

This is a representative sample of an approved waiver application for 14 CFR § 107.51(d)

I am requesting a waiver to 14 CFR 107.51(d)(1) and (2), minimum distance from clouds less than 500 feet below the cloud and less than 2,000 feet horizontally; to operate small UAS "clear of clouds" for purposes of training and R&D at a remote location as per the boundaries in red on the attached Google Earth image. The location is a remote area in Class G airspace with the nearest airport 15 miles away. The closest residence is 7 miles from the north boundary of the operations area. The only road within 5 miles of the operational area is the access road to the location.

Flights conducted under this waiver will provide data under real conditions to support future requests to operate "clear of clouds" at minimum distances from clouds of less than 500 feet below cloud and less than 2,000 feet horizontally.

All flights will be conducted in accordance with our Flight Operations Manual, a copy of which is attached.

Flights under this waiver will not exceed 100 feet agl and 500 feet from the RPIC.

Details of the sUAS: Aircraft include small commercial off-the-shelf quad rotor aircraft. Each aircraft is equipped with telemetry, GPS geo-fencing, and GPS based automated waypoint functions. Specific details on the aircraft that will be used in this operation area included in our Flight Operations Manual. Typical missions will be pre-planned waypoint flights, allowing for maximum control and containment of the aircraft.

The aircraft geo-fencing capabilities allows the pilot to set maximum altitudes and flight distances, aiding in remaining within a pre-determined area. Telemetry displayed on the controller screen includes information on altitude, heading, distance from the home point, battery life, signal strength, GPS health, and displays the aircraft geographic location, home point and tablet location on a map background, including an indicator of the direct path back to home point. Telemetry information is also available overlaid on the camera view option. The flight control software includes automatic return to home in case of a lost link or low battery. Auto-land is activated at critically low battery to avoid a loss of control.

Pilot/Personnel Details:

The applicant is the sole RPIC requested under the terms of this waiver. Applicant is a current certificated flight instructor - instrument, airplane single engine land. Applicant's knowledge of meteorological factors, and the operations of aircraft in reduced visibility is to the standards required under 14 CFR Part 61 for a certificated flight instructor - instrument. Applicant will maintain currency in accordance with Part 61 to meet the terms of this request.

Operations conducted under this waiver will include a minimum of one visual observer (VO) to aid in maintaining clearance from obstacles, non-participating persons, and air traffic. VO(s) will be responsible to scan the operations area for other aircraft, vehicles and people on the ground. VO(s) will maintain immediate communication with the RPIC through verbal or two-way full duplex, hands free radio contact to inform of any encroachment of the operations area. The VO(s) will hold an FAA Part 107 certificate and at a minimum will hold a FAA private pilot certificate or higher.

The training involved in the above qualifications includes material on aircraft operations in instrument conditions and meteorological factors. VOs will maintain required currency in their qualification, or will attend yearly refresher with the Responsible Person (CFI) on the subjects listed above. The RPIC will ensure documentation of this training is obtained and available upon request. The above requirements and further details on required training will be in our Flight Operations and Training Manuals.

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

How will the Remote PIC see and avoid other aircraft that may be flying in the clouds, or be hidden from view because of the clouds?

Flights will not exceed 500 feet from the RPIC and 100 feet AGL, allowing the RPIC and VO to maintain a visual line of sight. This flight distance will be included in our Flight Operations Manual as a prescribed maximum for flights conducted under the provisions of this waiver, which will aid the RPIC or VO in having sufficient time to see and avoid in the unlikely event another aircraft is operating at such low altitudes under cloudy conditions. The sUAS is operated at very low speeds, and similar to the provisions for helicopters in 14 CFR 91.155(b)(1), the slow speed and ability to hover affords the RPIC time to avoid obstacles or other traffic.

Additionally, the VO will be positioned such that his view of the operational area is at an angle to that of the RPIC, better enabling sighting of other aircraft that may come into proximity of the sUAS or enter clouds nearby. However, the applicant does understand that operations such as helicopters, agricultural application, or other unmanned aircraft may be operating in such conditions. The RPIC and VO will also maintain a listening watch for the sounds of low flying aircraft. The RPIC will return the sUAS to home, or immediately descend to 50 feet agl or below tree line if another aircraft is seen or heard anywhere in the vicinity.

The RPIC will maneuver the sUA in accordance with traffic avoidance techniques contained in FAA Advisory Circular 90-48D and the Aeronautical Information Manual Section 8-1-8. The sUA has the ability to stop and hover (the RPIC always has the ability to take over control during an RTH), thereby greatly reducing the complexity of the conflict geometry. In a worst-case scenario, the RPIC can force an emergency landing on the spot, sacrificing the sUA if required.

In order to avoid potential conflict with instrument flight rules aircraft, operations under this request will be limited to no higher than 100 feet AGL.

In the case that unauthorized persons or vehicles are located, the RPIC will adjust flight to avoid them and move toward the home point or pre-determined contingency safe points if able.

How will the remote PIC know when the aircraft is flying too close to the clouds and prevent accidental flight into the clouds?

The sUAS is operated at very low speeds, and similar to the provisions for helicopters in 14 CFR 91.155(b)(1), the slow speed and ability to hover affords the RPIC time to more easily judge lateral closing distance and proximity to cloud. The positioning of the VO at an angle to the RPIC will also assist in maintaining lateral cloud clearance requirements. The use of ground reference landmarks will aid the pilot in judging lateral proximity to areas of cloud.

Cloud bases can be determined by comparing with the heights of prominent ground objects surrounding the operational area, and can be measured using smart-device applications that can measure angles, distance, and elevations such as XXXXXX or XXXXXXXX.

What is maximum vertical distance the aircraft will be visible to the Remote Pilot in Command (Remote PIC), Visual Observer(s), and other aircraft? How was that visibility determined?

Past experience with the sUAS finds that the aircraft operated by the applicant are comfortably visible against a variety of backgrounds up to 1/3 mile (1760 feet) in any direction. As noted above, under the terms of this request, the flight operations manual will require a mission plan of no more than 500 feet from the RPIC, as well as the existing limitation of no more than 100 feet agl.

When using automated waypoint flight, the mission can be programmed for specific altitudes, which will aid the RPIC in determining the location and orientation of the aircraft as well as the proximity of the aircraft to clouds.

To increase conspicuity, whenever operations are conducted in conditions in proximity to clouds, the sUAS will operate additional lighting visible from at least 3sm in daylight conditions. A minimum of 2 commercially available LED lights, with manufacturer specifications for at least 3sm visibility, (consistent with the minimum candela rating per the US Coast Guard standard for anchor lights Title 33 Part 84.14), will be mounted on the aircraft to ensure visibility by the RPIC, VO, and other aircraft. Reflective tape will be attached to any sUAS operated under the terms of this waiver and placed so as to be visible from any orientation. The reflective tape colors will be high contrast to the sUAS aircraft color, i.e. bright red or blue on a white sUAS, bright yellow or silver on a dark colored sUAS, or both.

In the case one person has lost sight, the others will use immediate communication to aid the person who has lost sight, utilizing clear directional commands using compass directions. In the case the RPIC has lost sight and cannot quickly regain visual contact, the automated return-to-home function will be activated. In the event of communication failure between RPIC and VO(s) the RPIC will immediately return the aircraft to home and land. Return to home would not be initiated by the RPIC if, in the opinion of the RPIC, the path and altitude from the last known location would interfere with other aircraft and/or would cause the aircraft to operate over people. The RPIC could alternatively force an emergency landing on the spot, sacrificing the sUA if the RTH path is deemed unsafe.