date)

Manager, Operations Support Group (Title)

FAA Form 7711-1 (7-74)

Version Date: December 14, 2017

FAA FORM 7711-1 UAS COA Attachment Page 1 of 12
2018-WSA-1108-COA

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

CERTIFICATE OF WAIVER OR AUTHORIZATION

ISSUED TO
University of Colorado-Boulder Part 91

ADDRESS
1111 Engineering Drive
Boulder, CO 80309

This certificate is issued for the operations specifically described hereinafter. No person shall conduct any operation pursuant to the authority of this certificate except in accordance with the standard and special provisions contained in this certificate, and such other requirements of the Federal Aviation Regulations not specifically waived by this certificate.

OPERATIONS AUTHORIZED
Operation of the Mistral Unmanned Aircraft System (UAS), in Class E and G Airspace up to and including 5,000 feet above ground level (AGL), not to exceed 10,000 feet Mean Sea Level (MSL), in the vicinity of Sterling, CO under the jurisdiction of Denver Air Route Traffic Control Center (ARTCC). See attachment 1.

LIST OF WAIVED REGULATIONS BY SECTION AND TITLE
N/A

STANDARD PROVISIONS

1. A copy of the application made for this certificate shall be attached and become a part hereof.
2. This certificate shall be presented for inspection upon the request of any authorized representative of the Federal Aviation Administration, or of any State or municipal official charged with the duty of enforcing local laws or regulations.
3. The holder of this certificate shall be responsible for the strict observance of the terms and provisions contained herein.
4. This certificate is nontransferable.

Note-This certificate constitutes a waiver of those Federal rules or regulations specifically referred to above. It does not constitute a waiver of any State law or local ordinance.

SPECIAL PROVISIONS

Special Provisions A-D are set forth on the reverse side hereof.

The certificate is effective from May 15, 2018 to May 14, 2020 and is subject to cancellation at any time upon notice by the Administrator or his/her authorized representative.

BY DIRECTION OF THE ADMINISTRATOR

BYRON G Y CHEW
Digitally signed by BYRON G Y CHEW
Date: 2018.05.14 15:25:58 -07'00'

FAA Western Service Center AJV-W2 (Region)

B. G. Chew (Signature)

May 15, 2018 (Date)

Acting Manager, Operations Support Group (Title)

FAA Form 7711-1 (7-74)

Version Date: November 1, 2017

FAA FORM 7711-1 UAS COA Attachment
2018-WSA-1185 COA

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

CERTIFICATE OF WAIVER OR AUTHORIZATION

ISSUED TO
University of Colorado Boulder — Part 91

ADDRESS
1111 Engineering Drive
Boulder, CO 80309

This certificate is issued for the operations specifically described hereinafter. No person shall conduct any operation pursuant to the authority of this certificate except in accordance with the standard and special provisions contained in this certificate, and such other requirements of the Federal Aviation Regulations not specifically waived by this certificate.

OPERATIONS AUTHORIZED

Operation of the Arcturus T-16 XL Unmanned Aircraft System (UAS) in Class E and G airspace, at or below 15,000 feet above Mean Sea Level (MSL) in the vicinity of Alamosa County, CO as depicted in Attachment 1, under the jurisdiction of Denver Air Route Traffic Control Center (ARTCC). See Special Provisions.

LIST OF WAIVED REGULATIONS BY SECTION AND TITLE

N/A

STANDARD PROVISIONS

1. A copy of the application made for this certificate shall be attached and become a part hereof.
2. This certificate shall be presented for inspection upon the request of any authorized representative of the Federal Aviation Administration, or of any State or municipal official charged with the duty of enforcing local laws or regulations.
3. The holder of this certificate shall be responsible for the strict observance of the terms and provisions contained herein.
4. This certificate is nontransferable.

Note-This certificate constitutes a waiver of those Federal rules or regulations specifically referred to above. It does not constitute a waiver of any State law or local ordinance.

SPECIAL PROVISIONS

Special Provisions A thru D, inclusive, are set forth on the reverse side hereof.

The certificate 2018-WSA-1185 is effective from May 23, 2018 to May 22, 2020 and is subject to cancellation at any time upon notice by the Administrator or his/her authorized representative.

BY DIRECTION OF THE ADMINISTRATOR

BYRON G Y CHEW
Digitally signed by BYRON G Y CHEW
Date: 2018.05.22 14:40:39 -07'00'

FAA Western Service Center, AJV-W2 (Region)

B. G. Chew (Signature)

May 22, 2018 (Date)

Acting Manager, Operations Support Group (Title)

FAA Form 7711-1 (7-74)

Version Date: November 1, 2017

FAA FORM 7711-1 UAS COA Attachment Page 1 of 11
2019-WSA-3325 COA

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

CERTIFICATE OF WAIVER OR AUTHORIZATION

ISSUED TO
University of Colorado Boulder Part 91

ADDRESS
1111 Engineering Drive
Boulder, CO 80309

This certificate is issued for the operations specifically described hereinafter. No person shall conduct any operation pursuant to the authority of this certificate except in accordance with the standard and special provisions contained in this certificate, and such other requirements of the Federal Aviation Regulations not specifically waived by this certificate.

OPERATIONS AUTHORIZED
Operation of the Talon Unmanned Aircraft System (UAS) in Class E and G airspace at or below 1,000 feet Above Ground Level (AGL), not to exceed 6,500 feet Above Mean Sea Level (MSL), over the Pawnee Grassland, CO, under the jurisdiction of Denver Terminal Radar Approach Control (D01), Cheyenne Radar Approach Control (CYS), and Denver Air Route Traffic Control Center (ZDV). See attachment 1.

LIST OF WAIVED REGULATIONS BY SECTION AND TITLE
N/A

STANDARD PROVISIONS

1. A copy of the application made for this certificate shall be attached and become a part hereof.
2. This certificate shall be presented for inspection upon the request of any authorized representative of the Federal Aviation Administration, or of any State or municipal official charged with the duty of enforcing local laws or regulations.
3. The holder of this certificate shall be responsible for the strict observance of the terms and provisions contained herein.
4. This certificate is nontransferable.

Note-This certificate constitutes a waiver of those Federal rules or regulations specifically referred to above. It does not constitute a waiver of any State law or local ordinance.

SPECIAL PROVISIONS

Special Provisions A thru C, inclusive, are set forth on the reverse side hereof.

The certificate, 2019-WSA-3325 is effective from April 10, 2019 to April 09, 2021 and is subject to cancellation at any time upon notice by the Administrator or his/her authorized representative.

BY DIRECTION OF THE ADMINISTRATOR

BYRON G Y CHEW Digitally signed by BYRON G Y CHEW Date: 2019.04.05 13:47:16 -07'00'

FAA Western Service Area (Region)

B. G. Chew (Signature)

April 5, 2019 (Date)

Tactical Operations Manager (AJV-W23) (Title)

FAA Form 7711-1 (7-74)

Version Date: November 1, 2017

FAA FORM 7711-1 UAS COA Attachment Page 1 of 11
2018-WSA-1116 COA

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

CERTIFICATE OF WAIVER OR AUTHORIZATION

ISSUED TO
Public Agency – University of Colorado, Boulder

ADDRESS
Research and Engineering Center for Unmanned Vehicles
429 UCB
Boulder, CO 80309-0429

This certificate is issued for the operations specifically described hereinafter. No person shall conduct any operation
pursuant to the authority of this certificate except in accordance with the standard and special provisions contained in this certificate, and such other requirements of the Federal Aviation Regulations not

OPERATIONS AUTHORIZED
Operation of the Tempest, Unmanned Aircraft System (UAS) in Class E and G airspace at or below 2,500 feet AGL in the vicinity of Denver ARTCC, Denver TRACON, Cheyenne Approach, and Minneapolis ARTCC under the jurisdiction of Denver Center, or as delegated. See Attachment 1.

LIST OF WAIVED REGULATIONS BY SECTION AND TITLE
N/A

STANDARD PROVISIONS

1. A copy of the application made for this certificate shall be attached and become a part hereof.
2. This certificate shall be presented for inspection upon the request of any authorized representative of the Federal Aviation Administration, or of any State or municipal official charged with the duty of enforcing local laws or regulations.
3. The holder of this certificate shall be responsible for the strict observance of the terms and provisions contained herein.
4. This certificate is nontransferable.

Note-This certificate constitutes a waiver of those Federal rules or regulations specifically referred to above. It does not constitute a waiver of any State law or local ordinance.

SPECIAL PROVISIONS

Special Provisions Nos. A thru D, inclusive.

The certificate 2018-WSA-1116 is effective from April 23, 2018 to April 22, 2020 and is subject to cancellation at any time upon notice by the Administrator or his/her authorized representative.

BY DIRECTION OF THE ADMINISTRATOR

Vonnie L Giles
Digitally signed by Vonnie L Giles
Date: 2018.04.06 12:06:33 -05'00'

FAA Central Service Center AJV-C23 (Region)

Vonnie L. Giles (Signature)

April 4, 2018 (Date)

Tactical, Operations Manager, CSA (Title)

FAA Form 7711-1 (7-74)

Version Date: November 1, 2017

FAA FORM 7711-1 UAS COA Attachment 2018-CSA-2643-COA-R

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

CERTIFICATE OF WAIVER OR AUTHORIZATION

ISSUED TO
Public Agency – University of Colorado, Boulder Part 91

ADDRESS
Research & Engineering Center for Unmanned Vehicles
429 UCB
Boulder, CO 80309-0429

This certificate is issued for the operations specifically described hereinafter. No person shall conduct any operation
pursuant to the authority of this certificate except in accordance with the standard and special provisions contained in this certificate, and such other requirements of the Federal Aviation Regulations not

OPERATIONS AUTHORIZED
Operation of the Tempest, Mistral, S2 and Drak, Unmanned Aircraft System (UAS) in Class E & G airspace at or below 2500 AGL airspace the state of Kansas under the jurisdiction of Kansas City ARTCC, Denver ARTCC, Wichita TRACON and Marshall. See Attachments.

LIST OF WAIVED REGULATIONS BY SECTION AND TITLE
N/A

STANDARD PROVISIONS

1. A copy of the application made for this certificate shall be attached and become a part hereof.
2. This certificate shall be presented for inspection upon the request of any authorized representative of the Federal Aviation Administration, or of any State or municipal official charged with the duty of enforcing local laws or regulations.
3. The holder of this certificate shall be responsible for the strict observance of the terms and provisions contained herein.
4. This certificate is nontransferable.

Note-This certificate constitutes a waiver of those Federal rules or regulations specifically referred to above. It does not constitute a waiver of any State law or local ordinance.

SPECIAL PROVISIONS

Special Provisions Nos. A thru D, inclusive.

The certificate 2018-CSA-2643-R is effective from December 28, 2018 to December 27, 2020 and is subject to cancellation at any time upon notice by the Administrator or his/her authorized representative.

BY DIRECTION OF THE ADMINISTRATOR

JOHN A WITUCKI Digitally signed by JOHN A WITUCKI Date: 2018.10.22 11:44:32 -05'00'

FAA Central Service Center AJV-C23 (Region)

John A. Witucki (Signature)

October 22, 2018 (Date)

(A) Tactical, Operations Manager, CSA (Title)

FAA Form 7711-1 (7-74)

Version Date: November 1, 2017

FAA FORM 7711-1 UAS COA Attachment 2018-CSA-2789-COA-R

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

CERTIFICATE OF WAIVER OR AUTHORIZATION

ISSUED TO
Public Agency – University of Colorado, Boulder Part 91

ADDRESS
Research & Engineering Center for Unmanned Vehicles (RECUV)
429 UCB
Boulder, CO 80309-0429

This certificate is issued for the operations specifically described hereinafter. No person shall conduct any operation
pursuant to the authority of this certificate except in accordance with the standard and special provisions contained in this certificate, and such other requirements of the Federal Aviation Regulations not

OPERATIONS AUTHORIZED
Operation of the Mistral, Drak, Tempest and S2, Unmanned Aircraft System (UAS) in Class G and Class E airspace (VFR) at and below 2,500 feet above ground level (AGL) within the boundaries described on the map in Attachment 1 under the jurisdiction of Bismarck, Omaha, Sioux Gateway, Des Moines and Joe Foss Field TRACON, Rapid City RAPCON and Minneapolis (ZMP) and Denver (ZDV) ARTCC. See attachment 1.

LIST OF WAIVED REGULATIONS BY SECTION AND TITLE
N/A

STANDARD PROVISIONS

1. A copy of the application made for this certificate shall be attached and become a part hereof.
2. This certificate shall be presented for inspection upon the request of any authorized representative of the Federal Aviation Administration, or of any State or municipal official charged with the duty of enforcing local laws or regulations.
3. The holder of this certificate shall be responsible for the strict observance of the terms and provisions contained herein.
4. This certificate is nontransferable.

Note-This certificate constitutes a waiver of those Federal rules or regulations specifically referred to above. It does not constitute a waiver of any State law or local ordinance.

SPECIAL PROVISIONS

Special Provisions Nos. A thru E, inclusive.

The certificate 2018-CSA-2789-R is effective from January 28, 2019 to January 27, 2021 and is subject to cancellation at any time upon notice by the Administrator or his/her authorized representative.

BY DIRECTION OF THE ADMINISTRATOR

JOHN A WITUCKI Digitally signed by JOHN A WITUCKI Date: 2018.11.26 11:30:16 -06'00'

FAA Central Service Center AJV-C23 (Region)

John A. Witucki (Signature)

November 26, 2018 (Date)

(A) Tactical, Operations Manager, CSA (Title)

FAA Form 7711-1 (7-74)

Version Date: November 1, 2017

FAA FORM 7711-1 UAS COA Attachment Page 1 of 11
2018-CSA-2645 COA

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

CERTIFICATE OF WAIVER OR AUTHORIZATION

ISSUED TO
Public Agency – University of Colorado, Boulder Part 91

ADDRESS
Research & Engineering Center for Unmanned Vehicles
429 UCB
Boulder, CO 80309-0429

This certificate is issued for the operations specifically described hereinafter. No person shall conduct any operation pursuant to the authority of this certificate except in accordance with the standard and special provisions contained in this certificate, and such other requirements of the Federal Aviation Regulations not specifically waived by this certificate.

OPERATIONS AUTHORIZED
Operation of the Drak, Mistral and Tempest, Unmanned Aircraft System (UAS) in Class E and G, excluding all Class B, C, D and special use airspace at or below 2500' AGL under the jurisdiction of Omaha; Sioux City; Des Moines APPROACH; Marshall GCA; Minneapolis ARTCC; Kansas City ARTCC and Denver ARTCC. See attachment 1.

LIST OF WAIVED REGULATIONS BY SECTION AND TITLE
N/A

STANDARD PROVISIONS

1. A copy of the application made for this certificate shall be attached and become a part hereof.
2. This certificate shall be presented for inspection upon the request of any authorized representative of the Federal Aviation Administration, or of any State or municipal official charged with the duty of enforcing local laws or regulations.
3. The holder of this certificate shall be responsible for the strict observance of the terms and provisions contained herein.
4. This certificate is nontransferable.

Note-This certificate constitutes a waiver of those Federal rules or regulations specifically referred to above. It does not constitute a waiver of any State law or local ordinance.

SPECIAL PROVISIONS

Special Provisions Nos. A thru E, inclusive.

The certificate 2018-CSA-2645 is effective from November 14, 2018 to November 13, 2020 and is subject to cancellation at any time upon notice by the Administrator or his/her authorized representative.

BY DIRECTION OF THE ADMINISTRATOR

JOHN A WITUCKI Digitally signed by JOHN A WITUCKI Date: 2018.11.13 11:22:23 -06'00'

FAA Central Service Center AJV-C23 (Region)

John A. Witucki (Signature)

November 13, 2018 (Date)

(A) Tactical, Operations Manager, CSA (Title)

FAA Form 7711-1 (7-74)

Version Date: November 1, 2017

FAA FORM 7711-1 UAS COA Attachment Page 1 of 14
2019-CSA-3425-COA-R

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

CERTIFICATE OF WAIVER OR AUTHORIZATION

ISSUED TO
Public Agency – University of Colorado, Boulder Part 91

ADDRESS
Research & Engineering Center for Unmanned Vehicles (RECUV)
429 UCB
Boulder, CO 80309-0429

This certificate is issued for the operations specifically described hereinafter. No person shall conduct any operation
pursuant to the authority of this certificate except in accordance with the standard and special provisions contained in this certificate, and such other requirements of the Federal Aviation Regulations not

OPERATIONS AUTHORIZED
Operation of several, Unmanned Aircraft System (UAS) in Class E and Class G airspace at 2500 AGL and below, Southern Oklahoma and Northern Texas under the jurisdiction of Oklahoma City TRACON (OKC), Fort Worth ARTCC (ZFW), Kansas City ARTCC (ZKC), Vance RAPCON (END), Sheppard RAPCON (SPS), Fort Sill RAPCON (FSI/LAW), Dallas/ Ft Worth TRACON (DFW),,Abilene TRACON (ABI), Midland TRACON (MAF), and Lubbock TRACON (LBB). See Attachment 1.

LIST OF WAIVED REGULATIONS BY SECTION AND TITLE
N/A

STANDARD PROVISIONS

1. A copy of the application made for this certificate shall be attached and become a part hereof.
2. This certificate shall be presented for inspection upon the request of any authorized representative of the Federal Aviation Administration, or of any State or municipal official charged with the duty of enforcing local laws or regulations.
3. The holder of this certificate shall be responsible for the strict observance of the terms and provisions contained herein.
4. This certificate is nontransferable.

Note-This certificate constitutes a waiver of those Federal rules or regulations specifically referred to above. It does not constitute a waiver of any State law or local ordinance.

SPECIAL PROVISIONS

Special Provisions Nos. A thru D, inclusive.

The certificate 2019-CSA-3425-R is effective from June 21, 2019 to June 20, 2021 and is subject to cancellation at any time upon notice by the Administrator or his/her authorized representative.

BY DIRECTION OF THE ADMINISTRATOR

VONNIE L GILES Digitally signed by VONNIE L GILES Date: 2019.05.22 14:19:28 -05'00'

FAA Central Service Center AJV-C23 (Region)

Vonnie, L. Giles (Signature)

May 23, 2019 (Date)

Tactical, Operations Manager, CSA (Title)

FAA Form 7711-1 (7-74)

Version Date: November 1, 2017

FAA FORM 7711-1 UAS COA Attachment Page 1 of 17
2019-CSA-3424-COA-R

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

CERTIFICATE OF WAIVER OR AUTHORIZATION

ISSUED TO
Public Agency – University of Colorado, Boulder Part 91

ADDRESS
Research and Engineering Center for Unmanned Vehicles
429 UCB
Boulder, CO 80309-0429

This certificate is issued for the operations specifically described hereinafter. No person shall conduct any operation
pursuant to the authority of this certificate except in accordance with the standard and special provisions contained in this certificate, and such other requirements of the Federal Aviation Regulations not

OPERATIONS AUTHORIZED
Operation of the Tempest, Drak, and Mistral Unmanned Aircraft System (UAS) in Class G and E airspace, from Surface up to 2,500 feet Above Ground Level (AGL), within the location defined in Attachment 1, under the jurisdiction of Kansas City Air Route Traffic Control Center (ARTCC), Fort Worth ARTCC, Vance Radar Approach Control (RAPCON), Altus RAPCON, Fort Sill RAPCON, Lubbock TRACON and Sheppard RAPCON.

LIST OF WAIVED REGULATIONS BY SECTION AND TITLE
N/A

STANDARD PROVISIONS

1. A copy of the application made for this certificate shall be attached and become a part hereof.
2. This certificate shall be presented for inspection upon the request of any authorized representative of the Federal Aviation Administration, or of any State or municipal official charged with the duty of enforcing local laws or regulations.
3. The holder of this certificate shall be responsible for the strict observance of the terms and provisions contained herein.
4. This certificate is nontransferable.

Note-This certificate constitutes a waiver of those Federal rules or regulations specifically referred to above. It does not constitute a waiver of any State law or local ordinance.

SPECIAL PROVISIONS

Special Provisions Nos. A thru D, inclusive.

The certificate 2019-CSA-3424-R is effective from July 1, 2019 to June 30, 2021 and is subject to cancellation at any time upon notice by the Administrator or his/her authorized representative.

BY DIRECTION OF THE ADMINISTRATOR

VONNIE L GILES Digitally signed by VONNIE L GILES Date: 2019.05.22 13:10:36 -05'00'

FAA Central Service Center AJV-C23 (Region)

Vonnie, L. Giles (Signature)

May 22, 2019 (Date)

Tactical, Operations Manager, CSA (Title)

FAA Form 7711-1 (7-74)

Version Date: November 1, 2017

Acronym List

AC	FAA Advisory Circular
BIS	Bureau of Industry and Security (Department of Commerce)
CCL	Commerce Control List
CFI	University of Colorado Boulder Flight Instructor
COA	FAA Certificate of Waiver or Authorization
CUUF	University of Colorado Boulder Utilization of Facilities
DO	Director of Flight Operations
DDTC	Directorate of Defense Trade Controls (Department of State)
EAR	Export Administration Regulations
ECCN	Export Control Classification Number
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FOM	Flight Operations Manual
FCF	Functional Check Flight
FSIMS	Flight Standards Information Management System
IRISS	Integrated Remote and In-Situ Sensing
ITAR	International Traffic in Arms Regulations
OEC	Office of Export Controls
OFAC	Office of Foreign Assets Controls (Department of Treasury)
NOTAM	Notice to Airmen
PIC	Pilot in Command
QRH	Quick Reference Handbook
RECUV	Research and Engineering Center for Unmanned Vehicles
RSO	Registered Student Organization
SAR	Safety Action Report
UAS	Unmanned Aircraft System
UAC	Unmanned Aircraft Advisory Committee
UCB	University of Colorado Boulder
USML	United States Munitions List (ITAR)
VMC	Visual Meteorological Conditions
VO	Visual Observer

University of Colorado Boulder Unmanned Aircraft Safety Action Report

All Pilots or Visual Observers must submit this report to the DO within 24 hours of any accident/incident, as defined below. Only one report for each event is required. However, the Pilot and VO may both submit a separate SAR for the same event.

This report is used to document any unsafe events that occur while flying or preparing to fly an unmanned aircraft. The following definitions are based on COA requirements, 14 C.F.R. 107.9, and In addition, this SAR will be used by the DO and the UAS Committee for consideration and possible investigation. The intent of this report is to learn and become safety as well as to assist in compliance with FAA, NTSB, and UCB reporting requirements.

- "Accident" or "incident" is defined as any:
    - Fatal injury, where the operation of a UAS results in a death occurring within 30 days of the accident/mishap
    - Serious injury
        - Serious injury means:
            - Hospitalization for more than 48 hours, commencing within 7 days from the date of the injury
            - Any bone fracture (except simple fractures of fingers, toes, or nose)
            - Severe hemoorahages, nerve, muscle, or tendon damage
            - Involving any internal organ
            - Involving second- or third-degree burns, or any burns affecting more than 5 persent of the body surface
    - Loss of consciousness
    - Total unmanned aircraft loss
    - Substantial damage to the unmanned aircraft system where there is damage to the airframe, power plant, or onboard systems that must be repaired prior to further flight
    - Damage to property, other than the unmanned aircraft.
    - Any incident/mishap that results in an unsafe/abnormal operation including but not limited to:
        - A malfunction or failure of the unmanned aircraft's on-board flight control system (including navigation)
        - A malfunction or failure of ground control station flight control hardware or software (other than loss of control link)
        - A power plant failure or malfunction
        - An in-flight fire
        - An aircraft collision

        - Any in-flight failure of the unmanned aircraft's electrical system requiring use of alternate or emergency power to complete the flight
    - A deviation from any provision contained in the COA
    - Any incident that requires NTSB notification under 49 C.F.R. § 830.5
    - A deviation from an ATC clearance and/or Letter(s) of Agreement/Procedures
    - A lost control link event resulting in
        - (1) Fly-away, or
        - (2) Execution of a pre-planned/unplanned lost link procedure.
    - Loss of over $250.00 in equipment through damage or loss
    - Non-compliance with FAR or COA requirements
    - Any other event any crewmember deems worthy of a SAR

Name:_____

Department/Position_____

Date: _____

Email address: _____

Phone: _____

UAS Crew Position_____

1. What was the date of the accident?

2. What was the time of the accident?

3. Using Lat/Long, what was the location of the accident?

4. Who was acting as the PIC?

5. Who was acting as the VO(s)?

6. Were there any other crewmembers, for example PAC-M, PAC-O?

7. Were there any injuries, if so, please describe?

8. Was there any damage to any property other than the UAS?

9. Was the flight under Part 107, a COA, or hobbyist? If it was a COA, which one?

10. What were the weather conditions: ceiling, visibility and wind?

11. Were all FOM procedures followed? If not, please specify.

12. Preflight Check Complete? Yes____ No____

13. All Briefings Conducted? Yes____ No____

14. Checklists Used? Yes____ No____ (Please attach if used)

15. NOTAM Issued? Yes____ No____

16. Were all FAA procedures followed?

17. Were you current and qualified on the accident aircraft type?

18. Was there any conflict with manned aircraft?

19. Was this a "Fly-Away" event?

20. Was there any contact with any ATC facilities regarding this flight, if so, which one(s)?

21. Was there any contact with local law enforcement or safety personnel regarding the flight? If so, which one(s)? Please provide any reports from these agencies.

22. What was the FAA Registration Number of the aircraft?

23. If this flight was done in partnership with another agency or entity please provide their contact information.

24. If this flight was part of a research grant please provide the P.I.'s contact information

25. What was the flight number on the day of the accident?

26. What was the flight duration?

27. What were the flight conditions: Class of Airspace, Phase of Flight, Line of Sight / Beyond Line of Sight, Purpose of Flight?

28. How many hours of sleep the night prior to the accident did you get?

29. At what time did your work day begin on the day of the accident?

30. How many consecutive days did you work immediately prior to the day of the accident?

31. Was there any alcohol or drug use?

32. Did you feel pressure to participate in the operation, or to operate beyond limitations you felt comfortable with?

33. Please provide all electronic logs pertinent to the flight?

34. Provide a description of the accident flight.

University of Colorado Boulder UAS Accident/Incident Criteria and Protocols

All Incidents or Accidents which require the filing of Safety Action Report (SAR) must be reported to the DO immediately regardless of whether they meet the criteria listed below to be categorized as a Type I, II, or III event at CU. The DO retains authority to implement or follow any protocol as they see fit, regardless of Type. Strict adherence to the COA language, Part 107, and any other regulations or laws is required.

	Criteria	PIC Duties	Protocol
Type III - UAS Damage Only	- Small UAS (less than 55lbs), (which includes components, payloads and ground stations) with a value of two-thousand dollars or less that is damaged beyond repair or requires more than two-hundred-fifty dollars to repair - Suspected failure to follow FAA or FOM requirements	- Notify Director of Operations (DO) - Complete SAR - Notify any other necessary authorities (e.g., ATC)	- DO will review SAR and notify the UAS Committee Chair and submit the initial FAA or NTSB Accident/Incident report as required - The DO shall determine the probable cause of the incident. - The standard of proof required for a finding of responsibility is a preponderance of evidence, i.e., the information gathered demonstrates that it is "more likely than not" that the conduct occurred. - After the DO finds the "Probable Cause," the factual findings will be presented to persons involved in the incident/accident, including PIC, and they

			will be given seven (7) days to comment. - At the conclusion of the seven (7) days, the DO shall consider any written comments submitted and prepare the written results of the investigation to include: 1. Probable cause 2. Training recommendations 3. Policy recommendations - The UAC will review the results of the investigation for bias, impartiality, thoroughness, and sufficiency to support the finding. The results will be amended or adopted by the UAC as necessary. - The UAC will determine whether any recommended corrective actions are necessary and then forward any recommended corrective actions to the proper authority for implementation. - DO will make any final reports as required by law.

Type II - Fly-away event - Major Damage to Aircraft - Damage to CU property (not including UAS) - Minor Injury	Any UAS: - Involved in a fly-away event (UAS flew away and the pilot was not able to return the aircraft to intended landing point, or the UAS was lost and not found) - Valued at more than two-thousand dollars (which includes components, payloads and ground stations) and is damaged beyond repair, or requires more than two-hundred-fifty dollars to repair - Damages CU Boulder property, excluding the UAS.	- Notify Director of Operations (DO) - Complete SAR - Notify the Office of Export Control if applicable - Notify any other necessary authorities (e.g., ATC)	- DO will review SAR and notify the UAS Committee Chair and submit the initial FAA or NTSB Accident/Incident report as required. - DO shall determine the probable cause of the incident. - The standard of proof required for a finding of responsibility is a preponderance of evidence, i.e., the information gathered demonstrates that it is "more likely than not" that the conduct occurred. - After the DO finds the "Probable Cause," the factual findings will be presented to persons involved in the incident/accident, including PIC, and they will be given seven (7) days to comment. - At the conclusion of the seven (7) days, the DO shall consider any written comments submitted and prepare the written results of the investigation to include: 1. Probable cause 2. Training recommendations

	- Minor Injury (Individual required professional medical attention but was not admitted to a hospital; examples include broken bone or damage to tendons, laceration requiring stitches, or the individual misses up to two days of work due to the injury)		3. Policy recommendations - The UAC will review the results of the investigation for bias, impartiality, thoroughness, and sufficiency to support the finding. The results will be amended or adopted by the UAC as necessary. - The UAC will determine whether any recommended corrective actions are necessary and then forward any recommended corrective actions to the proper authority for implementation - DO will make any final reports as required by law
Type I - Damage to non-CU property - Serious injury - Loss of separation with manned aircraft	Any UAS: - Any private property loss - Major injury (Individual required professional medical attention and was admitted to a hospital, or the individual	- Notify Director of Operations (DO) - Complete SAR - Notify local law enforcement, as applicable	- DO will review SAR and notify the UAS Committee Chair and submit the initial FAA or NTSB Accident/Incident report as required. - At this time, the UAC Chair may convene an investigation board for a formal investigation to determine the probable cause of the incident.

	misses more than two days of work due to the injury, or suffers any injury possibly resulting in a disability) - Any situation where the FAA determines loss of separation occurred, or when a manned aircraft was forced to alter course or altitude due to the UAS	- Leave UAS in its state of rest - Notify the Office of Export Control if applicable - Notify any other necessary authorities (e.g., ATC)	- If convened, DO shall lead an investigatory board made up of additional individuals nominated by DO and confirmed by majority of UAC. - The standard of proof required for a finding of responsibility is a preponderance of evidence, i.e., the information gathered demonstrates that it is "more likely than not" that the conduct occurred. - After the DO and/or board finds the "Probable Cause," the factual findings will be presented to persons involved in the incident/accident, including PIC, and they will be given seven (7) days to comment. - At the conclusion of the seven (7) days, the DO and board shall consider any written comments submitted and prepare the written results of the investigation to include: 1. Probable cause 2. Training recommendations 3. Policy recommendations

			- Results of the investigation (formal investigation or not) will be reviewed for bias, impartiality, thoroughness of the investigation, and sufficiency to support the finding. The results will be amended or adopted by the UAC. - The UAC will determine whether any recommended corrective actions are necessary and then forward any recommended corrective actions to the proper authority for implementation - DO will make any final reports to the FAA /NTSB as required

PIC UAS Post Accident Checklist

This checklist must be accomplished by the PIC In the event of any accident or incident meeting the criteria listed in the FOM appendix under "University of Colorado Boulder UAS Accident/Incident Criteria and Protocols." If possible, accomplish these items in order. In all situations, the protection of life takes priority. The number in parenthesis after each item of this checklist denotes which Type Event: I, II, or III requires that item to be completed.

1. If there is a "Fly-Away" event, immediately notify the nearest Air Traffic Control facility

2. Notify local law enforcement / EMS if there is a serious injury or private property damage

3. Notify DO

4. Notify the FAA and/or NTSB if required

5. Photograph UAS, do not remove any parts or log files of any type from the aircraft

6. In a Category I accident leave the UAS in its initial resting place until it is released by the NTSB, FAA, Law Enforcement, or the DO

7. Complete the "Safety Action Report" located in the FOM

8. Provide the following items to the DO within 24 hours, or as soon as possible:

    1. UAS
    2. Checklists used during the mission
    3. NOTAM number for the NOTAM in effect at the time of the event (if applicable)
    4. Photos taken in step 5
    5. SAR
    6. Any documentation received from law enforcement, the FAA, or NTSB