Part 107 Waiver Safety Explanation Guidelines and Guiding Questions

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§ 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)?
   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) from the moving vehicle.**
   a. How will the RPIC be able to see the sUA when both are moving?
   b. How will a VO who meets the requirements of § 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?

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 if the control link is lost?
   c. How does this procedure account for all areas where the sUA will be operated?
   d. If the control link is lost, how will the RPIC ensure the sUA 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 small unmanned aircraft (sUA) 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 small unmanned aircraft (sUA) when not flying in compliance with the lighting requirements of §107.29**.

§ 107.31 Visual Line of Sight Aircraft Operation

1. General

a. Describe how the remote pilot in command (RPIC) will be able to continuously know and determine the position, altitude, and movement of the small Unmanned Aircraft (sUA).

b. Describe how the RPIC will ensure the sUA remains in the area of intended operation. How will this be verified?

c. Describe how the RPIC ensures the operation will not go beyond the capabilities of the command and control link. How will that be tested and verified?

d. What is the route of flight? What factors, with regards to the route of flight, will affect command and control, flight over people/moving vehicles/obstructions, etc.?

e. Does the sUA have a return to home (RTH) function? If so, how does the RPIC ensure the sUA does not overfly people/vehicles or collide with obstructions during the RTH flight?

2. Detect and Avoid (DAA)

a. How will the RPIC monitor the airspace surrounding the operation of the sUA to remain well clear of other aircraft?

b. Will a Detect and Avoid (DAA) system be used with the operation?
    1) What type of DAA system is to be used? RADAR / ACOUSTIC / VISUAL?
    2) Is the DAA system ground based or airborne?
    3) Is the DAA system compliant with the Industry Based DAA Performance Standard or a combination of standards? i.e. portions of RTCA and portions of ASTM
    4) If the DAA is ground based, is there adequate low altitude DAA coverage to support the operation?
    5) What is the maximum distance the system is effective in detecting other aircraft?
    6) Has the DAA system been tested and proven reliable in the desired operating environment?
    7) What is the maximum altitude above ground level the sUA will be flown during this operation?
    8) What is the avoidance strategy?
    9) If avoidance is automated, what safeguards are there to protect the system from undesired behavior?
    10) Describe how the RPIC interfaces with the DAA system to monitor the airspace and manage the DAA operation?
    11) What is the minimum distance for detection so that the avoidance strategy can be carried out?

12) If using an obstruction/shielded DAA concept of operations, what is the shielding criteria?
13) What are the DAA system operating limitations?
14) How will ADS-B IN be integrated into the DAA system?
15) What is the alerting criteria for non-cooperative intruders and ADS-B equipped intruders?
16) Describe how the system visibly and audibly alerts the RPIC of operating area intruders?
17) Is there visible and audible alerting for DAA system failures/degradation?

c. Describe how the RPIC monitors the surface of the operating area to ensure the sUA will not overfly people or moving vehicles or how the sUA has been determined sufficiently safe to operate over people or moving vehicles (i.e Cat. 1-4 compliant, safe operational history, impact mitigation such as a parachute, or restricted operational areas).

d. If conducting obstruction/shielded operations, how are safe states defined?

e. If using VO(s) with the operation, will the VO(s) be able to maintain visual surveillance of 2 statute miles (sm) around the sUA's position, and/or be able to maintain VLOS with the sUA at all times?

3. Lighting

a. Describe the anti-collision lighting used on the sUA, in order for it to be seen by crewmembers in other aircraft from a distance of at least 1 statute mile (sm) during daytime operations and 3sm if conducting nighttime operations.

4. Alerts

a. Describe how the RPIC will be alerted of a degraded function or failure of the sUAS.

b. Will there be an audible and visual alert of the degraded function or failure as required by industry standards?

c. What are the procedures in the event of a degraded function or failure of the sUAS?

d. What are the C2 lost link procedures?

5. Training

a. Describe how the responsible person will ensure that relevant knowledge is required of all persons participating in the operation.

b. What training will be required for the operation?

c. How will the training be documented and maintained?

6. Weather

a. What are the weather limitations on the sUA to be operated?

b. How will you determine the weather conditions at the launch and recovery site as well as along the intended route ?

c. How will you comply with 107.51?

7. Command and Control

a. Describe the command and control link of the sUAS.

b. Is the command and control link configuration FCC approved? If so, please provide the approval number?

§ 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, § 107.31 requires that all VO(s) be able to see the small unmanned aircraft (sUA) 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. 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 throughout the entire flight in place of the RPIC doing so).

§ 107.35 Operation of Multiple Small Unmanned Aircraft (sUA)

1. **Describe how the operation will remain safe during a failure of single and multiple small unmanned aircraft (sUA) simultaneously.**
   a. How does the system simultaneously control multiple participating sUA and prevent them from colliding with each other?
   b. How will the system ensure individual participating sUA 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?
   d. Will the proposed operations use one or more Visual Observers (VO)?
   e. How will the RPIC safely stop all participating sUA in the event of a hazard?
   f. How will the RPIC know when a single sUA has failed, and how will he/she respond?
   g. How will the RPIC respond to multiple sUA 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 communicate with each other? If so, what path do the communications follow?
   k. How do the system and/or individual sUA 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) and know they must yield the right-of-way to the sUA.**
   a. How will operators of other aircraft know they need to give way to your sUA in flight?
2. **What procedure will you use to ensure the operator of the manned aircraft is aware the sUA does not need to yield the right-of-way?**
   a. How will operators of other aircraft visually locate your sUA inflight?

§ 107.39 Operation over Human Beings

The following section is for operators who need to fly over human beings with a small unmanned aircraft (sUA) that will *not* meet the requirements of subpart D of part 107.

NOTE: sUA that weigh 0.55 pounds or less and are equipped with shielded rotating parts (i.e., prop guards) that will prevent lacerations to human skin do not require a waiver.

1. **Describe the proposed operation in detail.**

2. **What is the takeoff weight of the sUA, including payload and the required equipage listed below?** Express this number to the nearest hundredth pound (i.e., 0.85 lbs., 1.52 lbs.).

To obtain a waiver to operate over human beings, the FAA now requires additional equipage, which increases the takeoff weight of the sUA. Depending on the sUA's takeoff weight, a Parachute Recovery System conforming to the ASTM F3322–18 (or newer) standard may be required and, if so, must be included in the weight calculation. There may be differences in the special provisions of the issued waiver and handling of the waiver application. **Operators must add the weight of the following required equipage to derive the takeoff weight**:

a) Anti-collision light to increase the conspicuity of the sUA to at least one statute mile for daytime operations and three statute miles for civil twilight and night operations, for collision avoidance purposes,
b) Remote ID broadcast module (unless the drone is on the FAA-accepted DOC standard remote ID list found on uasdoc.faa.gov),
c) Mechanism to shield or prevent rotating parts from causing lacerations to human skin, and
d) A Parachute Recovery System (PRS) conforming to the ASTM F3322–18 (or newer) standard if the takeoff weight of the sUA, its payload, the anti-collision light, RID, and rotating parts shielding mechanism is more than 0.88 pounds. For those cases, add the weight of the PRS to the total takeoff weight.

Note: If the takeoff weight of the sUA's payload, including the anti-collision light, RID, rotating parts shielding mechanism, and, if required, a Parachute Recovery System, is more than 3.50 pounds, the waiver application will be evaluated on a case-by-case basis. Additional details about the proposed operation and safety justification may be required.

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

1. **Describe how you will ensure that a loss of control of the small unmanned aircraft (sUA) at higher speeds 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, flying over 87 knots/100 mph, will not increase the likelihood of the sUA hitting another aircraft, person, or property?
   b. How will the RPIC maintain visual line of sight of the sUA as prescribed in §107.31, when it is flying over 87 knots/100 mph?

2. **Describe the anti-collision lighting on the sUA, in order for it to be seen by crewmembers in other aircraft from a distance of at least 1 statute mile (sm) during daytime operations and 3sm if conducting nighttime operations.**
   a. Will the sUA be sufficiently visible by crewmembers in other aircraft in the location where the RPIC will operate?
      1) If yes, how will you accomplish this?
      2) If no, why do crewmembers in other aircraft not need to be able to see your sUA?

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

1. **Describe how the small unmanned aircraft (sUA) will not pose a hazard to aircraft, persons on the ground, and others' property when operating at altitudes other than those prescribed in § 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)?

2. **Describe the anti-collision lighting used on the sUA, in order for it to be seen by crewmembers in other aircraft from a distance of at least 1 statute mile (sm) during daytime operations and 3sm if conducting nighttime operations.**
   a. Will the sUA be sufficiently visible by crewmembers in other aircraft in the location where the RPIC will operate?
      1) If yes, how will you accomplish this?
      2) If no, why do crewmembers in other aircraft not need to be able to see your sUA?

3. **Describe how the RPIC will be able to accurately determine the sUA altitude 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), and
      3) 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 § 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. **In addition to filing a NOTAM, describe how the RPIC will communicate/coordinate with Air Traffic Control (ATC) if required by a Special Provision in your Certificate of Waiver and based on the complexity of your operation.**

§ 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) when operating with visibility less than 3 statute miles (sm).**
   a. How will the RPIC maintain VLOS of the sUA when visibility is reduced?
   b. What is the maximum distance the sUA 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 will be able to avoid non-participating aircraft when operating with visibility less than 3sm.**
   a. How will the RPIC see and avoid, or detect and avoid, non-participating aircraft when the ground or flight visibility is less than 3sm?
3. **Describe the anti-collision lighting used on the sUA, in order for it to be seen by crewmembers in other aircraft from a distance of at least 1sm during daytime operations and 3sm if conducting nighttime operations.**
   a. Will the sUA be sufficiently visible by crewmembers in other aircraft in the location where the RPIC will operate?
      1) If yes, how will you accomplish this?
      2) If no, why do crewmembers in other aircraft not need to be able to see your sUA?

§ 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) when operating closer to clouds than the distances prescribed in § 107.51(d).**
   a. How will the RPIC know when the sUA is flying too close to the clouds and prevent accidental flight into the clouds?
   b. What is the maximum vertical distance the sUA 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 the anti-collision lighting used on the sUA, in order for it to be seen by crewmembers in other aircraft from a distance of at least 1 statute mile (sm) during daytime operations and 3sm if conducting nighttime operations.**
   a. Will the sUA be sufficiently visible by crewmembers in other aircraft in the location where the RPIC will operate?
      1) If yes, how will you accomplish this?
      2) If no, why do crewmembers in other aircraft not need to be able to see your sUA?

§ 107.145 Operation over Moving Vehicles

The following section is for operators who need to fly over human beings located inside a moving vehicle with a small unmanned aircraft (sUA) that will *not* meet the requirements of subpart D of part 107.

NOTE: sUA that weigh 0.55 pounds or less and are equipped with shielded rotating parts (i.e., prop guards) that will prevent lacerations to human skin do not require a waiver.

1. **Describe the proposed operation in detail.**

2. **What is the takeoff weight of the sUA, including payload and the required equipage listed below?** Express this number to the nearest hundredth pound (i.e., 0.85 lbs., 1.52 lbs.).

To obtain a waiver to operate over human beings located inside a moving vehicle, the FAA now requires additional equipage, which increases the takeoff weight of the sUA. Depending on the sUA's takeoff weight, a Parachute Recovery System conforming to the ASTM F3322–18 (or newer) standard may be required and, if so, must be included in the weight calculation. There may be differences in the special provisions of the issued waiver and handling of the waiver application. **Operators must add the weight of the following required equipage to derive the takeoff weight**:

a) Anti-collision light to increase the conspicuity of the sUA to at least one statute mile for daytime operations and three statute miles for civil twilight and night operations, for collision avoidance purposes,
b) Remote ID broadcast module (unless the drone is on the FAA-accepted DOC standard remote ID list found on uasdoc.faa.gov),
c) Mechanism to shield or prevent rotating parts from causing lacerations to human skin, and
d) A Parachute Recovery System (PRS) conforming to the ASTM F3322–18 (or newer) standard if the takeoff weight of the sUA, its payload, the anti-collision light, RID, and rotating parts shielding mechanism is more than 0.88 pounds. For those cases, add the weight of the PRS to the total takeoff weight.

Note: If the takeoff weight of the sUA's payload, including the anti-collision light, RID, rotating parts shielding mechanism, and, if required, Parachute Recovery System, is more than 3.50 pounds, the waiver application will be evaluated on a case-by-case basis. Additional details about the proposed operation and safety justification may be required.