

Part 107 Waiver Safety Explanation Guidelines and Guiding Questions

§ 107.25 Operation from a Moving Vehicle or Aircraft

- 1. Describe how you will ensure the dynamic (i.e., ever-changing) area of operation is evaluated for potential hazards and risks to non-participating persons and property. Include a description of how you will mitigate those risks so the hazards are controlled or eliminated.**
 - a. How will you identify potential hazards to other aircraft, people, and property before flying and during flight?
 - b. From what kind of vehicle will the Remote Pilot in Command (RPIC) be operating the small unmanned aircraft system (sUAS) or drone?
 - c. Where will the RPIC and Visual Observer(s) (VO), if used, be in the vehicle or along the route?

- 2. Describe how the RPIC and VO will be able to maintain visual line of sight (VLOS) with the small unmanned aircraft (sUA) or drone from the moving vehicle.**
 - a. How will the RPIC be able to see the sUA or drone when both are moving?
 - b. How will a VO who meets the requirements in Title 14, Code of Federal Regulations (14 CFR) § 107.33, be used for operations conducted under this waiver?
 - c. What will the VO's responsibilities and/or duties be during flight?
 - d. What will the RPIC or VO(s) do if they lose VLOS with the sUA or drone?

- 3. Describe how all persons involved in the operation will stay free of distractions that may prevent them from fulfilling their duties.**
 - a. How will the RPIC and VO(s) communicate during flight?
 - b. How will the RPIC and VO(s) remain free from distractions during flight?

- 4. What are the procedures the RPIC will follow during a loss of data link with the sUA? How do these procedures account for the dynamic movement and positioning of the RPIC and ground control station?**
 - a. What will the RPIC do if he/she loses the command and control link with the sUA?
 - b. How will the RPIC and VO(s) maintain VLOS with the sUA or drone if the control link is lost?
 - c. How does this procedure account for all areas where the sUA or drone will be operated?
 - d. If the control link is lost, how will the RPIC ensure the sUA or drone will not fly over other people?

§ 107.29 Operation at Night

The following section is for operators who need to fly at night or during periods of civil twilight without functioning anti-collision lighting visible for at least 3 statute miles that has a flash rate sufficient to avoid a collision.

1. Please provide the following information:

- a. Is your drone equipped with anti-collision lighting?
If no, see Guidelines 2 and 3; if yes, continue to 1b
- b. Is the anti-collision lighting visible for at least 3 miles?
If no, see Guidelines 2 and 3; if yes, continue to 1c
- c. Do the anti-collision lights flash?
If no, see Guidelines 2 and 3; if yes, continue to 1d
- d. Will the anti-collision lights be functioning during the intended flight?
If no, see Guidelines 2 and 3

Note: If “yes” is answered to all the above questions, you may be able to operate in compliance with the requirements of §107.29 without a waiver.

- 2. If you answered “no” to any portion of Guideline 1, explain why you need to fly while not complying with the lighting requirements of §107.29, and describe in detail any mitigating factors such as location or supplemental lighting.**
- 3. If you answered “no” to any portion of Guideline 1, describe any technology, crew resource management, and/or procedural safety precautions you will use to prevent other aircraft from colliding with your drone when not flying in compliance with the lighting requirements of §107.29.**

§ 107.31 Visual Line of Sight Aircraft Operation

- 1. Describe how the Remote Pilot in Command (RPIC) will be able to continuously know and determine the position, altitude, attitude, and movement of his/her small unmanned aircraft (sUA) or drone and ensure the sUA or drone remains in the area of intended operation without exceeding the performance capabilities of the command and control link.**
 - a. When the RPIC or person operating the small unmanned aircraft system (sUAS) or drone cannot see the sUA or drone, how will they know, at all times, the current real-time (1) geographic location, (2) altitude above the ground, (3) attitude (orientation, deck angle, pitch, bank), and (4) direction of flight of the sUA or drone?

- b. If the primary method of maintaining this awareness fails, how will the RPIC maintain current and accurate knowledge of this information?
- c. How will the RPIC determine the operational limits of the command and control link in the flight environment and at the location of flight?

2. Describe how the RPIC will avoid other aircraft, flying over/into people on the ground, and ground-based structures and obstacles at all times.

- a. How will the RPIC see and avoid, or detect and avoid, all other aircraft when operating beyond visual line of sight (BVLOS)?
 - *For example, actions taken or procedures followed by the RPIC, use of a Visual Observer(s) (VO), or use of equipment/technology.*
- b. How will the RPIC know the location(s) of other aircraft that may be at risk of hitting the sUA or drone?
- c. How will the sUA or drone yield the right-of-way to all aircraft, airborne vehicles, and launch and reentry vehicles as required by Title 14, Code of Federal Regulations (14 CFR) § 107.37?
- d. When operating BVLOS, how will the RPIC identify and avoid flying over/into persons on the ground (as required by 14 CFR § 107.39)?
- e. If an equipment/technology method is used—
 - 1) What kind equipment/technology?
 - 2) How does it work?
 - 3) How is it tested to determine system reliability and limitations?
 - *Consider providing data from the testing used to make those determinations.*

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

- a. Will the sUA or drone be visible for at least 3 mi in the location where the RPIC will operate?
 - 1) If yes, how will you accomplish this?
 - 2) If no, why do other aircraft not need to be able to see your sUA or drone from at least 3 mi?

4. Describe how the RPIC is alerted of a degraded sUAS or drone function.

- a. When flying BVLOS, how will the RPIC be alerted if the sUAS or drone malfunctions or its capability degrades, and how will he/she respond?
- b. Additional sUAS or drone Details:

Note: If the sUAS or drone has a determined level of reliability, please provide the following information with your waiver application:

- 1) Mean time between failure testing with results
- 2) Reliability or maintenance program for the sUAS or drone
- 3) Life limits on the sUAS or drone and its components
- 4) System architecture
- 5) Hardware reliability analysis
- 6) Software design assurances and control
- 7) Any operational restrictions or limitations associated with this reliability level
For example, altitude limits or airspeed restrictions imposed by the manufacturer or self-imposed by the operator

5. What procedure will be followed to ensure the required persons participating in the operation have relevant knowledge of all aspects of operating a sUA or drone that is not in visual line of sight of the RPIC?

- a. If the sUA or drone uses Global Positioning System (GPS) functionality, how will the RPIC determine the GPS signal availability for the flight time and location, before and during each intended flight?
- b. If the sUA or drone uses GPS location to safely operate, what will the RPIC do if the GPS fails to provide location information, or provides reduced GPS position accuracy?

6. Describe how the RPIC will operate the sUA or drone within the weather requirements while en route.

- a. When flying BVLOS, how will the RPIC meet the requirements for visibility and cloud clearance specified in 14 CFR § 107.51?

7. Describe the emitters and command and control link used in the sUAS or drone.

- a. Include the Federal Communications Commission (FCC) grant of equipment authorization and FCC ID number for each emitter on the sUA or drone or at the pilot station.
- b. Include the frequency licenses used by the sUA or drone or at the pilot station.
- c. If the equipment is licensed by rule, indicate the FCC rule that applies (e.g., Title 47, CFR § 87.18).
- d. If the frequency is leased, provide a copy of the leasing agreement.
- e. Include a complete description of the emitters.
- f. Frequency or frequencies used to transmit
- g. Antenna type, antenna mainbeam gain, and antenna pattern
- h. Maximum range
- i. Transmission power in watts and Decibel-milliwatts (dBm)
- j. Emission modulation
- k. Receiver sensitivity

- l. System losses
- m. Acceptable bit error rate

§ 107.33 Visual Observer

1. **Describe how you will account for the communication latency between the visual observer(s) (VO) and the Remote Pilot in Command (RPIC).**
 - a. How will the RPIC and VO(s) communicate with each other if they are not near each other?
 - b. If this communication method fails, how will the RPIC and VO(s) be alerted to the failure?
 - c. What will the RPIC and VO(s) do if a communication failure occurs?

Note: A VO may not be required for certain part 107 operations. If a VO is part of your operation, Title 14, Code of Federal Regulations (14 CFR) § 107.31 requires the VO(s) to all be able to see the small unmanned aircraft (sUA) or drone throughout the duration of the flight. You may need a waiver to certain portions of § 107.33 (specifically § 107.33(b) and § 107.33(c)(2)) if your operation requires the use of multiple VOs, not all of which will be able to maintain visual line of sight with your sUA or drone. An example of operations where this may apply is when using a daisy-chain of VOs (where VO(s) maintain direct visual contact with the sUA or drone throughout the entire flight in place of the RPIC doing so).

§ 107.35 Operation of Multiple Small Unmanned Aircraft

1. **Describe how the operation will remain safe during a failure of single and multiple small unmanned aircraft (sUA) or drone simultaneously.**
 - a. How does the system simultaneously control multiple participating sUA or drone and prevent them from colliding with each other?
 - b. How will the system ensure individual participating sUA or drone remain contained in the pre-determined operational area?
 - c. How will the Remote Pilot in Command (RPIC) see and avoid, or detect and avoid, all other aircraft when operating multiple sUA or drone?
 - d. Will the proposed operations use a Visual Observer(s) (VO)?
 - e. How will the RPIC safely stop all participating sUA or drone in the event of a hazard?
 - f. How will the RPIC know when a single sUA or drone has failed, and how will he/she respond?
 - g. How will the RPIC respond to multiple sUA or drone failing at the same time?

- h. What additional preflight safety procedures would the RPIC undergo to ensure safe operation?
 - *For example, preflight computer simulations, personnel training.*
- i. How many command and control links and procedures does the system use?
- j. Do the sUA or drone communicate with each other? If so, what path do the communications follow?
- k. How do the system and/or individual sUA or drone respond when communications fail?
- l. How will the RPIC maintain a stand-off distance (buffer zone) from non-participating people or property?

§ 107.37 Operation Near Aircraft; Right-of-Way Rules

1. **Describe how all manned aircraft pilots are able to detect and avoid the small unmanned aircraft (sUA) or drone and know they must yield the right-of-way to the sUA or drone.**
 - a. How will other operators of other aircraft know they need to give way to your sUA or drone in flight?
2. **What procedure will you use to ensure the operator of the manned aircraft is aware the sUA or drone does not need to yield the right-of-way?**
 1. How will operators of other aircraft visually locate your sUA or drone in flight?

§ 107.39 Operation over Human Beings

The following section is for operators who need to fly over human beings with a drone that will not meet the requirements of Subpart D of Part 107.

Note: You should only apply for a waiver to 107.39 if you are unable to meet the requirements of [Part 107 Subpart D](#).

1. **Explain why are you unable to operate your drone in compliance with any of the four categories listed in Part 107 Subpart D.**
2. **Describe your intended operation in detail, including procedures, roles and responsibilities of flight crew, technology, minimum operating altitudes, standoff distances, flight duration(s), flight path(s), operational history, and site-specific details.**
3. **Provide information showing how the drone, upon impact with a person:**
 - a. Will not exceed a low probability of serious injury or casualty

- b. Does not have any exposed rotating parts that could lacerate human skin
- c. Does not have any safety defect(s) that exceed a low probability of causing serious injury or casualty

Note: Casualty is defined as a serious or fatal accident

4. If you indicated the use of a parachute in Guideline 2 above, you must also provide all of the following:

- a. Make, model, and serial number(s) of the parachute(s),
- b. Testing data for the parachute(s),
Note: This could consist of an ASTM compliance report for the parachute system, combined with the flight testing data performed by a third party testing agency (TPTA). Testing data must include injury severity and likelihood, demonstrated parachute functionality, and rate of effective deployments within expected parameters.
- c. Safe deployment altitude, including how that altitude is ensured.

§ 107.51(a) Operating Limitations for Small Unmanned Aircraft: Groundspeed

- 1. Describe how you will ensure a loss of control of the small unmanned aircraft (sUA) or drone at higher speed poses no additional hazard or explain how any additional hazard to other aircraft, people, or property on the ground will be controlled or eliminated.**
 - a. How will the Remote Pilot in Command (RPIC) ensure the sUA or drone, flying at over 87 knots/100 mph, will not increase the likelihood of the sUA or drone hitting another aircraft, person, or property?
 - b. How will the RPIC maintain sight of the sUA or drone when it is traveling at over 87 knots/100 mph?

- 2. Describe how the visual conspicuity of the sUA or drone will be increased to be seen at a distance of at least 3 statute miles (mi).**
 - a. Will the sUA or drone be visible for at least 3 mi in the location where the RPIC will operate?
 - 1) If yes, how will you accomplish this?
 - 2) If no, why do other aircraft not need to be able to see your sUA or drone from at least 3 mi?

§ 107.51(b) Operating Limitations for Small Unmanned Aircraft: Altitude

- 1. Describe how the small unmanned aircraft (sUA) or drone will not pose a hazard to aircraft, persons on the ground, and others' property 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 aboveground level (AGL)?

- 2. Describe how the visual conspicuity of the sUA or drone will be increased to be seen at a distance of at least 3 statute miles (mi).**
 - a. Will the sUA or drone 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 or drone from at least 3 mi?

- 3. Describe how the RPIC will be able to accurately determine the sUA or drone altitude, attitude, and direction of flight.**
 - a. How will the RPIC know, while keeping eyes on the sUA or drone, 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 or drone?
 - b. How will the RPIC maintain visual line of sight with the sUA or drone (i.e., meet the requirements of 14 CFR § 107.31) at the maximum altitude and distance requested in the waiver application?

- 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).**

- 5. 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.**

§ 107.51(c) Operating Limitations for Small Unmanned Aircraft: Minimum Flight Visibility

- 1. Describe how the Remote Pilot in Command (RPIC) will be able to maintain visual line of sight (VLOS) with the small unmanned aircraft (sUA) or drone when operating with visibility less than 3 statute miles (mi).**
 - a. How will the RPIC maintain VLOS of the sUA or drone when visibility is reduced?
 - b. What is maximum distance the sUA or drone will be visible to the RPIC, Visual Observer(s), and other aircraft?
 - 1) How was that visibility determined?
- 2. Describe how, and what procedures will be used to ensure, the sUA or drone will be able to avoid non-participating aircraft when operating with visibility less than 3 mi.**
 - a. How will the RPIC see and avoid, or detect and avoid, non-participating aircraft when the ground or flight visibility is less than 3 mi?
- 3. Describe how the visual conspicuity of the sUA or drone will be increased to be seen at a distance of at least 3 mi.**
 - a. Will the sUA or drone be visible for at least 3 mi in the location where the RPIC will operate?
 - 1) If yes, how will you accomplish this?
 - 2) If no, why do other aircraft not need to be able to see your sUA or drone from at least 3 mi?

§ 107.51(d) Operating Limitations for Small Unmanned Aircraft: Cloud Clearance

- 1. Describe how the Remote Pilot in Command (RPIC) will be able to maintain visual line of sight with the small unmanned aircraft (sUA) or drone when operating closer to clouds than the distances prescribed in Title 14, Code of Federal Regulations (14 CFR) § 107.51(d).**
 - a. How will the RPIC know when the sUA or drone is flying too close to the clouds and prevent accidental flight into the clouds?
 - b. What is the maximum vertical distance the sUA or drone will be visible to the RPIC, Visual Observer(s), and other aircraft?
 - 1) How was that visibility determined?

2. **Describe how the RPIC will be able to locate and avoid non participating aircraft when operating closer to clouds than the distances prescribed in § 107.51(d).**
 - a. How will the RPIC see and avoid other aircraft that may be flying in the clouds or be hidden from view because of the clouds?

3. **Describe how the visual conspicuity of the sUA or drone will be increased to be seen at a distance of at least 3 statute miles (mi).**
 - a. Will the sUA or drone be visible for at least 3 mi in the location where the RPIC will operate?
 - 1) If yes, how will you accomplish this?
 - 2) If no, why do other aircraft not need to be able to see your sUA or drone from at least 3 mi?

§ 107.145 Operation over moving Vehicles

The following section is for operators who need to fly over moving vehicles with a drone that will not meet the requirements of Subpart D of Part 107.

Note: You should only apply for a waiver to 107.145 if you are unable to meet the requirements of [Part 107 Subpart D](#).

1. **Explain in detail why your drone cannot meet any of the requirements listed in [§107.145\(a\)](#).**

2. **Describe your intended operation in detail, including procedures, roles and responsibilities of flight crew, technology, minimum operating altitudes, standoff distances, flight duration(s), flight path(s), operational history, and site-specific details.**

3. **Provide information showing how the drone, upon impact with a person inside a moving vehicle:**
 - a. Will not exceed a low probability of serious injury or casualty
 - b. Does not have any exposed rotating parts that could lacerate human skin
 - c. Does not have any safety defect(s) that exceed a low probability of causing serious injury or casualty

Note: Casualty is defined as a serious or fatal accident

4. **If you indicated the use of a parachute in Guideline 2 above, you must also provide all of the following:**
 - a. Make, model, and serial number(s) of the parachute(s),
 - b. Testing data for the parachute(s),

Note: This could consist of an ASTM compliance report for the parachute system, combined with the flight testing data performed by a third party testing agency (TPTA). Testing data must include injury severity and likelihood, demonstrated parachute functionality, and rate of effective deployments within expected parameters.

- c. Safe deployment altitude, including how that altitude is ensured.