SAFETY *in* NUMBERS

Understanding the Parameters for Small UAS Operations

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Love it or hate it, we are inextricably linked to the power of numbers in our everyday lives. Although they might seem to overreach or in some cases limit our actions, numbers also provide the means for structure and safety. That's especially evident in the transportation arena, where numbers help keep our roads, bridges, tunnels (and runways) structurally sound, keep vehicle traffic moving at consistent and appropriate speeds (at least for some of us!), and provide data that drives critical decision-making and risk mitigation strategies for transportation infrastructure around the globe.

When the FAA established registration requirements for certain small unmanned aircraft systems (sUAS) in 2015, and later published the part 107 rule for non-hobbyist UAS operations in 2016, some stakeholders questioned how we arrived at some of the numbers used for operational limitations. For example: Why am I limited to only 400 feet? Why is my maximum speed 100 mph? And why were small UAS specifically limited to less than 55 pounds? (Spoiler alert: it wasn't in honor of basketball legend Dikembe Mutombo's uniform number.) We considered these and several other frequently asked questions for this article to explain why certain sUAS requirements exist. This may prove especially helpful for those remote pilot readers who are not as familiar with the FAA's methods for promulgating safety in the National Airspace System (NAS).

Why 55?

Public Law 112-95, section 331(6) defines a sUAS as "an unmanned aircraft weighing less than 55 pounds." Prior to this law, most of the non-military sUAS in the community were under the 25 kilogram mark, or roughly 55 pounds. "This weight was dictated by Public Law 112-95," says Aviation Safety Inspector James Malecha with the General Aviation and Commercial Division. "Fifty-five pounds was the weight defined by Congress so that's what we used."

It's worth noting also that the under 55-pound limit applies to the total weight of the sUAS at takeoff and must include any payload. This is consistent with how weight restrictions are defined on other aircraft types, such as the 1,320-pound limit for light-sport.

Many of the popular (and even high-end) quadcopter models can accommodate a camera and battery and still be comfortably below 55 pounds. However, if you are planning to operate a UAS that is 55 pounds or greater, you will need to use the FAA's Section 333 exemption process (www.faa.gov/uas/beyond_the_basics/section_333) and register your UAS via the traditional paper route.

Under part 107, the maximum speed for a sUAS is 87 knots or 100 mph, with the assumption that higher speeds (like higher weight) equate to greater risks. Some commenters on the proposed part 107 rule stated that the limit should be lower, while others argued there shouldn't be a limit at all. The FAA determined the 87-knot speed risk was acceptable given that the limitation must be considered within the entire framework of rules. That is, the pilot must be able to balance the speed of the sUAS while also remaining within visual line-of-sight and cloud clearance limits, *and* operate in a manner that is not reckless or careless. There is also the expectation that a remote pilot planning to fly at the higher end of that speed limit would take the necessary precautions when performing the preflight inspection and implement the appropriate mitigations needed for that type of operation. That includes a review of emergency procedures and any potential hazards that may exist.

Like many of the operational parameters set in part 107, this is one that can be waived. The FAA will consider operation-specific mitigations to address additional risk posed by sUAS operations that exceed 87 knots.

Why is There a Ceiling?

Another limitation, which applies to both hobbyists and part 107 operations, is the 400-foot above ground level (AGL) ceiling. Since a majority of manned aircraft operations occur at 500 feet AGL and higher, this limit creates a 100-foot buffer zone between the two worlds. Exceptions include when aircraft takeoff and land and during helicopter and agricultural operations. The rule clearly states that sUAS operations should in no way interfere with aircraft operations at an airport and should always yield right of way to manned aircraft. To further boost this "see-and-avoid" protection, a remote pilot must also remain 500 feet below and 2,000 feet horizontally from clouds, operate with no less than three miles visibility, and know the location and flight path of his or her unmanned aircraft at all times.

One additional note on the altitude restriction: since part 107 operations commonly involve the inspection of structures or towers, the rules specify that a sUAS can fly within a 400-foot radius of a structure, including its highest point. For example, a remote pilot can fly at 1,600 feet AGL over a radio tower that is 1,200 feet high and still be legal.

In order to comply with the altitude and speed restrictions, remote pilots are encouraged to research some of the methods outlined in Advisory Circular (AC) 107-2, which include the use of an onboard GPS device that can detect both ground-speed and altitude. A more old-school method to eyeball 400 feet AGL is to imagine the height of a 30- to 40-story building or about two additional arm lengths above the Statue of Liberty.

Let's Talk About the Weather

Some remote pilots have asked why it's important to study weather when they're operating at such low altitudes and within line-of-sight. As we mentioned earlier, sUAS must be operated within the prescribed limits for visibility and cloud clearance to help with see-and-avoid protection. Having an understanding of weather is critical to ensuring these requirements are met. Further, a remote pilot must also be able to assess weather conditions as part of his or her required preflight actions. Atmospheric pressure and density, wind, and uneven surface heating are all factors that can affect sUAS performance and must be considered before flying. For example, convective currents, which can form over heated surfaces like a parking lot or plowed field, can adversely affect the controllability of a sUAS. Likewise, wind can also be affected by the types of terrain or structures that exist in the immediate operating area, sometimes causing abrupt changes in direction or speed. The appendices in AC 107-2 contain helpful information on how to assess these and other risk factors before flight.

Transparency on Visibility

Some stakeholders have raised the concern that certain limitations in part 107, like visibility, cloud clearance, and prohibited night operations, are more restrictive than what's required for part 91. It's true that part 91 does allow aircraft operating in Class G airspace to operate with one statute mile visibility and to keep clear of clouds. However, as the FAA has stated in the preamble of part 107, sUAS can be difficult for manned aircraft pilots to see due to their size. Additionally, unlike manned aircraft, sUAS are not required to carry equipment like traffic collision avoidance systems (TCAS) or Automatic Dependent Surveillance-Broadcast (ADS-B) that aid in collision avoidance. Because of these factors, the FAA has determined that more stringent requirements are necessary than those found in part 91.

Night operations under the 107 rule are prohibited, but the rule does allow sUAS operations during civil twilight, provided the proper anti-collision lights are used. The rationale here is that night operations are inherently more risky and may impede a remote pilot's ability to safely perform required tasks, such as yielding right-of-way. Also, remote pilots should be aware that the nighttime prohibition is waivable through a process by which the operator explains to the FAA how they will appropriately mitigate these risks to meet an acceptable level of safety.

Why Do I Need to Take a Test?

Since the part 107 rule was announced last June, the associated remote pilot knowledge test and certification requirements are areas that have generated a great deal of discussion and feedback. Some have asked why a knowledge test is even necessary when they're not flying a plane.

Remote pilots may not be flying an airplane, but by law, they are operating an aircraft. With that privilege comes the responsibility to learn and understand certain principles of airmanship as well as basic rules, regulations, and aeronautical knowledge areas that pertain to operating safely in the NAS. These include aviation weather, airspace classification, airport operations, and much more. The knowledge test is one way of assessing competency in these areas and preparing a remote pilot candidate for what to expect in the operating environment. Then there's the matter of meeting the statutory requirements of having an airman certificate when serving as an airman "in command … who navigates aircraft when under way," per Title 49 of the United States Code. Finally, the knowledge test provides the opportunity for the remote pilot candidate to verify his or her identity and age with a government-issued ID, as well as verify his or her English language proficiency at the testing center.

Incidentally, before the rule became effective, a sUAS operator seeking to fly commercially was required to use a special exemption process (Section 333) that required the operator to hold at least a sport pilot certificate. Part 107, which was designed as an enabling rule to reduce the cost of entry into the commercial UAS market, relieves the sport pilot requirement and thus reduces the time and money needed to obtain an airman certificate.

While they're not required to take the knowledge test to fly under 107, some active part 61 pilots believe their training and experience in the NAS should automatically qualify them to operate a sUAS commercially. The FAA certainly acknowledges the aeronautical knowledge and flight experience necessary to obtain a pilot certificate under part 61, but the agency does not believe that knowledge and experience alone will equip the certificate holder with all of the tools necessary to safely pilot a sUAS.

To help get a better perspective on why this is, have a look at your pilot certificate for a moment. Does it include a seaplane or multi-engine rating, or rotorcraft or balloon privileges? If not, would you be legal to fly these aircraft? The same principle applies to being a remote pilot in command. The FAA understands that flying a sUAS is not nearly as difficult as the practical skills required to transition to a rotorcraft, for example, but a basic knowledge of certain unique items is required to hold a remote pilot certificate. If a part 61 pilot certificate holder meets the flight review requirements of 14 CFR section 61.56, then he or she only needs to complete a part 107 online training course available at www.FAASafety.gov to become a certificated remote pilot.

That actually leads us to another question we've received, which is why a part 61 pilot needs to be current to obtain a remote pilot certificate. "For starters, this is required simply by the fact that there are several people who may have received a pilot certificate under part 61, but who may have done so 30, 40, or 50 years ago," says Malecha. "Aviation changes constantly, so this requirement ensures folks have a level of aviation knowledge that is up to date."

It's also worth pointing out that there are other ways to satisfy the section 61.56 requirements, besides having a flight review. Obtaining a new rating or certificate, completing a level in the FAASTeam's WINGS pilot proficiency program, or taking the regular checkride an air carrier pilot might receive through employment are all ways to satisfy the currency requirement.

Is That Your Final Answer?

Opinions may vary on the relevance of some of the operational requirements discussed here and with others found in part 107, but keep in mind that they were designed within the context of providing for the safety needs of the public, as well as all other users of the NAS.

"When part 107 was created, we contemplated risk management concepts and safety mitigation strategies as best we could with the most current technology and data," says Malecha. "At the same time, our aim was to impose the minimal burden necessary to ensure the safety and security of a small UAS operation." Because small UAS technology and operations will evolve so quickly, the rule has a waiver provision for those who can provide an acceptable level of safety with actions that go beyond the basic requirements. See the FAA's UAS waiver portal www.faa.gov/uas/request_waiver for more information.

One final note: This rulemaking is only one step in the FAA's broader effort to fully integrate all UAS operations into the NAS. With the rule now underway, the FAA will begin accumulating additional operational experience, and number-crunching the data that can be used to assist with the integration of higher-risk operations in the future.

See, numbers aren't all bad!

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We realize you may have other questions on areas that were not covered in this article. A full list of frequently asked questions is available on the FAA's UAS page: www.faa.gov/uas. Another good suggestion is to have a look at the preamble of the part 107 rule. It is lengthy, but it explains in great detail how the FAA considered and addressed the comments and concerns they received before 107 was published as a final rule. See the previously referenced UAS website for a direct link.