

DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION					
CERTIFICATE OF WAIVER OR AUTHORIZATION					
ISSUED TO University of Colorado Boulder	Part 91				
ADDRESS 1111 Engineering Drive Boulder, CO 80309					
This certificate is issued for the operations specifically described hereinafter. No person shall conduct any operation pursuant to the authority of this certificate except in accordance with the standard and special provisions contained in this certificate, and such other requirements of the Federal Aviation Regulations not specifically waived by this certificate.					
OPERATIONS AUTHORIZED Operation of the Talon Unmanned Aircraft System (UAS) in Class E and G airspace at or below 1,000 feet Above Ground Level (AGL), not to exceed 6,500 feet Above Mean Sea Level (MSL), over the Pawnee Grassland, CO, under the jurisdiction of Denver Terminal Radar Approach Control (D01), Cheyenne Radar Approach Control (CYS), and Denver Air Route Traffic Control Center (ZDV). See attachment 1.					
LIST OF WAIVED REGULATIONS BY SECTION AND TITLE N/A					
STANDARD PROVISIONS					
<p>1. A copy of the application made for this certificate shall be attached and become a part hereof.</p> <p>2. This certificate shall be presented for inspection upon the request of any authorized representative of the Federal Aviation Administration, or of any State or municipal official charged with the duty of enforcing local laws or regulations.</p> <p>3. The holder of this certificate shall be responsible for the strict observance of the terms and provisions contained herein.</p> <p>4. This certificate is nontransferable.</p>					
Note-This certificate constitutes a waiver of those Federal rules or regulations specifically referred to above. It does not constitute a waiver of any State law or local ordinance.					
SPECIAL PROVISIONS					
Special Provisions A thru C, inclusive, are set forth on the reverse side hereof.					
<p>The certificate, 2019-WSA-3325 is effective from April 10, 2019 to April 09, 2021 and is subject to cancellation at any time upon notice by the Administrator or his/her authorized representative.</p> <p style="text-align: center;">BY DIRECTION OF THE ADMINISTRATOR</p> <table border="0" style="width: 100%;"><tr><td style="width: 50%; text-align: center;"><u>FAA Western Service Area</u> (Region)</td><td style="width: 50%; text-align: center;"><u>B. G. Chew</u> (Signature)</td></tr><tr><td style="text-align: center;"><u>April 5, 2019</u> (Date)</td><td style="text-align: center;"><u>Tactical Operations Manager (AJV-W23)</u> (Title)</td></tr></table>		<u>FAA Western Service Area</u> (Region)	<u>B. G. Chew</u> (Signature)	<u>April 5, 2019</u> (Date)	<u>Tactical Operations Manager (AJV-W23)</u> (Title)
<u>FAA Western Service Area</u> (Region)	<u>B. G. Chew</u> (Signature)				
<u>April 5, 2019</u> (Date)	<u>Tactical Operations Manager (AJV-W23)</u> (Title)				

Purpose: To prescribe UAS operating requirements in the National Airspace System (NAS) for the purpose of Public Aircraft Operations. The holder of this COA will be referred herein as the “Proponent”.

Public Aircraft

1. A public aircraft operation is determined by statute, 49 USC §40102(a)(41) and §40125.
2. All public aircraft flights conducted under a COA must comply with the terms of the statute.
3. All flights must be conducted per the declarations submitted in the application, and as specified in the following Standard/Special Provisions.
4. This COA provides an alternate means of complying with 14 CFR §91.113(b) for unmanned aircraft operations.
5. All operations will be conducted in compliance with Title 14 CFR §91 and the conditions of the authorization issued herein. If the operator cannot adhere to any of these requirements a separate FAA Form 7711-2 Waiver application may be required.

STANDARD PROVISIONS

A. General.

1. The review of this activity is based upon current understanding of UAS operations and their impact in the NAS. This COA will not be considered a precedent for future operations. As changes occur to policy, procedures, and regulatory requirements, limitation and conditions for UAS operations will be adjusted.
2. All personnel connected with the UAS operation must read and comply with the contents of this authorization and its provisions.
3. A copy of the COA including the special limitations must be immediately available to all operational personnel at each operating location whenever UAS operations are conducted.
4. This authorization may be canceled at any time by the Administrator, the person authorized to grant the authorization, or the representative designated to monitor a specific operation. As a general rule, this authorization may be canceled when it is no longer required, there is an abuse of its provisions, or when unforeseen safety factors develop. Failure to comply with the authorization is cause for cancellation. The proponent will receive a written notice of cancellation.
5. During the time this COA is approved and active, a site safety evaluation/visit may be accomplished to ensure COA compliance, assess any adverse impact on ATC or airspace, and ensure this COA is not burdensome or ineffective. Deviations, accidents/incidents/mishaps, complaints, etc., will prompt a COA review or site visit to address the issue. Refusal to allow a site safety evaluation/visit may result in cancellation of the COA. Note: This section does not pertain to agencies that have other existing agreements in place with the FAA.
6. Frequency spectrum approval is independent of the COA process and requires the proponent to obtain certification and frequency assignments (licenses) from the National

Telecommunications and Information Administration (NTIA) (47 CFR Part 300) or Federal Communications Commission (47 CFR Part 2, Subpart J and 47 CFR Part 87, Subpart D) and frequency licenses (47 CFR Part 87) when applicable for the control link, ATC radios, transponders, detect and avoid systems, and navigation systems used to support this COA. Equipment licensed under 47 CFR Part 5 (Experimental) or 47 CFR Part 15 (Radio Frequency Devices) does not provide the protection necessary for NAS operations.

B. Airworthiness Certification.

The Unmanned Aircraft System will be maintained in a condition for safe operation while conducting operations in the NAS. The proponent has made its own determination that the unmanned aircraft is airworthy. The unmanned aircraft system must be operated in strict compliance with all provisions and conditions contained in the Airworthiness Safety Release, including all documents and provisions referenced in the COA application.

C. Operations.

1. Unless otherwise authorized as a special provision, a maximum of one unmanned aircraft will be controlled:
 - a. From a single control station, and
 - b. By one pilot at a time.
2. A Pilot-in-Command (PIC) is the person who has final authority and responsibility for the operation and safety of flight, has been designated as PIC before or during the flight, and holds the appropriate category, class, and type rating, if appropriate, for the conduct of the flight. The responsibility and authority of the PIC as described by 14 CFR §91.3, Responsibility and Authority of the Pilot-in-Command, apply to the unmanned aircraft PIC. The PIC position may rotate duties as necessary with equally qualified pilots. The individual designated as PIC may change during flight.

Note: Flight Crew Member (UAS). In addition to the flight crew members identified in 14 CFR Part 1, Definitions and Abbreviations, an Unmanned Aircraft System flight crew members include pilots, sensor/payload operators, and visual observers and may include other persons as appropriate or required to ensure safe operation of the aircraft.

3. Operations (including lost link procedures) should not be conducted over populated areas, heavily trafficked roads, or an open-air assembly of people, unless the Airworthiness Certification does not restrict these operations.
4. When necessary, transit of airways and routes must be conducted as expeditiously as possible. The unmanned aircraft should not plan to loiter on Victor airways, jet routes, Q and T routes, IR routes, or VR routes.
5. For flights operating on an IFR clearance, the PIC must ensure positional information in reference to established National Airspace System (NAS) fixes, NAVAIDs, and/or waypoints are provided to ATC. The use of latitude/longitude positions is not authorized, except oceanic flight operations.
6. UAS operations at night, unmanned aircraft must operate with:

- a. Unless stipulated in the special provisions, an operational mode 3/A transponder with altitude encoding, or mode S transponder (preferred) set to an ATC assigned squawk
 - b. Position/navigation and anti-collision lights on at all times during flight unless stipulated in the special provisions or the proponent has a specific exemption from 14 CFR §91.209.
7. Unless installed as part of a Detect and Avoid (DAA) system, the use of a Traffic Collision Avoidance System (TCAS) in Traffic Advisory (TA) or Traffic Advisory/Resolution Advisory (TA/RA) modes while operating an unmanned aircraft is prohibited.

D. Safety of Flight.

1. The operator or delegated representative is responsible for halting or canceling activity in the COA area if, at any time, the safety of persons or property on the ground or in the air is in jeopardy, or if there is a failure to comply with the terms or conditions of this authorization.
2. See-and-Avoid.

Unmanned aircraft have no on-board pilot to perform see-and-avoid responsibilities; therefore, when operating in the National Airspace System provisions must be made to provide an alternate means of compliance to 14 CFR §91.113.

 - a. The operator and/or delegated representatives are responsible at all times for collision avoidance with all aviation activities and the safety of persons or property on the surface with respect to the UAS.
 - b. UAS pilots will ensure there is a safe operating distance between other aviation activities and the unmanned aircraft at all times.
 - c. Any crew member responsible for performing see-and-avoid requirements for the UA must have and maintain instantaneous communication with the PIC.
 - d. Visual observers must be used at all times except in Class A airspace, active restricted areas, and warning areas designated for aviation activities or as authorized in the Special Provisions. Observers may either be ground-based or airborne in a chase plane.

(1) Visual Observers:

 - (a) Must be able to communicate clearly to the pilot any instructions required to remain clear of conflicting traffic, using standard phraseology as listed in the Aeronautical Information Manual when practical.
 - (b) The PIC is responsible to ensure visual observers are able to see the aircraft and the surrounding airspace throughout the entire flight, and
 - (c) The PIC is responsible to ensure visual observers are able to provide the PIC with the UA's flight path, and proximity to all aviation activities and other hazards (e.g., terrain, weather, structures) sufficiently to exercise effective control of the UA to:

- Comply with 14 CFR § 91.111, §91.113 and § 91.115, and
- Prevent the UA from creating a collision hazard, and
- Comply with all conditions of this COA.

E. Notice to Airmen (NOTAM).

1. A Distant (D) NOTAM must be issued prior to conducting UAS operations not more than 72 hours in advance, but not less than 24 hours for UAS operations prior to the operation for routine operations unless operations are contained within Class A airspace, active restricted or warning areas that are designated on the appropriate aeronautical chart or airport directory. This requirement may be accomplished:
 - a. Through the operator's local base operations or (D) NOTAM issuing authority, or
 - b. By contacting the NOTAM Flight Service Station at 1-877-4-US-NTMS (1-877-487- 6867). The issuing agency will require:
 - (1) Name and contact information of the pilot filing the NOTAM request
 - (2) Location, altitude, or operating area
 - (3) Time and nature of the activity.
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 practical before flight and 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.

F. Reporting Requirements

1. Documentation of all operations associated with UAS activities is required regardless of the airspace in which the UAS operates. NOTE: Negative (zero flights) reports are required.
2. The Proponent must submit the following information on a monthly basis through the COA Application Processing System (CAPS):
 - a. Name of Proponent, and aircraft registration number,
 - b. UAS type and model,
 - c. All operating locations, to include city name and latitude/longitude,
 - d. Number of flights (per location, per aircraft),
 - e. Total aircraft operation hours,
 - f. Takeoff or landing damage, and

g. Equipment malfunction. Required reports include, but are not limited to, failures or malfunctions to the:

- (1) Control station
- (2) Electrical system
- (3) Fuel system
- (4) Navigation system
- (5) On-board flight control system
- (6) Powerplant

h. The number and duration of lost link events (control, performance and health monitoring, or communications) per UAS, per flight.

3. Incident/Accident/Mishap Reporting

a. The proponent must provide initial notification to the FAA via email at mail at 9-AJV-115-UASOrganization@faa.gov and via the CAPS forms (Incident/Accident) within 24 hours of an incident or accident that meets the following criteria:

(1) All accidents/mishaps involving UAS operations where any of the following occurs:

(a) Fatal injury, where the operation of a UAS results in a death occurring within 30 days of the accident/mishap

(b) Serious injury, where the operation of a UAS results in:

- Hospitalization for more than 48 hours, commencing within 7 days from the date of the injury was received;
- A fracture of any bone (except simple fractures of fingers, toes, or nose);
- Severe hemorrhages, nerve, muscle, or tendon damage;
- Involving any internal organ; or
- Involves second- or third-degree burns, or any burns affecting more than 5 percent of the body surface.

(c) Total unmanned aircraft loss

(d) Substantial damage to the unmanned aircraft system where there is damage to the airframe, power plant, or onboard systems that must be repaired prior to further flight

(e) Damage to property, other than the unmanned aircraft.

(2) Any incident/mishap that results in an unsafe/abnormal operation including but not limited to

(a) A malfunction or failure of the unmanned aircraft's on-board flight control system (including navigation)

(b) A malfunction or failure of ground control station flight control hardware or software (other than loss of control link)

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- (c) A power plant failure or malfunction
- (d) An in-flight fire
- (e) An aircraft collision involving another aircraft.
- (f) Any in-flight failure of the unmanned aircraft's electrical system requiring use of alternate or emergency power to complete the flight
- (g) A deviation from any provision contained in the COA
- (h) A deviation from an ATC clearance and/or Letter(s) of Agreement/Procedures
- (i) A lost control link event resulting in
 - Fly-away, or
 - Execution of a pre-planned/unplanned lost link procedure.
- b. Initial reports must contain the information identified in the CAPS Accident/Incident Report.
- c. Follow-on reports describing the accident/incident/mishap(s) must be submitted by providing copies of proponent aviation accident/incident reports upon completion of safety investigations.
- d. The above procedures are not a substitute for separate accident/incident reporting required by the National Transportation Safety Board under 49 CFR §830.5.
- e. For other than Department of Defense operations, this COA is issued with the provision that the FAA be permitted involvement in the proponent's incident/accident/mishap investigation as prescribed by FAA Order 8020.11, Aircraft Accident and Incident Notification, Investigation, and Reporting.

G. Registration

The proponent must comply with the aircraft registration and marking requirements set forth in 14 CFR Parts 47 and 45, or Part 48, prior to conducting flight operations authorized by this COA. Title 49 United States Code (49 USC) sections 44101 through 44104 contain the laws requiring aircraft registration in the United States.

H. 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 as soon as practicable in advance to coordinate and de-conflict. Approval from the scheduling agency is required for regulatory SUA, but not for MTR's and non-regulatory SUA. If 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 AP/1B contact the FAA at email address <mailto:9-AJV-115-UASOrganization@faa.gov> with the IR/VR routes affected and the FAA will provide the scheduling agency information. Scheduling agencies for SUAs are listed in the FAA JO 7400.10.

AIR TRAFFIC CONTROL SPECIAL PROVISIONS**A. Coordination Requirements.**

1. Proponent filing and the issuance of the required distance (D) NOTAM, in accordance with Standard Provision E of this COA will serve as advance notification to ATC about UAS operations conducted under this authorization.
2. Cancellation of the NOTAM will serve as notification to ATC of completion of flight in accordance with this provision

B. Communication Requirements.

Air Traffic Control Special provisions A through C will be used in lieu of maintaining direct two-way communications.

C. Emergency/Contingency Procedures.

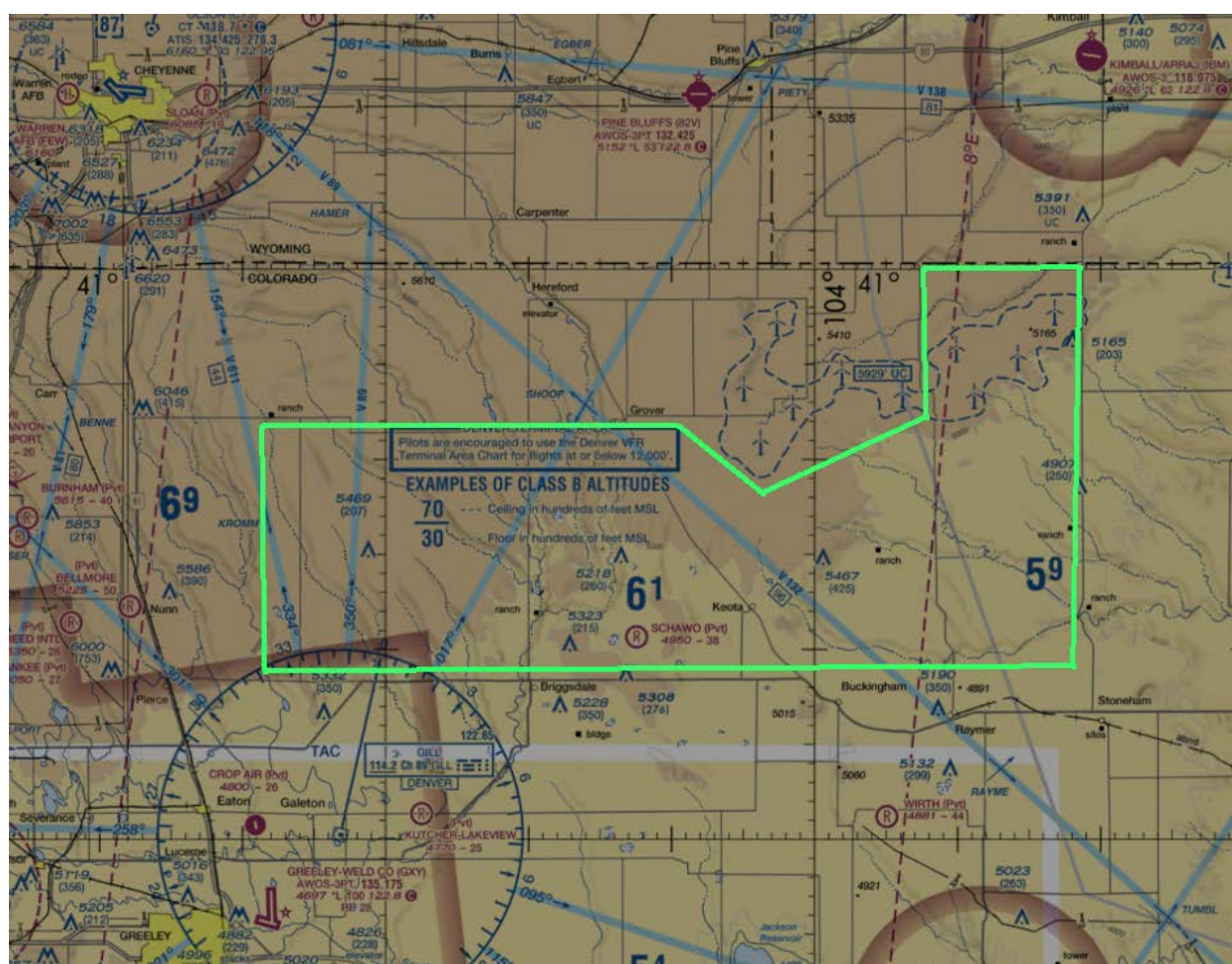
1. Lost Link Procedures: ATC does not need to be notified provided the PIC complies with the following provisions:
 - a. If an aircraft fails to receive the signal for more than 5 seconds, the aircraft will initiate lost link procedures.
 - c. Lost Link procedures will be programmed to ensure the UA remains within the operations area should a lost link maneuver be executed from any location within the planned flight area.
 - d. Upon reaching the recovery location the aircraft will land. In certain situations, it may be more desirable, due to surrounding obstructions, to have the pre-determined lost link profile for the aircraft to land in place. The PIC will determine the safest lost link flight profile and program it before flight. If at any time after initiating lost link procedures the link with the UAS is regained, the PIC will land the UAS as soon as practical via the method he deems appropriate to ensure maximum safety.
2. Lost Communications: Loss of communication between the PIC and the observers, or any other crew member, using hand-held radios will result in the immediate termination of all flights, by landing in place.
3. Emergency/Fly-Away Procedure:
 - a. In the event of an emergency, the PIC must immediately contact the ATC facility having jurisdiction for the airspace, state the nature of emergency and pilot intentions.
 - b. In the event of a fly-away toward an area or airport where the PIC has determined the UAS may create a hazard to aviation or persons on the ground, the PIC will immediately notify D01 at 303-342-1590, CYS at 307-772-6767/6032, or ZDV at 303-651-4248. The PIC will provide the following information::
 - (1) Approximate location
 - (2) Direction of flight
 - (3) Last known altitude
 - (4) Maximum remaining flight time

AUTHORIZATION

This Certificate of Waiver or Authorization does not, in itself, waive any Title 14 Code of Federal Regulations not specifically stated, nor any state law or local ordinance. Should the proposed operation conflict with any state law or local ordinance, or require permission of local authorities or property owners, it is the responsibility of the proponent to resolve the matter. This COA does not authorize flight within Temporary Flight Restrictions, Special Flight Rule Areas, regulatory Special Use Airspace or the Washington DC Federal Restricted Zone (FRZ) without pre-approval. The proponent is hereby authorized to operate small Unmanned Aircraft System in the NAS within the areas defined in the Operations Authorized section of the cover page.

Operations Area

NW point	40 51' 47.54" N	104 38' 46.15" W	Clockwise
	40 51' 47.67" N	104 09' 36.92" W	
	40 58' 16.90" N	104 03' 43.13" W	
	40 52' 18.01" N	103 52' 16.87" W	
	41 00' 04.74" N	103 52' 26.64" W	
	41 00' 08.30" N	103 41' 32.90" W	
	40 39' 10.85" N	103 41' 58.40" W	
	40 38' 55.41" N	104 38' 33.58" W	



ATC Boundaries

