A Time of Day / sUA Weight

TIME OF DAY* × Daylight

*At what **time of day** will you be operating your sUAS (select all that apply)?*

ANTI-COLLISION LIGHTING ○ YES ○ NO

*If you are flying during **Civil Twilight or at Night**, is your sUA equipped with operational anti-collision lighting visible for at least 3 statute miles and with a flash rate sufficient to avoid a collision?*

sUA WEIGHT* 4.7 Kilograms

*What is the maximum weight of your **sUA** on takeoff, during operations, and upon landing, including everything onboard or attached to it?*

B Payload / Line of Sight / Platform

TRANSPORTING PROPERTY* ○ YES ◉ NO

*Will your sUA be **transporting or carrying anything in flight**? (This includes anything the sUA may pick up in flight.)*

HAZARDOUS MATERIALS ○ YES ○ NO

*If you are transporting or carrying anything in flight, is it considered hazardous as defined in **49 CFR § 171.8**?*

Examples of hazardous materials include, but are not limited to, explosives, flammable materials, economic poisons (such as insecticides, fungicide, rodenticides, herbicides, and fertilizer), and certain biological materials.

TRANSPORTING FOR COMPENSATION OR HIRE ○ YES ○ NO

*If it is not considered hazardous, will your sUA be **transporting property for compensation or hire**? In this context, "transporting" describes carrying property from one location and dropping it off at another location.*

CROSSING STATE BOUNDARIES ○ YES ○ NO

If you are transporting property for compensation or hire, will your sUA cross any state boundaries while in flight?

CONTROL STATION* × Stationary Vehicle

*Will your sUA be operated from (**select all that apply**)?*

POPULATION LEVEL Select Population Level

*If you are **operating from a moving vehicle**, what is the most populated area your sUA will fly over?*

VISUAL LINE OF SIGHT* ◉ YES ○ NO

*Will the Remote Pilot in Command, person manipulating the flight controls (if used), and Visual Observer (if used) **be able to see your sUA at all times** during the course of your operation (i.e., operating within Visual Line of Sight (VLOS))?*

OBSERVER ROLE Select Observer Role

*If you are flying beyond visual line of sight, will each **Visual Observer** (if used) be able to maintain line of sight and effective communications throughout the entire operation?*

VISIBILITY FROM CONTROL STATION* ◉ YES ○ NO

*Will the **visibility from the control station** be at least 3 statute miles for the duration of the flight?*

C UAS Operation Details

SINGLE AIRCRAFT* (●) YES ( ) NO

*Will the Remote Pilot in Command **operate one sUA at a time** and will each Visual Observer (if used) be responsible to observe one sUA at a time during the operation?*

RIGHT OF WAY* (●) YES ( ) NO

*Will your sUA have the **ability to give way** to and remain at a well clear distance from all other aircraft?*

MAX GROUNDSPEED* 22 Meters per second

*What is the **maximum groundspeed** at which your sUA will fly during your operation?*

MAX ALTITUDE* 1000 Feet

What is the maximum altitude above the ground at which your sUA will fly during your operation?

NEAR STRUCTURE* ( ) YES (●) NO

*If you are flying over 400 feet above the ground, will your sUA be **operating within 400 feet of a structure**?*

Examples of what is considered a structure include buildings and towers. Vegetation, such as trees, and terrain are not considered structures under 14 CFR § 107.

DISTANCE FROM CLOUDS* (●) YES ( ) NO

*Will you be **flying the sUA** farther than 2000 feet horizontally or 500 feet below the clouds?*

D Operation Over People

OVER PEOPLE OR MOVING VEHICLES* ( ) YES (●) NO

*Will you be **operating over people** who are NOT **essential to your sUAS operation** OR over people in **moving vehicles**?*

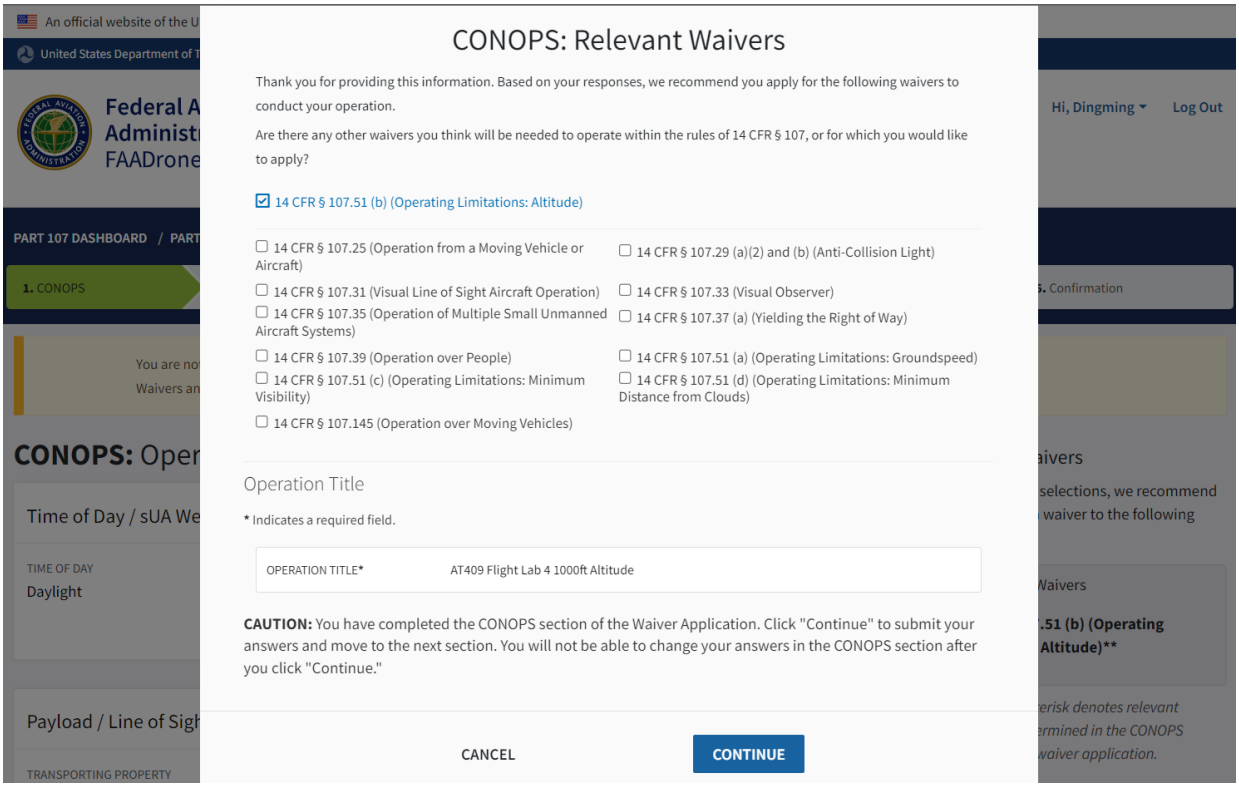
OPERATION CATEGORY Select Operation Cat

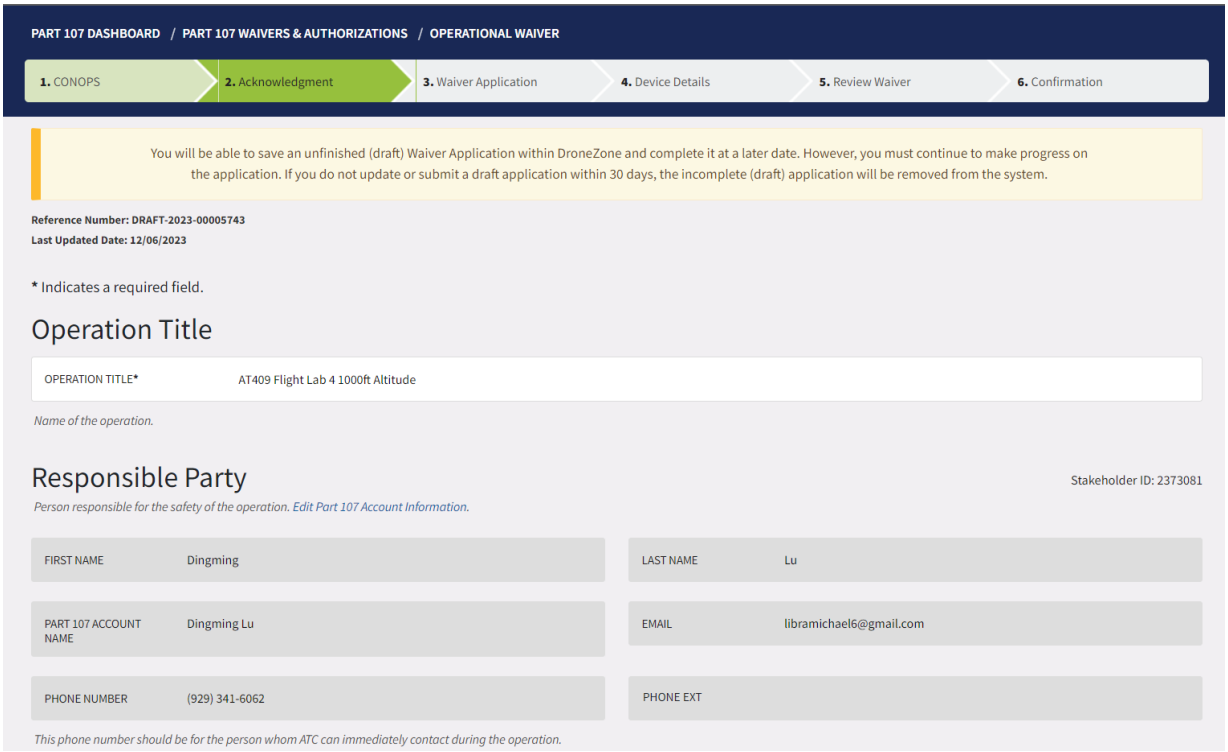
*If you are operating **over people** not directly participating in your operation, with which **Part 107 Subpart D** category will your operation comply?*

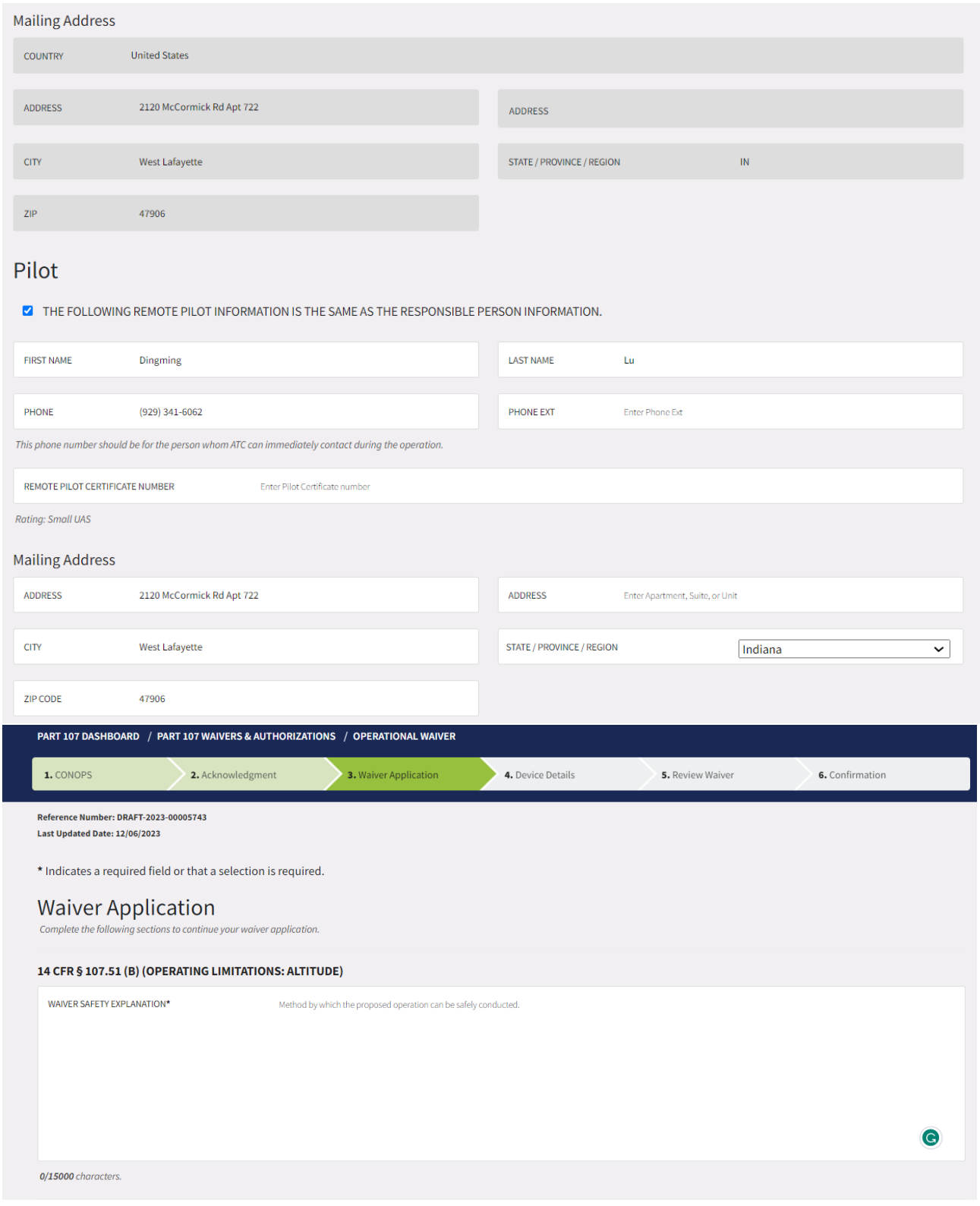
OVER MOVING VEHICLES ( ) YES ( ) NO

*If you are operating over people and are non-compliant with an operation category, will you be operating over any person located inside a **moving vehicle**?*

BACK NEXT


CONOPS: Relevant Waivers
Thank you for providing this information. Based on your responses, we recommend you apply for the following waivers to conduct your operation.
Are there any other waivers you think will be needed to operate within the rules of 14 CFR § 107, or for which you would like to apply?
14 CFR § 107.51 (b) (Operating Limitations: Altitude)
14 CFR § 107.25 (Operation from a Moving Vehicle or Aircraft)
14 CFR § 107.29 (a)(2) and (b) (Anti-Collision Light)
14 CFR § 107.31 (Visual Line of Sight Aircraft Operation)
14 CFR § 107.33 (Visual Observer)
14 CFR § 107.35 (Operation of Multiple Small Unmanned Aircraft Systems)
14 CFR § 107.37 (a) (Yielding the Right of Way)
14 CFR § 107.39 (Operation over People)
14 CFR § 107.51 (a) (Operating Limitations: Groundspeed)
14 CFR § 107.51 (c) (Operating Limitations: Minimum Visibility)
14 CFR § 107.51 (d) (Operating Limitations: Minimum Distance from Clouds)
14 CFR § 107.145 (Operation over Moving Vehicles)
Operation Title
* Indicates a required field.
OPERATION TITLE*
AT409 Flight Lab 4 1000ft Altitude
CAUTION: You have completed the CONOPS section of the Waiver Application. Click "Continue" to submit your answers and move to the next section. You will not be able to change your answers in the CONOPS section after you click "Continue."
CANCEL
CONTINUE


PART 107 DASHBOARD / PART 107 WAIVERS & AUTHORIZATIONS / OPERATIONAL WAIVER
1. CONOPS
2. Acknowledgment
3. Waiver Application
4. Device Details
5. Review Waiver
6. Confirmation
You will be able to save an unfinished (draft) Waiver Application within DroneZone and complete it at a later date. However, you must continue to make progress on the application. If you do not update or submit a draft application within 30 days, the incomplete (draft) application will be removed from the system.
Reference Number: DRAFT-2023-00005743
Last Updated Date: 12/06/2023
* Indicates a required field.
Operation Title
OPERATION TITLE*
AT409 Flight Lab 4 1000ft Altitude
Name of the operation.
Responsible Party
Stakeholder ID: 2373081
Person responsible for the safety of the operation. Edit Part 107 Account Information.
FIRST NAME
Dingming
LAST NAME
Lu
PART 107 ACCOUNT NAME
Dingming Lu
EMAIL
libramichael6@gmail.com
PHONE NUMBER
(929) 341-6062
PHONE EXT
This phone number should be for the person whom ATC can immediately contact during the operation.



Waiver Safety Explanation:

We are writing to formally request a waiver for the provisions outlined in 14 CFR Part 107.51(b) to allow for the operation of small unmanned aircraft (sUA) at an altitude of 1,000 feet above

ground level (AGL) within the boundaries of the coordinates listed below, located in West Lafayette, IN. The purpose of this operation is to act as training for Purdue University students in the Unmanned Aerial Systems major.

40.474896 N, -87.029394 W

40.526595N, -87.0300166W

40.526481N, -86.9766797W

40.475747N, -86.9770310W

40.467998N, -86.9890103W

We will use one type of UAS aircraft:

1. C-Astral Bramor ppX

All pilots that fly under this waiver will have their Part 107 Remote Pilot Certification and will have previous training on the Bramor ppX.

We have identified the risks in this operation as follows:

- Possible collision with obstacles (trees, buildings, vehicles, power lines)
- Possible collision with aircraft
- Loss of control due to signal loss or battery depletion
- Flying over people not involved in the operation
- Loss of visual line of sight with the sUA by the PIC and/or VO
- Inability of ATC notification to cease operation

We will address these risks and our plan to mitigate them using the FAA's Waiver Safety Explanation Guideline questions and add additional information as needed to create a holistic safety plan.

WSEG Question #1:

1. Describe how the small unmanned aircraft (sUA) will be able to avoid non participating aircraft and structures when operating at altitudes other than those prescribed in Title 14, Code of Federal Regulations (14 CFR) § 107.51(b).

a. How will the Remote Pilot in Command (RPIC) and Visual Observer(s) (VO), if used, see and avoid other aircraft when flying over 400 feet above ground level (AGL)?

The RPIC and VOs will be able to effectively avoid other aircraft and obstacles when flying at an altitude of 1000 feet AGL using the following methods:

1. To enhance safety measures, at least two visual observers will be engaged to aid in the identification and avoidance of structures and non-participating aircraft, encompassing both sUA and manned aircraft like airplanes and helicopters. In the event of an approaching aircraft, detection will be initiated either by the recognition of engine/rotor noise or by the onboard remote ID module, the PingRX Pro. This RID module will alert the RPIC of nearby aircraft on the telemetry screen of the ground control station, prompting the PIC to immediately reduce altitude to 50 feet AGL. Subsequent actions will include either landing or loitering until the area is deemed clear of potential risks.

The VOs will employ specific communication protocols, detailed in a pre-flight briefing, ensuring clarity and coordination. Preplanned landing zones, likely mirroring the takeoff zone, will further streamline operational logistics.

2. Utilizing geo-fencing technology, preprogramming will be implemented to steer clear of potential obstacles such as trees, power lines, and structures within the designated flight area. The altitude limit will be capped at 950 feet AGL, incorporating a 50-foot buffer to account for altitude variations. Additionally, the lateral range will be confined to no more than 400 feet from the ground control station.
3. The Bramor ppX utilized for this operation will be equipped with a high intensity anti-collision strobe light, namely the Lume Cube Strobe, which is rated for visibility of 3 statute miles by the manufacturer, facilitating visual line of sight (VLOS) maintenance for both the RPIC and VO as well as identification for manned aircraft pilots. In addition, high visibility tape will be used on the top and bottom of the Bramor ppX's wings to ensure an additional level of identification.
4. The RPIC will utilize the control station tablet to actively monitor the sUA's altitude and location concerning potential obstacles.
5. In the face of an imminent collision threat, the RPIC will prioritize maintaining altitude while conducting a rapid assessment to determine whether maintaining the 950 feet altitude or executing a quick descent is the optimal course of action. Emphasizing safety, the Bramor ppX will not descend if the non-participating aircraft is below the Bramor ppX, and a bank left or right will be employed as a yielding method to avert possible collision.

WSEG Question #2.

2. Describe how the visual conspicuity of the sUA will be increased to be seen at a distance of at least 3 statute miles (mi).

a. Will the sUA be visible for at least 3 mi in the location where the RPIC will operate?

b. If yes, how will you accomplish this?

c. If no, why do other aircraft not need to be able to see your sUA from at least 3 mi?

To enhance the visibility of the Bramor ppX, we will provide additional conspicuity measures by affixing a Lume Cube Strobe light. This strobe, featuring multi-color illumination (red, green, and white), has been verified by the manufacturer to maintain visibility for a distance of at least 3 statute miles during daylight hours, as referenced in the above section. Complementing this, high visibility tape on the top and bottom of the aircraft will be applied, aiding in the recognition by other aircraft of the Bramor ppX.

With the lateral distance being limited to 400 feet from the ground control station, visual line of sight is anticipated to be consistently maintained. Because the SW edge of the proposed operating area exists on the boarder of Class D airspace, 5 nautical miles from KLAF, the RPIC and VOs will automatically anticipate encountering manned aircraft during each flight, thus ensuring situational awareness is always maximized.

To address the concern of the operational area boardering Class D airspace, the RPIC will be perpetually committed to yielding the right of way to other aircraft, prioritizing safety to avoid potential collision hazards. Our first line of defense, as referenced earlier, is the PingRX Pro remote ID module that will be onboard the Bramor ppX and connected to the ground control station. This will ensure the RPIC and VOs are aware of all aircraft in the area. The visual

observers will act as the second line of defense by assisting the RPIC in identifying and locating other aircraft should the RID module fail. If an aircraft is observed or heard, the VOs will promptly communicate its position and direction to the RPIC. Subsequently, the RPIC will assess whether the approaching aircraft poses a collision hazard or if there is sufficient clearance, adhering to the principles outlined in 14 CFR § 107.37.

These measures collectively aim to ensure the safe operation of the Bramor ppX in consideration of potential air traffic, especially within the border of Class D airspace.

WSEG Question #3.

3. Describe how the RPIC will be able to accurately determine the sUA altitude, attitude, and direction of flight.

> a. How will the RPIC know, while keeping eyes on the sUA, the current real-time (1) geographic location, (2) altitude AGL, (3) attitude (orientation, deck angle, pitch, bank), and (4) direction of flight of the sUA?
>
> b. How will the RPIC maintain visual line of sight with the sUA (i.e., meet the requirements of 14 CFR § 107.31) at the maximum altitude and distance requested in the waiver application?

a. Prior to flight, the RPIC will ensure that they follow the checklist in starting the aircraft and confirming all systems are working properly. This will include checking correct GPS calibration, ensuring altitude changes properly, and the attitude and direction the aircraft is facing is correct. The RPIC will be able to match the flight path seen visually with the flight path on the control station tablet. The RPIC will also in real time be able to see in the control station the speed, altitude, attitude and heading. The RPIC will also listen for verbal callouts done by a VO of heading and altitude indication while the RPIC is actively observing the aircraft.

b. The RPIC will maintain visual line of sight with the sUA by utilizing wing markings in the form of high visibility marking tape to the top and bottom of the aircraft. The aircraft will also utilize high visibility strobes as mentioned before to maintain visibility at the maximum distance and height requested. To aid in making sure the sUA will not exceed the height or flight plan, it will be geofenced into a set flight area.

WSEG Question #4.

4. Describe the area of operations using latitude/longitude, street address, identifiable landmarks, or other maps to include the distance from and direction to the nearest airport, (e.g., 4.8 miles SE of XYZ Airport).

The operational area is located within West Lafayette, IN, bounded by the following coordinates:

40.474896 N, -87.029394 W

40.526595N, -87.0300166W

40.526481N, -86.9766797W

40.475747N, -86.9770310W

40.467998N, -86.9890103W

The above image visually shows the boundaries of our proposed flight area. The entirety of the area exists in Class G airspace, but the SW portion boarders on the Class D controlled airspace of KLAF. Thus, our proposed operational area is 5 nautical miles NE of Purdue University Airport (KLAF).

WSEG Question #5.

1. Describe how the RPIC will be able to be contacted by Air Traffic Control (ATC) in case the operation needs to be terminated, as well as a procedure to notify ATC when the operation begins and ends.

The operating team will have a handheld radio tuned into the ATC frequency at 119.6 and will actively monitor it. We will conduct a radio check to ensure we can hear ATC in the area we will be operating before conducting the mission. The team will also make sure their phones have signal and the ability to reach ATC. Prior to takeoff, a VO will call the Lafayette tower at this number 765-743-2611 and notify the tower. Once the mission is complete and the sUA has landed, a VO will again notify the tower of completion. Should an incident arise where the mission needs to be terminated, a VO will call the tower immediately and give the last known distance, direction, altitude and heading of the aircraft.

Lost Link Procedures and Loss of Control:

In case of loss of link, the aircraft will be set to loiter. The RPIC will try to move the ground station and controller closer to the aircraft to try and regain the lost link. If link cannot be regained, the sUA will go into loss link procedures. The RPIC will alert the crew verbally if they

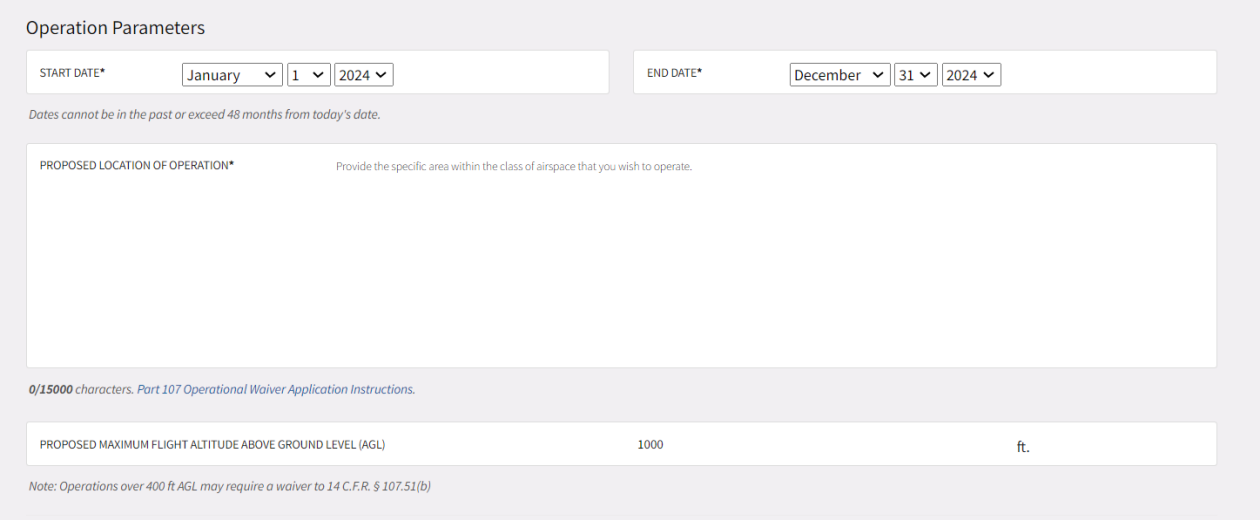
notice the sUA has lost connection with the ground control station. In case of loss of control, the same procedures will be followed with the deployment of the parachute to bring the sUA safely down. If the aircraft loses control, a VO will reach out to the Lafayette Air Traffic Control tower and notify them of the incident.

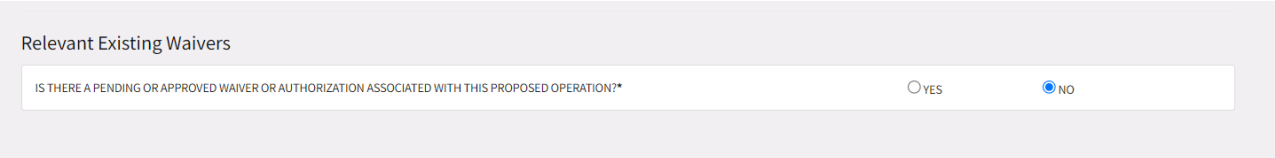
Avoidance of Persons Plan:

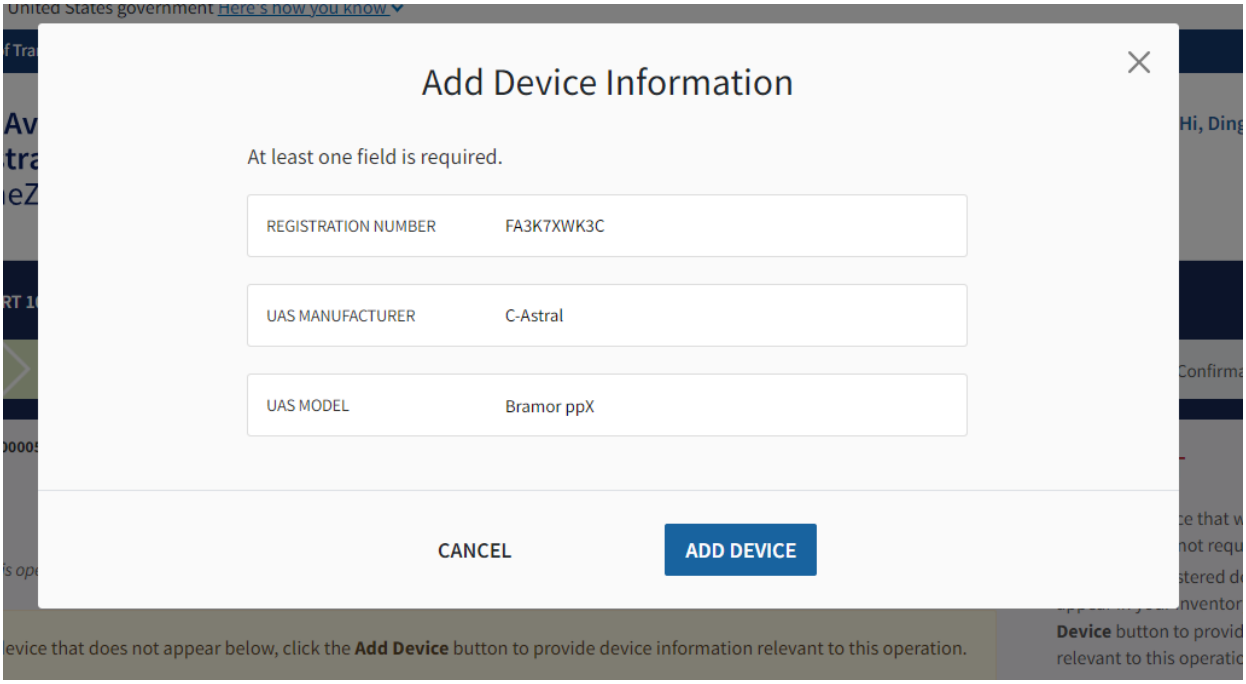
The flight crew will be wearing bright yellow vests with a large P on the back. The takeoff area will be partitioned off and far away from anyone that could walk into the area. The area will be monitored by the VOs to also watch for potential pedestrians if they try to move through the area of operations. The area of operation is primarily rural fields, which should limit the amount of foot traffic or vehicles that try to move through the area.

Conclusion:

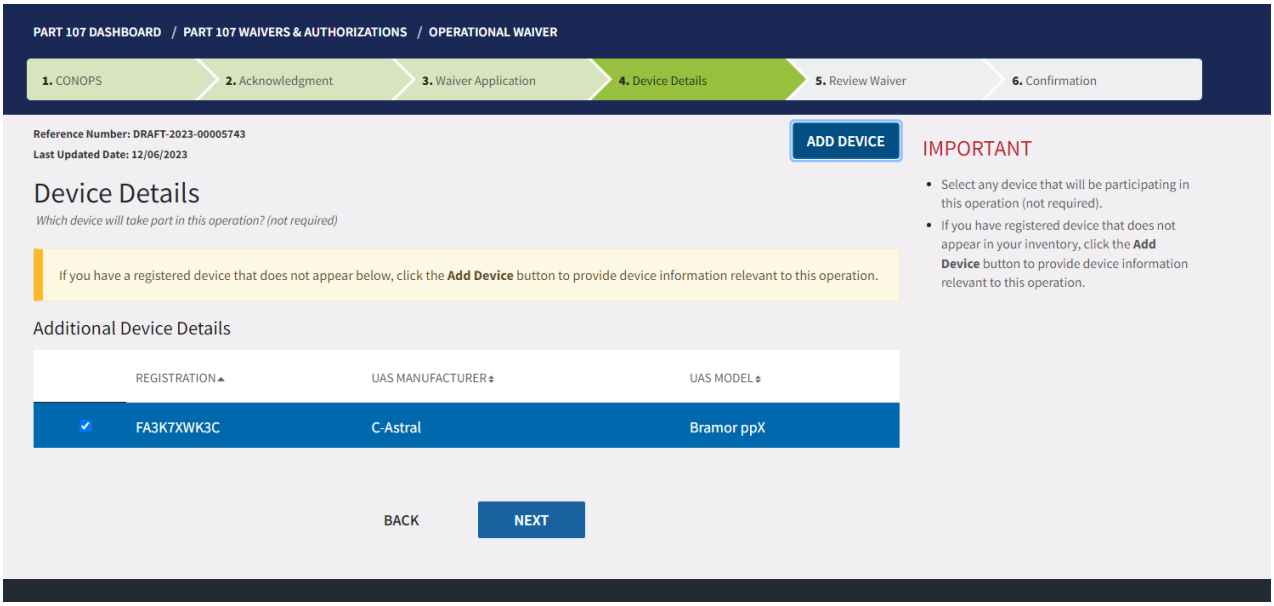
We believe that the risks associated with the proposed operation have been identified and adequately addressed through the outlined mitigation measures. The safety precautions, detailed risk assessment, and adherence to the FAA's Waiver Safety Explanation Guidelines contribute to a robust safety plan.



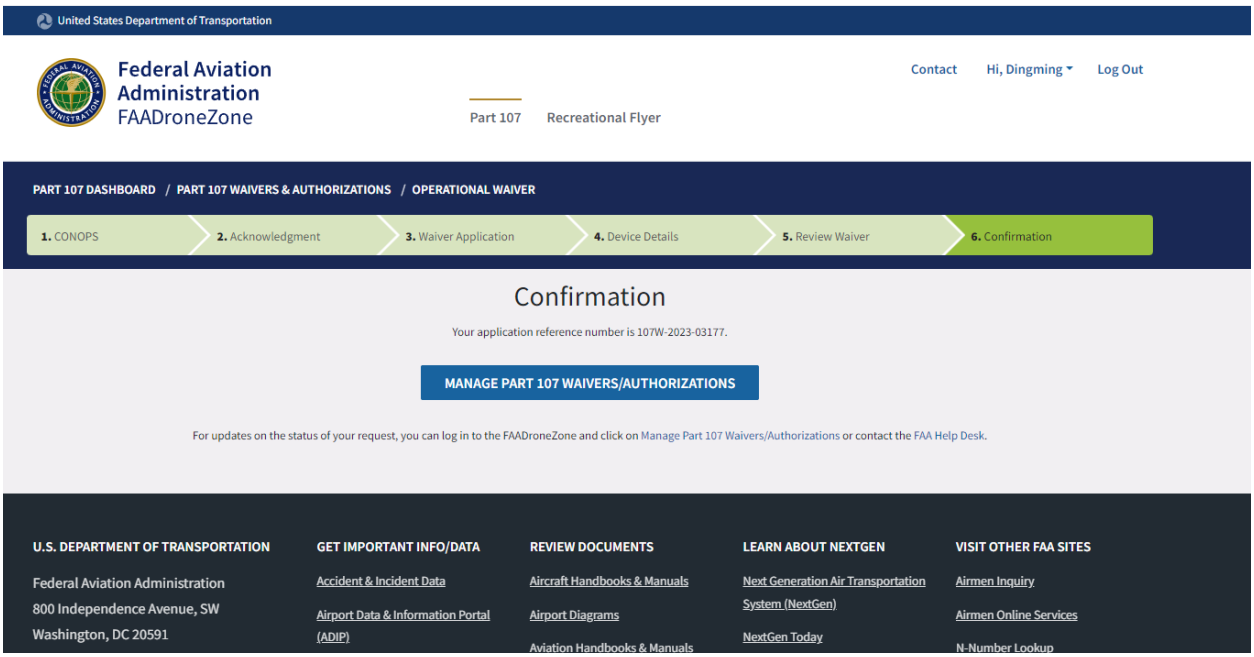




C-Astral, Bramor ppX, FA3K7XWK3C



Your application reference number is 107W-2023-03177..


United States Department of Transportation
Federal Aviation Administration
FAADroneZone
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Hi, Dingming
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Part 107
Recreational Flyer
PART 107 DASHBOARD / PART 107 WAIVERS & AUTHORIZATIONS / OPERATIONAL WAIVER
1. CONOPS
2. Acknowledgment
3. Waiver Application
4. Device Details
5. Review Waiver
6. Confirmation
Confirmation
Your application reference number is 107W-2023-03177.
MANAGE PART 107 WAIVERS/AUTHORIZATIONS
For updates on the status of your request, you can log in to the FAADroneZone and click on Manage Part 107 Waivers/Authorizations or contact the FAA Help Desk.
U.S. DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration
800 Independence Avenue, SW
Washington, DC 20591
GET IMPORTANT INFO/DATA
Accident & Incident Data
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Aircraft Handbooks & Manuals
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Airmen Inquiry
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N-Number Lookup