U.S. Department
of Transportation
Federal Aviation Administration

Office of the Chief Counsel

800 Independence Ave., S.W.
Washington, D.C. 20591

MAR 13 2018

Mr. Richard E. Jennings
112 Woodland Road
Fredericksburg, VA 22401

Dear Mr. Jennings:

This letter provides a response to your request for clarification concerning "what constitutes the not-to-exceed takeoff weight" for purposes of operations conducted in accordance with 14 CFR part 107—Small Unmanned Aircraft Systems. Specifically, you quote the definition of "small unmanned aircraft" codified at § 107.3, which states a small unmanned aircraft is one "weighing less than 55 pounds on takeoff, including everything that is on board or otherwise attached to the aircraft." Your request for clarification presents an example of a small unmanned aircraft that weighs 54 pounds prior to inflation of the helium envelope. You further state, "the helium envelope provides 30 pounds (ignoring the weight of the helium) of 'positive' buoyancy" and ask whether the small unmanned aircraft in such a case weighs 54 pounds or 24 pounds at takeoff.

In the *Operation and Certification of Small Unmanned Aircraft Systems*, 81 FR 42064 (June 28, 2016), the FAA finalized its definition of "small unmanned aircraft" to include aircraft that weigh less than 55 pounds *on takeoff*. The FAA noted other regulations use the term "on takeoff" to mean the "total takeoff weight." Id. at 42086 (referring to the definitions of "large aircraft," "light-sport aircraft," and "small aircraft" codified at 14 CFR § 1.1, because those definitions use the phrase "maximum takeoff weight" or "maximum certificated takeoff weight"). Based on the plain meaning of § 107.3, therefore, the small unmanned aircraft you describe would weigh at least 54 pounds on takeoff; the operator of the small UAS would need to consider the weight of the helium on board the aircraft in determining the total weight.

The FAA intended to apply part 107 to operations of small UAS that present only a minor risk to people. In promulgating part 107, the FAA stated the measurement of weight on takeoff ensures a risk-based application of part 107 to the most suitable category of low-risk small UAS operations; in this regard, "in the event of a crash, a heavier aircraft can do more damage to people and property on the ground than a lighter aircraft." 81 FR at 42086. As a result, in accordance with direction from Congress, the FAA stated that part 107 applies only to operations of small unmanned aircraft that weigh less than 55 pounds on takeoff. Pub. L. 112-95 § 331(6) (Feb. 14, 2012). The FAA clarified, "it is the total mass of the small unmanned aircraft that is important; the manner in which that mass is

achieved is irrelevant." 81 FR at 42086. As a result, the weight of the small unmanned aircraft on takeoff refers to the aircraft's total mass.

I understand your desire to use "positive buoyancy" as a means of decreasing the weight of the small unmanned aircraft. For purposes of § 107.3 and Public Law 112-95 § 331(6), however, the FAA does not consider such buoyancy in the determination of empty weight, or takeoff weight. In this regard, the FAA considers the weight of the gas on the small unmanned aircraft when determining the weight of the aircraft on takeoff. This conclusion that positive buoyancy does not affect the weight of the aircraft on takeoff is consistent with the plain language of § 107.3, as the definition of "small unmanned aircraft" therein does not mention buoyancy or other principles that may apply to lighter-than-air aircraft. The FAA's airship design criteria define a maximum heaviness, and a maximum lightness, which takes into account the buoyancy of the gas on board. However, these values are used for aircraft certification purposes in determining airship performance rather than the design weight. The FAA currently uses empty weight of the airship, without buoyancy, to define the weight of an airship.[1]

While the aforementioned discussion is relevant to the definition of "small unmanned aircraft" under part 107, it does not indicate the FAA should decline to consider positive buoyancy in other contexts. For example, while the definition of "small unmanned aircraft" is not subject to waiver, if an applicant seeks to apply for a waiver of an operational restriction under part 107, subpart D, the risk mitigation strategy could include how the buoyancy of a small unmanned aircraft assists in ensuring safety. As such, this interpretation is limited to the definition of small unmanned aircraft under part 107.

We appreciate your patience and trust that the above responds to your concerns. If you need further assistance, please contact my staff at (202) 267-3073. This letter has been prepared by Katie Inman, Operations Law Branch, Office of the Chief Counsel and coordinated with the General Aviation and Commercial Division of the Flight Standards Service.

Sincerely,

Lorelei D. Peter
Assistant Chief Counsel for Regulations, AGC-200

[1] FAA Airship Design Criteria, No. FAA-P-8110-2 (1995), *available at* https://www.faa.gov/aircraft/air_cert/design_approvals/airships/airships_regs/media/aceAirshipDesignCriteria.pdf.

REJ Aviation Services, Inc.
112 Woodland Rd.
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November 20, 2017

Ms. Lorelei Peter
Manager, AGC-200, 9th floor
800 Independence Ave., S.W.
Washington, DC 20591

Subject: Legal Interpretation of 14 CFR Part 107 definition of sUAS legal takeoff weight

Dear Ms. Peter;

It has come to my attention that there are various interpretations/opinions of what constitutes the not-to-exceed takeoff weight for a small unmanned aircraft system (sUAS) as defined in §107.3. The specific definition in question is "*Small unmanned aircraft* means an unmanned aircraft weighing less than 55 pounds on takeoff, including everything that is on board or otherwise attached to the aircraft."

The specific interest lies when the sUAS has the positive buoyancy characteristics of an airship incorporated into its design. For example, if the weight of the sUAS prior to inflation of the helium envelope is 54 pounds, and the helium envelope provides 30 pounds (ignoring the weight of the helium) of "positive" buoyancy does the sUAS weigh 54 pounds or 24 pounds at takeoff?

If I were to have the sUAS on a weight scale just prior to launch, the scale would read "24 pounds", not "54 pounds". Note that the vehicle, in its ready airworthiness state for takeoff, includes the helium buoyancy. Also, loss of buoyancy during flight would be recognizable as a non-normal condition, subject to an immediate landing by the remote pilot in command.

This question is important for two reasons; (1) so as not to be violated by an airworthiness inspector, and (2), to allow "trade space" to use the difference between the 54 pounds and 24 pounds to support design options and future customer needs, such as larger and heavier batteries for longer missions times, for example Homeland Security applications.

Your attention to this legal interpretation is greatly appreciated!

Sincerely;

Richard E. Jennings
President, REJ Aviation Services, Inc.