Flight Operations Manual

Division of Public Safety

UNIVERSITY OF COLORADO **BOULDER**

Flight Operations

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Chapter 1: Introduction

1.1 Introductory Thoughts

1.1.1 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, as described in section 2.1.1, is recognized by the Chancellor for this purpose. 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 uncrewed aircraft in the national airspace system. These paths are: COAs, FAR Part 107, and Recreational Flyers 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. Recreational Flyers 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 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.

1.1.2 Authority

FAR 91, COA

It is the responsibility of all UCB associated individuals who intend to fly UAS for university business[1] under any flight rules, including the authority granted by UCB-owned COAs, Part 107 or the Hobby Exemption, to understand and appropriately apply the content in this manual. Deviations from the FOM need to be reasonably mitigated following an assessment of risk performed in consultation with the DO and University Risk Management. Applicability of specific FOM sections for different types of operations (e.g., Part 107, Hobby, etc.) is listed below.

Only UCB associated individuals are authorized to operate under the authority granted by any UCB COA. UCB employees, instructors and students who wish to operate in UCB-owned COAs are expected appropriately apply content in this manual except when a deviation is approved as part of an FAA approved COA or those solely pertaining to Recreational Flyers.

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

[1] As defined by the university administrative policy glossary to include activity that carries out the university's mission of instruction, research and service or that provides support to the university's instruction, research, and service activities.

In cases where a discrepancy exists between this manual and the Federal Aviation Regulations (FARs), including COAs, the FARs shall take precedence. This section is to be interpreted such that if the FOM and FARs contain different rules on the same subject, the FARs take precedence. If the FOM contains rules on a subject not covered in the FARs, these rules are valid. For example, the FOM introduces stipulations not included in the COAs or FARs, such as duty time rules. This is not considered a discrepancy. As another example, if the FOM and FARs were to offer different conceptions of the VFR weather minimums, the FARs take precedence. In some situations, a COA may contain rules, that the FOM does not. In this situation, all COA rules must be adhered too also.

1.1.3 Reproduction

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

1.1.4 Format

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

1.1.5 Electronic copy

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

1.1.6 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.

1.1.7 Time reference

All references to time, included dates are based on Universal Coordinated Time (UTC) unless otherwise defined. UTC may be referred to as Zulu time.

1.1.8 Gender reference

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

1.1.9 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.

1.1.10 Change Indicators

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

1.1.11 University-FAA Contact

DPS (Division of Public Safety) shall be the point of contact between the University and FAA for the following:

- Applying for or renewing COAs
- Submitting accident reports
- Submitting monthly flight reports
- Contacting ATC to explore the feasibility of a COA under consideration
- Giving official statements to the FAA regarding flight activity

UAS pilots licensed by the University will not communicate with the FAA on the University's behalf without authorization by DPS. If UAS pilots are contacted by the FAA, for example due to an accident report, pilots will coordinate with DPS on responses. Contact for the purpose of academic outreach, faculty research and expertise, contracts and grants are excluded from this requirement.

1.2 Definitions

FAR 1, COA

-ADS-B: Acronym for Automatic Dependent Surveillance Broadcast. This is a technology in which an aircraft determines its position via GNSS and broadcasts it so that the aircraft can be tracked. The FAA mandated ADS-B out for all manned aircraft in certain airspace classes as of January 1, 2020.

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

-Advisory Circular 91-57C (AC 91-57C): This AC supports the limited recreational operation of unmanned aircraft (UA) by explaining how a recreational flyer of UA may comply with the statutory requirements of Title 49 of the United States Code (49 U.S.C.) This AC provides guidance for operating Unmanned Aircraft under the exception, including operations for certain educational and research purposes; FAA recognition of community-based organizations (CBO); and application for fixed sites and CBO-sanctioned UA flying events.

-Aircraft: For the purposes of this manual the definition of “Aircraft” refers to any UAS multirotor, airplane, helicopter, or airship.

-Airworthiness Directive (AD): Issued by the DO to address any unsafe conditions associated with aircraft or aircraft systems.

-Airworthiness Manual: The UCB-owned UAS document delineating airworthiness certification standards.

-AGL: Reference to above ground level altitude. AGL altitude expressed in feet measured above ground level.

-Alaris Pro: UAS logging and maintenance tracking software.

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

-Associate Vice Chancellor (AVC): Individual ultimately responsible for all UAS-related decisions and policymaking on campus.

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

-Category: A broad classification of different kinds of aircraft, such as airplane, rotorcraft, or airship.

-Class: A sub-classification of aircraft, such as airplane single engine land, airplane single engine sea, or airplane multi engine land.

-Cloud Ceiling: The lowest layer of clouds or obscuring phenomenon with 5/8 or greater coverage. Ceiling means the height above the earth's surface of the lowest layer of clouds or obscuring phenomena that is reported as "broken", "overcast", or "obscuration", and not classified as "thick" or "partial".

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

-Day: Defined as 30 minutes prior to official sunrise until 30 minutes after official sunset.

-Difficulty Rating: The DPS-assessed rating to ascertain the required skill level for a given aircraft type.

-Director of Flight Operations (DO): Individual delegated by the AVC 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. The DO holds the day-to-day authority over UAS operations; their decisions can be appealed to the AVC.

-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.

-FAR 1: Contains regulations regarding definitions.

-FAR 61: Contains regulations regarding pilot certification.

-FAR 67: Contains regulations regarding medical standards and certification.

-FAR 89: Contains regulations regarding UAS remote ID. As of the beginning of 2021, these regulations will not be in effect for several years.

-FAR 91: Contains general operating regulations.

-Fire Weather Watch: Issued when the combination of dry fuels and weather conditions support extreme fire danger over a select area.

-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 Operations Training Manual (FOTM): The UCB-created UAS training and certification document.

-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.

-Flight Risk Assessment Tool (FRAT): Used to evaluate mission risk.

- Recreational Exemption or Recreational Flyers: A CU Boulder student flying recreationally as defined by House Resolution (H.R.) 302 or other applicable federal law.

- Education Exemption or EDU Exemption: Any CU personnel who flies under the conditions described in circular AC 91-57c.

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

-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, PI and/or Faculty Member.

-MSL: Reference to above mean sea level altitude. MSL altitude expressed in feet measured from mean sea level.

-MTOW: Maximum Takeoff Weight.

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

-Night: The time between the end of evening civil twilight and the beginning of morning civil twilight.

-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.

-DPS: Division of Public Safety. This is the agency within the CU administration which governs UAS 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.

-Red Flag Warnings: A weather warning issued only by the National Weather Service for a select area. This warning forecasts warm temperatures, low humidity in dried fuel moistures, and strong winds expected within 24 hours.

-Remote ID: an FAA-mandated technology to remotely broadcast the identity, location, control station location, altitude, etc. of a UAS. Remote ID regulations are contained in FAR89.

-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.

-Type: a specific make and model of aircraft.

-Type rating: DPS's certification for a pilot to fly a certain aircraft type that requires more training beyond the scope of the initial certification and aircraft class training.

-UA: Uncrewed Aircraft, the airborne component of an uncrewed aircraft system.

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

-UAC: UAS Committee. This committee serves an advisory role and makes recommendations on policy to the DO and AVC.

-Uncrewed Aircraft System (UAS): Any uncrewed 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 (VLOS):

> FAR107.31
>
> (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, uncrewed aircraft system must be able to see the uncrewed aircraft throughout the entire flight in order to:
>
> > (1) Know the uncrewed aircraft's location;
> >
> > (2) Determine the uncrewed aircraft's attitude, altitude, and direction of flight;
> >
> > (3) Observe the airspace for other air traffic or hazards; and
> >
> > (4) Determine that the uncrewed aircraft does not endanger the life or property of another.
>
> (b) Throughout the entire flight of the small, uncrewed aircraft, the ability described in paragraph of this section must be exercised by either:
>
> > (1) The remote pilot in command and the person manipulating the flight controls of the small, uncrewed aircraft system; or
> >
> > (2) A visual observer.

-Visual Meteorological 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).

-Very High Frequency Omnidirectional Range Radio (VOR) – for the purposes of this manual, VOR is taken to mean VORs, VOR/DMEs, and VORTACs collectively.

Chapter 2: Operational Policies

2.1 Oversight and authority

2.1.1 UAC

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

1. establish and maintain the UAS policy;
2. periodically review this policy and associated procedures and recommendations of the DO; and,
3. review UAS policy and procedure exceptions proposed by the DO.

The Committee is chaired by the Associate Vice Chancellor for the Division of Public Safety and may include the following representatives as appointed by the Chancellor:

a. Associate Vice Chancellor for Division of Public Safety, Chair
b. Associate Vice Chancellor of Research Integrity (Compliance)
c. CU Boulder Police Department Representative
d. Vice Chancellor for Infrastructure and Sustainability Representative
e. Campus Use of University Facilities (CUUF) Committee Chairperson
f. Director of Flight Operations
g. IRISS Representative
h. Research & Engineering Center for Uncrewed Vehicles (RECUV) Representative
i. University Risk Management Representative
j. Student Affairs Representative
k. Student Representative, appointed by the VC for Student Affairs

2.1.2 DO

The DO is delegated by the AVC 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 authority

regarding these issues and will implement the policies desired by the AVC to the maximum extent practical while still adhering to all federal, state and local laws. The DO will submit an annual report to the committee on flight activity, including any required reports that were submitted to the FAA or NTSB.

The DO's decisions can be appealed to the AVC.

2.1.3 AVC

The AVC holds the ultimate authority regarding UAS operations. As such, they make the final decisions regarding UAS policy as advised by the DO and UAC.

2.1.4 Adherence to regulations

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.

2.2 Role of Pilot in Command (PIC)

2.2.1 Responsibility and authority of PIC

FAR 91

Each PIC is responsible for determining how to apply the content of this manual to the specific circumstances of a flight. During flight missions, risks from necessary deviations from the manual must be reasonably mitigated and reported by the PIC to the DO via email within one business week after the flight mission is concluded.

(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.

2.2.2 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.

2.3 Crew duties, responsibilities, and requirements

2.3.1 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 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.

2.3.2 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.

2.3.3 Minimum crew complement

COA, FSIMS 8900.1

Under the UCB Blanket COA, FAR Part 107, and AC 91-57C the minimum crew required for UAS operations is one PIC.

For all other operations under UCB COAs the use of a VO is required. Therefore, the minimum crew required is a PIC and VO.

2.3.4 Crew qualifications

COA

Each Pilot or VO must be trained in accordance with the Flight Operations Training Manual and 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 categories, difficulty levels, and types (if typerating is required). A list of these specific UAS's 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 from a different category, difficulty level, or type (if typerating is required) not specifically listed in their training folder.

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

2.3.5 Flight currency

COA, FAR 61

A PIC is considered current if in the last two years they have done one of the following:

1. passed a checkride with a CFI;

2. obtained or renewed a Remote Pilot Certificate under 14 CFR Part 107;

3. or passed the FAA Recreational UAS Safety Test (TRUST).

Additionally, a PIC must complete three takeoffs and landings within 90 days prior to conducting the following operations:

1. Flight above 400 ft above ground level (AGL)

2. Flight over persons or congested areas, which includes Main Campus, East Campus, South Campus, and Williams Village. Flights to satisfy the three takeoffs and landings requirement may be conducted over campus in the presence of a CFI.

Because PICs can maintain currency of their own accord it may be necessary to for CFIs to prioritize training and checkride requests lower than other training and check-ride requests.

Pilots may be qualified on multiple similar aircraft, for instance all skill difficulty level 1 airplanes. In this case, the DPS strongly suggests that the PIC maintain currency on each aircraft type they intend to operate.

Pilots must maintain their Alaris Pro logbook for FAA or management review at any time. The pilot's Alaris Pro electronic logbook, issued by the DO, is the only acceptable means of compliance with this rule.

Part 107 users not flying on behalf of CU or not flying a CU-owned aircraft, and those using the Recreational Exemption, do not need to log this information.

For an individual to act as PIC of an aircraft at night, the PIC must have completed three landings to a full stop from the hours of 60 minutes past official sunset to 60 minutes prior to official sunrise within the preceding 90 days. These landings can be completed on any aircraft, UAS category, difficulty level, or type (if type rating is applicable).

Please see the Appendix for a list of categories, classes, and types of aircraft for the purposes of qualification and currency.

2.3.6 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.

2.3.7 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.

2.3.8 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 privileges does not meet FAA English language proficiency requirements, the DO will suspend those privileges.

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

2.4 Required preflight preparation

2.4.1 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 must 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

2.4.2 NOTAM submission

COA, FAR 91

The PIC is responsible to ensure that NOTAMS are issued for all flight activities in accordance with applicable COAs and FARs. NOTAMS aren't required for blanket COA operations at or below 400 feet above ground level. NOTAMS are required for all other COA's.

Unless explicitly stated otherwise in a COA, all UAS operating area NOTAMs must be submitted with the center point defined based on a radial and distance from the nearest VOR. Any other form of center point – including latitude/longitude, address, etc. – are not an acceptable means of defining a NOTAM center point.

NOTAMs should not be submitted for a duration longer than required for operations or with a vertical/lateral larger than that which is required for operations. For example, if duty time requirements exist, the NOTAM must end as the duty day ends, and the NOTAM height should not extend to an altitude beyond the VLOS range of the aircraft.

2.4.3 FRAT submission

The PIC must ensure that a FRAT is submitted via Alaris Pro no later than 48 hours before the planned mission. The FRAT must be approved by UCB flight operations before the mission is conducted.

2.4.4 UAS checklist submission

The PIC is responsible for submitting a completed UAS checklist via Alaris Pro just before the mission begins.
If the PIC is unable to digitally submit a UAS checklist, a physical checklist is required. The checklist must also be completed just before the mission begins. When the digital Alaris Pro checklist becomes available, it must be completed along with the “Date Discrepancy” field filled with the date of the flight.

2.4.3 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.

2.5 Operational policies

2.5.1 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.

2.5.2 Right of way

FAR 91.113

UAS operators must yield to all other traffic, manned and uncrewed. Despite the right-of-way rules, vigilance must always be exercised by each party to see and avoid other traffic.

2.5.3 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.

2.5.4 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.

2.5.5 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.

2.5.6 Flights 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 Village) is considered a congested area and is therefore prohibited unless specific written permission is granted by the UAC or DO.

2.5.7 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.
- Avoid causing congestion on the frequency by limiting any non-essential radio traffic so the VO, MC and PIC have adequate communication opportunities.

Note that approval to transmit on FAA frequencies is separate from approval to fly in the NAS.

2.5.8 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 taxi (if applicable), takeoff, climb, descent, approach, landing, and any time in which the crew needs to communicate with Air Traffic Control.

2.5.9 Operation near military training routes

No person may operate a UAS within 8 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 designate, in writing, a representative to handle MTR coordination and approval in situations where it is deemed appropriate.

Unsuccessful attempts to contact an MTR operator must be taken to mean the route is active.

2.5.10 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.

2.5.11 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.

2.5.12 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.

2.5.13 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

2.5.14 Checklist usage

FAR 91

Crewmembers will utilize checklist procedures for all flight operations. Trainees will be shown the electronic checklist in Alaris pro during ground school. It is incumbent upon them to modify the checklist to suit the aircraft UAS which they operate, or to create a new checklist suited to the aircraft UAS they will be operating. An instructor must be

notified of any changes made to the checklist so that they may update the electronic version in Alaris Pro.

2.5.15 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.

2.5.16 Fatigue management

FAR135, FAR121

The following definitions apply to the fatigue management section of this manual:

- Calendar day – the elapsed time beginning at midnight and ending at the next midnight 24 hours later.
- Rest – the period free of all work or duty. Time spent in transportation is not considered rest.

No UCB UAS crewmember may operate with a duty day exceeding 12 hours.
Duty day periods must be established such that the crew has adequate time to become thoroughly familiar with all operational considerations and can conduct thorough preflight preparation.

UCB UAS crewmembers must be provided a rest period in accordance with the duty day length as follows:

9 consecutive hours of rest for 8-hour duty day or less
10 consecutive hours of rest for 8-9-hour duty day
11 consecutive hours of rest for 9-12-hour duty day

Note that crewmembers' duty days are limited by the rest period: if only 9 hours of rest was provided, the maximum permissible duty day length is 8 hours.

UCB UAS crewmembers must be relieved of all duty for at least 24 consecutive hours during any consecutive 7-day period. No UCB UAS crewmember may be assigned any duty, nor may they accept any duty, within this 24-hour period.

No UCB UAS crewmember may be assigned to any duty, nor may any crewmember accept any duty, during rest periods.

No UCB UAS crewmember may be assigned any duty, nor may any crewmember accept any duty, which will exceed the following flight time limits:

1000 hours per calendar year
100 hours per calendar month
30 hours in any consecutive 7-day period
8 hours between rest periods
8 hours per day

These time limits above refer to flight time, not total work time. There are no specific requirements for the number of hours in the work week provided that the limits on flight time and duty time are met, and that rest time requirements are met.

All COA or CU Boulder duty times are binding; the most restrictive duty time limit must be used.

2.6 Weather requirements

2.6.1 Ceiling and visibility requirements

FAR91

No flights may be conducted when the cloud ceiling is below 1000’ AGL.

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

2.6.2 Cloud clearance requirements

FAR91

Airspace	**Flight Visibility**	**Distance from clouds**
Class A	N/A	N/A
Class B	3 statute miles	Clear of clouds
Class C	3 statute miles	500 feet below, 1000 feet above, 2000 feet horizontal.
Class D:	3 statute miles	500 feet below, 1000 feet above, 2000 feet horizontal.
Class E: Less than 10,000 MSL	3 statute miles	500 feet below, 1000 feet above, 2000 feet horizontal

Class E: At or above 10,000 feet MSL	5 statute miles	1000 feet below, 1000 feet above, 1 statute mile horizontal
Class G (day)	1 statute mile	Clear of clouds
Class G (night)	3 statute miles	500 feet below, 1000 feet above, 2000 feet horizontal.

2.6.3 Fire Weather

No UAS will be operated, without approval by a university officer, during and within the physical perimeters of a Red Flag Warning. During a Fire Weather Watch, which indicates a possible Red Flag Warning in the next 48 hours, extreme caution is to be used when operating.

Information about weather warnings and advisories including fire weather can be found from the National Weather Service at: https://www.weather.gov/

2.6.4 Wind

No flights are allowed with winds exceeding any aircraft limitations from the manufacturer or CU airworthiness certificate. Flights in sustained winds over 15 knots must be acceptable under the appropriate risk assessment for the specific flight and mission.

2.7 Medical requirements

2.7.1 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.

Crewmember can report changes to their medical information to the DO using the email address: directorofflightoperations@colorado.edu

2.7.2 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.

Any crewmember who uses any medicine which could cause drowsiness, impaired judgement, impair any basic motor function, or otherwise impair the PICs ability to fly safely shall immediately remove themselves from any crewmember duty while the medicine is in effect.

2.7.3 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.

2.7.4 Corrective lenses

If a crewmember requires corrective lenses to achieve 20/20 vision, these lenses must be worn during all flight operations and while performing any crew duty.

2.7.5 General Aeromedical Considerations

Crewmembers are highly encouraged to self-assess their medical fitness to fly before flying using the following checklist:

IMSAFE checklist

- I – Illness: flying with an illness that could impair your ability to fly is disallowed.
- M – Medication: flying while under the influence of any medication which could impair your ability to fly is disallowed.
- S – Stress: there are no hard rules for flying while stressed out. Stress and irritability is a sign of fatigue. Stress can worsen your judgement and overall is not a good state of mind to be in when flying. If you're stressed out, seriously consider canceling or postponing your flight.
- A – Alcohol: flying while inebriated is disallowed.
- F – Fatigue: fatigue is a serious impairment to flying. Ensure you meet all fatigue-related stipulations and strive to have more rest than is required.
- E – Emotion: if you are experiencing significant emotional trauma as a result of stress, a significant event such as the loss of a family member, etc. consider that your state of mind is not suitable to flying and seriously consider postponing or cancelling your flight.

2.8 UAS specifications

2.8.1 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 shortened under any circumstances. CU personnel or affiliates must occupy all required crew positions during flight operations.

2.8.2 UAS 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.

2.8.3 Aircraft discrepancies

COA, FSIMS 8900.1

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

2.9 Logbook and documentation requirements

2.9.1 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.

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

Recreational Flyers must have their AMA card on their person while flying strictly for pleasure over UCB property.

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

2.9.2 PIC Logbook

COA

All PICs must log every flight they make in their Alaris Pro account within 24 hours of flight completion. 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. Failure to log flights on time is grounds for revoking PIC credentials. DPS allows for crew to make one logbook mistake per year; within this limit, DPS will take no action against the crewmember outside of reminding them of the requirement to log flights on time. Outside of this, DPS's response will be governed by the Internal Evaluation Manual. The procedure to file a single flight log can be found in the appendix.

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.

2.9.3 Training Logbook

All instructors will log student flight time via a Training Log in Alaris Pro.

2.9.4 Logging Failures

Failure to log flights on time is grounds for revoking PIC credentials. DPS allows for crew to make one logbook mistake per year; within this limit, DPS will take no action against the crewmember outside of reminding them of the requirement to log flights on time.

2.10 Flights over UCB property

2.10.1 Notifications for flights over UCB property

All pilots flying under a UCB COA 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.

All non-CU-certified pilots flying under FAR107 must request permission from the DO a minimum of 10 days in advance. This request must include a plan containing specific details about how the operation will be conducted in a safe and compliant manner. UCB-trained COA pilots wishing to fly over campus under FAR107 may request to do so 48 hours in advance as per the above paragraph.

Flight requests sent to the DO can be for multiple flights in one message.

Approval from the DO must be received before the flights. A message sent with no reply does not constitute approval.

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

DPS intends to be conservative regarding approving over-campus flights. A flight request should be accompanied with justification as to why the flight must occur over campus and not at a more remote location. For example, testing new aircraft that can easily be transported would not be appropriate to conduct over campus.

Pilots flying under UCB COAs must have received on-campus training in order to be eligible to request on-campus operations, with the exception of CU South Boulder since this area is much less congested than other parts of campus.

2.10.2 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.

2.10.3 Professional photo and video licensing

All operators who plan to obtain photo or video footage of university owned property from a UAS operated under the authority granted by policies or procedures in this FOM must adhere to the agreement stipulated below:

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

Contact University Strategic Relations for additional information.

> University Strategic Relations
> 3100 Marine St, Rm. 505
> Campus Box 584
> Boulder, Colorado 80309-0584

2.10.4 Flights near residence halls

Recreational Flyers – No Recreational Flyer 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.

2.11 Accident and incident procedures

2.11.1 Accident investigation

COA, FSIMS 8900

If the AVC deems it necessary the UAC Chair will convene a board to investigate an accident. Other accidents are investigated internally by the Flight Operations Department. 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

University Counsel will be provided a copy of all accident investigation reports to ensure legal sufficiency.

2.11.2 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 VOs may all 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 uncrewed 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 uncrewed aircraft loss
- Substantial damage to the uncrewed 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 uncrewed aircraft.
- Any accident/mishap that results in an unsafe/abnormal condition including, but not limited to:
    - A malfunction or failure of the uncrewed 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 uncrewed aircraft’s electrical system requiring the 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 or 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

2.12 Internal evaluation manual

UCB maintains a compliance program in which DPS staff will conduct a site visit. The goals of this visit are as follows: (a) to assess the crew's competency performing their duties, (b) to determine the degree to which the crew complies with stipulations in the FARs/COA/FOM, and (c) to determine if the rules are burdensome or ineffective.

The UCB Internal Evaluation Manual governs compliance visits. No crewmember is exempt from the prospect of compliance visits; any crewmember operating with any affiliation to CU is subject to compliance visits.

A copy of the Internal Evaluation Manual can be obtained by emailing the Director of Flight Operations.

2.13 Reporting Alaris Pro Issues, Concerns, or Recommendations

Issues, questions or recommendations for Alaris Pro will be submitted to Flight Operations. Flight Operations works with Alaris Pro to address issues from all users at CU Boulder. If Flight Operations or Alaris Pro deems it necessary, a joint meeting between Alaris Pro, Flight Ops and the proponent may be arranged.

Chapter 3: Crew training and standardization

3.1 Introductory thoughts

3.1.1 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. Specific training and certification standards are presented in the UCB Flight Operations Training Manual (FOTM).

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.*

3.1.2 Delegation

The UAC has delegated the DO as the individual responsible for the training and certification of all UCB PICs, CFIs, VOs, and Examiners. 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 AVC.

3.1.3 Privileges of each crew position

The basic rights, responsibilities, and authorities of each crew or other certificated position are delineated below:

- VO
    - Assist the PIC in seeing and avoiding other traffic
- PIC

    - Serve as the legal authority who is responsible for conducting aircraft operations in a safe and compliant manner
- CFI
    - Provide one-on-one training with pilot trainees so as to review ground school material and prepare them for the oral portion of the checkride
    - Provide flight instruction to train pilots on the maneuvers needed to pass the flight portion of the checkride and operate the aircraft safely
    - Conduct additional ground and flight training in the following approved topics and subject areas: UAS night training and On-Campus operations training
        - Has authority to sign off and certify trainees as competent in these new areas of operation
    - Conduct recurrency events
        - Has authority to sign off trainee's logbook at completion of recurrency event
    - Conduct biannual flight reviews
        - Has authority to sign off trainee's logbook at completion of biannual flight review
- Examiner
    - Teach initial PIC ground school
    - Administer checkrides (both oral and flight portion) and issue PIC/VO certification based on the trainee’s competency during the checkride

3.1.4 Training programs

FAR 67, FSIMS 8900.1, COA

The DO will maintain separate training programs for PIC, VO, CFI and Examiners. This training will meet all FAA and UAC prescribed requirements for such a training curriculum. The FOTM provides the basis and outline for all training programs developed and used by the DO.

3.1.5 Type ratings and PIC qualifications on multiple UAS

PICs may be qualified on multiple UAS types. If the MTOW of the UAS is greater than or equal to 20 lbs., or uses a turbine propulsion system, the pilot will require a *type rating* to operate it. Each PIC must take a separate checkride for every UAS they intend to fly which requires a type rating.

For UAS less than 20lbs MTOW (Maximum Takeoff Weight), the pilot may be qualified, by taking one checkride on an appropriate UAS, on all UAS in a given category and difficulty level. For example, if a PIC wants to become qualified on skill level 1 airplanes, they can take a checkride using any skill level 1 airplane.

3.1.6 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.

3.1.7 Crew disqualification

Any UCB CFI has the right to disqualify any UCB PIC or VO if given evidence that the crewmember in question is operating or has been operating in an unsafe or noncompliant manner.

The DO has the right to disqualify any UCB CFI or Examiner if given evidence that the CFI/Examiner in question is not upholding high standards for checkrides, not training crewmembers adequately, or operating in an unsafe or noncompliant manner.

3.2 VO requirements

3.2.1 Initial requirements

All Visual Observers (VOs) must complete the following in order to receive VO qualifications:

1. UCB Initial VO Curriculum
2. Practical Test

3.2.2 Practical test requirements

The required checkride for certification as a VO on all UAS category, difficulty level, or type (if type rating is required) is practical in nature. Practical testing includes real world application, scenario based rational, and relevant knowledge evaluated through both verbal discussion and flight proficiency. Common practical testing requirements are shown below. Certification requirements and task areas are specifically described in the FOTM airman certification standards sections.

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

3.2.3 Biannual recurrent training

No recurrent VO training is required.

3.3 PIC requirements

3.3.1 Initial requirements

All PIC trainees must complete the following:

1. UCB Initial PIC course (ground school)
2. One-on-one training event with an instructor
3. Practical test (checkride)

3.3.2 Practical test requirements

The required checkride for certification as a PIC on a UAS category, difficulty level, or type (if type rating is required) is practical in nature. Practical testing includes real world application, scenario based rational, and relevant knowledge evaluated through both verbal discussion and flight proficiency. Common practical testing requirements are shown below. Certification requirements and task areas are specifically described in the FOTM airman certification standards sections.

-Verbal test on FAR's: 1, 61, 67, 91, 107, UCB FOM, COAs, and airspace
-Flight of a UCB UAS under the supervision of a UCB CFI showing competency in all aspects of operation from preflight through post flight.

3.3.3 Biannual recurrent training

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:

> (1) A minimum of 1 hour of ground training and at least the minimum amount of time required for a CFI to determine the applicant's flying abilities. The review must include topics that cover the PICs, UAS, environment, external pressures, and the COA.
>
> (2) A review of the current general operating regulations and flight rules of part

91; Flight Review ground knowledge format and specifics are outlined in the FOTM.

(3) 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. Flight Review flight maneuvers are outlined in the FOTM.

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 individual's 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.

Example: A PIC who completed their initial certification on 6 August 2019 would be qualified until August 31st, 2021.

Any PICs certified under the previous 25-calendar month BFR requirement prior to the publication of version 5 of the FOM are grandfathered in and are due for a BFR at the end of the 25th month following their checkride.

3.4 CFI requirements

3.4.1 Initial requirements

All instructors must complete the following to receive CFI qualifications:

1. Appointed by DO
2. UCB CFI curriculum
3. Practical test (checkride)

3.4.2 Practical test requirements

The required checkride for certification as a CFI is practical in nature. Practical testing includes real world application, scenario based rational, and relevant knowledge evaluated through both verbal discussion and flight proficiency. Common practical testing requirements are shown below. Certification requirements and task areas are specifically described in the FOTM airman certification standards sections.

-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.

3.4.3 Biannual recurrent training

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 individual's training folder and be maintained for a minimum of three years.

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

3.5 Examiner requirements

3.5.1 Initial requirements

1. Appointed by DO
2. Employee of DPS
3. Hold UCB CFI credentials
4. Complete UCB Examiner curriculum
5. Pass Practical test (checkride)

Individuals who hold CFI privileges and are employees of DPS as of October 1, 2020, are automatically qualified as Examiners.

3.5.2 Practical test requirements

The required checkride for certification as a PIC on a UAS category, difficulty level, or type (if type rating is required) is practical in nature. Practical testing includes real world application, scenario based rational, and relevant knowledge evaluated through both verbal discussion and flight proficiency. Common practical testing requirements are shown below. Certification requirements and task areas are specifically described in the FOTM airman certification standards sections.

-Must show currency as a UCB PIC and CFI to the satisfaction of the DO
-During the practical test observation, the Examiner candidate must demonstrate the ability to judge the competency of the trainee to operate as a UCB PIC or VO.
-Must be an employee of DPS.

3.5.3 Biannual recurrent training

FAR 61, COA

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

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 Examiner privileges.

Completion of an Examiner review will be noted in the individual’s training folder and be maintained for a minimum of three years.

Individuals holding Examiner privileges on 1 November 2020 are grandfathered and will be due for an Examiner no later than 31 December 2022.

3.6 Specialized training

3.6.1 Nighttime training

No PIC may exercise nighttime flight PIC or VO privileges granted in a COA without first having completed nighttime training with a UCB CFI.

3.6.2 On-campus training

No PIC may operate over main campus, east campus, or Williams Village without prior on-campus training from a UCB CFI.

3.6.3 Flights under non-blanket-area COAs

No PIC may operate under a COA other than the blanket COA without prior training on the stipulations contained within that COA from a UCB CFI.

3.7 General training policies

3.7.1 Checkride standards

These areas have been determined prior to each checkride and apply to all applicants. The DPS flight operations department has moved to adopt FAA proven practices, with the creation of the new FOTM, which includes the airman certification standards, an outline of all the required knowledge, risk management, and skills are listed. For each checkride the applicant must possess adequate ability in each of these areas in order to successfully pass. Depending on the difficulty rating of the UAS to be flown for a given checkride some of the flight maneuver tolerances will change (this is objectively described in the ACS) but for all “oral” / ground portion of checkrides the questions will be asked to the same standard for all applicants.

For clarification purposes and in conjunction with the new manual implementation the following statement has been added to replace the previous statement which warranted this initial question: “All checkride applicants will be held to predetermined checkride standards. Initial checkrides consist of ground and flight portions. The tolerances on flight maneuvers required for the flight portion of the checkride my change on UAS and the UAS predetermined difficult level. All ground portions of the checkride will be completed in conjunction with the airman certification standards outlined in the FOTM which state what knowledge, risk assessment, and skills are required to successfully pass the relevant checkride.”

3.7.2 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 another attempt for at least thirty days after the second or subsequent failure.

3.7.3 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.

3.7.4 Cancellations

A cancellation of a training event, flight review, or checkride must be communicated to the instructor/examiner administering the event a minimum of 24 hours before the scheduled start time of the event. *Failure to notify in time may result in the trainee or applicant needing to be scheduled after existing training requests.* This requirement may be waived based on instructor and examiner discretion in extenuating circumstances.

Disenrolling from a ground school class requires a minimum of 48 hours' notice. A cancellation within 48 hours of the scheduled start of ground school will result in the trainee being ineligible to enroll in a ground school course for the subsequent six months.

This policy does not extend to cancellations for weather-related reasons.

Chapter 4: Airworthiness

4.1 Authority and oversight

4.1.1 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.

4.1.2 Oversight

COA

The AVC has designated the DO and the Flight Operations Department responsible for the initial airworthiness certification, as defined in section 4.2.2, of all UAS flown under UCB COAs and over UCB property. The DO will issue a signed airworthiness certificate for each UAS found to be airworthy by CU. This letter will include any limitations or restrictions as appropriate. Any modifications of a previously airworthy aircraft must be approved by Flight Operations and certificated as airworthy.

Continuing airworthiness is the responsibility of each individual PIC before operating their UAS. DPS requires that this continuing airworthiness inspection be completed according to a checklist.

4.2 Airworthiness certification program

4.2.1 Airworthiness certification manual

The UCB UAS Airworthiness Certification Manual delineates the standards against which aircraft are evaluated, including the standards for initial airworthiness of a given aircraft type and the standards for certifying aircraft modifications.

In lieu of the CU Airworthiness standards individuals or organizations within CU may choose to use any relevant industry or DOD accepted standard for airworthiness certification. The intent to use an alternate standard, and the specific standard to be

used, must be communicated to DPS prior to commencing the airworthiness review. In all cases DPS remains responsible for independently validating UAS test results conform to the standard used.

A copy of the airworthiness manual can be obtained by emailing directorofflightoperations@colorado.edu or by visiting the Flight Operations website.

All the following must be certified as airworthy by the Division of Public Safety:

- All aircraft types
- All aircraft modifications and certain repairs
- Certain payloads

Aircraft are certified according to their category (airplane, helicopter, multirotor, airship), origin (commercial-off-the-shelf, user-assembled commercial off-the-shelf, and entirely novel), and desired mode of operation (experimental vs. operational).

The experimental mode of operation is intended for the following circumstances:

- Testing of aircraft for student projects.
- Testing of aircraft prior to operational certification.

Experimental airworthiness certificates carry limitations regarding where the aircraft is operated along with the purpose of operations. These limitations are included in an experimental airworthiness certificate and are summarized as follows:

1. The aircraft may only be flown in a remote location, far from any infrastructure or people who could be adversely affected by an aircraft malfunction,
2. Regardless of the applicable flight rules, the aircraft may only be flown in daytime VFR conditions, and
3. The aircraft must be flown by an experienced pilot, and
4. The aircraft may only be flown for engineering and testing purposes.

The airworthiness manual differentiates between *type certificates* and *airworthiness certificates*. Type certificates certify that an aircraft type is airworthy. Airworthiness certificates are specific to an individual aircraft and certify that the aircraft conforms to its type design and that it is in a condition for safe operation.

Aircraft which have been deemed airworthy as of 1 October 2020 are still considered airworthy and do not need to be recertified under the new certification standards.

All airworthiness assessments must be performed or validated by DPS employees with formal training in aerospace engineering. The specific requirements are contained in the airworthiness manual.

4.2.2 Initial airworthiness

COA

The following definitions applies for the purposes of initial airworthiness standards:

- Smart battery – a battery with any microcontroller onboard to aid in reading out the battery level to a user or to communicate with the aircraft/charger system.
- Standard battery – a battery consisting solely of cells, connectors, and a case. Batteries not meeting this description are qualified as smart batteries.

Existing approved commercial UAS: Check the appendix for a list of aircraft which already carry a type certificate and the corresponding flying difficulty levels.

UAS on this list may obtain an airworthiness certificate by emailing the Director of Flight Operations and requesting an airworthiness certificate. The DO may require an inspection to confirm that the aircraft conforms to its type design.

Operators of aircraft which have been certified as airworthy as of 1 October 2020 must contact DPS to be issued a new airworthiness certificate according to the new certification scheme. Note that the aircraft is still airworthy, but new paperwork reflecting the new airworthiness manual is required.

If the aircraft isn't on the above list, the DO must be contacted to perform an airworthiness evaluation and to issue a type certificate and airworthiness.

UAS listed above must be flown with strictly OEM parts (excluding batteries), unless third-party parts are certified as airworthy by DPS.

UAS listed above must be flown with strictly OEM batteries if the aircraft requires smart batteries, unless third-party batteries are certificated as airworthy by DPS. UAS requiring only standard batteries may fly using any appropriate battery.

4.2.3 Airworthiness directives

FAR39

The conditions for issuing airworthiness directives are delineated in the Airworthiness Certification Manual.

ADs will be issued when an unsafe operating condition exists with a product, and is likely to exist or develop in other products of a similar design.

Compliance with ADs is mandatory.

The AD will specify inspections which must be carried out, conditions or limitations that must be complied with, and any actions which must be taken to resolve the unsafe condition.

ADs apply to each product identified, regardless of modification.

The AD will recommend methods to resolve the unsafe condition. Alternate means of compliance with the AD are acceptable if first approved by DPS.

4.2.4 Payloads

Certain payloads are subject to airworthiness certification. This does not apply to the following payloads:

- The payload does not change the external aerodynamic shape of the aircraft in any way.
- The payload does not require the aircraft CG to be located outside of the certificated CG limits, and the payload does not require the aircraft gross weight to exceed the maximum certificated gross weight.
- The payload does not draw power from the aircraft flight battery or any aircraft electrical systems.
- They payload does not interface with any onboard aircraft systems, including GPS, servos, autopilot or stability augmentation system, flight controls, radio systems, or any internal aircraft bus.
- Payloads that are entirely self-contained and not reliant on any aircraft systems.
- Payloads from the aircraft OEM or third-party payloads explicitly supported by the OEM.

For a payload to be certified as airworthy, an existing airworthy aircraft onto which it will be mounted must be identified.

4.2.5 Modified and repaired aircraft

This standard applies to aircraft that are modified in any way from their original state, as well as certain repairs. This includes all modifications, no matter how small.

Aircraft which undergo significant repairs or any modifications must be inspected by DPS.

The requirement for inspections after repairs only relates to significant repairs. The following situations are examples of routine maintenance which do not require any inspection of DPS:

- Inspecting, servicing, or replacing components per manufacturer or type certificate guidelines.

- Replacement of common wear items, such as landing gear and propellers.
- Firmware updates.

For a modified aircraft to be certified as airworthy, the unmodified aircraft must meet the applicable airworthiness standards delineated in this manual.

Aircraft modified per a modification specifically mentioned on the aircraft's type certificate need not be subjected to these certification standards.

Contact the Director of Flight Operations to certify a modified aircraft. Note that, upon inspection of the aircraft and the desired modifications, the DPS may certify the aircraft as airworthy without any further testing of inspection.

4.2.6 Flying difficulty evaluation

The Airworthiness Manual contains guidance and standards to evaluate the flying difficulty of an aircraft, which has implications for training and currency as delineated in section 2 of this manual.

See the appendix for a list of aircraft according to their DPS-evaluated piloting difficulty level. Upon the publication of this manual, this list contains some of the most commonly-flown aircraft. In order to evaluate the flying difficulty of an aircraft not on the list, please contact the Director of Flight Operations.

4.3 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.

4.4 Student projects

No student projects may be flown without airworthiness certification from DPS.

Chapter 5: Part 107 operations

5.1 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.

5.2 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.

UCB 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.

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.

5.3 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.

5.4 Hobby exemption users

Any individuals who are operating under the hobby exemption, and who are not flying over UCB property are exempt from this chapter. However, 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.

5.5 Part 107 Waivers

Any pilot associated with UCB who obtains a Part 107 waiver must follow all provisions granted by that waiver. The pilot must submit the waiver to Flight Operations for record keeping. If the waiver is not in compliance with UCB UAS Policy or procedure, the use of the waiver must be approved by Flight Operations before use.

Chapter 6: UAS weighing less than 0.55 pounds

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

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 of drugs or alcohol.
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: Recreation Flights

7.1 Applicability

This chapter applies to recreational flights which can operate within the limits of 49 U.S.C. § 44809 and FAA AC 91-57C
AC 91-57C flights covered under this paragraph are flights from UCB property for the following purposes:

- Recreation and Enjoyment
- Registered Student Organizations

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.

All recreational pilots flying from UCB property must strictly follow AC 91-57C, other relevant UAS policy, and the UCB FOM.

Recreational Flying is only for pleasure flying and not for official research or CU business.

7.2 Academy of Model Aeronautics membership

All pilots conducting AC 91-57C flights from UCB property and Boulder Aeromodelling Society must be current Academy of Model Aeronautics (AMA) members. Details can be found on the AMA website.
Through an arrangement with Boulder Aeromodelling Society (BAS) students do not need a separate membership to fly as BAS.

7.3 AMA safety code

All pilots flying from UCB property as AC 91-57C pilots must follow all AMA Safety Code and flying site guidelines and requirements.
A copy of the AMA safety code is included for reference:

As an AMA Member I agree:

- I will not fly a model aircraft in a careless or reckless manner.
- I will not interfere with and will yield the right of way to all human-carrying aircraft using AMA See and Avoid Guidance and a spotter when appropriate.
- I will not operate a model aircraft while under the influence of alcohol or any drug that could adversely affect my ability to safely control the model.
- I will avoid flying directly over unprotected people, moving vehicles, and occupied structures.
- I will fly Free Flight (FF) and Control Line (CL) models in compliance with AMA's safety programming.

- I will maintain visual contact of an RC model aircraft without enhancement other than corrective lenses prescribed to me. When using an advanced flight system, such as an autopilot or First Person View (FPV), I will comply with AMA's advanced flight system programming.
- I will only fly models weighing more than 55 pounds, including fuel, if certified through AMA's large model airplane program.
- I will only fly a turbine-powered model aircraft in compliance with AMA's gas turbine program.
- I will not fly a powered model closer than 25 feet to any individual, except for myself or my helper(s) located at the flightline, unless I am taking off or landing, or as otherwise provided in AMA's Competition Regulation.
- I will use an established safety line to separate all model aircraft operations from spectators and bystanders.

This copy of the AMA safety code is current as of February 3, 2020. The latest AMA safety code can be found at modelaircraft.org.

7.4 Recreational Registration and Certification

AC 91-57C

7.4.1 Requirements

AC 91-57C PICs must complete the DPS Flight Ops training module to understand campus policy and compliance with AC 91-57C. After completing the training module, pilots must register their vehicle with the FAA and pass the FAA TRUST exam.

7.4.2 Registration

The AC 91-57C module is available on the DPS Flight Operations website and below. (**https://canvas.colorado.edu/enroll/YJACAB**)

After completing the module, PICs must register their vehicle with the FAA.

Note that UAS over 250 g or 0.55 lbs must have a current registration number that is visible on the aircraft.

To register a vehicle for AC 91-57C, PICs must go to the FAA Drone Zone Website and register their vehicle as a hobbyist. A first-time registration will also require the completion of the TRUST exam

Registration Website: https://faadronezone-access.faa.gov

Upon passing the TRUST exam, PICs will receive a certificate from the FAA, and have the ability to register their UAS.

When these items are complete PICs must email a copy of their TRUST exam certificate, AMA insurance card, and vehicle registration number to the DO.

If everything is in order the PIC will be added to the list of approved AC 91-57C recreational pilots, and receive a certificate from DPS.

If requested by an FAA inspector or law enforcement officer, the PIC must provide:

1. Their TRUST exam certificate,
2. Their DPS AC 91-57C recreational pilot certificate
3. Their AMA insurance card

These items can be hard copy or digital.

7.5 Visual Observers

AC 91-57C, FAR 107

All AC 91-57C pilots must maintain visual line of sight with the UAV throughout the entire flight. The use of a VO is optional if the see and avoid requirement is fulfilled by the PIC. If the PIC must look away from the UAV for long periods of time or use FPV software, the pilot is no longer fulfilling the see and avoid requirement and therefore must utilize a VO who must be co-located with the PIC.

7.6 Airspace

AC 91-57C flyers may only fly in uncontrolled (Class G) airspace up to 400 feet AGL.

AC 91-57C flyers are also expected to fully comply with special use airspace designations, special flight rules, and TFRs published.

AC 91-57C pilots may use the FAA's LAANC to check airspace restrictions and obtain permission to fly in controlled airspace. AC 91-57C pilots should not contact ATC for permission to fly in controlled airspace.

7.7 UAS Night Operations

AC 91-57C

AC 91-57C flyers or VOs must maintain VLOS at night so the UAV must be equipped with anti-collision lighting, visible up to 3 statute miles. The vehicle must also be equipped with orientation lighting that the PIC can see throughout the flight.

7.8 Flight areas

Flight approvals over the three UCB campuses for AC 91-57C pilots 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 Policy and procedures

East Campus: AC 91-57C flights over the South Boulder Campus will be approved for registered pilots on a case-by-case basis depending on site availability.

Pilots must not fly within 200 feet of any residential occupied buildings to avoid nuisance and noise disruptions. Pilots must not capture footage of any private areas, including residence hall rooms or windows. UAS cameras shall not be directed at the windows of any privately-owned residence not located on CU Boulder property.

To request flight approval for these operations pilots shall email the DO at directorofflightoperations@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.

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

South Boulder Campus: AC 91-57C flights over the South Boulder Campus will be approved for registered pilots on a case-by-case basis depending on site availability.

To request flight approval for these operations pilots shall email the DO at directorofflightoperations@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 Village: AC 91-57C flights will be approved for registered pilots 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 directorofflightoperations@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 Policy and procedures

Regardless of flight location, pilots should be prepared to present a current AMA membership card and current FAA registration when making an application to fly on campus.

Chapter 8: Export control

8.1 Applicability

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.

8.2 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.

8.3 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

8.4 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 uncrewed 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

8.5 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.

8.6 Obtaining export control license 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.

9.2 Battery types

Batteries are very common in all UAS operations. There are many different brands, types, and designs of batteries. It is important to know the specifics behind the batteries intended for use in the UAS (how it operates, how it charges, common failure points or known issues, etc). With new technology there are now also smart batteries. These batteries communicate in some way with the UAS to a greater extent than standard batteries. Smart batteries can be very beneficial but require extra complexity which could cause failures. It's important to know what batteries work with your UAS, for more reference the Airworthiness Manual.

- Smart battery – a battery with any microcontroller onboard to aid in reading out the battery level to a user or to communicate with the aircraft/charger system.
- Standard battery – a battery consisting solely of cells, connectors, and a case. Batteries not meeting this description are qualified as smart batteries

9.3 Propeller safety

Propellers can be made from many different types of materials and connected to different engines. All propellers should be treated with extreme caution and care. Before each flight propellers should be secured and tightened to proper manufacture specification. Each time a propeller is connected to a motor which has any potential of starting the PIC should notify the crew and bystanders and treat the propeller if it was running. The PIC should become familiar with and commit to memory all ways to deactivate power to a spinning propeller.

Chapter 10: International operations

10.1 Applicability

All UAS flights by CU Boulder Faculty, Staff and Students that occur in foreign countries or international airspace must follow the requirements of this chapter.

10.2 Crewmember qualifications

All personnel who act as pilots in foreign UAS operations must be current and qualified as a CU Boulder UAS pilot in addition to any applicable licensure requirements imposed by foreign governments.

10.3 Flight operations requirements

All personnel requesting to fly in foreign countries or international airspace must notify the Director of Flight Operations (DO) as soon as possible in the planning stages.

The DO will assist personnel with navigating the requirements to fly UAS in foreign airspace. CU Boulder personnel have flown in numerous countries, and we have established contacts with the aviation regulators in many countries. UAS operational regulations vary greatly between countries, therefore each request will be handled on a case-by-case basis so the operational review can be tailored to the mission requirements and pertinent regulations in place at the time.

Prior to flights being conducted in foreign or international airspace express written approval must be obtained from the DO. Detailed descriptions of the scope of the operations and all pertinent procedures that are unique to the operations will be listed in the approval letter.

10.4 Export control requirements

Prior to flights being conducted in foreign or international airspace express written approval must be obtained from the Office of Export Controls. Export control requirements can often take considerable time to navigate. The Office of Export Controls should be consulted immediately upon the initiation of any project planning to use UAS outside the United States. Refer to the CU Boulder UAS Policy for additional information.

10.5 Contracts

Applicable contracting personnel should be made aware of plans to fly UAS in foreign or international airspace as soon as possible. Contracts will be coordinated with Export

Controls, Legal, and Flight Operations throughout the approval process to ensure all applicable laws are complied with and the interests of CU Boulder are protected.

Chapter 11: Crewed Aircraft Operations

11.1 CUUF Procedures

According to CU Use of Facilities (CUUF) procedures the takeoff and landing of crewed aircraft on CU Boulder property is prohibited with the following exceptions:

1. Emergency response, such as Flight For Life air ambulance operations. Training and demonstration of emergency capabilities are not included in this exception.
2. Flights that have been pre-approved by CUUF and all other pertinent CU Boulder stakeholder's dependent on the particulars of the request.

11.2 Applications for approval

Individuals and organizations applying for an exemption to be allowed to land and takeoff from CU Boulder shall follow these procedures.

1. Notify the Flight Operations Department of the request including contact information, dates of planned operations, type of aircraft, requested operating area, air carrier operating certificates if applicable, crewmembers flight certification documents and insurance coverage.
2. The Flight Operations Department will coordinate with the operator on a safety plan, risk assessment and other required planning as the situation dictates. The Flight Operations Department will forward this information the CUUF for their consideration. Flight Operations does not make the decision on whether to approve or deny an application. That authority rests solely with CUUF.

11.3 Definitions

A crewed aircraft is any airplane, helicopter, gyrocopter, ultralight, hang-glider, glider, powered parachute, powered paraglider, airship, blimp, hot air balloon, gas filled balloon, or urban air mobility vehicle capable of carrying a human.

Chapter 12: AC 91-57C for Research and Educational Flights

12.1 Applicability

This chapter applies to pilots conducting UCB sanctioned educational or research purposes who wish to operate within the limits of 49 U.S.C. § 44809 and FAA AC 91-57C. Pilots are advised to also review https://www.faa.gov/uas/educational users. Any student flying for official CU coursework must adhere to the regulations in this chapter.

Recreational Registration and Certification

AC 91-57C

12.2 Certification Requirements

PICs wishing to operate under AC 91-57C for official CU ~~r~~esearch and educational flights must comply with the following requirements:

- Complete the CU Boulder AC 91-57C digital training module
- Complete the FAA AC 91-57C TRUST exam
- Register their vehicle with FAA Drone Zone
- Be a current AMA member
- Provide all certifications to Flight Operations
- If the UAS is other than an unmodified off the shelf product it must undergo an airworthiness evaluation by the Flight Operations department. Details on this can be found in Chapter 4 of this manual.
- Log all flight activities in Alaris Pro

Compliance with these items is mandatory.

12.3 Operations from CU property

- Complete on Campus training which is available through the Flight Operations Department before any operations on CU property
- Receive approval for all on campus flights

12.4 Boulder Aeromodelers Society Access

Through an arrangement with Boulder Aeromodeling Society (BAS) students, faculty or staff do not need a separate membership to fly as BAS when the purpose of the flight is related to official CU duties, research or classes.

12.5 Visual Observers

AC 91-57C

All AC 91-57C pilots must maintain visual line of sight with the UAV throughout the entire flight. The use of a VO is optional if the see and avoid requirement is fulfilled by the PIC. If the PIC must look away from the UAV for long periods of time or use FPV software, the pilot is no longer fulfilling the see and avoid requirement and therefore must utilize a VO whom must be co-located with the PIC.

12.6 Airspace

AC 91-57C

AC 91-57C flyers may only fly in uncontrolled (Class G) airspace up to 400 feet AGL.

AC 91-57C flyers are also expected to fully comply with special use airspace designations, special flight rules, and TFRs published.

AC 91-57C pilots may use the FAA's LAANC to check airspace restrictions and obtain permission to fly in controlled airspace. AC 91-57C pilots should not contact ATC for permission to fly in controlled airspace.

12.7 UAS Night Operations

AC 91-57C

AC 91-57C flyers or VOs must maintain VLOS at night so the UAV must be equipped with anti-collision lighting, visible up to 3 statute miles. The vehicle must also be equipped with orientation lighting that the PIC can see throughout the flight.

Chapter 13: Blanket Area COA

13.1 Description

3. The Blanket Area COA is a COA provided to any federal, state, or other public entity who requests one for sUAS operations. This COA is issued with the same restrictions and limitations to all agencies. No variations from the standard language of the COA are allowed.
4. CU Boulder maintains a Blanket Area COA for all sUAS users on campus who have a need to fly within the limitations and restrictions of the COA, University policy and procedures, and any applicable requirements by the landowners of the property the pilot wishes to fly from.
5. CU Boulder also maintains numerous additional COA's that are specifically tailored to meet the needs of projects at the university. If your project requires permissions to fly that are not allowed under the Blanket Area COA, FAR Part 107 or AC 91-57C, please reach out the flight operations department to discuss options that may be available for a new COA to meet your needs.

13.2 FAA Limitations and Requirements

A. Operational:

1. The issuing of a NOTAM and the use of a Visual Observer (VO) are not required for small UAS operations under 14 CFR Part 91 that meet all the following criteria:
a. Weighs less than 55 pounds;
b. Have a maximum airspeed of 100 miles per hour (87 knots) or less;
c. Are operated in class G airspace at or below 400 feet above ground level, or at or below the UAS facility map altitudes; and
d. Remain within visual line of sight.
e. For those operations not meeting the above criteria, all VO and NOTAM provisions of this document apply.

2. The uncrewed aircraft (UA) must be operated within visual line of sight (VLOS) of the pilot in command (PIC) and the person manipulating the flight controls at all times. This requires the PIC to be able to use human vision unaided by any device other than corrective lenses. Although the remote PIC and person manipulating the controls must maintain the capability to see the UA, using one or more visual observers (VO) allows the remote PIC and person manipulating the controls to conduct other mission-critical duties (such as checking displays), while still ensuring situational awareness of the UA.

3. Must yield right of way to other aircraft, manned or uncrewed.

4. First-person view cameras cannot satisfy "see-and-avoid" requirements but can be used as long as the visual requirement is satisfied in other ways.

5. Remain within a maximum altitude of 400 feet AGL, or if higher than 400 feet AGL, within a 400-foot radius of a structure's upper most limit. In all cases, the UAS must remain within Class G airspace. NOTAM and VOs are required for all operations above 400 feet AGL.

6. Must maintain a minimum visibility of three statute miles from control station.

7. No person may act as a remote PIC or VO for more than one UA at one time.

8. No operations from a moving vehicle or watercraft unless the operation is over a sparsely populated area and the PIC and VO are co-located.

9. Lost link procedures must remain within VLOS of the PIC and VO.

10. The remote PIC may deviate from the requirements of this rule in response to an in-flight emergency.

11. Requests to operate in an area outside the approved operating area of this authorization should be limited to emergency and/or life threatening operations. Coordinate these flights through the special government interest (SGI) process by calling the System Operations Support Center (SOSC) at 202-267-8276, or email: 9-ATOR-HQ-SOSC@faa.gov.

B. Notice to Air Missions (NOTAM).

1. A Distant (D) NOTAM must be issued, not less than 24-hours but not more than 72-hours, in advance of conducting routine UAS operations.

2. The area of operation defined in the (D) NOTAM must only be for the actual area to be flown for each day defined by a point and the minimum radius required to conduct the operation.

3. Operator must cancel (D) NOTAMs when UAS operations are completed or will not be conducted.

4. For first responders only. Due to the immediacy of some emergency management operations, the (D) NOTAM notification requirement may be issued as soon as practicable before flight. If the issuance of a (D) NOTAM may endanger the safety of persons on the ground it may be excluded. If the (D) NOTAM is not issued, the proponent must be prepared to provide justification to the FAA upon request.

C. **Small UAS Night Operations**.

1. Small UAS operations may be conducted at night, as defined in Title 14 CFR § 1.1, provided the following:

1. All operations under the approved COA that do not meet the requirements of B.1. above, must use one or more VOs.

2. Prior to conducting operations that are the subject of the COA, the remote PIC and VO must be trained to recognize and overcome visual illusions caused by darkness and understand physiological conditions which may degrade night vision. This training must be documented and must be presented for inspection upon request from the Administrator or an authorized representative; and

3. The small UAS must be equipped with lighted anti-collision lighting visible from a distance of no less than three statute miles. The intensity of the anti-collision lighting may be reduced if, because of operating conditions, it would be in the interest of safety to do so. Additionally, in order to comply with Title 14 CFR § 91.209, the aircraft must have position lighting that enables determination of location altitude, attitude, and direction of

D. Special Use Airspace.

1. Coordination and de-confliction between Military Training Routes (MTR) and Special Use Airspace (SUA) is the operator's responsibility. When identifying an operational area, the operator must evaluate whether an MTR or SUA will be affected. In the event the UAS operational area overlaps an MTR or SUA, the operator will contact the scheduling agency in advance and as soon as practicable to coordinate and de-conflict. Approval from the scheduling agency is required for regulatory SUA, but not for MTRs and non-regulatory SUA. If there is no response to coordination efforts, the operator must exercise extreme caution and remain vigilant of all MTRs and/or non-regulatory SUAs.

2. Scheduling agencies for MTRs are listed in the Area Planning AP/1B, *Military Planning Routes, North and South America*. If unable to gain access to the AP/1B, contact the FAA with the instrument routes/visual routes affected at the following email addressing: 9-AJV-115-UASOrganization@faa.gov. The FAA will provide the scheduling agency information.
Scheduling agencies for SUAs are listed in the FAA Order JO 7400.10, *Special Use Airspace.*

E. Flight Planning Requirements.
Operations must only be conducted beyond the following distances from the airport reference point (ARP) of a public use airport, heliport, gliderport, or water landing port listed in the Chart Supplement, Alaska Supplement, or Pacific Chart Supplement of the U.S. Government Flight Information Publications:
1. Five nautical miles (NM) from an airport having an operational control tower;
2. Three NM from an airport having a published instrument flight procedure, but not having an operational control tower;
3. Two NM from an airport not having a published instrument flight procedure or an

operational control tower; or
4. Two NM from a heliport.

F. Lost Link/Emergency/Contingency Procedures.
1. Lost Link Procedures: In the event of a lost link, the UAS pilot will comply with the following provisions:
a. The UA lost link will be programmed to ensure that the lost link flight does not fly over persons and the landing location is within the view of the PIC.
b. Lost link procedures will not transit or orbit over populated areas, Victor airways, busy roadways, and/or interstate highways.
c. Lost link procedures will be programmed to remain within the operations area and altitude, avoid unexpected turn-around and/or altitude changes, and will provide sufficient time to communicate with ATC if necessary.
2. Emergency/Fly-Away Procedures:
a. In the event of an emergency, the PIC will immediately contact the ATC facility having jurisdiction for the airspace, state the nature of emergency, and the pilot's intentions.
b. In the event of an UA fly-away, advise ATC of the following:
(1) Direction of flight;
(2) Last known altitude; and
(3) Maximum remaining flight time.

13.3 CU Boulder Limitations and Requirements

All pertinent requirements contained in CU Boulder policy or this manual that apply to operations under an FAA authorized COA or flight operations in general must be complied with. If there are any questions regarding what applies in a specific situation please reach out to flight operations for assistance.

Chapter 14: COA Application Process

14.1 COA Application Process

In order to receive the best outcome, we request new COA's requests to be submitted to Flight Operations at least 180 days in advance. If 180-days' notice is not possible, Flight Operations will work to submit the COA as fast as practical. However, given varying FAA processing issues it may not be possible to receive the COA by the deadline needed by the proponent.

14.2 COA Renewals

Approximately 90 days prior to COA expiration Flight Operations will reach out to the proponent inquiring if they would like the COA renewed. Any requested changes will be submitted to the Flight Operations by the proponent within 30 days of the renewal inquiry. Approximately 60 days prior to withdraws the renewal. In that case the COA will be allowed to expire.

14.3 COA Document Access

COA's and all associated backmatter are available in Alaris Pro.

Appendix

A.1 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
FOTM-	Flight Operations Training Manual
FCF-	Functional Check Flight
FRAT-	Flight Risk Assessment Tool
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 Uncrewed Vehicles
RSO-	Registered Student Organization
SAR-	Safety Action Report
UAS-	Uncrewed Aircraft System
UAC-	Uncrewed Aircraft Advisory Committee
UCB-	University of Colorado Boulder
USML-	United States Munitions List (ITAR)
VMC-	Visual Meteorological Conditions
VO-	Visual Observer

A.2 UCB 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 uncrewed 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 hemorrhages, nerve, muscle, or tendon damage
            - Involving any internal organ
            - Involving second- or third-degree burns, or any burns affecting more than 5 percent of the body surface
    - Loss of consciousness
    - Total uncrewed aircraft loss
    - Substantial damage to the uncrewed 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 uncrewed aircraft.
    - Any incident/mishap that results in an unsafe/abnormal operation including but not limited to:
        - A malfunction or failure of the uncrewed 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 uncrewed 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 Recreational Flyer? 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.

A.3 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

A.4 UCB 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	Any UAS: - Involved in a fly-away event (UAS flew away and the pilot was not able to return the aircraft to intended	- Notify Director of Operations (DO) - Complete SAR - Notify the Office of	- DO will review SAR and notify the UAS Committee Chair and submit the initial FAA or NTSB Accident/Incident report as required.

- Damage to CU property (not including UAS) - Minor Injury	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. - 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	Export Control if applicable - Notify any other necessary authorities (e.g., ATC)	- 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, in person for discussion. The draft report will be then provided in writing and the PIC 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,

	misses up to two days of work due to the injury)		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 misses more than two days of work due to the injury, or suffers any injury possibly resulting in a disability)	- Notify Director of Operations (DO) - Complete SAR - Notify local law enforcement, as applicable - Leave UAS in its state of rest - Notify the Office of Export Control if applicable - Notify any other	- 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. - If convened, DO shall lead an investigatory board made up of additional individuals nominated by DO and confirmed by majority of UAC.

	- 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	necessary authorities (e.g., ATC)	- 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, in person for discussion. The draft report will be then provided in writing and the PIC 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

A.5 Existing Airworthy Aircraft; Category, Class, Difficulty Ratings

Aircraft	Category, Class, Difficulty Level	Type rating required	Export control notes
DJI Mavic (all models and sizes)	Multirotors, difficulty level 1	No	
DJI Phantom (all models and sizes)	Multirotors, difficulty level 1	No	
DJI M600, and other similar large DJI multirotors	Multirotors, difficulty level 2	No	
IRISS Giant Quad (GQ)	Multirotors, difficulty level 3	Yes	
Skywalker, Pix Trainer, Swift Trainer, Blackswift S1	Airplane, difficulty level 1	No	
Drak, RAAVEN	Airplane, difficulty level 2	No	
Data Hawk	Airplane, difficulty level 2	No	
Twin Otter	Airplane, difficulty level 1	No	
Bixler	Airplane, difficulty level 1	No	
Super RAAVEN	Airplane, difficulty level 2	Yes	
Mistral (all variants)	Airplane, difficulty level 3	Yes	
Ttwistor	Airplane, difficulty level 3	Yes	
Tempest	Airplane, difficulty level 3	Yes	

As an example application of this: an individual can take a checkride on the Drak and be qualified on all difficulty level 2 airplanes which don’t require a type rating, including the RAAVEN and Data Hawk. The individual can maintain currency on this group of aircraft by maintaining currency on any aircraft in this group.

A.6 Fatigue Policy Example Applications, Fatigue Risk Assessment Tool

Example applications of fatigue policy

Scenario: during a high-stakes mission, the UAS crew has been operational for the previous 6 days. The ML thinks that flying on this 7th day is extremely important to accomplishing their goals. It would be a violation of rest day requirements for the ML to ask the UAS crew to be operational for this day, and it would be a violation for the UAS crew to accept this task. Similarly, it would be a violation for the ML to assign the UAS crew to any task, even tasks unrelated to their flight duties. Similarly, it would be a violation for the UAS crew to accept any task.

Scenario: on one day of flying, the UAS crew returns from their duties at midnight. The ML desires the UAS crew to be operational at 9 AM. Since only 9 hours of rest are provided for, the duty day length may not exceed 8 hours.

Scenario: the ML assigns the UAS crew to begin their duty day at 9 AM and be operational by 9:15 AM. This would be a violation since this is not sufficient time to become familiar with operational considerations before the flight.

Scenario: the UAS crew concludes their duty day at 8 PM and spends 2 hours in transportation after that. The ML wishes for the UAS crew to have 11 hours of rest so that a 10-hour duty day is possible the next day. Since the UAS crew was relieved at 8PM, the ML reasons that the UAS crew's duty day may begin at 7AM. This would be a violation since time spent in transportation is not rest: only 9 hours of rest are provided for in this scenario. If the ML desires the UAS crew to begin their duty at 7AM, then the duty day may not exceed 8 hours. If the ML desires the UAS crew to have a 10-hour duty day, then the duty day may not begin until 9AM.

Scenario: during the UAS crew's rest time or during a scheduled day off, the ML asks the UAS crew to attend a team dinner to debrief the preceding missions. This would be a violation since the UAS crew may not be assigned nor accept any duty during rest periods. All debriefing or meetings must not occur during the crew's rest period.

Fatigue risk assessment tool

Evaluate pilot fatigue based on the following factors:

- Hours of rest in excess of required rest requirements
- Hours of sleep
- Consecutive days of operation prior to the current operation
- Caffeine consumption 6 hours prior to bedtime
- Crossing time zone boundaries or seasonal time change
- Consumption of alcohol prior to sleep
- Consumption of nicotine prior to sleep

- Exercise prior to sleep
- Consistency of bedtime in preceding days

Category	**Risk Points**
Hours of rest in excess of rest requirements: • No additional rest: 0 points • 1 more hour: -1 points • 2 more hours: -2 points • 3 or more hours: -3 points	
Hours of sleep: • Fewer than 6 hours: 2 points • 6-7 hours: 1 point • 8-9 hours: 0 points • 10 or more hours: -1 point	
Consecutive days of operation prior to current operation • 0-2 days: 0 points • 3-4 days: 1 point • 5-6 days: 2 points	
Caffeine consumption: • Caffeine consumed within 6 hours of bedtime: 1 point • No caffeine consumed within 6 hours of bedtime: 0 points	
Alcohol consumption within 6 hours of bedtime: • None: 0 points • 1-2 drinks: 1 point • 3 or more drinks: 2 points	
Nicotine consumption within 6 hours of bedtime: • None: 0 points • Any amount: 1 point	
Exercise within 3 hours of bedtime: • None: 0 points • Any amount: 1 point	
Crossing of time zone boundaries within 1-week preceding flight: • None: 0 points • 1-hour time difference (including seasonal time changes): 1 point • 2-3-hour time difference: 2 points • 4+ hour time difference: 4 points	

Consistency of bedtime within preceding 3 days: • Bedtimes consistent to within ½ hour or better: 0 points • Bedtimes consistent to within 1 hour or better: 1 point • Bedtimes consistent to within 2 hours or better: 2 points • Bedtimes less consistent than described above: 3 points	

Risk levels:

- Low risk: score between -4 and 3
- Medium risk: score between 5 and 10
- High risk: score between 10 and 15

For a low fatigue risk score, the flight is not likely to be impacted by fatigue. However, the crew still needs to be aware of the issue and not be complacent.
For a medium fatigue risk score, fatigue is a greater concern. The crew should work to mitigate some of the concerns that lead to a high risk score in an attempt to lower it: for example, avoiding consumption of certain substances before bedtime or by spending more time resting.
For a high fatigue risk score, fatigue is a serious concern. It's worth considering cancelling or postponing the flight. It is strongly advised that the flight crew reduce the risk score by scheduling more rest, avoiding consumption of certain substances prior to bedtime, scheduling a day without operations, etc.

A.7 Single Pilot Log Alaris Pro

1) Go to the top of the page and hover over **Flight.**
2) Under the **Flight** dropdown menu click **Single Pilot**.
3) Double check the **Pilot** name and be sure it is correct.
4) Click the dropdown menu under **Select UAS** and choose the UAS you flew during the mission.
5) Click the dropdown menu under **Select Mission** and choose the most apt description of the mission.
6) Click **This is a Beyond Visual Line Of Sight (BVLOS) Mission** box if you are approved to fly out of visual line of sight under the COA you fly under and the mission requires it.
    a) Log the number of nautical miles flown outside of visual line of sight in the **Total Nautical Miles Traveled BVLOS (Whole Number or Decimal)** box.
    b) Log the total time flown outside of visual line of sight in the **Time Duration Traveled BVLOS (h:mm:ss)** box.
7) Do NOT click the **This is a Beyond Visual Line Of Sight (BVLOS) Mission** box if you are not approved to fly out of visual line of sight under the COA you flew under.
    a) IF VLOS was lost and was not approved you must submit a SAR to directorofflightoperation@colorado.edu within 24 hours of the incident.
8) Fill in the date of the flight in the **Date** box using the calendar or manually typing the date in.
9) Type in the duration of the flight in the **Flight Hours** and **Flight Minutes** boxes. If there are no flight hours or flight minutes leave that box blank.
10) Log the number of takeoffs on each battery in the **Takeoffs** box.
    a) For example if there are two flights (ie two takeoffs and landings) on the same battery log the total flight time of those two flights in the **Flight Hours and Minutes** boxes and log two in the **Takeoffs** box.
    b) If there was one flight on one battery and a second flight on another battery, those two flights require separate flight logs.
11) Log the takeoff time using the clock or by typing it into the **Takeoff Time** box.
12) Click the **Issues Encountered** dropdown menu and select the description of any issues that may have occurred during the flight. If none, select none.
13) Use the **Remarks** section to further expand on the purpose/objective of the mission. While it is not required it is highly recommended.
    a) For example: “Multirotor training with Shindle”
14) If the mission was for a specified project within your department select the correct project in the **Project** dropdown menu. If it was not, select **None selected.**
15) Type or paste the COA identifier into the **COA #** field.
16) Type or select the last name of the VO in the **Visual Observer** field.
17) If you feel it is necessary to add any additional documentation about the flight add the file in the **Attach a File** field.

18) Select the FRAT made for that mission in the **Attach a FRAT** field.
19) To add a telemetry file in the **Select Telemetry Segment** field. If there is no telemetry file to add leave the section blank.
20) Type latitude and longitude coordinates to the **Latitude and Longitude** boxes. If the coordinates are not known use the search bar or select on the map where the mission was flown. If using the search bar, after you search for the place you must also click the pin on the map for the latitude and longitude to appear in the boxes.
21) Certify that a satisfactory preflight was performed by checking the box underneath the **Flight Location** section.
22) If there was no **Aircraft Discrepancy** do not check the box. If there was an aircraft discrepancy check the box. Describe the discrepancy in the textbox and choose whether the discrepancy is critical by clicking **Critical Discrepancy - Aircraft is Grounded.** If it is not critical click **Deferred Discrepancy.**
23) Enter the log by clicking **Add Log.**

A.8 General FRAT Alaris Pro

FRATs are subject to change and may be tailored to individual departments or missions. The following FRAT serves as a general template.

Crew:

UAS Currency:

Condition	Risk Value
Current 0 - 30 days	0
Current 30 - 60 days	3
Current 60 - 90 days	5

Pilot Experience:

Condition	Risk Value
> 30 UAS flights UAS on type	0
10 - 30 flights on UAS type	3
< 10 flights on UAS type	7

# of Crew:

Condition	Risk Value
2 Crew members	0
3 - 5 Crew members	3
> 5 Crew members	5

Aircraft / Equipment

Battery Capacity:

Condition	Risk Value
< 2,000 mAh	0
2,000-10,000 mAh	3
>10,000 mAh	5

Aircraft Weight:

Condition	Risk Value
< 5 lb	0
5 - 10 lb	3
10 - 20 lb	5
> 20 lb	7

Payload Cost:

Condition	Risk Value
< 2,000$	0
2,000 - 7,000$	3
7,000 - 15,000$	5
15,000 - 25,000$	7
25,000 - 50,000$	9
50,000 - 100,000$	10

UAS Cost:

Condition	Risk Value
0 - 500$	0
500 - 1,000$	3
1,000 - 2,500$	5
2,500 - 5,000$	7
> 5,000$	9

Take Off Procedure:

Condition	Risk Value
Paved runway	0
Grass field	3
Hand launch	7
Bungee / winch launched	9

Autopilot:

Condition	Risk Value
No autopilot	0
Autopilot with manual flight mode	5
Fully autonomous autopilot	10

Environmental Factors

UAS Airport Proximity:

Condition	Risk Value
>8 NM from airport center point	0
5-8 SM from airport center point	3
< 5 SM from airport center point	5

UAS Proximity to Pilot:

Condition	Risk Value
Operation within 500 ft	0
Operation Greater than 500 ft Within VLOS	3
Operation Beyond VLOS	7

UAS Proximity to Airspace Violation:

Condition	Risk Value
Operation > 2000 ft away	0
Operation 2000 - 500 ft away	3
Operation < 500 ft away	7

Fire Conditions:

Condition	Risk Value
Operation conducted in wet / damp conditions	0
Operation conducted in dry conditions with minimal vegetation present	5
Operation conducted in dry conditions with flammable vegetation present	10

Crowd Proximity:

Condition	Risk Value
Flight in complete remote area (only crew risk)	0
Flight over sparsely populated area	3
Flight over moderately populated areas (includes bystander movement)	7

Flight over / within 1NM stationary crowds (severely populated areas)	**9**
Flights with permission In Active Restricted airspace	**9**

SUA Operations:

Condition	Risk Value
No SUA within 2NM laterally and 1000ft vertically	**0**
Flights with coordination and deconfliction within Warning/Alert areas	**3**
Flights with Coordination and deconfliction in active MOA	**7**
Flights within 2NM (500ft of alt) of boundary of active TFR	**10**

A.9 Which Flight Protocol Should I use

	Which Flight Protocol Should I Use?		
	COA	**107**	**Education and Research Hobby Exemption**
What is it?	COA is an authorization issued by the Air Traffic Organization to the University for a specific UA activity. The University has multiple approved COA's that describe various FAA authorized UAS activities	A FAA Part 107 Remote Pilot Certification is issued for individuals to operate UAS. Licensed operators are allowed to operate UAS for various purposes, but are bound to strict restrictions as set out by the FAA	49 U.S.C. 448 allows operation of a UAS by an institute of higher education for educational or research purposes to be defined as a "recreational purpose." "Educational" or "research purpose" is defined as: "(A) instruction of students at the institution; "(B) academic or research related uses of uncrewed aircraft systems that have been approved by the institution, including Federal research; "(C) activities undertaken by the institution as part of research projects, including research projects sponsored by the Federal Government; and "(D) other academic

			activities approved by the institution
What are the benefits?	More University Support and Resources A COA may allow for more specific types of operations and grant more flight privileges A COA may include special or specific provisions that apply to routine or repeated operations Clear and specific limitations and guidance from the FAA and University	More flexibility in the general types of operations permitted Less administratively burdensome than operating under a COA, less stringent reporting requirements to FAA Initial flight operation restrictions are clear and listed by FAA in rule Sets a minimum standard of FAA pilot competency	Operating under the Education and Research Exemption is the least administratively burdensome option

What are the risks?	Operators are not able to fly UAS under a COA for educational purposes (i.e. teaching students to operate UAS) The Operation must fit within the parameters of a COA COA operations typically include riskier operations (i.e. night, over people, restricted airspace)	Operator is primarily responsible for understanding the limitations of the flight operations Failure to follow FAA regulations could jeopardize an Operator's Part 107 license Operators are solely responsible for willful and wanton mis-operation of UAS Restrictions on flight operations may disqualify some uses	Operating under the "Recreational Purpose" exemption has the greatest number of limitations on the types of flying that are allowed Anyone intending to fly under the "Recreational Purpose" must still comply with FAA rules, including safety testing and UAS registration This option has the least amount of University oversight, leaving each Operator personally responsible for compliance with both University and FAA rules

Additional resources	FAA 107 restrictions include, but may not be limited to: 1) The drone must weigh between 0.55 and 55 lbs., must be registered with the FAA, and marked appropriately with the registration number; 2) The drone must stay within a maximum altitude of 400 feet AGL, except when flying within 400 feet of a tall structure; 3) The drone can only fly in Class G or uncontrolled airspace. Drone flight is allowed in controlled airspace but only with the appropriate authorization; 4) The drone must remain within visual line of sight of the drone pilot; 5) The drone cannot fly over people who are not directly participating in the operations and over moving vehicles; 6) The drone cannot be operated from within a moving vehicle, boat, or aircraft;

	7) The drone can only be operated during daylight or civil twilight (30 minutes before sunrise or after sunset), given that it is equipped with appropriate anti-collision lighting.
Regent Policy 13.D	Regent Policy 13.D governs indemnification of CU employees. In part, it is the policy of the University of Colorado to defend and indemnify public employees against claims that arise in the course and scope of public employment, unless the actions of the public employee are determined to have been the result of willful and wanton conduct.