

DEPARTMENT OF TRANSPORTATION**Federal Aviation Administration****14 CFR Parts 11, 21, 43, and 107**

[Docket No.: FAA–2018–1087; Amdt. Nos. 11–64, 21–105, 43–51, 107–8]

RIN 2120–AK85

Operation of Small Unmanned Aircraft Systems Over People

AGENCY: Federal Aviation Administration (FAA) and Office of the Secretary of Transportation (OST), Department of Transportation (DOT).

ACTION: Final rule.

SUMMARY: This rule finalizes the February 13, 2019 notice of proposed rulemaking titled “Operation of Small Unmanned Aircraft Systems over People” (the NPRM). In June 2016, the FAA published remote pilot certification and operating rules for civil small unmanned aircraft weighing less than 55 pounds. Those rules did not permit small unmanned aircraft operations at night or over people without a waiver. The NPRM proposed to modify these regulations to permit routine operations of small unmanned aircraft over people and at night under certain conditions, in addition to changing the recurrent training framework, expanding the list of persons who may request the presentation of a remote pilot certificate, and making other minor changes.

DATES: This rule is effective March 16, 2021, except for the amendments to §§ 107.61, 107.63, 107.65, 107.73, and 107.74 which are effective March 1, 2021.

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I. Executive Summary*A. Purpose of the Final Rule*

This rule amends title 14 of the Code of Federal Regulations part 107 (14 CFR part 107) by permitting the routine operation of small UAS at night¹ or over people under certain conditions.² This rule is the next step in the FAA’s incremental approach to integrating UAS into the national airspace system (NAS), based on demands for increased operational flexibility and the experience the FAA has gained since it initially published part 107. This rule also builds on the performance-based regulatory philosophy established in part 107.

*B. Overview of the Final Rule***1. Operations Over People**

This rule allows expanded routine operations of small unmanned aircraft over people without a waiver or exemption under certain conditions. Prior to this final rule, small UAS operations over people were limited to operations over people who are directly participating in the operation, located under a covered structure, or inside a stationary vehicle. This rule expands the ability to conduct operations over people, provided that the operation meets the requirements of one of four operational categories. This rule establishes subpart D to part 107, which sets forth the aircraft eligibility and operating requirements for the four categories of operations over people.

¹ See § 107.29. An operation at night was defined as an operation conducted between the end of evening civil twilight and the beginning of morning civil twilight, as published in the Air Almanac, converted to local time.

² See § 107.39. An operation over people was established as one in which a small unmanned aircraft passes over any part of any person who is not directly participating in the operation and who is not located under a covered structure or inside a stationary vehicle.

The first three categories of operations over people, which the Agency proposed in the NPRM (84 FR 3856, Feb. 13, 2019), are based on the risk of injury they present to people on the ground. In response to public comments, this rule also establishes a fourth category, which is based on the small unmanned aircraft having an airworthiness certificate. The FAA maintains the prohibition on open-air assemblies for Category 3, as proposed. Additionally, in response to comments, remote pilots are prohibited from operating a small unmanned aircraft as a Category 1, 2, or 4 operation in sustained flight over open-air assemblies unless the operation meets the requirements of § 89.110 or § 89.115(a) (remote identification operational and broadcast requirements for standard remote identification unmanned aircraft or unmanned aircraft with remote identification broadcast modules). To conduct operations involving sustained flight over open-air assemblies for Category 1, 2, and 4, remote pilots must voluntarily comply with the operating and broadcast requirements of § 89.110 or § 89.115(a) prior to the operational compliance date of the final rule for Remote Identification of Unmanned Aircraft. Following the operational compliance date for the final rule for Remote Identification of Unmanned Aircraft, all unmanned aircraft required to register must meet the operating requirements of the remote identification rule. Sustained flight over an open-air assembly includes hovering above the heads of persons gathered in an open-air assembly, flying back and forth over an open-air assembly, or circling above the assembly in such a way that the small unmanned aircraft remains above some part the assembly. ‘Sustained flight’ over an open-air assembly of people in a Category 1, 2, or 4 operation does not include a brief, one-time transiting over a portion of the assembled gathering, where the transit is merely incidental to a point-to-point operation unrelated to the assembly. Examples of open-air assemblies are described later in the preamble in Section VI.E.1. The FAA may waive compliance with this provision as appropriate. However, conditions of any waiver issued may require the operator to notify local law enforcement prior to the operation.

a. Category 1 Operations

Category 1 operations over people are permitted using a small unmanned aircraft that: (a) Weighs 0.55 pounds or less, including everything that is on board or otherwise attached to the aircraft at the time of takeoff and

throughout the duration of each operation; and (b) does not contain any exposed rotating parts that would lacerate³ human skin on impact with a human being. Remote pilots are responsible for determining that their small unmanned aircraft does not exceed the weight threshold and ensuring that their small unmanned aircraft does not contain any exposed rotating parts that would lacerate human skin. Furthermore, no remote pilot in command may operate a small unmanned aircraft as a Category 1 operation in sustained flight over open-air assemblies unless the operation meets the applicable remote identification requirements. The requirements for Category 1 operations over people are discussed in Section V of this preamble.

b. Category 2 Operations

Category 2 provides performance-based eligibility and operating requirements when conducting operations over people using unmanned aircraft that weigh more than 0.55 pounds but do not have an airworthiness certificate under part 21. To be eligible for Category 2 operations, a small unmanned aircraft must comply with the following three safety requirements.⁴ First, the small unmanned aircraft must be designed, produced, or modified such that it will not cause injury to a human being that is equivalent to or greater than the severity of injury caused by a transfer of 11 foot-pounds (ft-lbs) of kinetic energy

³ As explained in the NPRM, the FAA’s decision to ensure protection of skin from lacerating injuries is similar to the logic the National Highway Traffic Safety Administration employs. See Federal Motor Vehicle Safety Standards: Glazing Materials, 65 FR 44710, 44711 (July 19, 2000) (explaining NHTSA’s decision to assess whether “advanced glazings” are more likely to cause lacerations than “current glass,” and stating, “[a]lthough facial lacerations injuries are relatively minor (AIS 1 or 2), they . . . can be disfiguring”).

⁴ The Agency used the term “safety level” in the NPRM to refer to the “limitation of injury severity caused by transfers of kinetic energy from a rigid object, exposed rotating parts, or safety defects.” The term referred generally to the grouping of these three safety requirements for Categories 2 and 3 operations over people. Proposed § 107.125, “Means of Compliance,” also contained the term “safety level,” to require “justification, including any substantiating material, showing the means of compliance establishes achievement of or equivalency to the safety level identified in §§ 107.115(b)(1) and 107.120(b)(1).”

Since “safety level” implies a number or threshold on a scale as opposed to an overall level of safety afforded to the public based on a set of safety regulations, the FAA has decided instead to use the term “safety requirements” applicable to the specific category of operation. Further, the FAA clarifies that a means of compliance need only address the limitation of injury severity caused by impacts with small unmanned aircraft and exposed rotating parts capable of lacerating skin.

upon impact from a rigid object. A small unmanned aircraft will only be eligible to conduct Category 2 operations if the person submitting the declaration of compliance (the applicant) can demonstrate that the injury resulting from an impact between the small unmanned aircraft and a person on the ground is less than this injury severity limit.

Second, the small unmanned aircraft must not contain any exposed rotating parts that would lacerate human skin on impact with a human being. Third, the small unmanned aircraft must not contain any safety defects.

As a point of clarification, this rule uses the term “applicant” to refer to the person⁵ who submits a declaration of compliance to the FAA for review and acceptance. An applicant for a declaration of compliance may be anyone who designs, produces, or modifies a small unmanned aircraft.⁶

Furthermore, a small unmanned aircraft eligible to conduct Category 2 operations must: (1) Display a label on the aircraft indicating eligibility to conduct Category 2 operations; (2) have current remote pilot operating instructions that apply to the operation of the small unmanned aircraft; and (3) be subject to a product support and notification process. The eligibility requirements for Category 2 are discussed in Section VI.A. of this preamble.

This rule also sets forth certain operating requirements for remote pilots who conduct Category 2 operations. Specifically, a remote pilot must use a small unmanned aircraft that is: (1) Eligible for Category 2 operations; (2) listed on an FAA-accepted declaration of compliance as eligible for Category 2 operations; and (3) labeled as eligible to conduct Category 2 operations. Additionally, no remote pilot in command may operate a small unmanned aircraft as a Category 2 operation in sustained flight over open-air assemblies unless the operation meets the remote identification operational and broadcast requirements for standard remote identification unmanned aircraft or unmanned aircraft with remote identification broadcast modules even prior to the operational compliance date for remote

⁵ As defined in § 1.1, a person is an individual, firm, partnership, corporation, company, association, joint-stock association, or governmental entity. It includes a trustee, receiver, assignee, or similar representative of any of them.

⁶ As explained in Section VI.C., in the final rule the FAA has replaced the term “manufacturer” with applicant in order to make it clear that anyone may submit a declaration of compliance to the FAA, provided they can meet all the requirements of a declaration of compliance.

identification. The operating requirements for Category 2 are discussed in Section VI.E. of this preamble.

c. Category 3 Operations

Similar to Category 2, to be eligible for Category 3 operations a small unmanned aircraft must meet certain safety requirements. Although Category 3 operations are subject to a higher injury severity limit than Category 2, the risk of injury to an individual is mitigated by applying operating limitations.

To be eligible for Category 3 operations, a small unmanned aircraft must comply with the following three safety requirements. First, the small unmanned aircraft must be designed, produced, or modified such that it will not cause injury to a human being that is equivalent to or greater than the severity of injury caused by a transfer of 25 ft-lbs of kinetic energy upon impact from a rigid object. Second, the small unmanned aircraft must not contain any exposed rotating parts that would lacerate human skin on impact with a human being. Third, the small unmanned aircraft must not contain any safety defects.

Furthermore, a small unmanned aircraft eligible to conduct Category 3 operations must: (1) Display a label on the aircraft indicating eligibility to conduct Category 3 operations; (2) have current remote pilot operating instructions that apply to the operation of the small unmanned aircraft; and (3) be subject to a product support and notification process. The eligibility requirements for Category 3 are discussed in Section VI.A. of this preamble.

This rule also sets forth certain operating requirements for remote pilots who conduct Category 3 operations. Specifically, a remote pilot must use a small unmanned aircraft that is: (1) Eligible for Category 3 operations; (2) listed on an FAA-accepted declaration of compliance; and (3) labeled as eligible to conduct Category 3 operations. Category 3 also includes additional operating limitations not applicable to Category 2. These operating limitations are necessary to mitigate the increased risk of injury associated with the higher injury severity limit allowed for small unmanned aircraft conducting Category 3 operations. Specifically, Category 3 operations are prohibited over open-air assemblies of human beings and are only permitted if: (1) The operation is within or over closed- or restricted-access sites and everyone within that site has been notified that a small

unmanned aircraft may fly over them; or (2) the small unmanned aircraft does not maintain sustained flight over a person not directly participating in the operation or located under a covered structure or inside a stationary vehicle that can provide reasonable protection from a falling small unmanned aircraft. Sustained flight includes hovering above any person's head, flying back and forth over an open-air assembly, or circling above an uninvolved person in such a way that the small unmanned aircraft remains above some part of that person. Additionally, a closed- or restricted-access site could be an area that contains physical barriers, personnel, or both, as appropriate, to ensure no inadvertent or unauthorized access can occur. The operating requirements for Category 3 operations over people are discussed in Section VI.E. of this preamble.

d. Demonstrating Compliance With Safety Requirements

Before a small unmanned aircraft can be used for Category 2 or Category 3 operations, this rule requires the applicant to declare compliance with the applicable injury severity limit and the exposed rotating parts prohibition. The rule also requires the applicant to declare the small unmanned aircraft does not contain any safety defects and is subject to a product support and notification process. The applicant will be required to submit to the FAA a declaration of compliance in which the applicant declares it has demonstrated, using an FAA-accepted means of compliance, that the small unmanned aircraft, or specific configurations of that aircraft, satisfies the injury severity limit and exposed rotating parts prohibition. This rule also includes a record retention requirement for a person who either submits a declaration of compliance or a means of compliance. The FAA uses the term "means of compliance" to refer to the method the applicant uses to show that its small unmanned aircraft would not exceed the applicable injury severity limit on impact with a human being and does not contain any exposed rotating parts that could cause lacerations. The FAA must accept a means of compliance before an applicant can rely on it to declare compliance with the requirements of this rule.

This rule allows anyone to develop and submit to the FAA for acceptance any means of compliance that fulfills the Category 2 or Category 3 requirements. In the NPRM, the FAA provided a means of compliance for small unmanned aircraft to demonstrate that they do not have exposed rotating

parts that could lacerate human skin on impact with a human being. This means of compliance is not applicable to all types of small unmanned aircraft. The FAA anticipates that industry will develop and submit for FAA acceptance more comprehensive means of compliance that give credit for innovative materials and designs. The requirements related to means of compliance are discussed in Section VI.B. of this preamble.

This rule also requires an applicant to provide remote pilot operating instructions on sale or transfer of the small unmanned aircraft, or use of the aircraft by someone other than the applicant. The applicant must also establish and maintain a process to notify the public and FAA of any safety defects that cause the small unmanned aircraft to no longer meet the requirements of Category 2 or Category 3.

e. Category 4 Operations

The FAA received comments in response to the NPRM that criticized the Agency for insufficiently considering the reliability of the unmanned aircraft in determining whether a small unmanned aircraft could be operated safely over people. The FAA also received comments stating that if small unmanned aircraft were issued an airworthiness certificate, that certification should be sufficient to permit the small unmanned aircraft to operate over people. The FAA agrees that demonstrable reliability of the small unmanned aircraft is an alternative path for operations over people. Therefore, this final rule includes a fourth category to allow small unmanned aircraft issued an airworthiness certificate under part 21⁷ to operate over people in accordance with part 107, so long as the operating limitations specified in the approved Flight Manual or as otherwise specified by the Administrator, do not prohibit operations over human beings.⁸

⁷ See 14 CFR part 21, which provides the procedural requirements for airworthiness certification.

⁸ Small unmanned aircraft that receive an airworthiness certificate from another country will be treated in the same manner as other aircraft with a foreign airworthiness certificate. Currently, however, such aircraft will not be able to obtain recognition based on their certifying authority meeting an international standard because no international standards currently exist for the airworthiness certification of small unmanned aircraft. Individuals who wish to operate such aircraft in accordance with Category 4 will need to deregister their aircraft from the foreign authority's registry, and the FAA must receive notification of deregistration from the foreign authority. These individuals must also register their aircraft in the United States, apply for and receive an

Additionally, no remote pilot in command may operate a small unmanned aircraft as a Category 4 operation in sustained flight over open-air assemblies unless the operation meets the remote identification operational and broadcast requirements for standard remote identification unmanned aircraft or unmanned aircraft with remote identification broadcast modules even prior to the operational compliance date for remote identification.

To preserve the continued airworthiness of the small unmanned aircraft and continue to meet a level of reliability that the FAA finds acceptable for flying over people in accordance with Category 4, certain additional requirements apply. The person performing any maintenance, preventive maintenance, or alterations must use the methods, techniques, and practices prescribed in the manufacturer's current maintenance manual or Instructions for Continued Airworthiness that are acceptable to the Administrator, or other methods, techniques, and practices acceptable to the Administrator. In addition, the person must have the knowledge, skill, and appropriate equipment to perform the work. The owner must, unless they have entered into an agreement with another entity to operate the small unmanned aircraft, maintain records of maintenance performed on the aircraft as well as records documenting the status of life-limited parts, compliance with airworthiness directives, and inspection compliance of the small UAS. The requirements for Category 4 operations over people are discussed in Section VII of this preamble.

2. Operations Over Moving Vehicles

While small unmanned aircraft operations over people in moving vehicles were prohibited in § 107.39, the NPRM proposed to add a new section that made it clear that such operations were expressly prohibited. The FAA considered, however, allowing the operation of small unmanned aircraft over people in moving vehicles without a waiver and sought public comment on this proposal. After considering the comments received, the FAA finds that operations over people in moving

airworthiness certificate issued under part 21, and operate the small UAS in accordance with the operating limitations, which must not prohibit operations over people or over moving vehicles.

vehicles can be conducted safely, subject to certain conditions. Therefore, this rule allows small unmanned aircraft operations over people inside moving vehicles, subject to the following conditions. First, the small unmanned aircraft operation must either meet the requirements for a Category 1, 2, or 3 operation under the new subpart D of part 107 or meet the requirements for Category 4 small unmanned aircraft. Second, for Category 1, 2, or 3, the operation must meet one of the following conditions: (1) The small unmanned aircraft must be within or over a closed- or restricted-access site where any human being located inside a moving vehicle within the closed- or restricted-access site is on notice that a small unmanned aircraft may fly over them; or (2) if the operation is not within or over a closed- or restricted-access site, the small unmanned aircraft must not maintain sustained flight over moving vehicles. The requirements for operations over moving vehicles are discussed in Section VIII of this preamble.

3. Operations at Night

This rule allows routine operations of small UAS at night under two conditions. First, the remote pilot in command must complete a current initial knowledge test or recurrent training, as applicable, to ensure familiarity with the risks and appropriate mitigations for nighttime operations. Second, the small unmanned aircraft must have lighted anti-collision lighting visible for at least 3 statute miles that has a flash rate sufficient to avoid a collision. The requirements for operations at night are discussed in Section IX of this preamble.

4. Other Changes to Part 107

In addition to permitting routine operations over people and at night, this rule also amends part 107 to address the following subjects.

Remote Pilot Testing and Training Requirements

Part 107 previously required initial small UAS remote pilot applicants and small UAS remote pilots to complete either an initial aeronautical knowledge test or a recurrent aeronautical knowledge test within the previous 24 calendar months prior to operating a small UAS. This final rule revises these regulations to require recurrent training

instead of a recurrent aeronautical knowledge test. This final rule maintains, as proposed, the provision that people who hold a part 61 pilot certificate (other than holders of a student pilot certificate) and have completed a flight review within the previous 24 calendar months in accordance with § 61.56 may continue to complete either initial training or recurrent training. The final rule also harmonizes the subjects covered in the testing and training. The FAA is updating the related testing and training materials to add new information about night operations. The changes to the remote pilot testing and training requirements are discussed in Section X of this preamble.

Inspection, Testing, and Demonstration of Compliance

Section 107.7 contains certain requirements pertaining to inspection, testing, and demonstrations of compliance. In accordance with § 107.7(a), remote pilots must present their remote pilot certificate and identification on request from the Administrator. This rule extends that obligation to require remote pilots to present their remote pilot certificate and identification on request from: The Administrator; an authorized representative of the National Transportation Safety Board (NTSB); any Federal, State, or local law enforcement officer; and any authorized representative of the Transportation Safety Administration (TSA). In addition, the final rule requires that the person operating the small UAS must have their remote pilot certificate and identification in their possession when operating.

This rule also adds requirements to § 107.7 for any person holding an FAA-accepted declaration of compliance under subpart D. Under this rule, any person holding an FAA-accepted declaration of compliance must, on request, provide to the FAA such declaration and any other document, record, or report required to be kept in accordance with the regulations of this chapter. Furthermore, this rule allows the FAA to inspect the person's facilities, technical data, and small unmanned aircraft covered by the declaration of compliance to determine compliance. The amendments to § 107.7 are discussed in Section XI.A. of this preamble.

The FAA has used the terms “unmanned aircraft system” and “UAS” broadly when discussing UAS regulations. While this term is correct under many circumstances, it is imprecise in others. A small unmanned aircraft is simply the aircraft itself, while “unmanned aircraft system” refers also to the aircraft, the ground control station, communication links, and other components. In the case of operating over people, the remote pilot flies the aircraft over people, not the ground control station. In an effort to remediate any confusion the use of the term “small UAS” may have caused, this final rule uses the term “small unmanned aircraft” in any section discussing operations over people and moving vehicles, with the exception of where that term overlaps with existing requirements in part 107 that use “small UAS.” For example, the rule refers to small unmanned aircraft when discussing the requirements to operate over people and moving vehicles, but refers to small UAS when discussing the remote pilot operating instructions, as the regulations that refer to remote pilot responsibilities use “small UAS.” Additionally, the FAA maintained instances where “small UAS” was used

by commenters or in existing references (e.g., UAS Sightings Report).

This rule also makes minor clarifying amendments to several other sections of part 107, as described in Section XI of this preamble. In addition, to improve clarity, the FAA also made some organizational changes to the proposed regulatory sections, including renumbering of sections and restructuring the regulatory text.

C. Summary of Benefits and Costs

The FAA analyzed the impacts of this rule and expects the benefits to exceed the costs. The rule enables further operations of small UAS that will benefit the economy and facilitate innovation and growth across a variety of sectors, such as construction, education, infrastructure inspection, insurance, marketing, and event photography. Operations currently allowed under part 107 will become less onerous and, in many instances, more efficient with this rule because, in general, remote pilots would not necessarily need to avoid flying over people or clear an area of non-participating people in advance of flying.⁹

The costs of this rule include the FAA converting the administration of tests to administration of training;

manufacturers conducting testing, analysis, or inspection to comply with the requirements of manufacturing a small unmanned aircraft for operations over people; and remote pilots studying additional subject matter related to activities enabled by the final rule. The cost savings of this rule include relief provided through online training for remote pilots and relief from time the FAA expends in processing waivers.

The FAA bases the analysis of this rule on a fleet forecast for small unmanned aircraft that includes base, low, and high scenarios. Accordingly, this analysis provides a range of net impacts from low to high based on these forecast scenarios. The FAA considers the base scenario as the primary estimate of net impacts of this rule. For the primary estimate, over a 10-year period of analysis this rule will result in present value net cost savings (savings less costs) of \$688.27 million at a three percent discount rate, with annualized net cost savings of \$80.69 million. At a seven percent discount rate, this rule will result in present value net cost savings of \$551.31 million, with annualized net cost savings of \$78.49 million. The following table summarizes the quantified costs and cost savings of this rule for the three forecast scenarios.

TABLE 1—COSTS AND COST SAVINGS OF FINAL RULE
[\$millions]*

Forecast scenario	10-Year present value (3%)	Annualized (3%)	10-Year present value (7%)	Annualized (7%)
<i>Base Scenario—Primary Estimate:</i>				
Costs	146.44	17.17	119.98	17.08
Cost Savings	(834.71)	(97.85)	(671.28)	(95.58)
Net Cost Savings	(688.27)	(80.69)	(551.31)	(78.49)
<i>Low Scenario:</i>				
Costs	102.96	12.07	85.32	12.15
Cost Savings	(616.60)	(72.28)	(501.51)	(71.40)
Net Cost Savings	(513.64)	(60.21)	(416.19)	(59.26)
<i>High Scenario:</i>				
Costs	207.17	24.29	169.27	24.10
Cost Savings	(1,158.84)	(135.85)	(927.41)	(132.04)
Net Cost Savings	(951.67)	(111.56)	(758.14)	(107.94)

* Table notes: Columns may not sum to total due to rounding. Savings are shown in parenthesis to distinguish from costs. Estimates are provided at three and seven percent discount rates per Office of Management and Budget (OMB) guidance.

The operation of small unmanned aircraft over people may result in an increased safety risk. Although the FAA expects the probability of injuries that may occur from an operation of a small unmanned aircraft over people to be small, when that low probability is

multiplied by an increased number of operations, some additional risk of injury exists. This final rule’s performance-based requirements establish four categories of small unmanned aircraft operations defined primarily by injury severity level posed.

Compliance with the manufacturer and operating requirements that apply to these categories would mitigate the level of risk when operating over people.

⁹ The rule does not permit Category 3 operations over open-air assemblies of people. Operations that

occur pursuant to Category 1 and Category 2, however, would not be subject to this prohibition.

II. Legal Authority

The primary authority for this rulemaking is based on 49 U.S.C. 44807, which permits the Secretary of Transportation to determine whether “certain unmanned aircraft systems may operate safely in the national airspace system.” Section 44807 directs the Secretary to use a risk-based approach in making such determinations.¹⁰ Section 44807(b) establishes a specific list of factors the Secretary must consider in determining which types of UAS may operate safely: Size, weight, speed, operational capability, proximity to airports and populated areas, operation over people, operation within visual line of sight, or operation during the day or night. The Secretary must determine, based on these factors, which types of UAS do not create a hazard to users of the NAS or the public. If the Secretary determines that certain unmanned aircraft systems may operate safely in the NAS, then the Secretary must “establish requirements for the safe operation of such aircraft systems in the national airspace system.” 49 U.S.C. 44807(c). Although the authority of the Secretary to make determinations under Section 44807 whether certain unmanned aircraft systems may operate safely in the national airspace system terminates on September 30, 2023, the statute itself remains in effect after that date as a continuing source of specific authority for part 107.

Furthermore, this rulemaking is promulgated pursuant to 49 U.S.C. 40103(b)(1) and (2), which directs the FAA to issue regulations: (1) To ensure the safety of aircraft and the efficient use of airspace; and (2) to govern the flight of aircraft for purposes of navigating, protecting and identifying aircraft, and protecting individuals and property on the ground. In addition, 49 U.S.C. 44701(a)(5) charges the FAA with promoting safe flight of civil aircraft by prescribing regulations the FAA finds necessary for safety in air commerce and national security.

This rulemaking is also promulgated under 49 U.S.C. 44703(a), which

requires the Administrator to prescribe regulations for the issuance of airman certificates when the Administrator finds, after investigation, that an individual is qualified for, and physically able to perform the duties related to the position authorized by the certificate.

Finally, this rulemaking is also being issued consistent with DOT’s regulatory policy which requires that DOT regulations “be technologically neutral, and, to the extent feasible, they should specify performance objectives, rather than prescribing specific conduct that regulated entities must adopt.”¹¹

III. Background

As technology improves and the utility of small UAS for activities that previously required manned aircraft increases, the FAA anticipates an increased demand for flexibility in small UAS operations. This rulemaking is one of a number of regulatory steps the FAA is taking to allow for this growth. This rule permits small unmanned aircraft operations to operate over people, moving vehicles, and at night, allowing greater operational flexibility for uses such as motion picture filming, newsgathering, law enforcement, aerial photography, sports photography, and construction or surveying. This rule enables further operations integration of small UAS, which will benefit the economy by increasing opportunities for small UAS operations.

The FAA received over 900 comments in response to publication of the NPRM on February 13, 2019. The FAA considered the comments carefully, as described in this final rule.¹²

A. Related FAA and DOT Actions

The FAA is incorporating the operation of small UAS into the NAS

¹¹ 49 CFR 5.5(e).

¹² 84 FR 3856. Also on February 13, 2019, the FAA published two UAS-related rulemakings, in addition to the Operation of Small UAS Over People NPRM: The External Marking of Small Unmanned Aircraft Interim Final Rule (84 FR 3669) and the Safe and Secure Operations of Small Unmanned Aircraft Systems Advance Notice of Proposed Rulemaking (84 FR 3732).

The FAA notes that, as three rules were published related to UAS on the same day, a number of commenters submitted comments regarding a particular rule to another rule’s docket. Where a comment submitted to one docket clearly addressed only provisions contained in another rule, the FAA moved that comment to the appropriate docket and addressed it in the appropriate rule. Where a comment submitted to only one docket addressed more than one rule, the FAA left that comment in the docket to which the commenter had originally submitted the comment. The FAA has ensured that all comments addressing topics in each rule have been appropriately considered, regardless of the docket to which the comment was originally submitted.

using a phased, incremental, and risk-based approach.¹³ In 2012, Congress passed the FAA Modernization and Reform Act of 2012 (Pub. L. 112–95). Section 333 of Public Law 112–95 directed the Secretary to determine which types of UAS do not create a hazard to users of the NAS or the public or pose a threat to national security. Based on such findings, Congress directed the Secretary to establish requirements for the safe operation of such UAS.¹⁴

1. Registration and Marking Requirements for Small Unmanned Aircraft

On December 16, 2015, the FAA published the Registration and Marking Requirements for Small Unmanned Aircraft interim final rule (Registration Rule).¹⁵ The Registration Rule established, at 14 CFR part 48, a streamlined, web-based registration system for small unmanned aircraft. The FAA provided this process as an alternative to the registration requirements for manned aircraft found in 14 CFR part 47. The Registration Rule required all small UAS owners to register under part 47 or part 48 by March 31, 2016.

The Registration Rule also established marking requirements for small unmanned aircraft. In accordance with that rule, all small unmanned aircraft must display a unique identifier. Each small UAS operated in accordance with part 107 must display a unique registration number, visible on inspection of the small unmanned aircraft. Additionally, the FAA published the External Marking Requirement for Small Unmanned Aircraft interim final rule (External Marking Rule) on February 13, 2019.¹⁶ The External Marking Rule, effective February 25, 2019, requires all small unmanned aircraft owners display the FAA registration number on an external surface of the aircraft, rather than enclosing it in a compartment of the aircraft.

2. Operation and Certification of Small Unmanned Aircraft Systems

On June 28, 2016, the FAA and DOT jointly issued the Operation and Certification of Small Unmanned Aircraft Systems (hereinafter, “2016

¹³ For more information regarding the operation of small UAS, see <http://www.faa.gov/uas>.

¹⁴ Section 347 of Public Law 115–254 repealed Section 333, but replaced the relevant substantive provisions, codified at 49 U.S.C. 44807.

¹⁵ 80 FR 78594.

¹⁶ 84 FR 3669.

¹⁰ The predecessor to 49 U.S.C. 44807 was section 333 of Pub. L. 112–95 (section 333), which the Agency identified as the source of authority for 14 CFR part 107. The FAA Reauthorization Act of 2018 clarifies that, notwithstanding the repeal of section 333, all determinations and regulations issued under section 333 would continue in effect until modified or revoked. Section 44807(d) states the authority to make determinations under 49 U.S.C. 44807 will terminate on September 30, 2023. By this final rule, which the Agency publishes before the aforementioned sunset date, the Secretary determines that the small unmanned aircraft to which part 107 applies may continue to operate pursuant to part 107.

final rule”).¹⁷ That rule, codified at 14 CFR part 107, allows small UAS operations without requiring airworthiness certification, exemption, waiver, or certificate of authorization (COA). Part 107 sets forth a framework of operational rules to permit routine civil operation of small UAS in the NAS in a safe manner.

To mitigate risk to people on the ground and other users of the airspace, the 2016 final rule limited small UAS to daylight and civil twilight operations, confined areas of operation, and visual line-of-sight operations. The 2016 final rule also established airspace restrictions, remote pilot certification, visual observer requirements that apply when a remote pilot in command opts to use a visual observer, and operating limitations, to maintain the safety of the NAS and ensure small UAS do not pose a threat to national security. Finally, the 2016 final rule included a waiver provision, which allows individual operations to deviate from several applicable operating limitations if the Administrator finds the applicant could safely conduct the proposed operation under the terms of the certificate of waiver.

3. Secure Operations of Small Unmanned Aircraft Systems

The FAA has engaged in extensive outreach with Federal, State, local, and tribal law enforcement entities on the subject of small UAS operations. The FAA recognizes law enforcement officials are often in the best position to detect and deter unsafe and unauthorized UAS operations. The FAA works closely with these agencies to provide information regarding the evidence the FAA needs when taking enforcement actions and to share information in a timely manner.

As part of the FAA’s commitment to working with security partners, the Agency published the Safe and Secure Operations of Small Unmanned Aircraft Systems advance notice of proposed rulemaking (ANPRM) on February 13, 2019.¹⁸ In that publication, the FAA sought comment on whether, and in what circumstances, the Agency should promulgate new rules to require stand-off distances, additional operating and performance restrictions, the use of UAS Traffic Management (UTM), and payload restrictions. The FAA also sought comment on whether it should prescribe design requirements and require unmanned aircraft to have critical safety systems. The FAA

received over 1,800 comments in response to the ANPRM.

In addition, the FAA is establishing requirements for the remote identification of UAS. On May 4, 2017, the FAA convened an Aviation Rulemaking Committee (ARC) of industry stakeholders and observers from relevant government agencies to provide recommendations regarding technologies available for remote identification and tracking of UAS (UAS-ID ARC). The UAS-ID ARC’s objectives included identifying and recommending emerging technology as well as identifying requirements for fulfilling security and public safety needs of law enforcement, homeland defense, and national security communities. The UAS-ID ARC’s members included experts with knowledge and experience in electronic data capture, law enforcement, and public safety, among other areas. The working groups presented their findings and conclusions to the full UAS-ID ARC for consideration in making its recommendations. The UAS-ID ARC submitted its report to the FAA on September 30, 2017.¹⁹

The FAA published the Remote Identification of Unmanned Aircraft Systems NPRM (Remote ID NPRM) on December 31, 2019,²⁰ in which the FAA discussed the ARC’s report.²¹ The Remote Identification of Unmanned Aircraft Systems final rule (Remote ID final rule) is published in the same edition of the **Federal Register** as this final rule.

4. Limited Recreational Operations of Unmanned Aircraft

This rule amends part 107 and applies only to operations conducted under that part. Although this rule does not apply to operations that flyers conduct under 49 U.S.C. 44809 (“Exception for Limited Recreational Operations of Unmanned Aircraft”), the FAA received comments concerning recreational operations. This section establishes an “exception for limited recreational operations of unmanned aircraft”. It allows a person to fly an unmanned aircraft without specific certification or operating authority if the operation fulfills certain criteria.

¹⁹ The UAS Identification and Tracking Aviation Rulemaking Committee charter is available at https://www.faa.gov/news/updates/media/UAS_ID_and_Tracking_ARC_Charter.pdf. The UAS ID and Tracking ARC report is available at https://www.faa.gov/regulations_policies/rulemaking/committees/documents/media/UAS%20ID%20ARC%20Final%20Report%20with%20Appendices.pdf.

²⁰ 84 FR 72438.

²¹ 84 FR at 72456.

B. Micro UAS Aviation Rulemaking Committee

On February 24, 2016, the FAA chartered the Micro UAS Aviation Rulemaking Committee (ARC) (hereinafter “the Micro ARC”) on the subject of enabling operations of small UAS over people. On April 2, 2016, the Micro ARC provided a final report with recommendations²² to establish four categories for operations over people with small UAS, defined primarily by level of risk of injury posed. For each category, the Micro ARC recommended the FAA adopt a risk threshold that correlates to either a weight or an impact energy equivalent. The Micro ARC also recommended implementation of performance-based standards and operational restrictions to the extent necessary to minimize the risks associated with the operations.²³

IV. Operations Over People: General Discussion

This final rule allows routine operations over people in accordance with part 107 and under certain conditions without a waiver or exemption.²⁴ Consistent with the FAA’s proposal, the requirements for routine operations over people vary depending on the level of risk that operations of small unmanned aircraft present to people on the ground. The FAA proposed three categories of permissible operations over people based on the risk of injury they present: Category 1, Category 2, and Category 3. This rule finalizes those three categories as described in the following sections and adds a fourth category to permit operations over people that occur with small unmanned aircraft that have an airworthiness certificate. The following sections describe the requirements and limitations that mitigate the risks associated with operations over people. The discussion below also includes responses to comments received to the NPRM.

²² A copy of the Micro ARC’s final report has been placed in the docket for this rulemaking.

²³ 84 FR 3856, 3866–3867.

²⁴ Title 14 CFR 107.200 states that the Administrator may issue a certificate of waiver authorizing a deviation from any regulation specified in § 107.205 if the Administrator finds that a proposed small UAS operation can safely be conducted under the terms of that certificate of waiver. Section 107.205(g) currently lists the operations over people prohibition as a regulation that is subject to waiver. The Administrator also maintains authority to issue exemptions from regulations promulgated under 49 U.S.C. 44701(a) or (b) or any of sections 44702–44706 of title 49, if the Administrator finds the exemption is in the public interest. Title 14 CFR 11.81–11.103 details the process for obtaining such an exemption.

¹⁷ 81 FR 42064.

¹⁸ 84 FR 3732.

A. Safety Concerns

1. Risks of Operation

Some commenters expressed concern that the proposed rule was too permissive, not enforceable, and would have a negative effect on public safety. Chicago's First Lady Cruises, the International Association of Amusement Parks and Attractions (IAAPA), and numerous individuals expressed concerns about the proposed rulemaking because of the potential risks. The National Agricultural Aviation Association (NAAA) opposed allowing operations over people without a waiver because there is a lack of safety data, among other reasons addressed elsewhere in this rule. The commenter was concerned that the widespread use of small UAS has caused several incidents over the last two years, and allowing operations over people to become routine would open the floodgates to operators conducting unsafe operations. A few commenters opposed the proposed rule because they believe there is no way to properly enforce the rule. One commenter opposed operations over crowds, towns, and cities because of the lack of redundancy and safety infrastructure. Another individual cited unmanned aircraft interference with aerial firefighting activities as an example of the negative impact. One commenter noted a single unmanned aircraft can damage an aircraft or structure and expressed concern about unskilled remote pilots.

Between 2016 and September 2020, the Agency has issued 175 waivers for operations over people. The FAA issued these waivers based on a wide range of safety cases and has utilized available research, including the ASSURE reports. None of the 175 operations over people waiver holders have reported injuries to persons on the ground, nor have they reported damage to any property on the ground in excess of \$500.00, events that are required to be reported by § 107.9. Considering the safety record of these waivers for operations over people, the available safety data supports the determination that operations over people can occur safely in accordance with this rule.

Compliance with manufacturer and operating requirements as established for Categories 1, 2, and 3 and the airworthiness certification requirements of Category 4 will mitigate the safety risks of operating over people to a level the FAA finds acceptable. Moreover, the FAA has a carefully structured Compliance Program and an Enforcement Program to handle all statutory and regulatory violations,

including violations of part 107. The FAA establishes regulatory standards to ensure safe operations in the NAS. The FAA's system is largely based on, and dependent on, voluntary compliance with regulatory standards. FAA personnel use compliance, administrative, or legal enforcement actions to uphold the public's safety interest in ensuring that all regulated persons conform their conduct to statutory and regulatory requirements. FAA Order 8000.373A, *FAA Compliance Program*, and Order 2150.3, as amended, *Compliance and Enforcement Program*, are used to address safety concerns and actual or apparent deviations from regulations or standards. Public law and agency policy allow FAA program offices to use discretion when taking action to resolve safety issues in the NAS. FAA Orders 8000.373A and 2150.3, as amended, and the policies and procedures issued by program offices, guide agency personnel in the exercise of prosecutorial discretion, including the use of compliance, administrative, and legal enforcement action, to best ensure that regulated persons conform their conduct to statutory and regulatory requirements. Noncompliances by regulated persons willing and able to comply and willing to cooperate in corrective actions may be addressed with compliance actions, except when legal enforcement action is required or is preferred under agency policy. Under the Compliance and Enforcement Program, FAA program offices, such as Flight Standards Service, are policy owners for compliance actions. The FAA anticipates that in situations where law enforcement personnel need to ascertain whether an unmanned aircraft operating over people under this rule are compliant, the serial numbers broadcast by unmanned aircraft as required in the Remote ID final rule will allow law enforcement to expeditiously determine the make and model in the FAA database. Noncompliances by regulated persons unwilling or unable to comply or not cooperative in corrective actions are addressed with enforcement action.

Finally, the FAA notes that this rule prohibits Category 3 over open-air assemblies. Additionally, in response to comments, remote pilots are prohibited from operating a small unmanned aircraft as a Category 1, 2, or 4 operation in sustained flight over open-air assemblies unless the operation meets the requirements of § 89.110 or § 89.115(a) (remote identification operational and broadcast requirements for standard remote identification

unmanned aircraft or unmanned aircraft with remote identification broadcast modules). The FAA may waive compliance with this provision as appropriate. However, conditions of any waiver issued may require the operator to notify local law enforcement prior to the operation. All small unmanned aircraft operations are subject to remote identification requirements upon the applicable remote identification compliance date, as specified in the Remote Identification for Unmanned Aircraft final rule. This prohibition is discussed in more detail in Section XIV.B. For a further explanation of open-air assemblies and sustained flight, please see Section VI.E.

2. Risks of Small UAS Operations

Several commenters generally supported small UAS operations over people, and offered various suggestions. A commenter supported operations over people by those who conduct pre- and post-flight inspections of the small UAS and operate in a safe manner. Another commenter supported operations over people if the regulations mirror those of general aviation aircraft operating in a similar capacity. One commenter also expressed concerns about remote communication for UAS operations, stating that the U.S. must take steps to protect the "RF spectrum." In response to these comments, the FAA notes that the requirement to conduct safe operations exists in §§ 107.15, 107.19, and 107.23 and the requirement to conduct a preflight inspection is codified at § 107.49; moreover, small UAS and manned aircraft have different safety requirements and operational considerations, which the FAA has addressed in distinct regulations. As for protection of radio frequencies (RF) for small unmanned aircraft operations, the Remote Identification of Unmanned Aircraft Systems rule, which appears in this same issue of the **Federal Register**, addresses concerns about radio frequencies and UAS operations.

The Motion Picture Association of America (MPAA) and NCTA—the Internet & Television Association (NCTA) urged the FAA to use conditions and limitations of current film and television waivers as a baseline for professional newsgathering and closed-set small UAS operations over people. The FAA has reviewed and processed numerous requests for relief from the prohibition of operating small unmanned aircraft over people and has considered this information in finalizing this rule.

For Category 2 or Category 3 operations over people, a commenter asked whether the FAA would require

a second- or third-class medical certificate or BasicMed and suggested compliance with § 61.53(b). The FAA did not propose Categories 2 and 3 operations to require medical certification. Section 107.61(c) states that, to be eligible for a remote pilot certificate with a small UAS rating, the applicant must not know or have reason to know that they have a physical or mental condition that would interfere with the safe operation of the small UAS. The responsibility for knowing the effects of medication resides with the remote pilot and the FAA has many publications that are informative regarding remote pilots' use of medications.

3. Commenters Favoring Fewer Restrictions

Other commenters opposed regulations or restrictions for UAS, in general. DJI commented that flights over people are already occurring without serious consequences. DJI and the Commercial Drone Alliance (CDA) both believe proposing this rule for all unmanned aircraft under 55 pounds is too strict in consideration of the risks the operations present. CDA wrote that the proposed rules would impose undue costs without a corresponding safety or security benefit, and that there would be "no meaningful or scalable expansion of commercial small UAS operations, which would be limited to the smallest and lightest unmanned aircraft and narrowly-drawn operational areas." CDA asserts such an absence of expansion will result in the United States surrendering its leadership in innovation and aviation safety.

The FAA disagrees with these commenters, as this rule facilitates routine operations over people by implementing performance-based requirements, eliminating the burden of applying for a waiver, while still ensuring the safety of the public. In addition, the four categories of small unmanned aircraft operations over people allows for a significant expansion in the commercial utility of small UAS in the United States. All four categories of small UAS under 55 pounds may operate over people under certain conditions, which do not inherently limit operations to the lightest aircraft, nor do they result in narrowly-drawn operational areas. This rule supports innovation and allows the United States to continue to be a leader in UAS integration.

4. Airspace Comments

The FAA received some comments concerning operations over people in certain types of airspace. The City of

New York (NYC) objected to "open ended" Category 1 and Category 2 operations over people due to the complexity of NYC's airspace. NYC wrote that it "is home to huge volumes of manned air traffic, skyscrapers which block and reflect signals, and one of the most complex and noisy radio frequency environments." NYC reported it also faces heightened security and safety issues due to its dense population and critical infrastructure. Similarly, Metropolitan Airports Commission (MAC) expressed concerns regarding operations over people in and around areas with airports.

Most of the airspace in and around NYC is either class B, C, D, or E and includes Special Flight Rules Areas (SFRA) and Temporary Flight Restrictions (TFR), both of which require operators to receive specific authorizations to operate. For example, § 107.41 requires remote pilots to obtain airspace authorization from the FAA prior to operating in Class B, C, or D airspace or within the lateral boundaries of the surface area of Class E airspace adjacent to an airport. The FAA finds that the existing requirements for authorizations coupled with the operations over people requirements of this final rule are sufficient to mitigate risks in airport environments. The FAA disagrees with NYC's comment that Category 1 and Category 2 operations are "open ended." Category 1 restricts operation by weight and prohibits small unmanned aircraft from having any exposed rotating parts that would lacerate human skin. Aircraft eligible for Category 2 operations must comply with injury severity limits and are subject to the exposed rotating parts prohibition and a prohibition on having safety defects.

NYC also argued that NYC agencies must be permitted to provide input on whether specific waivers should be granted for small UAS operations over people in their airspace. The FAA does not agree and finds this request outside the scope of this rule. The FAA will evaluate all requests for waiver of the requirements finalized in this rule based on information the applicant provides.

A commenter stated the FAA should allow operations over people if there are no manned aircraft in the area, and suggested the operations should occur directly over the operator. Section 107.37(b) already prohibits operations of small unmanned aircraft so close to another aircraft as to create a collision hazard. In addition, § 107.39 continues to permit operations over a person who is directly participating in the operation.

The National Football League (NFL), Major League Baseball (MLB), the

National Association for Stock Car Auto Racing (NASCAR), and the National Collegiate Athletic Association (NCAA), responding together, noted the NPRM does not specify that "all other existing aviation restrictions, such as the sporting event temporary flight restriction, restrain the operations identified in the rule." These organizations asked FAA to specify that the authorizations provided in the proposed rules remain subject to rules generally applicable to aircraft. The FAA continues to restrict operations over sporting events by issuing TFRs and will not discontinue these restrictions with the implementation of this rule.

B. Comments in Support of Additional Requirements

Numerous commenters generally supported allowing operations over people without a waiver only if the FAA imposed requirements on the remote pilot, the small UAS, or restricted the operating environment.

Some commenters recommended allowing operations over people only if the remote pilot has an emergency plan to land the small unmanned aircraft safely away from people. Section 107.23 currently prohibits operating a small UAS in a manner so as to endanger the life or property of another. Although the FAA declines to require remote pilots to have an emergency plan, contingency planning may be necessary to mitigate the potential risks of undue hazards that could endanger persons or property on the ground. Section 107.49(a) requires that, prior to flight, the remote pilot must assess the operating environment and consider the risks to persons and property in the immediate vicinity. The FAA recommends that, as part of this assessment, remote pilots utilize a risk mitigation process prior to the initiation of every small UAS operation to control or eliminate hazards.²⁵ This may include emergency landing contingency planning. Additionally, remote pilots may only operate over people if they have an eligible small unmanned aircraft.

Several commenters recommended requiring additional training or testing for certain categories of operations over people. One commenter recommended hands-on training and stated a pilot should know how to fly proficiently, without the assistance of automation. A

²⁵ The FAA provides material on how to develop effective risk management processes in numerous Aviation Handbooks and Manuals, available on the FAA website, <https://www.faa.gov/>. In addition, the Advisory Circular (AC) associated with this rule, AC 107-2, provides additional information on risk management processes.

commenter also wrote that training pilots to identify and assess the risks of an operation is only worthwhile if pilots, in conducting operations over people, are trained to respond to (1) the loss of a Global Positioning System (GPS) signal, (2) the loss of communications links, (3) wind shears and other wind events, and (4) low-altitude weather events. As pilots are required to remain up to date on the current regulations, they should expect that required training and testing will include the regulatory requirements to fly over people. Additionally, §§ 107.73 and 107.74 include knowledge areas on adverse weather and emergency planning.

Great Midwestern Home Inspections, LLC suggested requiring onboard safety devices such as obstacle avoidance and GPS for a small unmanned aircraft used in operations over people. Another commenter wrote that a drone purchased off the shelf for \$29.95 should not be flown over people and that it would be preferable for the FAA to support responsible pilots through education and certification, and to work with manufacturers to design and equip a small UAS capable of avoiding accidents. Several commenters stated the FAA should not oversee or impose requirements on all small UAS in the same manner, but did not agree on which types of small UAS the FAA should regulate more closely than others. Several commenters asserted off-the-shelf “toys” presented safety problems. Other commenters opined the proposed rule favored “high-quality” small UAS equipped with safety features. In contrast, another commenter thought the FAA should regulate “over-the-counter” small UAS less than custom, commercial, and specialized small UAS. The FAA declines to require in this rule specific safety devices or prescriptive requirements based on perceived consumer quality. The FAA does not consider the cost of a small UAS an indicator of its safety; rather, as described in this preamble, treatment under this rule turns on whether a small unmanned aircraft fulfills the requirements of one of the four categories.

Some commenters recommended significantly restricting operations over people. A few commenters suggested the FAA only allow remote pilots to operate small UAS over people when the operation occurs within a closed site within which all human beings wear protective equipment. Regarding the comments on the requirement for a closed or restricted access site, please see the discussion about closed sites in greater detail in Section VI.E. below.

Category 3 operations must comply with such restrictions, which are not necessary for operations conducted in Category 1 or Category 2, as those operations are lower risk. As discussed later in Section VII, Category 4 small unmanned aircraft have demonstrated reliability through airworthiness certification; as a result, they do not require applicability of a regulation that restricts the operation to certain types of sites. However, Category 1, 2, or 4 operations that are not compliant with remote identification are prohibited from sustained flight over open air assemblies. Lastly, while the NPRM did not suggest wearing personal safety equipment, remote pilots and other personnel are not prohibited from wearing safety equipment.

Several commenters suggested the inclusion of limitations on who would be eligible to operate over people. One commenter suggested the FAA require (1) an active membership with the Academy of Model Aeronautics (AMA), and (2) that small unmanned aircraft be registered, have tracking lights, and be marked with numbers from both the FAA and AMA. These commenters recommended that pilots have a remote pilot certificate under part 107 for all commercial operations and that any failure to follow the rules result in heavy fines. The Agency disagrees with these recommendations. Requiring membership in an organization places an unnecessary burden on operators when multiple safety measures codified in part 107 already exist. Small unmanned aircraft registration is currently required under parts 47 and 48 and all part 107 operators are required to have a current remote pilot certificate. No regulatory changes are necessary for the FAA to take action in response to non-compliance with these rules.

Another commenter recommended imposing an age minimum for remote pilots allowed to conduct operations over people because the commenter believed young pilots cause problems that result in restrictions for responsible operators. Section 107.61 already requires applicants for remote pilot certificates to be at least 16 years old, and the FAA does not have data indicating that additional age restrictions are necessary at this time.

Several commenters asked the FAA to develop separate rules or requirements for specific types of operations. A commenter who opposed the NPRM suggested allowing operations over people only if the operations are necessary and occur pursuant to permission from the FAA, which should consider the operator’s training and

liability insurance. This commenter recommended a 24-hour hotline exist for operators to call for permission to fly over people.

Several commenters opposed operations over people except for commercial reasons, such as making a movie. PrecisionHawk, Inc. suggested the FAA create a separate category for operations over people to permit such operations when they occur to save lives or reduce exposure to hazardous situations. Similarly, a few commenters asked the FAA to establish a new category for low-risk operations and exempt such operations from certain rules; these commenters suggested this approach would obviate the need for waivers and thereby reduce the burden on the FAA. Part 107 does not distinguish between the purpose or type of the operation. This rule establishes minimum requirements for safe operations over people; these requirements apply to all part 107 operations. Amending the requirements based on purposes of operations would be inconsistent with the framework of part 107 and the risk assessment model on which it is based.

Small UAV Coalition commented that the FAA should add references to the section titled “Limitations on operations over human beings” to include other regulatory references because operations over people can also be authorized by waiver or exemption. The FAA does not believe this addition is necessary, as the opportunity to apply for and receive waivers and exemptions is clearly defined within the current regulatory framework.

C. Requests for Clarification

Some commenters supported allowing operations over people but believed the rules are too complicated or need clarification. A commenter suggested removing the double negative in the proposed draft of § 107.120(a)(3)(ii) to make it easier to read and to remove any potential textual ambiguity. This rule includes an update to the text of § 107.125(c)(2) [formerly § 107.120(a)(3)(ii)], for clarity.

A commenter noted that proposed § 107.39(a) is missing the “or” before paragraph (b), which the commenter believed is an error. The FAA notes that the language in this, and all regulations, states that (a), (b), or (c) applies, and is understood that in a continuous list that the “or” applies to all items previously listed.

Several commenters questioned how one could determine whether a small unmanned aircraft is flying directly over an individual. Section 107.31 requires all operations to be within visual line of

sight, specifically requiring that the remote pilot or visual observer (if used), must (1) know the unmanned aircraft's location; (2) determine the unmanned aircraft's attitude, altitude, and direction of flight; (3) observe the airspace for other air traffic hazards; and (4) determine that the unmanned aircraft does not endanger the life or property of another. Therefore, as the remote pilot or visual observer are required to have a holistic and complete view of the operating environment, they should be able to ascertain whether the unmanned aircraft is flying over people. Since part 107 became effective in 2016, remote pilots and visual observers have refrained from flying over people by keeping the small unmanned aircraft within visual line of sight. This requirement to maintain visual line of sight continues to apply to small UAS operations that occur under part 107.

Several commenters suggested the FAA consider population density in the development of this rule and categorize approvals of operations on this basis.²⁶ The FAA developed the eligibility requirements for Categories 1 and 2 to mitigate the risk of injury, regardless of population density in the operating area. Similarly, the eligibility requirements for Category 3 mitigate the risk of injury with both design elements and operating limitations, as described in Section VI.E. Finally, Category 4 small unmanned aircraft may operate over a variety of population densities, subject to the operating limitations associated with their airworthiness certification. With the risk mitigation measures this rule established for each category, limitations based on population density are unnecessary. Furthermore, Category 1, 2, or 4 operations that are not compliant with remote identification are prohibited from sustained flight over open air assemblies.

D. Minimum Stand-Off Distances

In the NPRM, the Agency requested comment on whether a prescriptive standard should exist for a minimum vertical or horizontal distance, and whether it should apply for operations

of small unmanned aircraft over people.²⁷ The FAA also requested commenters provide data to support any comments identifying a prescriptive standard.

Several commenters responded to this request, including the Association for Unmanned Vehicle Systems International (AUVSI); Motorola Solutions; the American Public Power Association (APPA), the Edison Electric Institute (EEI), and the National Rural Electric Cooperative Association (NRECA), responding together; and the Republic of China. These commenters supported the FAA's decision not to require specific minimum stand-off distances for operations over people. Droneport Texas, LLC commented that because the pilot only has access to the first 400 feet above the ground, further restrictions on the available airspace would "serve to handcuff remote pilots by reducing the latitude of operations." The National League of Cities (NLC) raised concerns that potential horizontal or vertical stand-off distances would be unachievable when combined with the safety requirements in the proposed rule. NLC stated this inability to comply might create incentives for small unmanned aircraft to operate at lower altitudes above people and property. Many commenters agreed that stand-off distances would reduce the number of locations that would be acceptable for small UAS operations.

Several commenters, including the Air Line Pilots Association, International (ALPA); the National Association of Counties; the National Association of State Aviation Officials (NASAO); the Air Medical Operators Association (AMOA) and the Association of Air Medical Services (AAMS), responding together; and the Metropolitan Airports Commission (MAC), supported the establishment of stand-off distances. Commenters encouraged stand-off distances as a way to prevent accidental collision, but did not agree on what those distances should be. Although APPA, EEI, and NRECA stated they do not support across-the-board mandatory stand-off distances, they expressed support for creating a stand-off distance for non-utility unmanned aircraft operated near electric infrastructure. These commenters referred to the requirements of Section 2209 of the FAA Extension, Safety, and Security Act of 2016 (FESSA 2016)²⁸ and stated

²⁷ 84 FR at 3888–89.

²⁸ Section 2209 requires "the Secretary of Transportation to establish a process to allow applicants to petition the Administrator of the Federal Aviation Administration to prohibit or

imposing such a restriction would protect infrastructure from unmanned aircraft interference and any potential harm.

Flytcam Motion Pictures was undecided about stand-off distances, but suggested that if they were required, the FAA should quantify the stand-off distance based on the size of the aircraft, its potential velocity, weight, and size of rotating edges. Another commenter suggested the FAA establish specific stand-off distances that consider the performance, size, and payload capabilities of small unmanned aircraft.

On further review, the FAA has determined that the framework of part 107 as codified in the final rule will maintain safety in the NAS. Mandatory minimum stand-off distances for small unmanned aircraft are not appropriate at this time. Part 107 already requires the remote pilot to ensure the small UAS operation does not pose an undue hazard to other aircraft, people, or property in the event of a loss of control of the aircraft. A prescriptive stand-off distance would not increase the level of safety of small UAS operations beyond the level that compliance with part 107, as amended by this rule, already achieves.

V. Category 1 Operations

The NPRM proposed to establish a category of operations over people using small unmanned aircraft that weigh 0.55 pounds or less, including everything that is on board or otherwise attached to the aircraft at the time of takeoff. The FAA determined that operations of small unmanned aircraft weighing 0.55 pounds or less, subject to all of the existing requirements governing operations in part 107, pose a low risk of injury when operating over people. The NPRM referred to this category of small unmanned aircraft operations as Category 1.

The NPRM explained that remote pilots in command would be responsible for determining that their small unmanned aircraft does not exceed 0.55 pounds and would therefore be eligible for operations in this category. The weight limit would apply from takeoff to landing, meaning that any cargo attached to the small unmanned aircraft must not cause the aggregate weight (unmanned aircraft

restrict the operation of an unmanned aircraft in close proximity to a fixed site facility." The FAA Extension, Safety and Security Act of 2016, Public Law 114–190, sec. 2209, 130 Stat. 615, 633–635 (2016). The FAA has determined that operations over moving vehicles can be conducted safely when following the requirements of this rule. A separate rulemaking action will address the process by which entities can submit a request to the FAA to restrict the airspace over a fixed site.

²⁶ Commenters suggested the FAA consider population density for a multitude of reasons. A commenter noted to consider population density to assist in the risk analysis of "hover versus transit only operations." Another commenter suggested the level of mitigation requirements should increase as the density of people in the operation area increases. One commenter stated Augusta, Georgia has an ordinance that includes a definition of highly populated area that they believe will help reduce the risk of accidents from unmanned operations over people. Another commenter asserted the FAA has not considered increasingly unpredictable weather patterns or population density leading to increasing accident rates.

plus cargo) to exceed 0.55 pounds. The NPRM did not propose any design standards for Category 1. The FAA invited public comment, however, on any available data on the risk of injury to persons posed by operations using small unmanned aircraft that weigh 0.55 pounds or less. The FAA also invited public comment on whether operations of small unmanned aircraft eligible to operate pursuant to Category 1 should be subjected to a performance-based requirement for exposed rotating parts.

A. Weight Threshold

The FAA received many comments on the proposed 0.55-pound weight threshold for small unmanned aircraft to qualify for Category 1 operations over people. Several commenters, including Droneport Texas, LLC, ALPA, Small UAV Coalition, and others supported the proposed weight threshold for Category 1. Many commenters supported having a weight-based category for low risk unmanned aircraft, but found the proposed weight limit too conservative and recommended to increase the threshold to 1 pound. Other commenters recommended weight thresholds ranging from 0.70 pounds to 8 pounds.

A number of commenters specifically cited the ASSURE study and recommended the Agency consider it for setting the weight threshold for Category 1 operations. As discussed in Section VI.A., the ASSURE study is consistent with the safety requirements the FAA proposed for small unmanned aircraft above 0.55 pounds. The FAA finds that small unmanned aircraft above 0.55 pounds must demonstrate compliance with the safety requirements to operate over people. Commenters also frequently cited the 0.55 pound weight limit as a stop-gap weight pulled from other studies in the early stages of UAS development that is now outdated.²⁹ DJI cited a June 2018 report from the National Academies of Science, Engineering, and Medicine, which opined that the FAA has an “overly conservative approach to safety risk assessments” and “tends to overestimate the severity and likelihood of risks from many types of drone operations.” The June 2018 National Academies of Science, Engineering, and Medicine report referenced by DJI was delivered prior to the publication of this proposed rule, and as such did not address the proposed requirements. The report provided recommendations on how the FAA could better facilitate the integration of small UAS by making

changes to the management and approval structure and did not opine on the specific requirements the FAA should consider for new regulations.

The 0.55 pound weight threshold as proposed is appropriate for a low-risk, weight-based category for small unmanned aircraft operations over people. Although several commenters recommended an increase in the weight threshold to 1 pound or more, the FAA reiterates that nothing in this rule precludes small unmanned aircraft weighing above 0.55 pounds from operating over people, as long as these small unmanned aircraft demonstrate that they do not pose an unacceptable risk to people on the ground by meeting the requirements for a Category 2, Category 3, or Category 4 operation.³⁰

As noted earlier, DJI and other commenters referenced the recommendations of the UAS Registration Task Force, which originally proposed the 0.55-pound weight threshold as a basis for determining the need to register a small unmanned aircraft, and stated this weight should not apply in the form of an operational safety requirement. When developing their recommendations for a weight-based threshold for Category 1 operations, the Micro UAS ARC considered the stipulations from the UAS Registration Task Force concerning use of the 0.55-pound threshold for anything other than a requirement to register the aircraft.

The FAA does not find that DJI’s report is specifically relevant to Category 1, as their analysis reviewed the small unmanned aircraft holistically, rather than the specifics of operations over people. While the FAA does not find the RTF report to be outdated, the FAA did not rely solely on it in determining the weight limit, as DJI implied. Instead, the FAA took the recommendation from the Micro UAS ARC report and the FAA analysis as described in the proposed rule and determined that the 0.55-pound weight limit was an appropriate limit for Category 1. The FAA has updated its analysis of Category 1 small unmanned

aircraft based on comments received, as discussed further in Section V.B.

A commenter suggested the category should be based more on speed than weight. This commenter said that “physics teaches that as speed increases it’s actually momentum or inertia that doubles.” Other commenters similarly suggested alternatives for the altitude or speed requirements for Category 1 small unmanned aircraft. Specifically, a commenter suggested the Agency permit Category 1 small unmanned aircraft to operate over people if they do not exceed 10 to 15 mph. This commenter believed the risk of injury increases as speed increases.

Although Boeing supported the 0.55-pound weight limit, it advocated for inclusion of a kinetic energy limit as well, which the company said would be consistent with FAA’s risk-based approach of regulating small UAS operations. To that end, Boeing recommended the rule include both a 0.55-pound weight limit and a requirement that the aircraft “will not cause injury to a human being that is equivalent to or greater than the severity of injury caused by a transfer of 10 foot-pounds of kinetic energy upon impact from a rigid object.”

The FAA proposed Category 1 to provide remote pilots with a low-risk category that is simple and straightforward. Remote pilots can determine compliance by simply weighing the aircraft and everything onboard or otherwise attached, which does not require any specialized equipment to measure. A category based on speed or injury limitation based on kinetic energy on impact would require a means of compliance to show how technology or other solutions would comply with the limitation. The 0.55-pound weight threshold represents an acceptable level of risk for Category 1. Any additional speed or altitude limitations beyond what is already required under part 107 would be inconsistent with the objective of having a lower-risk category.

B. Prohibition Against Exposed Rotating Parts

Due to comments received, this rule now prohibits from Category 1 eligibility all small unmanned aircraft with any exposed rotating parts that would lacerate human skin. The proposed rule did not include such a prohibition for Category 1. ALPA and the Coalition of Airline Pilots Association (CAPA) both stated that the Category 1 weight threshold alone is not sufficient for mitigating the potential risk of injury from exposed rotating parts. ALPA recommended prohibiting

²⁹ ARC, Registration Task Force ARC Report, 84 FR 3856, 3866–3867.

³⁰ While the FAA did not receive compelling data that the Category 1 weight limit should increase, the FAA will undertake a study to determine if the limit should be raised and perform a retrospective review of the rule. The timing of the retrospective review is based on conducting research on the safety of increasing the Category 1 limit in the future and collecting and analyzing cost and benefit data after the compliance date of the rule (*i.e.*, over enough of a time period to adequately collect and measure impacts from implementation). In addition, as part of the retrospective review, the FAA will undertake a study to determine whether the prohibition on exposed rotating parts that would lacerate human skin should be maintained or modified.

exposed rotating parts that could lacerate human skin for Category 1 operations. Other commenters believed propeller guards and other mitigations should be required equipment for operations over people, referring to potential serious eye injuries that exposed rotating parts could cause.

In contrast, Droneport Texas, LLC wrote that rotating parts on a small unmanned aircraft weighing 0.55 pounds or less are generally made of materials and rotate at speeds that could result in injuries rated at an abbreviated injury scale (AIS) level of 3 only if the operator conducted the operation in an extremely careless manner. This commenter asserted the probability of injury of this magnitude appears to be insufficient to justify a prohibition on exposed rotating parts.

The Agency agrees with the commenters who stated that exposed rotating parts on small unmanned aircraft weighing 0.55 pounds or less could be capable of causing lacerations even if the operator takes precautions. In addition, as small unmanned aircraft technology advances and high levels of performance are achieved with materials of construction that are lighter and stiffer than materials used today, small unmanned aircraft weighing 0.55 pounds or less will continue to experience performance improvements, which could increase the risks of laceration from exposed rotating parts. Category 1 operations must pose only a low risk of injury; therefore, it is the responsibility of the remote pilot to fly at appropriate altitudes and speeds to prevent their aircraft from causing injury to persons on the ground in the event of a mishap or collision. Finally, these small unmanned aircraft must not contain any exposed rotating parts that would lacerate human skin.

Category 1 provides a means for small unmanned aircraft to operate over people with minimal burden to the operator. As a result, in contrast to Categories 2 and 3, this rule does not require the submission of a declaration of compliance. Instead, this rule requires remote pilots of small unmanned aircraft to ensure that the rotating parts, if exposed, would not cause lacerations to human skin. Remote pilots may accomplish this by installing protective devices before operating over people. The original unmanned aircraft manufacturer could make available protective devices, purchased as aftermarket parts, or the owner or operator could design and install them. Regardless of the source of any protective device, the remote pilot must ensure the small unmanned aircraft does not contain exposed

rotating parts that would lacerate human skin and does not exceed the weight-based limitation of Category 1.

C. Prohibition on Sustained Flight Over Open-Air Assemblies for Category 1

While the NPRM did not propose any additional operating requirements for Category 1 beyond the existing regulations in part 107, the FAA received comments that necessitate an additional operating requirement. As discussed in Section XIV.B., remote pilots are prohibited from operating a small unmanned aircraft as a Category 1 operation in sustained flight over open-air assemblies unless the operation fulfills the remote identification operational and broadcast requirements for standard remote identification unmanned aircraft or unmanned aircraft with remote identification broadcast modules. Sustained flight over an open-air assembly includes hovering above the heads of persons gathered in an open-air assembly, flying back and forth over an open-air assembly, or circling above the assembly in such a way that the small unmanned aircraft remains above some part of the assembly.

VI. Category 2 and 3 Operations

To conduct operations over people using small unmanned aircraft that weigh more than 0.55 pounds, the Agency proposed two categories of aircraft eligibility based on the risk of significant human injury. To be eligible for operations over people in either of these categories, a small unmanned aircraft would first have to demonstrate compliance with the safety requirements applicable to the specific category of operation. These requirements set injury severity limits that impacts from a small unmanned aircraft might cause, prohibit lacerations from exposed rotating parts, and prohibit safety defects. Category 3 aircraft would be subject to additional operating limitations as a mitigation for allowing a higher level of injury severity than Category 2.

The FAA developed this rule under the framework of performance-based rulemaking, which allows for the greatest flexibility in meeting minimum safety requirements. The FAA anticipates that industry will utilize a wide variety of designs, configurations, materials, and methods to meet the safety requirements established by this rule. Small unmanned aircraft that meet the requirements and adhere to applicable limitations of Category 2 or Category 3, paired with the operating requirements of the respective categories, provide for a level of safety

the Administrator has determined is acceptable.

A. Eligibility of Small UAS To Conduct Category 2 and Category 3 Operations: Design and Production Requirements

To be eligible for Category 2 or Category 3 operations, the FAA proposed to require a small unmanned aircraft be designed, produced, or modified such that it does not exceed the applicable injury severity limit; does not contain any exposed rotating parts that would lacerate human skin on impact with a human being; and does not contain any safety defects identified by the Administrator. Additionally, the FAA proposed that an applicant would have to ensure that a small unmanned aircraft eligible for use in Category 2 or Category 3 operations would also have to display a label indicating which category or categories of operations it is eligible to conduct, have current remote pilot operating instructions, be subject to a product support and notification process, and that the applicant has received notification that the FAA has accepted the declaration of compliance.

As a point of clarification, this rule uses the term applicant to refer to the person who submits a declaration of compliance to the FAA for review and acceptance. An applicant for a declaration of compliance may be anyone who designs, produces, or modifies a small unmanned aircraft and is responsible for ensuring it meets all eligibility requirements to operate over people.

The FAA is finalizing most of these same eligibility requirements. The small unmanned aircraft must be designed, produced, or modified such that it does not exceed the applicable injury severity limit; does not contain any exposed rotating parts that could lacerate human skin on impact with a human being; and does not contain any safety defects to be eligible to operate over people in Category 2 or Category 3.

While the NPRM referred to these safety defects as being “identified by the Administrator,” the FAA recognizes that this phrasing could be misleading for both applicants and remote pilots. The FAA did not intend to limit who can identify a safety defect. While this list is not exhaustive, any safety defect identified by the Administrator, the applicant, a remote pilot, or a member of the public could affect the small unmanned aircraft’s eligibility for Category 2 or Category 3. Additionally, the safety defect could result in the FAA initiating the process to rescind a declaration of compliance, as discussed in Section VI.C.9–12. The FAA has resolved this in the regulatory text,

which reads “has verified that the unmanned aircraft does not contain any safety defects,” for both Categories 2 and 3.³¹ Additionally, the FAA changed “could cause lacerations” to “would cause lacerations” to better reflect the requirement the applicant must meet.

The FAA adopts the requirement that an applicant must ensure that a small unmanned aircraft eligible for use in Category 2 or Category 3 displays a label indicating which category or categories of operations it is eligible to conduct, has remote pilot operating instructions, and is subject to a product support and notification process. While the small unmanned aircraft must still be listed on a declaration of compliance, the FAA removed the eligibility requirement that the applicant must be notified, because the requirement as written implied that the applicant had a persistent need to check the declaration of compliance to ensure continued eligibility.

The Agency received numerous comments regarding the proposed eligibility requirements for Category 2 and Category 3 operations. As discussed in the following sections, commenters were concerned that the injury severity limits and the safety risk assessment were too conservative. Other commenters criticized the FAA for not considering the probability of an impact and focusing only on injury severity. Additionally, as discussed in greater detail in Section VII, several commenters faulted the FAA for failing to consider aircraft reliability. In consideration of the comments, the Agency adopts the proposed safety requirements for eligibility, but provides clarification in this preamble with respect to injury severity limits, the means of compliance process, and the declaration of compliance requirement.

The responsibility for ensuring eligibility of the small unmanned aircraft falls to the applicant. The applicant for a declaration of compliance must ensure his or her small unmanned aircraft complies with the eligibility requirements for Category 2 or Category 3, or both in accordance with §§ 107.120 and 107.130, as applicable. The applicant for a declaration of compliance must follow the process required by § 107.160, described in VI.C. of this preamble. The applicant must submit a declaration of compliance and receive acceptance from the FAA in order for its small unmanned aircraft to be eligible for operations over people. An applicant whose declaration of compliance has been accepted by the FAA must continuously fulfill the requirements in §§ 107.120 and 107.130,

as applicable, for the subject small unmanned aircraft to continue to be eligible for use in Category 2 or Category 3 operations.

1. Must Not Exceed Applicable Injury Severity Limit

The prohibition on exceeding the injury severity limit of the applicable category of eligibility is a critical component of the safety requirements. For Category 2 operations, the small unmanned aircraft must not be capable of causing an injury to a human being that is more severe than an injury caused by a transfer of 11 ft-lbs of kinetic energy from a rigid object. For Category 3 operations, the small unmanned aircraft must not be capable of causing an injury to a human being that is more severe than an injury caused by a transfer of 25 ft-lbs of kinetic energy from a rigid object. As discussed in Section VI.B., the applicant seeking to demonstrate eligibility of a small unmanned aircraft for Category 2 or Category 3 operations must use an FAA-accepted means of compliance, such as a test procedure contained in an industry consensus standard, to show that the small unmanned aircraft does not exceed the applicable injury severity limit.

Several commenters specifically addressed the injury severity limit based on a rigid object with 11 ft-lb of kinetic energy proposed for Category 2. A few commenters suggested that 11 ft-lbs of kinetic energy from a rigid object on collision with a person might not provide sufficient protection for children, the elderly, people with disabilities, or even the average citizen. The City of New York said a point of concern is the acceptability of a “Scale level 3” injury and “what that truly means relative to infants, elderly persons, during mass gatherings, and the effect on agitating a confined crowd.” Another individual opposed operations over people because the proposed rule did not address blunt force trauma and the varying impacts it could have, based on the existing condition of the individual who is hit or the part of the body that is hit.

The proposed rule stated the 11 ft-lb kinetic energy level “considers variations for all parts of the body for both adults and children, including when people are in various positions, such as standing, sitting, and prone.”³² The 11 ft-lb impact kinetic energy value that forms part of the injury severity limit for small unmanned aircraft impacts considers risks to various populations and averages these risks

across those populations. An injury that a small unmanned aircraft could cause to a person depends on many factors, including the person’s age, condition, or disability. The severity of injury also depends on additional factors such as the point of impact, the angle of impact, and the unmanned aircraft’s kinetic energy at the time of impact. For the reasons discussed in the following section, the injury severity limits provide an acceptable level of injury risk to all persons; accordingly, this rule finalizes the standards for Categories 2 and 3 as proposed, with no changes.

a. Range Commanders Council (RCC) Standards

As stated in the NPRM, the Agency based the proposed injury severity limits for operations under Categories 2 and 3 on extensive government research of human injury risk discussed in the Range Commanders Council’s (RCC) Common Risk Criteria Standards for National Test Ranges and existing FAA commercial space regulations for public safety. The RCC standards inform public safety risk from commercial space launches, government space launches, and aircraft operations at national test ranges. These standards are based on impacts from inert debris and other types of rigid objects and assume these rigid objects transfer all their kinetic energy on impact with a person. As explained in the NPRM, however, research conducted by the UAS Center for Excellence under the Alliance for System Safety of UAS through Research Excellence (ASSURE) establishes that small unmanned aircraft do not always impact a person or surface in the same manner that metallic fragments impact them.³³

To account for the disparity between impacts from rigid objects such as metallic fragments and small unmanned aircraft, the FAA proposed using injury severity caused by an impact from a rigid object as a threshold, rather than using an impact kinetic energy threshold alone. This standard aligns with existing risk acceptance policies for falling debris from commercial space launches,³⁴ and limits the risk of injury to the public, but expresses the safety limit in a way that allows small

³³ Arterburn, et al., FAA UAS Center of Excellence Task A4: UAS Ground Collision Severity Evaluation: Revision 2 (Apr. 28, 2017) (hereinafter “A4 Report”). The final report underwent peer review of researchers from FAA, the National Aeronautics and Space Administration, and industry participants. The report is available in the docket for this rulemaking.

³⁴ See *Licensing and Safety Requirements for Launch*, Supplemental Notice of Proposed Rulemaking, 67 FR 49456 (July 30, 2002), which the FAA finalized on August 25, 2006. 71 FR 50508.

³¹ See §§ 107.120(a)(3) and 107.130(a)(3).

³² 84 FR at 3875.

unmanned aircraft to take advantage of design features that limit the amount of kinetic energy that is ultimately transferred to a person on impact.

In the NPRM, the FAA specifically solicited comments on whether establishing an impact kinetic energy threshold and using kinetic energy transferred on impact is the appropriate method to measure the potential injury a small unmanned aircraft could cause on impact with a person. The FAA also solicited comments on the methods, processes, procedures used in the studies on which the FAA based its proposed standards.

Multiple commenters took issue with the FAA's reliance on RCC thresholds. CDA commented that, given the critical difference between commercial space vehicles or missiles and unmanned aircraft, the kinetic energy impact thresholds for commercial space have no relevant application to UAS. In its comment, ASSURE pointed out that it previously determined that the "RCC probability of fatality data is overly conservative and largely not applicable to elastic UAS."³⁵ Virginia Tech Mid-Atlantic Aviation Partnership (MAAP) stated rigid object energy thresholds are an overly conservative characterization of risk and commented that "an inelastic object impacting a person does not emulate UAS impact events." MAAP stated the generalization in the NPRM based on "the range commander data," which analyzed the impact of rigid shrapnel, is distinct from the impact of unmanned aircraft. MAAP asserted the reasons for the distinction are impact duration, contact area, and its energy transfer. MAAP explained these reasons in detail and concluded that "[a] straightforward and more transparent approach to defining thresholds can be achieved by establishing acceptable risk limits using biomechanical metrics applicable to the generalized UAS impact conditions."

AUVSI stated the proposed rule's injury threshold for Categories 2 and 3, and its basis on existing commercial space safety regulations and the RCC standards, was "fundamentally flawed." AUVSI asserted that the use of RCC standards would impose unnecessary burdens on UAS manufacturers because small UAS manufacturers would be forced to conduct testing and present data on the injury risk presented by both the aircraft and energy transfer from a

rigid object. AUVSI wrote there is no "record basis" for FAA proposing to use the RCC guidelines and declining to use the automotive injury criteria proposed by ASSURE or identifying an acceptable percentage-based risk as proposed in the ARC Report.

Several commenters also took issue with FAA's proposal to use injury thresholds based on kinetic energy measurements that are the same as those that apply to debris and shrapnel impacts from a commercial space launch operation, guided and unguided missiles, missile intercepts, and space reentry vehicles. Several of these individuals remarked, "[t]his is not the appropriate standard for small drones because no small drone has the characteristics of rocket shrapnel, and the FAA's injury assumptions are based on outdated studies from the 1960's." Like AUVSI, these commenters recommended instead that the FAA "make use of the research conducted by the ASSURE program, and use impact measurements, standards, and injury severity testing from the automotive industry, which are far more appropriate and informative."

The News Media Coalition was concerned that some of the specific kinetic energy thresholds rely on data and testing that is not available to consumers, including the journalist in the Coalition. The commenter wrote that industry "will be slow in rolling out new models that comply with the proposed rules" and journalists will not be able to conduct operations over people. The FAA expects manufacturers generally will conduct the required testing and declare compliance with the requirements of Category 2 or Category 3, rather than operators and remote pilots. The FAA envisions most journalists would simply purchase a small unmanned aircraft that has an FAA-accepted declaration of compliance and follow the applicable operating rules for the category of operation over people being conducted.

The FAA carefully reviewed comments related to the applicability of the RCC impact kinetic energy thresholds and reiterates certain key aspects of the Agency's policy. First, the FAA agrees with commenters that the RCC impact kinetic energy thresholds are applicable to impacts from inert debris and that small unmanned aircraft do not behave like inert debris when impacting a person. The Agency addressed this disparity by proposing injury severity limitations rather than kinetic energy thresholds, and notes that applicants must demonstrate through test, analysis, or inspection that the small unmanned aircraft does not

exceed the applicable injury severity limits. An FAA-accepted means of compliance will address the minimum testing, inspection, or analysis necessary to demonstrate compliance with the safety requirements. While some commenters objected to conducting tests, it is not appropriate to permit operations over people without applicants demonstrating compliance to the applicable regulations. This rule does not permit injuries caused by impacts of small unmanned aircraft that would be more severe than the injuries that could occur under commercial space regulations. It is unclear whether the commenters are advocating for higher risk to the general public when small unmanned aircraft are operating over them. Using biomechanical metrics does not align with the FAA's objective of creating performance-based safety requirements. However, any applicant could submit a means of compliance to the FAA for acceptance that utilized biomechanical metrics to show compliance with the safety requirements of this rule.

b. ASSURE Research Findings

The FAA sponsored ASSURE Tasks A4 and A14: UAS Ground Collision Severity Evaluation research to study and address several questions: (1) What should the hazard severity criteria be for a UAS collision? (2) What is the severity of a UAS collision with people on the ground? (3) What are the design characteristics of a UAS that could minimize the potential injury during a ground collision? and (4) Can the severity of UAS collision with a person be characterized into categories based on the UAS? ASSURE conducted research in consideration of such questions between 2015 and 2019, performing over 512 impact tests and simulations with 16 different fixed-wing and multi-rotor UAS, as well as various objects and payloads with weights ranging from 0.75 lbs. to 13.2 lbs. at a range of low to terminal velocities. ASSURE used impact testing with wood blocks to assess the injury that would result from an impact kinetic energy transfer from a rigid object at different kinetic energy levels (such as the levels for Categories 2 and 3). The ASSURE research team initially performed testing using crash test dummies to review and determine thresholds of serious but non-lethal injury utilizing the AIS. ASSURE then increased the fidelity of the injury modeling and testing by utilizing Post Mortem Human Subjects (PMHS) and compared the thresholds for serious but non-lethal injury established using the crash test dummies with the injury thresholds yielded from PMHS testing.

³⁵ David Arterburn, ASSURE Public Comment on the Notice of Proposed Rulemaking for Operations of Small Unmanned Aircraft Systems Over People 25 (February 27, 2019). Arterburn, et al., FAA UAS Center of Excellence Task A14: UAS Ground Collision Severity Evaluation 2017–2019 (August 15, 2019) (hereinafter "A14 Report").

Based on the FAA's experience evaluating waiver applications for operations over people and in consideration of the ASSURE research findings (Task A14: UAS Ground Collision Severity Evaluation 2017–2019), the Agency concludes a typical small unmanned aircraft can impact a person with significantly more than 11 or 25 ft-lbs of pre-impact kinetic energy and still not exceed the injury severity limits in the proposed rule. When discussing the ASSURE report and its definition of kinetic energy,³⁶ the FAA refers to the potential to cause injury due to the vehicle's mass and speed just prior to the collision as pre-impact kinetic energy. A portion of this pre-impact kinetic energy is transferred to a person during impact.

For example, the FAA analyzed the ASSURE research and found that, for a certain impact orientation, a DJI Phantom 3 unmanned aircraft can impact a person with up to 130 ft-lbs of pre-impact kinetic energy before exceeding the Category 2 injury threshold proposed in the NPRM. This situation demonstrates that an unmanned aircraft can impact a person with up to 11 times more pre-impact kinetic energy than a rigid object (130 ft-lbs vs. 11 ft-lbs) and result in the same level of injury severity. The FAA finds this example and other examples contained in the ASSURE research demonstrate that the injury severity limits based on transfers of impact kinetic energy from rigid objects will ensure that small unmanned aircraft meeting these requirements pose no greater risk to the general public than operations currently allowed under existing, relevant commercial space regulations.³⁷

The ASSURE research also found that small changes in small unmanned aircraft impact orientation, Center of Gravity (CG) alignment of the skull, and small unmanned aircraft impact location cause large changes in impact energy transfer. Addressing different impact orientations is relevant when assessing small unmanned aircraft typical failure modes for a means of compliance, as discussed in the following section.

³⁶ The A14 Report at vii states, "KE—Kinetic Energy (The impact KE forms the potential to cause injury due to the vehicle's mass and speed just prior to the collision while the material and structural response of the vehicle influence its ability to transfer KE to an impacted person and cause injury)."

³⁷ A14 Report at 7, 18; David Arterburn, ASSURE Public Comment on the Notice of Proposed Rulemaking for Operations of Small Unmanned Aircraft Systems Over People at 25 (February 27, 2019).

Many commenters, including ParaZero Drone Safety Systems, AUVSI, CDA, AiRXOS, Inc., AIA, Small UAV Coalition, New Mexico State University Physical Science Laboratory, PrecisionHawk, Inc., MAAAP, Deseret UAS, DJI, and numerous individuals considered and discussed research, particularly the ASSURE research, and contended that the FAA's analysis results in overly conservative kinetic energy impact thresholds. These commenters suggested the FAA should have more closely followed the findings of the Center of Excellence ASSURE's UAS Ground Collision Severity Evaluation. ASSURE wrote:

The NPRM's proposed performance-based metric of injury resulting from the impact of a rigid object at 11 ft-lbs and 25 ft-lbs . . . are overly conservative based upon the result of [Anthropomorphic Test Dummy (ATD)] and [Post-Mortem Human Surrogate (PMHS)] testing and lead to ambiguity in how to test sUAS to achieve Category 2 and Category 3 approvals.³⁸

ASSURE noted that its Task A14 team proposes the use of automotive injury performance-based metrics "consistent with the extensive FAA sponsored and funded testing conducted over the last two years to enable the use of standardized automotive based test methods and increase the number of aircraft capable of achieving [Category 2 and 3 operations] while still achieving the casualty definitions outlined in the NPRM."

The Agency developed the performance-based injury severity limits to allow industry to develop unique means of compliance. The FAA anticipates that the methodologies ASSURE highlighted in its comment to measure injury severity will be included in means of compliance submitted to the FAA for acceptance. Developers of means of compliance can use any measurable human injury scales as long as they demonstrate that small unmanned aircraft impacts do not cause injuries more severe than those caused by impact of a rigid object. Further, applicants must explain how the injury scales address the most severe types of injuries that would likely occur from a small unmanned aircraft impact. The FAA expects a means of compliance might consider a suite of injury scales to cover the likely types of injuries from a small unmanned aircraft impact. The FAA anticipates that organizations, including industry consensus standards bodies, may develop means of

³⁸ David Arterburn, ASSURE Public Comment on the Notice of Proposed Rulemaking for Operations of Small Unmanned Aircraft Systems Over People, 1 (February 27, 2019).

compliance by conducting rigid object testing against existing injury scales to meet the injury severity limits of this final rule and that the FAA would accept these means of compliance. Applicants submitting a declaration of compliance may then use this FAA-accepted means of compliance without themselves having to conduct the rigid object testing.

The FAA carefully considered the findings of ASSURE. The ASSURE research confirms that the injury severity limits for Categories 2 and 3 the Agency proposed in the NPRM provide an acceptable level of safety. Many commenters focused on the perception that the Categories 2 and 3 injury severity limits in the NPRM were too restrictive, without observing that the NPRM uses the injury severity caused by the impact of a rigid object at certain energy levels as the threshold for acceptability. The ASSURE research, summarized in the Task A14: UAS Ground Collision Severity Evaluation 2017–2019 report, provides data, injury metrics, and a test method to assess the injuries caused by the impacts of rigid objects with humans at the kinetic energy levels proposed in the NPRM and compares them to the injuries caused by small unmanned aircraft impacts with humans. Through the use of their test methods and injury analysis metrics, the ASSURE results show that a small unmanned aircraft can impact a human being with a much higher kinetic energy while causing a comparable level of injury as the injury that would result from an impact with a rigid object at the proposed kinetic energy levels. The ASSURE research establishes that small unmanned aircraft do not behave like rigid objects during an impact and have greater flexibility, fragility, and so on.

Data provided in ASSURE's reports as well as in ASSURE's comment on the NPRM demonstrate that small unmanned aircraft do not behave like rigid objects during an impact. For example, Figure 10 of ASSURE's comment in response to the NPRM shows ASSURE's data and evaluation results for the DJI Phantom 3 using the ATD Impact Head Injury Criteria (HIC₁₅).³⁹ The FAA's analysis of the results show that to cause equivalent HIC₁₅ injury level as the injury caused by a rigid object at 11 ft-lbs, the Phantom 3 would need to achieve an pre-impact kinetic energy of 130 ft-lbs. The same figure shows that to cause equivalent HIC₁₅ injury level as the injury caused by a rigid object at 25 ft-lbs, the Phantom 3 would need to

³⁹ A4 Report.

achieve a pre-impact kinetic energy of 220 ft-lbs. These examples, as well as other data in ASSURE's reports and comment on the NPRM, show that ASSURE tested small UAS that could meet the injury severity limits of the NPRM by placing some reasonable operating limitations on the small UAS, such as altitude or speed restrictions. Additionally, the small unmanned aircraft used in ASSURE's testing were all manufactured prior to the publication of the NPRM, and may not have design features that limit or reduce the amount of kinetic energy transferred on impact.

With the publication of this rule, manufacturers may take this opportunity to design new small unmanned aircraft of similar size, weight, and capability as the existing small unmanned aircraft designs ASSURE tested. ASSURE tested existing models of small unmanned aircraft to determine the severity of injuries potentially caused by impact. The FAA found that, in reviewing the ASSURE report, many existing models could, potentially with modifications, meet the injury severity limits of the proposed rule.

The FAA does not agree with ASSURE and other commenters that the requirements of this rule are too conservative. This final rule is performance-based, therefore the FAA anticipates that applicants would be able to use a variety of injury scales in a means of compliance including the injury scales identified by ASSURE and other commenters. The FAA finds that the requirements for Categories 2 and 3 as finalized in this rule set an appropriate balance between allowing small unmanned aircraft to operate over people without an airworthiness certificate while also limiting the risks of small unmanned aircraft operations to the general public.

The FAA also tasked ASSURE to develop a repeatable and simplified test methodology for assessing the level of injury severity of small unmanned aircraft to people on the ground in the event of a collision. The test methodology ASSURE produced from this research utilizes the lessons learned from their high fidelity crash test dummy and PMHS testing.⁴⁰ The methodology is a comprehensive means to perform impact testing and assess the severity of injury in a manner that is not cost prohibitive. The FAA would likely find acceptable a means of compliance based on ASSURE's test method, as described in the A14 Report. For further

discussion about means of compliance, see Section VI.B.

c. Other Methodologies To Evaluate Injury Severity

The Small UAV Coalition said the FAA's narrow focus on kinetic energy is inconsistent with other risk assessment models, such as the Specific Operations Risk Assessment (SORA) model adopted by the European Commission, based on its development by the Joint Authorities for Rulemaking on Unmanned Systems (JARUS). CDA similarly recommended adopting the JARUS-SORA model. The SORA provides a qualitative methodology to determine the intrinsic operational risk and a means to apply strategic and tactical mitigations to reduce risk to an acceptable level as determined by the approving authority. The SORA also recommends types of risk mitigations or controls that address common threats, scalable to the level of risk, to ensure the safety of the UAS operation. Under the SORA methodology, an operation over a gathering of people would require airworthiness certification or a mitigation or control acceptable to the approving authority. Operations under Categories 2 and 3, conducted in accordance with the requirements and the declaration of compliance process are consistent with the recommendations of the SORA. Further, the FAA has added a Category 4 to this rule, which enables small unmanned aircraft with an airworthiness certificate to operate over people in accordance with part 107. The FAA anticipates that waiver and exemption applicants will continue to use the SORA methodology to support waivers and exemptions including for activities not permitted under this rule, such as beyond visual line of sight operations. An individual commenter said operations over people should be governed by an equation that considers: (1) Probability of crash (considering weather, condition of UAS, proximity to buildings, etc.); (2) angle of flight path relative to people; (3) speed (including whether it will hover or just transition over people); and (4) height. The FAA acknowledges that considering the probability of a crash, angle of flight path, and speed is one method to determine risk to persons on the ground. However, this approach requires the FAA to evaluate each element for each operation to determine acceptability, which would increase the burden on applicants and the FAA. The commenter's equation does not provide specific performance-based requirements. The performance-based injury severity limits, exposed rotating parts prohibition, and operating

limitations that this rule establishes provides an acceptable level of safety while allowing flexibility for industry to develop varying ways to comply with the applicable requirements.

d. Injury Severity and Failure Rate Uncertainty

The European Union Aviation Safety Agency (EASA) recommended aligning the criteria to allow small UAS operations over people as much as possible between the United States and Europe. EASA noted that Category 3 "identifies a maximum KE threshold of 25 feet-lbs (about 34 Joules) for impact with a solid object." The requirements for the proposed 34 joules applicable to Category 3 small UAS and the 80 joules applicable to the new EASA Class 1 unmanned aircraft refer to transferred kinetic energy, address the effects of blunt trauma, limit operations over uninvolved people, and include additional technical requirements. Because they are quantitatively different, however, EASA was concerned "they could set Europe and the US on different regulatory courses for 'fly over people' operations." EASA stated the data from the RCC standard described in the proposed rule are too conservative. EASA reported that it had reviewed, in particular, the Gurdjian experiments to recalculate the energy values.⁴¹ As described in their comment, EASA asserts the ASSURE Ground Collision Severity Evaluation final report supports its recommendation to include a kinetic energy threshold of 80 joules.⁴²

The Category 3 operation in this rule and EASA's Class 1 unmanned aircraft operation share similarities, but have important differences. In particular, the EASA Sub-category C1, which includes the limitation of 80 joules of energy transfer on impact, also contains noise, alerting, structural, navigation, and datalink requirements that are not included in the FAA's Category 2 or Category 3 eligibility requirements. The design requirements addressing topics such as structural integrity and navigational performance are better suited for the aircraft certification process and are not appropriate for non-certificated aircraft. Because small unmanned aircraft under Categories 2 and 3 are not required to have an airworthiness certificate or meet design requirements such as those adopted by

⁴¹ EASA's comment cited Gurdjian, ES., Webster J.E., and Lisnner, H.R. (1949) Studies on skull fracture with particular reference to engineering factors. *American Journal of Surgery*, 78(5), 736-751. [https://doi.org/10.1016/0002-9610\(49\)90315-3](https://doi.org/10.1016/0002-9610(49)90315-3).

⁴² EASA, <https://www.regulations.gov/document?D=FAA-2018-1087-0415>.

⁴⁰ A14 Report, Scope p.1-5.

EASA, an increase in the kinetic energy values would allow injuries that are significantly more severe than the injuries that could occur under Category 2 or Category 3 of this rule. Both the ASSURE research and the Gurdjian experiments support the fact that an increase in the kinetic energy from the proposed requirement, without any mitigating design requirements such as those required under EASA's regulations, increases the injury severity limit beyond an acceptable level. The FAA envisions that the variety of the four different categories will likely provide greater flexibility than what EASA has provided. Without including additional design or certification requirements, the change EASA suggests would result in an unacceptable level of safety for the general public. The injury severity limits and exposed rotating parts prohibition are an appropriate set of regulations for enabling aircraft without airworthiness certification to operate over people in accordance with an acceptable level of safety.

The Agency, however, agrees that conformity to design requirements is another way to enable small unmanned aircraft operations over people, and has thus added a Category 4 to accommodate certificated aircraft. The proposed rule included a request for comments regarding how the FAA should approach the uncertainties regarding failure rates and injury severity. Several commenters contended that the FAA relied too heavily on the injury severity limits and did not adequately consider the reliability of the small UAS or the probability of failure. With regard to probability of failure, the Agency received several divergent comments: Some believe probability of failure was inherently low, while others thought probability of failure could be high. Although the reliability of the small unmanned aircraft is one factor in determining whether an operation over people is safe, the FAA's process for considering the reliability of aircraft is the airworthiness certification process. Given that operations under part 107 do not need to occur with small unmanned aircraft that have an airworthiness certificate, probability of failure is a less appropriate measurement than the combination of injury severity limits and restrictions on exposed rotating parts and safety defects for Categories 2 and 3, in addition to the operating limitations in Category 3 that reduce likelihood of impact to a human being. To address these comments, this rule allows aircraft that have an airworthiness certificate that does not prohibit operations over people to be

used for operations over people. These Category 4 eligibility requirements are discussed in Section VII of this preamble.

One commenter asked why the Agency did not distinguish between rotorcraft and fixed-wing aircraft. The commenter stated, "[t]hey fall differently, but we have the same rules for both." Although rotary-wing and fixed-wing small unmanned aircraft have unique flight characteristics and the manner in which they could impact a person could be different, any small unmanned aircraft must not exceed the injury severity limits, regardless of whether it is a rotary-wing, fixed-wing, or any other type aircraft. An acceptable means of compliance must account for the variations in aircraft configurations, unique failure modes, most probable impact orientations, impact trajectory angles, and velocities from flight test and dynamic modeling for different types of small unmanned aircraft to demonstrate compliance. A few commenters said the categories should be based on the flight altitude for the same small unmanned aircraft. A commenter suggested that a "Mavic Air" would be rated Category 2 up to 50 feet and Category 3 up to 80 feet.⁴³ The NPRM discussed the possibility of individual small unmanned aircraft being eligible for operations in more than one category through the use of variable modes or configurations. The FAA would consider a design feature that limits the altitude of a small unmanned aircraft to the maximum altitude associated with compliance as an example of a variable mode; for example, when not operating over people, a certain small unmanned aircraft would not need to limit its altitude. However, to operate over people, the remote pilot would operate in a mode that limits the aircraft's altitude to comply with the requirements for operating over people. To use variable modes or configurations, the remote pilot must not be able to inadvertently change the mode or configuration and instructions for how to change between modes or configurations must be available in the remote pilot operating instructions. Variable modes and configurations are discussed in Section VI.F.

2. Must Not Have Exposed Rotating Parts

To be eligible to conduct Category 2 or Category 3 operations over people, the Agency proposed prohibiting a

⁴³ The Mavic Air is a small unmanned aircraft that weighs in the range of 0.95–1.25 pounds, depending on the model and series.

small unmanned aircraft from being designed, produced, or modified such that it contains exposed rotating parts that could lacerate human skin on impact with a human being. As stated in the proposed rule, exposed rotating parts could cause lacerations or other serious injuries if these parts were to come into contact with a person. Such parts are a common feature to small unmanned aircraft on the market today. Due to the hazards this feature can pose, the Agency proposed restricting eligibility for Categories 2 and 3 to small unmanned aircraft that do not contain any exposed rotating parts that could lacerate human skin on impact. While the NPRM acknowledged that exposed rotating parts could be capable of injuries beyond just lacerations (*e.g.*, injuries to hair, teeth, and eyes), the Agency determined this prohibition, combined with the other limitations, were sufficient to mitigate the risk of injuries.

Several commenters asserted that protections for exposed rotating parts are not necessary for small unmanned aircraft. One of these commenters pointed out that data shows fewer injuries to uninvolved parties result from exposed propellers on small unmanned aircraft than the number of annual fatalities that occur from rotorcraft and operations that occur under part 103.⁴⁴

Manned aircraft with approved designs do not require shrouded rotors because compliance with applicable certification standards and operating limitations reduce the likelihood of an impact with a human being and therefore do not present a significant hazard to persons on the ground. Operating a small unmanned aircraft under Category 2 or Category 3 does not require airworthiness certification but, as described in this rule, design features such as shrouded propellers can mitigate the risk of laceration to persons on the ground. Ultralight vehicles operating in accordance with part 103 do not have airworthiness certificates. However, to mitigate the risk to persons on the ground, these vehicles are prohibited from operations over any congested area of a city, town, or settlement, or over any open-air assembly of persons.⁴⁵

⁴⁴ Title 14 CFR part 103 ("Ultralight Vehicles") applies to manned vehicles that only a single occupant operates for recreation or sport and, if unpowered, weigh less than 155 pounds. Part 103 applies to powered vehicles that weigh less than 254 pounds empty weight that meet other criteria. See 14 CFR 103.1.

⁴⁵ See 14 CFR 103.15 ("Operations over congested areas").

Many commenters suggested the prohibition on exposed rotating parts is too restrictive. The Small UAV Coalition commented that while the preamble of the NPRM refers to the prohibition on exposed rotating parts as a performance standard, it appears to result in requiring installing guards or shrouds to ensure that rotating parts are not exposed on impact. Uber Technologies asserted that the exposed rotating parts prohibition strictly based on any skin laceration, without consideration of severity or probability, creates an additional blanket prohibition on aircraft with any exposed rotating parts. If the restriction remains in the final rule, Uber Technologies recommended including a waiver process for exposed rotating parts, with appropriate inclusion of risk- and performance-based metrics. AeroVista Drone Academy believed the requirement for a manufacturer to establish that an aircraft design would not have exposed rotating parts that could lacerate human skin is “materially infeasible” without specific guidance as to what would meet this threshold. The Academy wrote that manufacturers would have to conduct prohibitively expensive and costly testing. A-Cam Aerials asked the Agency to reword the requirement so that small unmanned aircraft eligible for operations in Categories 2 and 3 be designed such that they “minimize” lacerations to human skin on impact with a person.

The FAA clarifies the primary safety objective of the exposed rotating parts prohibition is to protect human beings on the ground from lacerations upon impact with a small unmanned aircraft in typical human encounters and unmanned aircraft operational scenarios (including potential failure modes). The FAA distinguishes between a laceration, meaning a cut that goes all the way through the skin and may require emergent medical attention, and an abrasion, meaning a superficial injury to the skin. Additionally, the FAA uses the expression “typical human encounter” to describe normal impacts, such as an unmanned aircraft impacting a human being due to a loss of control, small UAS failures, or remote pilot error. Exposed rotating parts may pose a significant laceration hazard if they contact human skin, which is unacceptable for the safety of the general public. The performance-based standards for Categories 2 and 3 will protect persons on the ground from potentially serious injury. This rule does not prohibit the applicant from using exposed rotating parts, but only prohibits the presence of rotating parts

capable of lacerating human skin in typical human encounters. The FAA has issued waivers to companies for operations over people that employed combinations of motor stop technology and exposed rotating parts materials that could cause abrasions, but not lacerations. The technology and the testing methodologies these companies used could be utilized in a means of compliance accepted by the FAA.

The FAA anticipates that organizations, including industry consensus standards bodies, may develop means of compliance for an unmanned aircraft with exposed rotating parts that meet the prohibition on exposed rotating parts that would cause lacerations. Once those standards are accepted by the FAA, applicants submitting a declaration of compliance may then use that means of compliance without themselves having to develop the testing methodology or technology. Such a means of compliance may include specific material requirements, rotor specifications, or additional mitigating technologies.

As for the waiver process, § 107.39 will remain subject to waiver and the FAA will continue to review waiver applications on a case-by-case basis. With regard to the costs of complying with the prohibition, a summary of impacts is in the regulatory impact analysis available in the public docket for this rule.

Commenters were also concerned about installing shrouds that would guard propellers. An individual wrote that propeller guards and full body cages can “adversely affect flight characteristics” and that propeller guards could increase the likelihood of loss of control for some quadcopters. In addition, DJI said shrouding an entire rotating part, if that part is involved in propulsion, can affect the aerodynamics and performance of the aircraft.

This rule is performance-based and allows exposed rotating parts as long as they do not lacerate human skin. Adding rotor shrouds, full body cages, or other safety features might be ways to fulfill the requirement. The rule permits applicants to employ propeller guards or full body cages in consideration of maintaining appropriate flight characteristics for the small unmanned aircraft. Designs that use propeller guards that prevent the exposure of rotating parts in typical human encounters, would be acceptable to the FAA. The FAA acknowledges that lacerations to human skin may not be entirely preventable in every encounter scenario. The means of compliance will address how this requirement is met, and may contain design characteristics

and test methods to ensure that the applicant has taken all reasonable measures to mitigate the possibility of lacerations upon impact with a human being. While the inclusion of propeller guards or full body cages could adversely affect the flight performance of the small unmanned aircraft, the safety benefits provided by the prohibition outweigh the potential loss of performance.

An individual noted that lacerations from propellers and other parts do not rise to the level of AIS level 3. Not all lacerating injuries will result in severe injury, but rotating propellers and rotors could pose a significant laceration hazard if they come in contact with human skin. Overall, protection from lacerating injuries is necessary to mitigate the risk to the general public.

Droneport Texas, LLC said the FAA should be open to timely consideration and acceptance of alternatives to ducting or shrouding rotors, such as rotor shedding, in which lightweight rotors are jettisoned and drift to the ground, and rotor braking, in which all exposed rotating parts are mechanically or electrically stopped prior to impact. Ducting or shrouding of rotating parts is only one method of design implementation to protect from laceration. This rule does not prescribe specific design features to provide protection from exposed rotating parts; any such design features that Droneport Texas, LLC identified will be acceptable if they meet an FAA-accepted means of compliance.

DJI said it supports protecting people from sharp moving parts during operations where risks of lacerations exist, but notes this could exist with respect to operations near, not necessarily over, people. Section 107.19(c) states, “the remote pilot in command must ensure that the small unmanned aircraft will pose no undue hazard to other people, other aircraft, or other property in the event of a loss of control of the small unmanned aircraft for any reason.”⁴⁶ As stated in the NPRM, for small unmanned aircraft with exposed rotating parts that could cause a laceration, the remote pilot is responsible for determining the appropriate stand-off distance to ensure the small unmanned aircraft does not pose a hazard to other people when operating near them.

A few commenters urged the FAA to consider the likelihood of a laceration if a blade were to come into contact with human skin. Skydio said propeller

⁴⁶ In the NPRM, the FAA proposed clarifying § 107.19, as discussed in Section XII.C of this preamble.

guards are not necessary in all occasions because blade design and construction (e.g., size, speed, angles, and ability to retract) have a large impact on the likelihood of a laceration if a blade were to come into contact with a person. Additionally, Skydio said emergency propeller stopping mechanisms in software can shut down the rotors if they come close to or contact a person. Skydio advocated for a performance-based standard that allows exposed rotating parts, “so long as it can be demonstrated that the design heavily mitigates the chances and severity of the blades hurting people.” A commenter asserted folding propellers should be a mitigation factor for operations over people in deciding if a small unmanned aircraft could be used under § 107.39.

Under this rule, blade guards or shrouds on exposed rotating parts are not required if applicants can demonstrate, by a means acceptable to the FAA, that unprotected exposed rotating parts are incapable of lacerating human skin. Implementing a rotor brake or similar approach to stop the exposed rotating part before it makes contact with a person may be effective in protecting from lacerations, but this requires the applicant to demonstrate their effectiveness in all likely small unmanned aircraft failure scenarios. Similarly, folding propellers would be acceptable if the design is shown incapable of causing lacerations in accordance with an FAA-accepted means of compliance.

NASAO noted that some small unmanned aircraft have guards on the rotors, but stated it is not clear if this would meet the eligibility requirement. AUVSI and MAAP requested clarification that the prohibition on parts that can lacerate human skin applies only during the operating envelope of the aircraft or during failure mode. Several commenters supported the proposed rule if the small unmanned aircraft has propeller guards or some other piece of safety equipment, or is recognized as reliable, to mitigate the risk of a falling small unmanned aircraft. A commenter would give “professional-level” small UAS more latitude to conduct operations over groups of people, “while restricting toy drones that are less capable.”

The FAA agrees that the regulations should provide safety protection from propellers that could cause lacerations. This rule finalizes the prohibition on exposed rotating parts that could cause lacerations for Categories 2 and 3 as proposed, with no changes. Moreover, existing small unmanned aircraft designs will have to show compliance with these requirements. Small

unmanned aircraft that already incorporate rotor guards would need to demonstrate the effectiveness of the rotor guard to protect from lacerating human skin when impacting a person by following an FAA-accepted means of compliance. The applicability of the exposed rotating parts prohibition is limited to small unmanned aircraft operating over people under Categories 1, 2, and 3. To be eligible for Category 2 or Category 3 operations over people, the applicant must use an FAA-accepted means of compliance and demonstrate the design does not contain any exposed rotating parts that would lacerate human skin on impact.

3. Must Not Contain Safety Defects

To be eligible to conduct operations over people in accordance with Category 2 or Category 3, the Agency proposed requiring each small unmanned aircraft be designed, produced, or modified such that it does not contain any safety defects identified by the Administrator. As discussed previously, the FAA has removed “identified by the Administrator” for the sake of clarity. The NPRM explained the Agency considers a safety defect to be a material, component, or feature of a small unmanned aircraft that increases the likelihood that the small unmanned aircraft could cause a casualty or fatality to a person during an operation over people. As defined in the proposed rule, a safety defect in a small unmanned aircraft eligible for conducting Category 2 operations would cause the unmanned aircraft to exceed a low probability of causing a casualty to a person during an operation over people. A safety defect in a small unmanned aircraft eligible for conducting Category 3 operations would cause a small unmanned aircraft to exceed a low probability of causing a fatality to a person during an operation over people.

The NPRM proposed to define a casualty to be a serious injury, which corresponds to a level 3 injury on the AIS. While the FAA still finds the AIS to be a valuable tool in determining the severity of an injury, the FAA concludes that it is not necessary to define it strictly. Furthermore, several commenters suggested the FAA use AIS in lieu of the injury severity limits adopted in this rule. As discussed in the NPRM, the FAA did not find the use of AIS in measuring injury severity appropriate.⁴⁷ In order to eliminate confusion, the FAA finds it prudent to remove any regulatory references to AIS. The dictionary definition of “casualty”—a serious or fatal

accident⁴⁸—provides sufficient clarity as to the safety defect requirement. As such, the definition of “casualty” proposed in the NPRM has been removed from the final rule.

The NPRM provided the following examples of safety defects: Exposed wires or hot surfaces on a small unmanned aircraft that could cause electrocution or burns to a person on impact; damaged or defective lithium polymer or lithium-ion batteries that could cause casualties from battery fires or explosions; and sharp edges or projections that could cause lacerations or punctures as a result of an impact with a person. The NPRM also noted that as small unmanned aircraft designs evolve over time, potentially hazardous features or characteristics, unknown at the present time, could emerge.

One commenter noted the FAA did not provide an objective standard or process for discerning what constitutes a safety defect. Another commenter asked how egregious a safety defect would need to be to result in action on the part of the FAA.

To ensure this rule remains flexible and responsive to the changes in technology, this rule does not contain an exhaustive list of all potential safety defects or issues. An identified safety defect or issue will require action on the part of the FAA if the probability of serious injury or fatality exceeds the parameters of acceptable risk for Category 2 or Category 3. As discussed in Section VI.C., Declaration of Compliance, the FAA has implemented a process by which it will work with applicants on addressing and resolving any identified safety defects or issues that would render the small unmanned aircraft ineligible to operate over people. This rule adopts the prohibition of safety defects in small unmanned aircraft eligible to conduct operations in accordance with Categories 2 and 3, without change.

4. Must Display a Label

To qualify for operations over people in accordance with Category 2 or Category 3, the Agency proposed requiring the display of a label on each small unmanned aircraft, indicating the category or categories for which the small unmanned aircraft is eligible to conduct operations. The Agency explained that such labeling will assist the FAA in its oversight role by providing a simple and efficient way to determine whether a small unmanned

⁴⁸ “Casualty.” *Merriam-Webster.com Dictionary*, Merriam-Webster, <https://www.merriam-webster.com/dictionary/casualty>. Accessed 12 Aug. 2020.

⁴⁷ 84 FR 3856 at 3873.

aircraft is eligible to conduct operations over people. In addition, it will provide notice to remote pilots which category of operations they are eligible to conduct using that aircraft.

The Agency did not propose a prescriptive labeling requirement that specifies exactly how an applicant⁴⁹ must label an aircraft, what size font to use, specific location, and so on. Due to the large variety of small unmanned aircraft models that exist, the Agency explained that such a prescriptive requirement would be unnecessary. Instead, the proposed rule stated the small unmanned aircraft could be labeled by any means as long as the label is in English, legible, prominent, and permanently affixed to the aircraft. Given that a small unmanned aircraft could be eligible to conduct operations in more than one category of operations over people, the small unmanned aircraft would have to be labeled with each category of operations for which the small unmanned aircraft is eligible. The NPRM noted that some small unmanned aircraft that are manufactured prior to final publication of this rule may qualify for one or more categories of operations over people. If the FAA has accepted a declaration of compliance for one of these previously-manufactured small unmanned aircraft, the proposed rule would allow a remote pilot in command to operate the small unmanned aircraft over people, provided the unmanned aircraft is labeled for the appropriate category or categories of operation. This final rule requires a remote pilot to label a previously-manufactured small unmanned aircraft in accordance with the declaration of compliance. Also, if a label degrades such that it is no longer legible or attached to the aircraft, the proposed rule included a requirement that the remote pilot relabel the small unmanned aircraft. In response to the proposed labeling requirement, an individual commenter asked for an explanation of the purpose of the labeling requirement, saying he would personally prefer not to add additional markings to the aircraft. The FAA requires the label for two purposes. For the remote pilot, the purpose of the label is to list the categories of operations over people the small unmanned aircraft is eligible to conduct, as indicated on the FAA-accepted declaration of compliance. The other purpose of the label is for the FAA and

other agencies to determine that the small unmanned aircraft is eligible to conduct the operation.

AUVSI commented that the proposal would benefit from further clarification about who is responsible for labeling. AUVSI stated the NPRM is inconsistent about whether manufacturers or operators must label the aircraft. AUVSI noted that the proposed rule did not affirmatively require manufacturers to label unmanned aircraft, but that labeling is a prerequisite for a small unmanned aircraft to be eligible to conduct Category 2 or Category 3 operations. AUVSI interpreted this as placing the burden on the operators who want to conduct such operations. An individual commenter requested clarity on what responsibility the remote pilot in command has for ensuring that the small unmanned aircraft is properly labeled for Category 2 or Category 3.

This rule requires the applicant to label the small unmanned aircraft. Under this rule, the label must remain affixed to the small unmanned aircraft to remain eligible for Category 2 or Category 3 operations. For small unmanned aircraft manufactured prior to the effective date of this rule and listed on a declaration of compliance, the remote pilot has the responsibility of labeling the small unmanned aircraft before he or she may conduct operations under Category 2 or Category 3. Once the small unmanned aircraft is in the possession of the remote pilot, it becomes his or her responsibility to ensure the label remains clear, legible, and affixed to the aircraft. DJI opposed the proposed labeling requirement, expressing concern that the requirements for manufacturers would be too burdensome and that if the FAA rescinds a declaration of compliance, the labeling may become erroneous or outdated. The FAA does not consider the labeling requirement to be unduly burdensome, given the performance-based nature of the requirement. Additionally, because the remote pilot is ultimately responsible for ensuring the unmanned aircraft is both labeled appropriately and listed on an FAA-accepted declaration of compliance, per the applicable operating requirements, the risk of erroneously-labeled small unmanned aircraft being used for operations over people is low. The FAA encourages industry to develop a standard for the label to promote consistency and ease of understanding.

DJI recommended the FAA maintain a database of aircraft, similar to that instituted by Transport Canada, and allow this to inform potential small UAS buyers of the accepted products that currently meet the requirements for

their mission needs. The FAA will make available on the FAA website the status of each applicant's declaration of compliance for public access, to enable remote pilots to determine which small unmanned aircraft are eligible for operations over people. The FAA anticipates listing the aircraft by make, model and series, if applicable, serial number, and category.⁵⁰ This database will be the primary source of the eligibility of the small unmanned aircraft, while the label provides a simple and efficient way to indicate eligibility for operations over people.

DJI also expressed concern that operators may modify a manufacturer's small UAS, rendering the label "outdated". The FAA emphasizes the remote pilot is responsible for ensuring any modifications to the small UAS are in accordance with the remote pilot operating instructions in order for the small UAS to remain eligible under the FAA-accepted declaration of compliance. This rule requires the applicant to provide remote pilot operating instructions, on sale or transfer of the small unmanned aircraft, or use of the small unmanned aircraft by someone other than that person. The operating instructions should address, among other things, modifications that will not change the eligibility of the small unmanned aircraft to operate over people. To be eligible to operate over people, the applicant is required to label the small unmanned aircraft, however, this rule does not preclude remote pilots from labeling their own aircraft. Finally, the remote pilot is responsible for verifying the small unmanned aircraft is properly labeled before each flight and knowing the type of operations for which the small UAS is eligible.

Finally, Section 107.5, which prohibits any fraudulent or intentionally false record from being made, kept, or used to show compliance with any requirement of part 107, applies to records, which includes labels. In this regard, falsifying any part of any record intended to constitute proof of compliance with applicable requirements could subject the person who submitted the record to a civil penalty and could be a basis for rescinding a declaration of compliance if the FAA determined that the applicant falsified the records.

A clear and legible label will enable straightforward means of identification of the operations for which the small

⁴⁹ As described in Section VII.C., this rule identifies the person who submits a declaration of compliance as an applicant, rather than a manufacturer. An applicant is anyone who can attest to the ability that they meet all the requirements of the declaration of compliance.

⁵⁰ The NPRM proposed to list the aircraft by make and model, but did not list series. This rule contains the phrase "series, if applicable" to allow for both flexibility to applicants and for refined specificity in identifying small UAS eligible to operate over people.

unmanned aircraft is eligible. The FAA clarifies the language for the labeling requirement to include the word “missing” to ensure that remote pilots label previously manufactured small unmanned aircraft. As a result, this rule adopts the labeling requirement with this clarification.

5. Must Have Remote Pilot Operating Instructions

The Agency proposed requiring applicants to provide remote pilot operating instructions with product-specific information for operations in Category 2 or Category 3, including system description and system limitations and the category or categories of operations over people for which the applicant has declared compliance. The proposed rule stated that a person who submits a declaration of compliance for a small UAS for Category 2 or Category 3 should provide remote pilot operating instructions upon sale or transfer of the small unmanned aircraft, or use of the small unmanned aircraft by someone other than that person. Instructions would need to remain up-to-date to account for any modifications the applicant makes to the small UAS for as long as the declaration of compliance remains valid. Specifically, the proposed rule included a requirement to include all modifications the applicant determined do not change the ability of the small UAS to meet the requirements for the category of operation for which the applicant declared compliance in the remote pilot operating instructions. For a small unmanned aircraft that has variable modes or configurations, the applicant would provide instructions on how to verify the mode or configuration that the small UAS is in and how to switch between modes or configurations.

The FAA received a few comments related to the contents of the remote pilot operating instructions, which are addressed in Section VI.C. This rule finalizes the requirement, without change, that in order for the small unmanned aircraft to be eligible to operate over people, the applicant must provide remote pilot operation instruction requirements.

6. Must Be Subject to Product Support and Notification Process

The NPRM proposed requiring applicants certify on the declaration of compliance that a process exists to notify the public and the FAA if the applicant identifies a safety defect or condition with its small unmanned aircraft that would render the small UAS ineligible for operations over

people. The proposed rule did not suggest the FAA would automatically rescind a declaration of compliance if such notification occurred. The proposed rule stated the FAA would evaluate the report and correspond with an applicant to determine whether taking corrective action or rescinding the acceptance of the declaration would be appropriate. This process is described in more detail in VII.C.8–12.

Reporting safety issues will assist the FAA in both discovering product hazards and identifying risks of injury the FAA could address through direct communication with applicants, publication of Notices of Availability in the **Federal Register**, or education. Applicants' reporting will be a timely and effective source of information because applicants often learn of potential product safety problems at an early stage. For this reason, the NPRM proposed to require applicants to develop a system for maintaining and reviewing information about their products. This system will identify when an applicant's product might have a safety defect that increases the probability of causing serious injury or fatality during operations over people.

Subsequent to an applicant's discovery of noncompliance, the Agency proposed to require an applicant who submits a declaration of compliance to notify the FAA and the public of the existence of the safety defect. The notification to the FAA will describe the nature of the noncompliance and how the applicant plans to address it.

Notification to the public and owners of that make/model and series, if applicable, is a critical step in ensuring continued safety. Such notification could take the form of a notice on an applicant's website, electronic notification to owners who have registered the small unmanned aircraft with the applicant, or an update to the software used for the small unmanned aircraft, which advises the remote pilot of the change in status. Applicants should exercise diligence to ensure the intended audience receives communications involving any potential safety issues that would render the aircraft ineligible for operations over people. In this regard, the FAA expects applicants to design and utilize a system that will facilitate communication between the applicants and the owners of the small unmanned aircraft and could also inform the public at large.

The Small UAV Coalition supported the requirement that manufacturers establish a product support and notification process. APPA, EEL, and NRECA, commenting jointly, supported

the need for manufacturer accountability, but believed the FAA should require manufacturers to contact registered UAS owners directly by electronic means or by unmanned aircraft software updates. Commenters wrote that the need to avoid inefficient methods is critical when responding to an outage or other emergency. Commenters further stated “electric industry UAS operators require a uniform, reliable, predictable way of receiving information to ensure they can quickly and accurately identify information that would affect [their] compliance.”

While believing the requirements for the notification process to be generally sufficient, a commenter wrote that manufacturers should make it easier for pilots to know when a small unmanned aircraft is no longer compliant. This commenter suggested manufacturers provide instructions in their product manuals directing pilots to their websites to learn of safety defects. This commenter also suggested notifying purchasers through software or by email. A commenter also thought the FAA should require each pilot to register their small UAS when taking the mandated bi-annual knowledge test; that way, pilots could go no more than 24 months without receiving notification that a small UAS is non-compliant.

Another commenter stated the proposed rule did not provide a way for the FAA to identify and inform a specific fleet that a safety issue exists. The commenter believed the manufacturer has no responsibility to notify customers of safety issues, and that this is neither prudent nor scalable. This commenter suggested requiring manufacturers keep a list of customers and communicate directly with them and post notices of deficiencies on their websites.

The FAA disagrees with the commenter who believed that the proposed regulation was unclear regarding whether an applicant has a responsibility to provide notice of product issues to owners. The responsibility rests with applicants who submit declarations of compliance for the small unmanned aircraft, as they are in the best position to identify issues in a timely manner and to communicate with the owners. Additionally, the FAA may take action to inform the public in certain circumstances, in addition to the applicant's notification.

It is critical that applicants notify small unmanned aircraft owners of any product issues. The FAA declines to specify how the notification must occur. Applicants may have numerous ways of

contacting owners of small unmanned aircraft; the FAA declines to prescribe the manner of contact, particularly as technology evolves. This rule requires the applicant who submitted the declaration of compliance to notify the owners of safety deficiencies in a timely manner. The FAA agrees with commenters that it is important for this information to be received quickly so that owners and remote pilots can take appropriate action as necessary regarding use of their small unmanned aircraft. Therefore, the FAA finalizes the product notification requirements as proposed.

B. Means of Compliance

1. Means of Compliance

The Agency proposed to require an applicant producing a small unmanned aircraft eligible for Category 2 or Category 3 operations declare compliance with the safety requirements for the chosen category by using an FAA-accepted means of compliance. Demonstrating compliance with safety requirements includes verifying there are no safety defects, as described in Section VI.A.3. Under the proposed rule, a voluntary consensus standards body or an individual could develop an acceptable means of compliance, the latter of which the NPRM referred to as a custom means of compliance. Once the FAA accepts a means of compliance, any person submitting a declaration of compliance could use it to establish their small unmanned aircraft fulfills the requirements of the rule.

Several commenters suggested the means of compliance proposal was onerous, putting overly restrictive requirements on manufacturers. Commenters were concerned the proposed rule did not allow for innovation, would be too costly to implement, or would require manufacturers to create a system to a set of standards that seem arbitrary. In contrast, some commenters believed operators should be required to prove the small unmanned aircraft are safe to operate. The Agency carefully considered these comments and has determined the flexible, performance-based requirements combined with the means of compliance and declaration of compliance processes provide an effective and cost-efficient way to establish which small unmanned aircraft meet the appropriate eligibility requirements for operations over people.

Some commenters expressed concern that the requirements do not provide sufficient clarity as to how manufacturers would safely establish

their small unmanned aircraft would not exceed the injury severity limitations. One commenter believed standardized procedures should exist, possibly involving impacting test dummies, showing the impact effects of a small unmanned aircraft collision so that minor or negligent testing by manufacturers cannot be used to show compliance. The FAA agrees standardized test procedures could be an effective way to demonstrate applicants have fulfilled the applicable standards, but notes the rule allows for wide variance in the operating criteria and designs of small unmanned aircraft. The performance-based nature of this rule allows industry to develop new or innovative standardized methods, which might include test dummies, that will be effective in demonstrating compliance.

Some commenters asked whether owners of self-built small UAS can test their own aircraft. The FPVFC volunteered to create a checklist for small UAS self-certification of compliance for safety testing, which anyone could use. Any person intending to operate a self-built small UAS over people must follow an FAA-accepted means of compliance to list the small UAS on the declaration of compliance submitted to the FAA. The FAA anticipates small unmanned aircraft manufacturers producing many small unmanned aircraft may find some means of compliance more appropriate than others, as some test procedures may involve destructive testing of multiple small unmanned aircraft to demonstrate compliance. This rule permits owners of self-built small unmanned aircraft to develop a means of compliance that does not involve destructive testing of multiple copies of a particular small unmanned aircraft. Anyone may submit a proposed means of compliance to the FAA for review.

The News Media Coalition believed the Agency should rely on findings of the safety of certain models of small UAS and experience with waivers for operations over people to inform performance-based rulemaking that reflects the FAA's data. Until a final rule is published, the commenter wrote that the FAA should allow any subsequent operators of a model of small UAS that has already received a waiver to secure a waiver without undergoing new performance testing. Waivers are issued on a case-by-case basis in accordance with § 107.200. The decision to renew or modify a waiver will continue to depend on the details of the proposed operation.

2. Submittal and Acceptance of a Means of Compliance

As described previously, applicants submitting a declaration of compliance for acceptance must use an FAA-accepted means of compliance to establish compliance with the requirements. Any person may propose a means of compliance. A person who submits a means of compliance for FAA acceptance must provide a detailed description of the means of compliance and explain exactly how the testing, analysis, or inspection establishes the small UAS meets one or more of the safety requirements. When proposing the means of compliance for FAA acceptance, the applicant must include substantiating data, including studies or research reports, that supports the proposed means of compliance.

The FAA will indicate acceptance of a means of compliance by publishing a Notice of Availability in the **Federal Register** identifying the means of compliance as accepted and by informing the applicant of its acceptance.⁵¹ If the FAA does not accept a means of compliance, the FAA will notify the applicant of the rationale for its decision. The FAA may rescind a previously accepted means of compliance on determining the means of compliance does not meet the applicable requirements for operations over people.

When reviewing a means of compliance, the FAA will utilize a comprehensive set of criteria. The FAA will determine whether the testing, analysis, or inspection described in the means of compliance demonstrates that a small unmanned aircraft meets the appropriate regulatory requirements. A means of compliance must address the injury severity limits, the exposed rotating parts prohibition, or a combination of both, and verification that there are no safety defects. The FAA will determine whether the proposed means of compliance aligns with accepted methods used by the medical industry, consumer safety groups, or other peer-reviewed test methods. In addition, the FAA will consider whether the proposed means of compliance relies on exceptional remote pilot skill or excessive pilot workload to satisfy the requirements.

The NPRM provided a means of compliance in which an applicant could use a drop test procedure to

⁵¹ A means of compliance is not considered to be "FAA-accepted" until the means of compliance has been evaluated by the FAA, the applicant has been notified of acceptance. The FAA will publish a Notice of Availability in the **Federal Register** identifying the means of compliance as accepted.

demonstrate the small unmanned aircraft complies with the injury severity limits for Category 2 or Category 3. This FAA-provided means of compliance does not consider the effect of these aspects on an impact with a person because it assumes that the total kinetic energy of the small unmanned aircraft would be transferred to the person on impact.

In reality, however, the small unmanned aircraft may transfer much less energy than this assumed maximum. In this regard, the Agency acknowledged structural configuration, materials of construction, or other design features may function to reduce the amount of the total kinetic energy that is transferred to a person from a small unmanned aircraft during an impact. For example, the presence of energy-absorbing materials, or an energy-absorbing protective cage, may reduce the transfer of kinetic energy during an impact with a person. An applicant may provide data showing the amount of kinetic energy that is transferred to a person during an impact based on the impact-absorbing characteristics of the small unmanned aircraft. Some applicants might seek to use design features such as parachutes or other deployable devices that reduce impact velocity to establish a small unmanned aircraft would impact a person with a reduced amount of kinetic energy. Such design features will require the FAA's review to determine whether they assist in achieving an acceptable means of compliance if the small UAS relies on the proper functioning of these features.

Any person may propose a new means of compliance to the FAA as a way to show compliance with the requirements. The NPRM had referred to this as a "custom means of compliance," which several commenters found confusing. Commenters such as CDA and AirXOS remarked on the time and expense associated with the approval process for a custom means of compliance and were concerned that it would be difficult, time-consuming, and costly. The Agency agrees that any individual creating a means of compliance would likely incur greater cost compared to using the FAA-provided means of compliance or an existing FAA-accepted means of compliance. The FAA encourages the development and use of standardized test procedures from a voluntary consensus standards body as a means of compliance. However, applicants are not required to use them.

The NPRM only referred to "custom means of compliance" to distinguish the FAA-provided means of compliance or

a means of compliance provided by a voluntary consensus standards body from any other type of means of compliance. The NPRM stated a means of compliance submitted by a voluntary consensus standards body may be accepted more quickly than those submitted independently. The FAA will evaluate means of compliance submitted by a voluntary consensus standards body and by an independent party with the same level of rigor. The FAA generally works with voluntary consensus standards bodies in the development of these standards. As a result, any means of compliance based on these standards will already have gone through a comprehensive review process during development.

A commenter asked whether a deadline will exist for the means of compliance and if manufacturers could choose the methods to bring their small UAS into compliance. The FAA notes that there is no deadline for the submittal or acceptance of the means of compliance other than that it must be accepted by the FAA before an applicant can list it on a declaration of compliance. The NPRM stated a person submitting a means of compliance for FAA review could also submit the declaration of compliance listing that means of compliance at the same time. However, given that the FAA is no longer using the term "custom means of compliance," the FAA clarifies that, to obtain acceptance of a declaration of compliance, an applicant must identify the FAA-accepted means of compliance that it used. The FAA will finalize the means of compliance acceptance process as described in this section.

3. Rescission Process for a Means of Compliance

The NPRM proposed that it could rescind a means of compliance if the FAA determined from service history that the means of compliance did not meet the applicable standards for operations over people. However, the NPRM did not include regulatory text. In this final rule, the FAA has maintained the right to rescind a previously-accepted means of compliance and added regulatory text for clarity.

Some commenters expressed concerns about the ability of applicants to demonstrate compliance with the safety requirements. While Vortezon, Inc. agreed that small UAS manufacturers should bear the burden of demonstrating compliance with the injury severity limits, the commenter wrote that FAA itself should independently and thoroughly test the data submitted to support any means of

compliance applications. The commenter believed that delegating that responsibility might result in a lack of uniformity in establishing the standards under which the industry will operate. Vortezon wrote that the procedures the Federal Communications Commission (FCC) uses to approve radio frequency devices might provide a template for the FAA. Another commenter noted that the proposed rule sets up the FAA as the final authority in determining compliance with the requirements, which they considered an appropriate balance.

To ensure the continued eligibility of small unmanned aircraft operating over people, the FAA finds it necessary to make clear that compliance is an ongoing process, and that the FAA maintains the authority to continuously evaluate that the applicant's means of compliance provides factual and correct data. The FAA can exercise its authority to rescind a means of compliance if the small unmanned aircraft does not meet any or all of the requirements of the subpart as a result of errors or deficiencies in the test, inspection, or analysis. As such, this final rule includes a regulatory provision to allow the FAA to rescind the means of compliance.

4. FAA-Provided Means of Compliance

As described above, the FAA-provided means of compliance includes a test and inspection method in which applicants demonstrate their small unmanned aircraft will not exceed injury severity limitations or the exposed rotating parts prohibition. The FAA has not made any changes to the FAA-provided means of compliance discussed in the NPRM. The FAA anticipates applicants will submit for comprehensive means of compliance that include innovative materials and designs, unlike the FAA-provided means of compliance described in the NPRM.

a. FAA-Provided Injury Severity Limit Means of Compliance

The FAA-provided means of compliance for the injury severity limitations entails an applicant's calculation of the small unmanned aircraft's maximum kinetic energy. This means of compliance does not account for impact dynamics or other factors, but consists of using only the formula the FAA describes to calculate the small unmanned aircraft maximum kinetic energy. Use of this formula alone establishes the small unmanned aircraft will not exceed one of the injury severity limits because, as described above in Section VI.A.1. of this

preamble, 11 ft-lbs (for Category 2 operations) and 25 ft-lbs (for Category 3 operations) are kinetic energy values that assume a limit on injury severity. Applicants interested in using this test may find more information about the FAA-provided means of compliance in the NPRM and the associated Advisory Circular (AC) for this rule, AC 107-2A.⁵²

Several commenters specifically addressed the FAA-provided means of compliance. ASSURE stated, “[u]sing this means of compliance, there will be no aircraft with a commercially viable payload that can meet the § 107.115 Category 2 operations in the NPRM and as such this NPRM will do nothing to expand the operations of the sUAS in the U.S.” The Small UAV Coalition and AirXOS both agreed with ASSURE’s conclusion. The Small UAV Coalition urged the FAA to use the automotive injury metrics as ASSURE suggested. AirXOS and CDA both stated the FAA-provided means of compliance does not sufficiently permit different materials or structural configurations, which can affect the damage resulting from a collision with a small unmanned aircraft. Both commenters were similarly concerned the FAA-provided means of compliance does not consider devices that may deploy and reduce the maximum impact speed or the reduced probability of failure or impact. These commenters stated the rule, if adopted, would impede innovation. CDA also believed the risk analysis should give operators credit for operational safeguards.

The FAA acknowledges the limitations associated with the FAA-provided means of compliance for the injury severity limits. The Agency intended to provide a test method that applicants could use to show compliance with the injury severity limitations, with the understanding that industry would develop more flexible means of compliance using consensus standards organizations. The FAA expects these industry standards to consider that small unmanned aircraft often have non-rigid structures, which can reduce the kinetic energy transferred to a person on impact. The FAA also expects industry consensus standards to address the use of deployable devices, such as parachutes, to demonstrate compliance with the injury severity limitations. Unlike the FAA-provided means of compliance, those that industry provides could leverage variable modes and configurations. The FAA-provided

means of compliance allows applicants to have a method of complying with the injury severity limitations prior to development of any other means of compliance.

The FAA-provided means of compliance considers typical failures and environmental conditions during testing. Boeing asked the FAA to define what the NPRM meant in using the term “typical.” In this case, “typical” describes a likely occurrence during normal operations of the small unmanned aircraft, (e.g., human error, systems failures, or environmental conditions that could lead to a loss of operational control). Because each small unmanned aircraft and its anticipated operating environment are different, the applicant is best-suited to determine what is typical. This rule requires the applicant to submit substantiating data that includes sufficient information concerning the environmental conditions and the maximum speeds the manufacturer utilized, as well as any unique test conditions for both the level flight and free-fall scenarios. This means of compliance is now available as an FAA-accepted means of compliance with the finalization of this rule.

b. FAA-Provided Exposed Rotating Parts Means of Compliance

In the NPRM, the FAA provided a means of compliance for the exposed rotating parts prohibition, which would require an applicant to ensure the small unmanned aircraft does not have parts that are exposed. For example, if the propellers that provide lift and thrust for the small unmanned aircraft are internal to the unmanned aircraft, such as in a ducted fan configuration, and are incapable of making contact with a person as a result of an impact, then the parts would not be exposed. As a result, the aircraft would satisfy this requirement. An applicant must inspect the small unmanned aircraft to establish that it does not have any exposed rotating parts and determine that any rotating parts would not become exposed during an impact with a person.

The NPRM noted an industry consensus organization could develop a standard for small unmanned aircraft that have rotating parts protected by safety features. If the applicant tests those safety features and establishes they remain effective during impact, this could demonstrate that exposed rotating parts would not be capable of lacerating human skin. If, however, a small unmanned aircraft has rotating parts that are exposed without any protective safety features, the NPRM proposed to permit applicants or others

to show through testing, analysis, or inspection that the rotating parts would not be capable of lacerating human skin on impact with a person.

Several commenters addressed the issue of using a means of compliance to establish compliance with the exposed rotating parts prohibition. One commenter stated the ability to create novel means of compliance would drive innovation in finding alternatives to exposed rotating parts. The commenter believed the FAA should clarify that a small unmanned aircraft without rotating parts should not be required to submit proof of compliance.

To satisfy the eligibility requirements for Categories 2 and 3, a small unmanned aircraft must meet the performance-based requirements for exposed rotating parts by following an FAA-accepted means of compliance. A small unmanned aircraft that does not have any rotating parts would meet the FAA-provided means of compliance; the declaration of compliance would include an indication of this. Even if the small unmanned aircraft is designed to operate without rotating parts, the applicant must still submit a declaration of compliance to demonstrate the small unmanned aircraft complies with the exposed rotating parts prohibition and the injury severity limitation. This means of compliance is now available as an FAA-accepted means of compliance with the finalization of this rule.

5. Deployable Devices and Other Safety Mechanisms

In the proposed rule, the Agency stated applicants may want to consider the use or testing of design features such as parachutes, ballistic recovery systems, or other deployable devices that create drag to reduce the maximum impact speed. While the FAA did not consider the use of a deployable device in the FAA-provided means of compliance, this rule does not prohibit anyone from submitting a means of compliance that considers deployable devices. The FAA will evaluate such design features to determine whether they assist in achieving an acceptable means of compliance.

Several commenters submitted comments regarding the use of deployable devices. AirXOS said that, consistent with the FAA’s Safety Risk Management Policy,⁵³ the safety risk of a particular hazard should be assessed using a combination of the severity and likelihood (probability) of the potential

⁵² 84 FR 3877-3879. A copy of the AC 107-2A is available in the public docket for this rulemaking.

⁵³ FAA Order 8040.4B, Safety Risk Management Policy (May 2, 2017), available at https://www.faa.gov/documentLibrary/media/Order/FAA_Order_8040.4B.pdf.

outcome of the hazard. AirXOS stated the FAA should consider comparative safety benefits when evaluating the overall risk for operations over people. In addition to technological mitigations, AirXOS said the risk analysis should also consider operational safeguards, such as an operator having a comprehensive safety management system and flight proficiency training. MPAA and NCTA, commenting jointly, stated design safety features such as frangible components, propeller cages, propeller guards, parachutes, or padding that may increase the weight of a small unmanned aircraft are also likely to minimize the risk of injury. Some commenters suggested small UAS could be equipped with a range of safety mechanisms, including visual and audible alerts, collision avoidance systems, and parachutes.

Under this rule, applicants may choose to demonstrate compliance with the appropriate safety requirements of Category 2 or Category 3 using designs with safety features such as frangible components, propeller cages, propeller guards, parachutes, or padding. To do so, they must use an FAA-accepted means of compliance that incorporates those safety features as a means to comply with the injury severity limitations.

While use of other safety mechanisms (e.g., visual and audible alerts, collision avoidance systems, etc.) may decrease the likelihood of an impact with a person, the FAA will not factor in these devices in considering proposed means of compliance for Category 2 or Category 3 because they do not address the injury severity limitations or exposed rotating parts prohibition. The FAA may consider these devices as part of the Category 4 process or in a waiver application, particularly for applicants considering reliability and likelihood.

ParaZero and Indemnis both asserted that, even when equipped with a parachute, very few unmanned aircraft models will be capable of meeting the applicable kinetic energy limitation. A-Cam Aerials noted the proposed performance-based requirements would not permit certain operations even with mitigations, such as parachutes that adhere to the ASTM F3322-18 parachute standard.⁵⁴ The commenter requested the FAA consider allowing operational mitigations instead of requiring design mitigations, asserting these design considerations would limit the number of manufacturers that could

meet the injury severity limitations. The rule, however, does not require manufacturers to meet the requirements using the FAA-provided means of compliance. An applicant may choose to demonstrate compliance with the injury severity limitations using deployable devices, as long as the applicant describes the use of them in the proposed means of compliance. The Agency encourages industry to develop means of compliance that leverage existing and future industry standards for the design, maintenance, and testing of such devices.

One commenter believed parachutes are not necessary based on the accident record for small unmanned aircraft or the ASSURE report. The UAS Program Leader for the Memphis Fire Department wrote that if parachutes are required, these systems are unable to be tested. He noted that the fire department performs a preflight safety inspection and flight check before every takeoff, but would be unable to test, check, or inspect a parachute system. The FAA clarifies that a deployable device system is not required. Applicants have the discretion to incorporate the use of a deployable device.

C. Declaration of Compliance

The NPRM stated self-certification is the appropriate method for manufacturers to declare compliance with a performance standard. Self-certification, combined with the Agency's determination that the means of compliance the manufacturer has used is acceptable, will ensure the small unmanned aircraft, when operated over people, will afford the public an appropriate level of safety.

1. Persons Who May Submit a Declaration of Compliance

The NPRM proposed that any person or entity that designs, produces, or modifies a small unmanned aircraft for use in Category 2 or Category 3 operations must submit a declaration of compliance to the FAA for acceptance. The NPRM characterized any person who designs, produces, or modifies a small unmanned aircraft for such operations as a "manufacturer" for purposes of this rule.

Several commenters, including AUVSI, FPVFC, and several other individuals, commented on the use of the term "manufacturer." AUVSI indicated the FAA did not account for the entire range of entities that may wish to submit a declaration of compliance and recommended the Agency clarify that non-manufacturer third parties and operators that do not alter a small UAS would be eligible to

submit a declaration of compliance in order for that small UAS to become eligible for Category 2 or Category 3 operations, regardless of whether the entity originally manufactured or modified the small UAS. The person who submits the declaration of compliance must be able to demonstrate they have used an FAA-accepted means of compliance to fulfill the standard. Although the FAA does not expect the resale of small unmanned aircraft by non-manufacturer third parties to be a typical occurrence, if the applicant wishing to make the small unmanned aircraft eligible for operations under Category 2 or Category 3 is able to submit a declaration of compliance with all required elements, the FAA would accept that declaration even though that person has not designed, produced, or modified the small unmanned aircraft. To reduce confusion, the final rule clarifies that the responsible party is the applicant.

To be eligible to operate in accordance with Category 2 or Category 3, the small unmanned aircraft must be listed on an FAA-accepted declaration of compliance. The FAA does not restrict who may submit a declaration of compliance and anticipates entities that produce and sell a complete and operable small unmanned aircraft to submit the most declarations of compliance. Other persons who may submit a declaration of compliance include designers or producers of kits that contain all the components and parts from which to build an operable small unmanned aircraft eligible for Category 2 or Category 3 operations. One commenter stated the FAA should not consider someone who assembles a kit to be a manufacturer. A small unmanned aircraft listed on an FAA-accepted declaration of compliance could be sold as a kit. The person who assembles such kit per the provided instructions is not required to submit a declaration of compliance; however, in order for the small unmanned aircraft assembled from that kit to be eligible for Category 2 or Category 3 operations, the producer of the kit must have submitted a declaration of compliance and received from the FAA acceptance of the declaration.

Any person who builds a small unmanned aircraft from parts not in a complete kit or who modifies a small unmanned aircraft to be compliant with Category 2 or Category 3 must submit a declaration of compliance and receive FAA acceptance of it before the small unmanned aircraft would be eligible for operations under the applicable category. For example, a person who modifies a small unmanned aircraft that

⁵⁴ ASTM F3322-18, Standard Specification for Small Unmanned Aircraft System (sUAS) Parachutes, ASTM International, West Conshohocken, PA, 2018, <http://www.astm.org/cgi-bin/resolver.cgi?F3322>.

was originally produced prior to the effective date of this rule so that the small unmanned aircraft becomes eligible to conduct Category 2 or Category 3 operations must submit a declaration of compliance.

A small unmanned aircraft is not covered by a declaration of compliance if it has been modified outside the configurations and modifications allowed in the remote pilot operating instructions for that small UAS. For example, the person who submitted the declaration of compliance for the Category 2 operation would not be responsible for the new configuration of the small unmanned aircraft after modification. The person who modified the unmanned aircraft would be responsible for submitting a new declaration of compliance describing the new configuration and receiving acceptance of it to establish eligibility for the appropriate category before the small unmanned aircraft can be operated over people.

A few commenters suggested people who build their own small unmanned aircraft should not be considered manufacturers and therefore not be required to submit a declaration of compliance. Another commenter asserted a primary reason people choose to build their own small unmanned aircraft is to save money and these people will not have the financial resources or access to testing equipment to demonstrate compliance. The FAA disagrees with the assertion that a distinction should exist between home-built small unmanned aircraft and other small unmanned aircraft. The four categories this rule establishes are not based on the purpose for which the small unmanned aircraft was built. Any person designing and building a small unmanned aircraft and intending to operate over people under Categories 2 or 3 must submit a declaration of compliance.

The FAA finalizes the term “applicant” to describe the person who submits the declaration of compliance. The applicant refers to the person who declares that the small unmanned aircraft meets the eligibility requirements for operations over people.

2. Submission of Declaration of Compliance for FAA Acceptance

For a small unmanned aircraft to be eligible to conduct operations over people in accordance with Category 2 or Category 3, the Agency proposed to require the applicant to declare that the small unmanned aircraft complies with the applicable performance-based requirements through use of an FAA-accepted means of compliance. The

applicant would do this by submitting a declaration of compliance via an electronic form available on the FAA’s website.

By submitting a declaration of compliance, an applicant would declare that it: (1) Established and maintained a process to notify owners of small unmanned aircraft and the FAA of any unsafe conditions that render those small unmanned aircraft non-compliant with subpart D; (2) would correct any safety defects the FAA identified; and (3) would allow the Administrator to inspect its facilities, technical data, and any manufactured small unmanned aircraft and witness any tests necessary to determine compliance with this subpart.

In response to the proposed declaration of compliance requirements, one commenter believed the assumption of liability must be inherent to the concept of a declaration of compliance. The existence of a declaration of compliance, however, does not automatically release the applicant or the remote pilot from any potential liability. For example, if a remote pilot were to operate the small unmanned aircraft over people in a configuration not specified in the remote pilot operating instructions, in an unsafe condition, or in a careless or reckless manner, a valid declaration of compliance does not release the remote pilot from responsibility. This commenter also asked how the declaration of compliance relates to section 345 of the FAA Reauthorization Act of 2018, which deals with self-certification.⁵⁵ This rule is consistent with the statutory requirements in section 345 of the 2018 FAA Reauthorization Act. This statute requires FAA to develop a process for accepting “risk-based consensus safety standards relating to the design, production, or modification of small unmanned aircraft systems.” Public Law 115–254, sec. 345(a)(1). In consideration of these requirements, this rule allows an applicant to request FAA acceptance of a means of compliance that is based on consensus safety standards.

The Small UAV Coalition supported the proposal to allow “self-certification” of compliance with the applicable standards; however, because the FAA will accept declarations of compliance on determining the manufacturer has demonstrated compliance with the requirements of the rule, the Coalition

⁵⁵Public Law 115–254, sec. 345 (Oct. 5, 2018) (“Small Unmanned Aircraft Safety Standards”) requires the FAA to establish a process for acceptance and use of consensus safety standards for the design, production, and modification of small UAS.

noted the requirements seem similar to the means of compliance. The means of compliance and declaration of compliance go hand in hand. The means of compliance answers the question of how a person or entity meets the requirements of the rule. The declaration of compliance establishes the applicant is declaring it has met the applicable injury severity limitations, the exposed rotating parts prohibition, or a combination of these requirements through an FAA-accepted means of compliance.

DJI urged the Agency to allow manufacturers to demonstrate compliance to certain regulations through the declaration of compliance and recommended using Transport Canada’s “Remotely Piloted Aircraft Systems Safety Assurance Advisory Circular” (AC 922–001) as a model. While the FAA did not accept this recommendation to incorporate Transport Canada’s AC, the FAA notes that this rule allows applicants to show compliance with the requirements by submitting a declaration of compliance and receiving FAA acceptance.

While generally supporting the proposed framework for the declaration of compliance, AUVSI recommended the FAA ensure the framework operates flexibly to avoid undue burden on small UAS operators who modify their small UAS and on non-manufacturers that wish to certify a small UAS. AUVSI asked the FAA to ensure the framework would permit manufacturers to certify a “wide variety” of payloads and configurations without the need for re-certification as long as modifications were within a certain range. The Coalition asked the FAA to ensure compatibility between the rules allowing night operations and operations over people, including any modifications for night operations.

Operations of small unmanned aircraft under Category 1, Category 2, or Category 3 must adhere to the applicable performance-based eligibility requirements, regardless of any modifications. The FAA will permit applicants to identify acceptable modifications, including payloads and configurations, in the remote pilot operating instructions as part of their declaration of compliance. Because the injury caused by an impact from the small unmanned aircraft could be different for each modification that changes the small unmanned aircraft configuration or properties, they must fulfill the applicable standard through an FAA-accepted means of compliance. This rule allows such evaluation by test, analysis, or inspection. For example, an applicant may not have to conduct

separate evaluations for two different brands of propellers if they are the same diameter, pitch, weight, and material. If, through analysis, an applicant proves the propellers will behave the same, he or she would only have to conduct the impact test with one brand of propeller, but could list both brands of propellers as approved equipment in the remote pilot operating instructions.

A commenter recommended including a requirement in the declaration of compliance that all “written communications be written in proper English and follow standards for plain language.” The FAA declines to accept this recommendation, as the Agency finds it unnecessary to provide prescriptive writing requirements.

This rule adopts the declaration of compliance submission as proposed, with the clarification that any person may submit a declaration of compliance for FAA acceptance. The Agency has determined accepting declarations of compliance is appropriately risk-based and suitable for allowing operations over people, as it is sufficient for the level of risk involved.

3. Contents of Declaration of Compliance

The NPRM proposed that an applicant intending to list a small unmanned aircraft as eligible for operations over people in accordance with Category 2 or Category 3 would submit a declaration of compliance to the FAA. A template for the declaration of compliance will be available in an electronic form on the FAA’s website. A completed declaration of compliance will include information the Administrator would require for both determining that a small unmanned aircraft complies with the applicable requirement and for tracking those models of small unmanned aircraft that were declared compliant. Applicants will declare they have met the requirements of the rule through an FAA-accepted means of compliance and include the following information:

- FAA-accepted means of compliance used.
- Name of the applicant.
- Physical address of the applicant.
- Email address of the applicant.
- Small unmanned aircraft make, model and series, if applicable.
- Serial number or range of serial numbers for the small unmanned aircraft (open-ended are permitted).
- Whether the declaration of compliance was an initial or an amended declaration of compliance and, if amended, the reason for the resubmittal.
- Declaration that the applicant:

- Has demonstrated the small unmanned aircraft meets the injury severity limitations of Category 2, Category 3, or both, and the exposed rotating parts prohibition;

- Has demonstrated the small unmanned aircraft does not have any safety defects;

- Has satisfied the requirement to maintain a product support and notification process; and

- Will, upon request, allow the Administrator to inspect its facilities and its technical data.

- Any other information as required by the Administrator.

If an applicant amends an FAA-accepted declaration of compliance, the applicant must include the reason for the amendment. For example, the amendment could be to identify a different means of compliance, update an address, or correct a misspelling.

This final rule states the applicant must make a declaration for the items in the declaration of compliance instead of a certification. This change in the regulatory text does not change items required in the declaration of compliance; instead, it simply removes any potential confusion associated with the airworthiness certification process.

Information contained in declarations of compliance will be publicly available. By posting the declarations or otherwise making the information in the declarations publicly available, the FAA and the public will be able to determine which make, model, and series, if applicable of small unmanned aircraft are eligible to conduct operations over people pursuant to Categories 2 and 3. No comments specifically addressed the contents of the declaration of compliance. The Agency also did not receive any comments regarding its proposal to make information about accepted declarations of compliance available to the public through an FAA website. This rule adopts the requirements related to contents of the declaration of compliance, as proposed.

Some commenters addressed the requirement that applicants allow the FAA to inspect their facilities. A commenter stated that the requirement for facility inspections seems difficult for overseas manufacturers and generally unnecessary. Access to each applicant’s facilities provides a mechanism for the FAA to validate procedures, processes, and methods as well as the data used to demonstrate compliance with the safety requirements. The FAA regularly performs routine inspections of facilities of those who hold type certificates and production certificates overseas. The FAA maintains authority to inspect

overseas facilities at which a manufacturer designs, produces, or modifies small unmanned aircraft for operations under Category 2 or Category 3.

One commenter found the proposed rule unclear regarding whether a person who either designed or modified a small unmanned aircraft would be subject to the on-site inspections proposal. An applicant who submits a declaration of compliance to operate over people would be subject to the onsite inspection requirement. On request, the person who submits the declaration of compliance must be prepared to demonstrate how they can validate that they are in compliance with their declaration of compliance and this rule.

The Agency adopts the list of information that must be included in the declaration of compliance as proposed, with no changes.

4. Accountability for Persons Submitting Declarations of Compliance

After an applicant declares a specific small unmanned aircraft meets the requirements of a particular category, the Agency proposed to require the applicant to monitor the small unmanned aircraft to ensure it complies with the applicable requirements. Specifically, an applicant would monitor the validity of the means of compliance used and verify it does not exceed the injury severity limitations and complies with the exposed rotating parts prohibition. The applicant would track the construction, related safety analysis, and service history to ensure they do not reveal any hazardous conditions or safety defects that could increase the risk of a small unmanned aircraft operation over people. Moreover, the applicant must continue to ensure that the remote pilot operating instructions satisfy the regulatory requirements. To satisfy these obligations, an applicant may have to monitor its manufacturing processes, small unmanned aircraft operational usage, and collection of accident and incident data. Monitoring could also include information that owners and operators of the small unmanned aircraft provide. Should the FAA identify a safety issue that warrants review of an applicant’s data, records, or facilities, this rule requires applicants to grant access to facilitate such review.

Furthermore, the Agency proposed to require applicants submit an actual record declaring compliance. Section 107.5, which prohibits any fraudulent or intentionally false record from being made, kept, or used to show compliance with any requirement of part 107, will apply to such records. In this regard,

falsifying any part of any record intended to constitute proof of compliance with applicable requirements could subject the person who submitted the record to a civil penalty and would be a basis for rescinding a declaration of compliance.

The Agency did not receive any comments regarding the falsification provisions proposed and adopts those provisions without change.

5. Declaring Compliance for Multiple Small Unmanned Aircraft With the Same Make and Model

In the NPRM, the Agency recognized that applicants producing the same make and model of small UAS on a large scale may not wish to perform individual unit testing to demonstrate that each small unmanned aircraft fulfills the applicable requirements. The Agency clarified that the proposed rule text would allow applicants to declare compliance for a make and model of small unmanned aircraft, rather than declaring compliance for *each* small unmanned aircraft an applicant designs, produces, or modifies.⁵⁶ The NPRM stated the applicant could establish and maintain a production quality system and design configuration control system to provide for consistent repeatability, to confirm each small unmanned aircraft fulfills the applicable standard for which the applicant declared compliance. As a result, an applicant could avoid testing every aircraft it constructs. Using a quality assurance system could confirm each aircraft subsequently manufactured would meet the performance-based requirements of this rule. The FAA received no comments on this policy and adopts the inclusion of “make and model” in the regulatory text of the section that sets forth the requirements for declarations of compliance, as proposed.

6. Declaring Compliance for a Small Unmanned Aircraft That Is Eligible for Multiple Categories of Operations

If an applicant conducts testing or engages in analysis or inspection to determine a small unmanned aircraft could meet the requirements for operations in both Categories 2 and 3 in the appropriate modes or configurations, the NPRM proposed to require the applicant to submit only one declaration of compliance. On that declaration of compliance, the applicant would identify the categories of operation for which it determined the small unmanned aircraft was compliant and the means of compliance used for each category. The Agency did not

receive any comments regarding this proposal and adopts it without change. For more information on the requirements for small unmanned aircraft with variable modes and configurations, see Section VI.F. of this preamble.

7. FAA Acceptance of a Declaration of Compliance

The NPRM proposed to require an applicant to provide information on its declaration of compliance regarding whether it has used an FAA-accepted means of compliance or a means of compliance the FAA has not yet accepted. If an applicant uses a means of compliance that the FAA has not yet accepted, the FAA must review and accept the means of compliance before the FAA can accept the declaration of compliance. The FAA will notify the applicant of its decision regarding acceptance of the means of compliance and declaration of compliance. Once the FAA accepts a declaration of compliance, the FAA will make the declaration of compliance, or information from the declaration, publicly available. The Small UAV Coalition commented that the NPRM does not describe what the FAA review will entail or how long it will take. The Small UAV Coalition further commented that, because the Agency did not describe whether it would undertake any discretionary review of the declaration of compliance, it expects a quick acceptance or denial.

The FAA will use its discretion to review and validate that the applicant meets the requirements of the FAA-accepted means of compliance through test data, third party validation, or the like, before rendering a decision on the declaration of compliance. Because means of compliance will vary in complexity, the FAA cannot provide estimates regarding the time needed for considering declarations. The FAA may request additional information from the applicant to determine whether the small unmanned aircraft listed in the declaration of compliance meets the listed FAA-accepted means of compliance. The FAA will respond to declaration of compliance submissions once it completes its review.

The proposed rule provides a sufficient framework for the Agency’s approach for overseeing compliance with the proposed standards. The FAA adopts the process for accepting the declaration of compliance as proposed, with no changes.

8. Submitting a New Declaration of Compliance for a Modified Small Unmanned Aircraft

The Agency proposed to require any person who modifies a small unmanned aircraft in a way that could affect the eligibility of the small unmanned aircraft to operate over people under Category 2 or Category 3 to submit a new declaration of compliance and receive FAA acceptance of it before anyone operates the small unmanned aircraft over people. If an individual modifies the small unmanned aircraft in a manner that the original applicant identifies in the remote pilot operating instructions as an allowable change, the individual will not need to submit a new declaration of compliance. When a person submits a declaration of compliance for a small unmanned aircraft that was not previously eligible for operations over people, the FAA would verify the small unmanned aircraft fulfills the applicable standard.

The News Media Coalition stated this requirement imposes an unnecessary and unreasonable burden and suggested the FAA require any buyer of a secondhand small UAS to be solely responsible for determining their own compliance with the rules, rather than requiring the seller of secondhand small UAS to provide remote pilot operating instructions or meet other requirements. Before operating over people, the remote pilot is responsible for ensuring that the small unmanned aircraft they intend to use is eligible to conduct operations over people. Prior to purchasing a small unmanned aircraft for the purpose of operations over people, buyers should verify the small unmanned aircraft has current remote pilot operating instructions and is listed on a valid declaration of compliance.

Some applicants may choose to provide criteria that describes acceptable modifications in their remote pilot operating instructions, rather than specific acceptable parts. In this regard, several commenters were concerned that adding or changing a camera could result in a disqualifying modification. Applicants can determine which payloads or modifications would be permitted and still meet the standard of Category 2 or Category 3.

Another commenter asked the FAA to specify that “modifying the firmware” would be exempt from the requirement, as the commenter stated several manufacturers install firmware that is more restrictive than the regulations. Updates to small unmanned aircraft firmware would be acceptable as long as they occur in accordance with the remote pilot operating instructions.

⁵⁶ 84 FR at 3882.

APPA, EEI, and NRECA, commenting jointly, applauded the FAA's recognition of the need for operational flexibility and supported the proposal "as an appropriate balance between operators' needs and public safety with minor clarification." Specifically, the commenters recommended the rule require manufacturers to identify permissible modifications in terms of weight, size, and shape, as opposed to specific identification of a make or model of equipment. The Agency declines to include this prescriptive requirement, as such detail is unnecessary and market forces will incentivize manufacturers to craft operating instructions that address the needs of prospective buyers and users of the small unmanned aircraft.

9. Notification of a Safety Issue

The NPRM stated the FAA would notify an applicant that submitted a declaration of compliance if it determines the small unmanned aircraft is not compliant with the injury severity limits or prohibition on exposed rotating parts or because the small unmanned aircraft has a potential safety defect. The FAA would identify such safety issues through a variety of means. The FAA may receive consumer complaints, industry safety bulletins, or an individual applicant's notification that a safety issue has arisen. Applicants would have the opportunity to discuss potential safety issues with the FAA. As a result of such discussion, the FAA may determine a safety issue does not actually exist, that the applicant has incorporated an adequate mitigation to address and correct the safety issue, or that a safety issue still exists.

To correct a safety issue, an applicant could develop a correction and test the aircraft to ensure the aircraft no longer has a safety issue. The applicant must correct any safety issues they identify after manufacturing the small unmanned aircraft on an ongoing basis to ensure continued eligibility for Category 2 or Category 3 operations.

The Agency proposed to require resolution of any identified safety issue. In the absence of acceptable resolution, the rule indicates the FAA would commence rescission proceedings, as explained below. A commenter stated, that as the NPRM is written, the FAA has no way of identifying, then informing a specific fleet that there is a safety issue. This commenter further stated there is no requirement for manufacturer responsibility to keep a list of customers and both communicate directly and post notices of defects and rescission on their website. As noted previously, there are multiple ways by

which the FAA could become aware of a safety issue. The FAA must inform the applicant of any known safety issues. Additionally, the holder of the declaration of compliance must establish and maintain a product support and notification process to ensure that safety issues are communicated to the public and the FAA. This rule adopts the safety issue process, as proposed.

10. Notice of Rescission of a Declaration of Compliance

The NPRM proposed to rescind a declaration of compliance if the FAA becomes aware that a small unmanned aircraft for which an applicant has declared compliance is no longer qualified for operations over people. The FAA proposed new procedural rules to govern any action to rescind a declaration of compliance; therefore, the FAA's rules under 14 CFR part 13 would not apply.

The proposed rule stated the FAA may rescind a declaration of compliance if any of the following conditions exist: (i) A small unmanned aircraft for which a declaration of compliance was accepted no longer complies with the applicable safety requirements; (ii) the FAA finds a declaration of compliance violates § 107.5(a); or (iii) the Administrator determines a safety emergency exists.

The proposed rule set forth a procedure for rescission that begins with the FAA sending the applicant a notice of proposed rescission. The notice would set forth the Agency's basis for the proposed rescission and provide the applicant 10 business days to submit evidentiary information to refute the proposed notice of rescission. DJI commented on the proposed timeline for submitting information, stating 10 days is not sufficient to understand the notice and gather and provide information to FAA. DJI suggested 30 calendar days. The FAA agrees that 10 days might be insufficient. This rule extends the notice period to 30 calendar days.

If an applicant does not contest the allegation that a safety issue exists, or if the applicant fails to respond within the required time period, the NPRM proposed to issue a notice rescinding the declaration of compliance. The FAA would publish the final rescission on the FAA website and specify the category of small unmanned aircraft to which the rescinded declaration applies. If the FAA rescinds a declaration of compliance as a result of an unresolved safety issue, the FAA proposed to allow an applicant to petition for reconsideration of the

decision or modify the small unmanned aircraft such that the safety issue is resolved, at which point the applicant could submit a new declaration of compliance, which the FAA may accept.

As noted in the NPRM, a rescission of a declaration of compliance would not render a small unmanned aircraft inoperable, but rather no longer eligible for operations over people in Category 2 or Category 3. The small unmanned aircraft could resume operations over people only after the FAA reinstates acceptance of the declaration of compliance or accepts a new declaration that applies to the small unmanned aircraft. Either the original or a subsequent applicant could submit a new declaration of compliance.

In addition to publishing any final rescission of a declaration of compliance on the FAA website, the Agency stated the FAA would publish notification of any applicable safety defects in the **Federal Register** as a Notice of Availability. Such a notice will inform remote pilots that the identified aircraft are no longer eligible to conduct operations over people and would notify applicants not to incorporate the defective material, component, or feature into any upcoming designs without appropriate mitigations. The NPRM also proposed that, on rescinding a declaration of compliance, the FAA would publish the makes and models of small unmanned aircraft that are no longer eligible to operate over people. Remote pilots would be prohibited from using those aircraft to operate over people until the issue is resolved. On correcting a safety defect, the applicant would submit a new declaration of compliance to the FAA identifying the means of compliance the applicant used to correct the safety defect.

Additionally, the NPRM proposed to permit the owner or remote pilot of a small unmanned aircraft to correct a safety defect associated with their aircraft. Any person who chooses this option must submit a declaration of compliance to the FAA identifying the means of compliance used to correct the safety defect. By modifying the small unmanned aircraft such that it is again in compliance with the applicable requirements, that person would become the responsible person listed on the declaration of compliance for their specific small unmanned aircraft.

The FAA sought comment on whether this process provides sufficient opportunities for applicants to resolve safety issues and whether the procedure would adequately inform the public of safety defects. The FAA received a few comments regarding the process. DJI

expressed general support, saying it agrees it is important for the FAA to have a mechanism for serious safety issues to be discussed and addressed by the applicant in collaboration with FAA for operations over people.

The National Association of Mutual Insurance Companies (NAMIC) stated publication of the rescission on the FAA website and the Notice of Availability in the **Federal Register** are insufficient to notify pilots that operations over people are no longer safe. NAMIC recommended the FAA use the contact information it has for registered small unmanned aircraft to notify registered operators of safety defects and rescissions. Another commenter stated that, as written, the proposed rule does not give the FAA a means to identify a safety issue and then inform a specific fleet of that issue; nor does it impose a responsibility on the manufacturer to do so. The commenter questioned why the proposed rule would not require the manufacturer to communicate directly with its customers and post notices of defects and rescissions on their website. The commenter also questioned whether the **Federal Register** is an effective means of communication, suggesting that “while it may satisfy the legal concept of the FAA’s obligation, it is not a useful way to reach operators.”

Publication in the **Federal Register** and on the FAA website are sufficient notification. This process of notification is similar to what the FAA uses for airworthiness directives and resolution of safety issues. The **Federal Register** and the FAA website are an effective and timely means of communicating aviation-related safety considerations to the public. The FAA may consider using the registration system as an additional way to notify registered owners of small unmanned aircraft. The rule allows the FAA to request compliance documentation and to inspect facilities as appropriate. Further, members of the public, including applicants and owners, may inform the FAA of potential safety defects. With regard to notification to owners and operators, each applicant must maintain a notification process and is required to inform the public and the FAA of safety defects. Although the rule does not specify how applicants would comply with this requirement, applicants may find posting on their websites an effective way to notify owners of any small unmanned aircraft safety defects. The FAA expects applicants to use their notification processes to disseminate this information.

Aside from increasing the notification period before the rescission from 10 business days to 30 calendar days, the

Agency adopts the rescission procedure as proposed.

11. Emergency Rescission of a Declaration of Compliance

The NPRM proposed an emergency rescission process for a declaration of compliance. Prior to rescission of a declaration of compliance, the FAA would typically initiate the safety issue notification process with the applicant. However, if the Administrator determines an emergency exists and safety of persons requires an immediate rescission of a declaration of compliance, the FAA may exercise its authority under 49 U.S.C. 46105(c)⁵⁷ to issue an emergency order rescinding a declaration of compliance. Under these circumstances, rescission would go into effect immediately, without the FAA initiating the notification process or the rescission procedures previously described. The order would remain in effect until the basis for issuing the order no longer exists. The emergency order would be considered a final agency decision; as such, an applicant may appeal the decision as provided in 49 U.S.C. 46110 following the issuance of the order. The FAA did not receive any comments about the emergency rescission process. This rule adopts the process as proposed, with no changes.

12. Petition for Reconsideration of a Rescission of a Declaration of Compliance

Once a declaration of compliance is rescinded, the FAA proposed that an applicant would have the opportunity to petition the FAA for reconsideration. An applicant seeking reconsideration must petition the FAA within 60 days of the date of issuance of the notice of rescission. The petition would have to show: (1) The lack of a material fact in the original response to the notification of the safety issue and address why that fact was not present in the original response; (2) an important factual error existed in the decision to rescind the declaration of compliance; or (3) that the FAA did not correctly interpret a law, regulation, or precedent. The FAA would consider this petition and issue a final agency decision either affirming or withdrawing the rescission of the declaration of compliance. An applicant could appeal the final agency decision as provided in 49 U.S.C. 46110.

The FAA did not receive comments concerning the reconsideration process.

⁵⁷ When the Administrator determines that an emergency exists related to safety in air commerce and requires immediate action, the Administrator may issue an immediately effective order to meet the emergency, with or without notice, under 49 U.S.C. 46105(c).

The FAA adopts the reconsideration process, as proposed, with no changes.

D. Small Unmanned Aircraft Manufactured Previous to the Effective Date of This Rule

Some remote pilots and manufacturers of small unmanned aircraft may wish to use existing small unmanned aircraft to conduct operations over people. The Agency does not seek to preclude existing small unmanned aircraft from conducting operations over people. Instead, the proposed rule included procedures to establish the eligibility of existing small unmanned aircraft to operate over people. As explained in the NPRM, an applicant with a previously manufactured small unmanned aircraft may establish eligibility to operate over people by listing the applicable aircraft serial numbers for the identified small unmanned aircraft on the declaration of compliance submitted to the FAA. An applicant requesting acceptance would be responsible for developing remote pilot operating instructions for the existing aircraft and making those instructions available to remote pilots or owners of the small UAS.

The NPRM did not propose to require that an applicant locate owners or remote pilots operating existing small unmanned aircraft and provide the remote pilot operating instructions personally to them. Rather, if a remote pilot owns an existing aircraft that an applicant has identified on a declaration of compliance as eligible for Category 2 or Category 3 operations and the remote pilot intends to conduct operations over people using that aircraft, the remote pilot would be able to access the remote pilot operating instructions if the applicant posted them online.

The proposed rule did not identify an applicant seeking FAA acceptance of a declaration of compliance as the only person who could label a small unmanned aircraft manufactured prior to the effective date of the rule. Requiring an applicant to contact all remote pilots of a particular make and model of small unmanned aircraft and provide them with labels would be unreasonable. The NPRM noted that an applicant could make a label available to remote pilots, either as a website download or for cost. Overall, remote pilots could choose to label their existing aircraft in any manner that meets the requirements of the proposed rule.

The American Petroleum Institute (API) and other commenters suggested the FAA ensure small UAS owners are not required to buy new aircraft that are appropriately labeled or submit their

own declaration of compliance. The News Media Coalition wrote that its members had made significant investments in their current fleets of small unmanned aircraft and do not wish to see them become “immediately obsolete.” An individual commenter said they should be allowed to make modifications to allow their small UAS to become eligible to be used for Category 2 or Category 3 operations. A commenter stated small unmanned aircraft might need upgrades to make the blades safer, but believed the FAA should leave those owners alone. Another commenter asked for guidance on how the use of shrouds applies to existing models. A commenter sought a simple way for everyday operators to determine whether existing equipment can safely operate over people. This commenter wrote that while ‘certified’ equipment may accomplish this going forward, there is a large gap for existing small UAS. This commenter recommended the example of the European notice of proposed amendment (NPA), which specifies certain altitude limits, speeds, and weights.

Small UAS designs that can currently operate under the provisions of part 107 will continue to be able to operate in accordance with part 107 after this rule becomes effective. When the remote pilot wishes to conduct operations over people, however, that person must ensure his or her existing small unmanned aircraft is eligible for the operation. For operations in accordance with Category 2 or Category 3, this involves verifying the FAA has accepted a declaration of compliance concerning the small unmanned aircraft. For Category 1, the remote pilot must verify the aircraft complies with the weight and exposed rotating parts standards. Anyone with a previously manufactured small unmanned aircraft may follow an existing FAA-accepted means of compliance and submit and request acceptance of a declaration of compliance verifying the aircraft is eligible to operate over people.

News Media Coalition believed the FAA should encourage manufacturers to test and certify currently available models, both newly manufactured models and recently sold models. The News Media Coalition asked the FAA to encourage manufacturers to offer a way to upgrade existing small UAS so that they are compliant with any new rules. The News Media Coalition said manufacturers could accomplish this through either a kit or a software or firmware upgrade.

The Agency declines to specify how or if small unmanned aircraft

manufactured prior to the effective date of this rule may meet the requirements of this rule, but notes that an applicant may follow an FAA-accepted means of compliance that incorporates any number of mitigations, including software or firmware updates.

The Small UAV Coalition supported the proposal to apply the requirements of this rule to existing small unmanned aircraft models, such that operations over people with those models may not occur until the FAA has accepted a declaration of compliance for them. The Small UAV Coalition suggested the rulemaking explicitly recognize that an operation with an existing small unmanned aircraft model may occur pursuant to a waiver or exemption, without a declaration of compliance. This rule does not eliminate the ability for a person to submit a waiver under part 107. The FAA evaluates such requests on a case-by-case basis.

The Security Industry Association opined that the proposed rule’s certification process for manufacturers and users seeking to acquire a means of compliance was reasonable. The commenter, however, asked the FAA to provide guidance to small businesses that manufacture small UAS on writing service agreements that comply with the rulemaking and do not subject the small business owners to frivolous lawsuits. However, such agreements are outside the scope of this rulemaking.

The FAA included the previously manufactured small unmanned aircraft section in the NPRM to ensure the requirement for labeling of such small unmanned aircraft would be clear. Given the reorganization of the regulatory text, that specific section is no longer necessary and therefore, the final rule does not include this section.

E. Remote Pilot Operating Requirements

The NPRM proposed to apply several operating limitations and requirements to operations under Categories 2 and 3. Several of the operating requirements apply to both Categories 2 and 3, while Category 3 operations are also subject to additional operating limitations and requirements. This rule adopts the requirements as proposed and clarifies that the remote pilot must verify that the declaration of compliance associated with the small unmanned aircraft is valid. It is the remote pilot’s responsibility to ensure that the small unmanned aircraft is eligible for the intended operation, which the remote pilot can determine by checking the FAA website.

To conduct operations over people under Category 2 or Category 3, remote pilots must ensure their small

unmanned aircraft is eligible for the applicable category or categories of operations. The remote pilot must ensure that the small unmanned aircraft meets the injury severity limits, exposed rotating parts prohibition, and the prohibition on safety defects. The FAA does not expect, nor does it require the remote pilots to inspect the means of compliance or to verify the product support and notification system. However, the remote pilot has a requirement to check that the small UAS is in a condition for safe operation, per § 107.15. The most effective way for a remote pilot to verify that the small unmanned aircraft meets the safety requirements is to ensure it is listed on an FAA-accepted declaration of compliance.

Remote pilots must also ensure their small unmanned aircraft is labeled to indicate the category of eligibility. If a label degrades such that it is no longer legible or attached to the aircraft, the remote pilot must ensure the small unmanned aircraft is relabeled in English such that the label is legible, prominent, and will remain on the small unmanned aircraft for the duration of the operation before operating the aircraft over people. The FAA received a few comments on the labeling requirement, one of which expressed support for it. Several commenters asked the FAA to clarify who is responsible for labeling the small unmanned aircraft. An individual commenter believed the labeling provision could force current UAS owners to buy future systems that are already labeled for operations over people, in the event that the UAS manufacturer chooses not to submit a declaration of compliance for those systems currently in the market. Finally, another commenter opposed making the manufacturer responsible for labeling the small unmanned aircraft. The applicant must meet the eligibility requirements for the small unmanned aircraft if he or she wishes to obtain FAA acceptance of a declaration of compliance to operate over people. Furthermore, if the remote pilot wishes to use a small unmanned aircraft that is listed on a FAA-accepted declaration of compliance, but does not possess a label because the small unmanned aircraft was produced prior to the effective date of this rule, the remote pilot must ensure the small unmanned aircraft is labeled in accordance with the terms of the declaration of compliance before using the aircraft for operations under Category 2 or Category 3.

The proposed rule did not restrict the areas in which operations under Category 1 or Category 2 may occur

because these categories present a lower risk of causing severe injuries. The proposed rule did, however, restrict the areas in which Category 3 operations may occur, due to the increased injury severity limits of Category 3. Specifically, the FAA proposed to prohibit Category 3 operations over open-air assemblies of human beings. The FAA also proposed to limit Category 3 operations as follows: The operation is within or over closed- or restricted-access sites after anyone within that site is on notice that a small unmanned aircraft may fly over them; or, if not in a closed- or restricted-access site, the small unmanned aircraft does not sustain flight over a person not either directly participating in the operation, located under a covered structure, or inside a stationary vehicle. Furthermore, in response to comments, remote pilots are prohibited from operating a small unmanned aircraft as a Category 1, 2, or 4 operation in sustained flight over open-air assemblies unless the operation meets the requirements of § 89.110 or § 89.115(a) (remote identification operational and broadcast requirements for standard remote identification unmanned aircraft or unmanned aircraft with remote identification broadcast modules). Sustained flight over an open-air assembly includes hovering above the heads of persons gathered in an open-air assembly, flying back and forth over an open-air assembly, or circling above the assembly in such a way that the small unmanned aircraft remains above some part the assembly. The FAA may waive compliance with this provision as appropriate and is discussed in more detail in Section XIV.B. However, conditions of any waiver issued may require the operator to notify local law enforcement prior to the operation. All small unmanned aircraft operations are subject to remote identification requirements upon the applicable compliance date, as specific in the Remote Identification for Unmanned Aircraft final rule.

1. Operations Over Open-Air Assemblies of Human Beings

The FAA received a few comments addressing the proposal to prohibit Category 3 operations over open-air assemblies of people. One commenter recommended the FAA clarify what it means by an “assembly of people” and provide a quantity or density of people that constitute a significant risk. The FAA has declined to define this term by regulation; rather, the FAA employs a case-by-case approach in determining how to apply the term “open-air

assembly.”⁵⁸ Whether an operational area is an open-air assembly is evaluated by considering the density of people who are not directly participating in the operation of the small unmanned aircraft and the size of the operational area. Such assemblies are usually associated with public spaces. The FAA considers some potential examples of open-air assemblies may include sporting events, concerts, parades, protests, political rallies, community festivals, or parks and beaches during certain events. Some potential examples that are less likely to be considered open-air assemblies include individual persons or families exiting a shopping center, athletes participating in friendly sports in an open area without spectators, individuals or small groups taking leisure in a park or on a beach, or individuals walking or riding a bike along a bike path, but whether an open-air assembly exists depends on a case-by-case determination based on the facts and circumstances of each case. The remote pilot must assess whether the operational area would be considered an open-air assembly prior to conducting flight operations. Legal interpretations and opinions regarding open-air assemblies may be found on the FAA website.⁵⁹ The FAA will continue to provide education opportunities and outreach to remote pilots on conducting safe operations. Additional resources for operators can be found on the FAA website.

The Washington Progress Group stated the prohibition on Category 3 operations over open-air assemblies is reasonable for operators who are satisfied with restricting flights to unpopulated areas, or who are able and willing to control the ground environment over which they are flying, but asserted the restriction is too limiting for most commercial missions that operate in populated open areas and may need to hover. The commenter suggested the FAA consider allowing operations to occur in airspace the public assumes is safe.⁶⁰ To implement

⁵⁸ Rebecca MacPherson, *Legal Definition of “Densely Populated” and “Congested Airway,”* FAA Office of Chief Counsel, Regulations Division (August 28, 2012); Rebecca MacPherson, *Response to December 4, 2009 Letter*, FAA Office of Chief Counsel, Regulations Division (March 3, 2010).

⁵⁹ https://www.faa.gov/about/office_org/headquarters_offices/ogc/practice_areas/regulations/interpretations/.

⁶⁰ The commenter cited Matthews, et al., “An Achievable Path to UAS Integration in the NAS”, <https://www.safeaccess4uas.com/paperuas-integration-nas.html>; FAA Sponsored Sense and Avoid Workshop, “Sense and Avoid (SAA) for Unmanned Aircraft Systems (UAS), Second Caucus Workshop Report,” January 18, 2013. The commenter refers to measurements of accident

this standard, the commenter suggested the FAA require a proponent for UAS operations to proffer a safety case.

The FAA maintains its prohibition on Category 3 small unmanned aircraft operations over open-air assemblies of people, as the limitation will be a means for the FAA to maintain an appropriate level of safety for such operations. This prohibition is subject to waiver. An applicant who proposes risk mitigation measures that would achieve an acceptable level of safety when operating over open-air assemblies may qualify for and receive a waiver. Alternatively, a person choosing to demonstrate the reliability of their small unmanned aircraft may choose to obtain an airworthiness certificate and be eligible for Category 4 operations.

The Electronic Privacy Information Center (EPIC) provided statistics from a 2017 Pew survey⁶¹ that the commenter believed are “directly relevant to the proposal to allow drones to operate over people.” EPIC argued that the limitations proposed for Category 3 operations should apply to all operations. For flying over open-air assemblies of people, EPIC believed the FAA should require operators obtain and hold a permit that would “allow for press or photography drones,” as a means of accountability.

The FAA developed the limitations for Category 3 operations as a way to mitigate the level of risk associated with the increased injury severity limitations. The FAA does not find it necessary to apply the limitations to operations under Categories 1 and 2, as those categories are sufficiently safe to operate over open-air assemblies without prior notification to persons not directly participating in the operation. However, in response to security concerns raised in comments, remote pilots are prohibited from operating a small unmanned aircraft as a Category 1, 2, or 4 operation in sustained flight over open-air assemblies unless the operation meets the requirements of § 89.110 or § 89.115(a) (remote identification operational and broadcast requirements for standard remote identification unmanned aircraft or unmanned aircraft with remote identification broadcast modules). See Section VI.E.3. for a description of sustained flight and open-

levels in certain airspace as a “Target Level of Safety.” The commenter also cited FAA Order 1100.161 CHG 1, https://www.faa.gov/documentLibrary/media/Order/Order_1100.161_CHG_1.pdf.

⁶¹ Hitlin, Paul, “8% of Americans Say They Own a Drone, While More than Half Have Seen One in Operation,” Pew Research Center (Dec. 19, 2017), available at <https://www.pewresearch.org/fact-tank/2017/12/19/8-of-americans-say-they-own-a-drone-while-more-than-half-have-seen-one-in-operation/>.

air assemblies. The FAA may waive compliance with this provision as appropriate. The FAA similarly does not issue permits for specific operations, such as small unmanned aircraft operated by the press, because the FAA's statutory obligations concerning aviation safety do not require differentiating between the purposes for operations that may occur under part 107.

The Agency did not propose training or testing requirements for persons operating a small unmanned aircraft eligible to operate in either Category 2 or Category 3. With regard to Category 3 operations, the NPRM requested responses to several questions related to whether the Agency should require pilot training and testing requirements before allowing Category 3 operations over open-air assemblies. Specifically, the FAA requested comment on the following questions:

- To conduct operations over open-air assemblies using a small unmanned aircraft that can transfer up to 25 ft-lbs kinetic energy to a person on impact, should the remote pilot-in-command have additional skills, experience, or currency beyond what part 107 currently requires?
- If so, what kind of skill, experience, or currency should be required (*e.g.*, minimum time operating the small UAS to be used, minimum number of take offs and landings, etc.)?
- How should that skill, experience, or currency be documented?

Several commenters responded to these questions. Commenters did not agree on the path forward with regard to open-air assemblies and Category 3. One commenter recommended the FAA consider training requirements to conduct Category 3 operations over open-air assemblies of people. Motorola Solutions stated public safety officials should be allowed to conduct operations over open-air assemblies without a waiver using a Category 3 small unmanned aircraft if the remote pilot in command has additional skills, experience, and currency beyond what part 107 currently requires. In contrast, the News Media Coalition said the FAA should not require training based on the number of people on the ground, but should focus on ensuring remote pilots are trained and knowledgeable in all circumstances. Another commenter opined that, until the FAA requires a practical test with specified minimum skills, experience, and currency for remote pilots, any additional requirements for Category 3 operations over open-air assemblies should be left to market forces to create industry-accepted standards.

This rule does not require additional training, skills, experience, or currency for Category 3 operations. Although pilot experience might be relevant in determining whether an operation under either category meets the level of safety required for operations over people, the FAA lacks sufficient information and data to assess whether any training or time spent piloting a particular aircraft would be appropriate for ensuring safety.

2. Operations Within or Over Closed- or Restricted-Access Site

The FAA proposed allowing Category 3 operations at closed- or restricted-access sites in which access to the site is restricted and when those people who are permitted access to the sites are advised of the occurrence of the operation. The FAA anticipates that a closed- or restricted-access site could be an area that contains physical barriers, personnel, or both, as appropriate, to ensure no inadvertent or unauthorized access can occur. For example, an operator should ensure that access is restricted through public notices and signage, flagging and barricading, erecting temporary fencing, or posting personnel at points of entry, as appropriate. In addition, issuing notice that a small unmanned aircraft may operate over people within the site will enhance the situational awareness of people within it. Notice could be written and posted at the entry point of the restricted area or be in a letter or contract prior to the operation. Verbal notice in addition to the written notice might be appropriate in some cases. Operators may want to consider whether providing written notification could be helpful to meet operators' own evidentiary needs. In accordance with this limitation, remote pilots must ensure no inadvertent or unauthorized access to the site occurs. The FAA expects adequate assurance could include receiving assistance from personnel, or placing physical barriers such as barricading and fencing or monitoring personnel to ensure inadvertent or unauthorized access to a closed- or restricted-access site does not occur. Geographical boundaries, such as rivers, canals, cliffs, and heavily wooded areas may also serve as effective barriers to restrict access. In some circumstances, it may not be possible for a small unmanned aircraft to take off and land inside a closed- or restricted-access site. The proposed limitations on Category 3 operations would therefore allow for takeoffs and landings to occur outside the site. In such circumstances, small unmanned aircraft could then transit to the site to conduct the desired

operation, provided the aircraft does not maintain sustained flight over persons not directly participating when outside the site.

The FAA received several comments relevant to the restriction of Category 3 operations from sustaining flight over people unless those people are within a closed- or restricted-access site and have received notice that a small unmanned aircraft may fly over them. One commenter stated consent, rather than notice, would be most appropriate in restricted spaces because the public would likely be more amenable to the use of larger unmanned aircraft over them if consent was first required. This commenter recommended the FAA create another category for small UAS that require only consent and not notice. ALPA said a single, one-time notification to people not directly involved in the small UAS flight operation is not sufficient to reduce the risk of the operation. ALPA added this is true when an operation of small unmanned aircraft occurs in an open area where the zone of operations cannot easily be defined or depicted.

The FAA declines to require consent for Category 3 operations over people in a closed- or restricted-set because notice is sufficient for persons who choose to assume the risk of being present in the area of operation. With regard to ALPA's concerns about Category 3 operations in dynamic airport environments, the FAA is aware that areas like a non-movement area at an airport do not permit public access and are an appropriately closed- or restricted-sites. If an airport authority chooses to conduct Category 3 operations at the airport, they must provide notification prior to the operation. The FAA encourages providing frequent and timely notification to ensure the safety and awareness of all persons in the environment of operation.

The National Institute for Occupational Safety and Health (NIOSH) invited the FAA to join it in developing a performance-based, tiered approach for operations of small unmanned aircraft near people at worksites to minimize the occupational risks. NIOSH believes additional research and proactive risk mitigation measures are necessary. NIOSH also encouraged the FAA to collaborate with the Occupational Safety and Health Administration (OSHA). The FAA declines to require additional standards specific to construction sites. Part 107 does not place any additional burden or restrictions on any workplace. The wide variety of small unmanned aircraft types and operations make it impractical to set specific criteria, including stand-off

distances, speed limits, mass, altitude, and the like, for operations over people. Workplace personnel responsible for safety rules should consider developing operating conditions to ensure remote pilots conduct safe small unmanned aircraft operations.

Flytcam Motion Pictures agreed that having restricted sites for Category 3 operations was reasonable, particularly around construction sites, agricultural fields, oil fields, and areas of search and rescue operations. The commenter noted these sites already have established safety measures in place and many of the personnel wear hard hats or helmets. The commenter did not, however, believe Category 3 operations are appropriate on closed-set motion picture and television productions. The commenter also pointed out that personnel on motion picture and television sets are unlikely to be wearing equipment to protect them. The commenter recommended that closed-set motion picture filming still require the user to go through the waiver process to describe how they can conduct operations safely. Additionally, ALPA recommended that small unmanned aircraft operations in these areas be restricted to Category 1 or Category 2. For operations over people at a construction site, the Associated General Contractors (AGC) of America asked FAA to clarify in this rulemaking that workers at the construction site qualify as “participating in the operation.”

The injury severity limits, exposed rotating parts prohibition, and the operating restrictions for Category 3 operations are sufficient risk mitigations for all closed- and restricted-access sites. Under these requirements, operation of the small unmanned aircraft itself presents a sufficiently low risk, particularly when combined with a notification requirement that allows people in the vicinity of the operation to assume the risk or to leave the area when the operation is taking place. Construction sites are often closed- or restricted-access sites in which people within the sites might not directly participate in the small unmanned aircraft operation. Under these circumstances, operations over people can still occur over these individuals in accordance with this rule. The FAA discussed the distinction between people directly participating and not participating in the final rule for part 107.⁶² This final rule for operations over people does not change that policy.

3. Operations Not Within or Over Closed- or Restricted-Access Sites

For Category 3 operations over people not located within a closed- or restricted-access site, the Agency proposed to prohibit sustained flight, as doing so reduces the likelihood of injury by limiting protracted duration of a flight over a person. Additionally, the Agency proposed to prohibit remote pilots from operating a Category 3 aircraft over open-air assemblies of people.

In response to the proposal concerning Category 3 operations over people not located within closed- or restricted-access sites, the Small UAV Coalition pointed out the proposed rule did not include a definition of “sustained” operation. The Coalition stated the FAA should consider hovering or circling over persons to be “sustained,” in contrast to merely transiting over a person. The FAA maintains the prohibition on sustained flight for Category 3 operations outside of a closed- or restricted-access site, in addition to prohibiting all operations over open-air assemblies. Sustained flight includes hovering above any person’s head, including any person in an open-air assembly; flying back and forth over a person or open-air assembly; or circling above an uninvolved person or open-air assembly in such a way that the small unmanned aircraft remains above some part of that person or open-air assembly. Operations conducted under Category 3 only permit sustained operations over people directly participating in the operation or under a covered structure or inside a stationary vehicle. Category 1, 2, or 4 operations that are not compliant with remote identification are also prohibited from sustained flight over open-air assemblies.

The AeroVista Drone Academy recommended allowing “transient overflight” of non-participating persons who are equipped with hardhats and other equipment or non-participants who have provided informed consent. In addition, AeroVista recommended the establishment of a new category of “active participants,” which would consist of persons involved in an operation, are informed of the risks, have provided informed consent, and can carry out appropriate emergency procedures. These active participants would be identified by special clothing or being in a closed-access site.

This rule provides flexibility for operating over people not directly participating in the operation, unless it is a sustained flight over an open-air assembly for Category 1, 2, or 4. This

rule allows operations under Category 1 or Category 2 to occur over all people, including sustained flight over people not directly participating in the operation, unless that sustained flight is over an open-air assembly. The FAA finalizes the requirement to permit Category 3 over people only if: (i) The operation is within or over closed- or restricted-access sites and anyone within that site has been notified that a small unmanned aircraft may fly over them; or (ii) the small unmanned aircraft does not maintain sustained flight over a person not either directly participating in the operation, located under a covered structure, or inside a stationary vehicle with no changes. Such restrictions are consistent with the risk-based framework for this rulemaking.

F. Variable Modes and Variable Configurations of Small UAS

The Agency proposed to allow small unmanned aircraft configured to conduct operations in more than one category. For example, an aircraft may be designed in such a way that it would be eligible to conduct Category 2 operations in one mode or configuration and Category 3 operations in another. Alternatively, a small unmanned aircraft could meet the requirements to operate over people only when in one particular mode or configuration.

Using different modes or configurations, an applicant could design a small unmanned aircraft to meet the performance requirements of multiple categories of operations over people. The NPRM explained that, to transition between various modes or configurations, an applicant could use a variety of methods, such as software-enabled performance limitations or hardware configurations. The Agency proposed that a small unmanned aircraft would only be eligible for operation in more than one category if the remote pilot in command cannot inadvertently change the mode or configuration. A change of mode or configuration, therefore, could only result from a deliberate action on the part of the remote pilot in command. The applicant should test the small unmanned aircraft in the mode or configuration to which the applicant wishes to declare compliance. The declaration of compliance must include each category for which the applicant has tested or analyzed the small unmanned aircraft.

The Agency sought comment on means of compliance that address incorporation of software, including software updates or changes, to enable performance limitations and variable modes or configurations to meet the

⁶² 81 FR 42064, 42128 (June 28, 2016).

proposed safety level. The FAA also sought comment in the NPRM on how it should review means of compliance for the impact kinetic energy or exposed rotating parts safety thresholds to address the appropriateness of using software to limit or establish safe performance of the small unmanned aircraft. In response, the Agency received general comments on variable modes and configurations.

Flytcam Motion Pictures expressed concern that many pilots lack both the technical understanding of various systems and procedures required to operate safely and to understand the regulations in part 107. While agreeing the pilot should not be able to change the mode inadvertently, Flytcam was concerned the Agency had “a lot of confidence that the pilot will ensure the aircraft is configured properly.” The FAA does not share these concerns because the regulations require remote pilot operating instructions to describe how to verify and change the mode or configuration of the small unmanned aircraft. Remote pilots who hold certificates under part 107 are capable of using the remote pilot operating instructions to determine how to employ the appropriate mode or configuration for the intended operation. The remote pilot in command is also responsible for complying with all applicable regulations, including conducting a preflight inspection.

The Agency adopts the proposal as drafted to allow small unmanned aircraft to be configured in more than one category.

G. Record Retention Requirements

The Agency proposed requiring applicants to maintain small unmanned aircraft records related to their declarations of compliance for a minimum of two years after ceasing production and requiring applicants to retain all supporting information for a means of compliance for as long as the means of compliance remains accepted. The NPRM explained that, in the event of a safety defect, or if the FAA initiated an action to address a compliance issue, this information would be critical to determine the cause, scope, and severity of the defect or infraction.

For applicants submitting a means of compliance for FAA acceptance, the submitter would be required to retain and make available to the Administrator, on request, and for as long as the means of compliance remains accepted, the detailed description of the means of compliance and justification showing how the means of compliance meets the requirements. When submitting a

declaration of compliance, the applicant must retain all supporting information used to meet the safety requirements. The applicant must retain this information for 2 years after the cessation of production of the small unmanned aircraft listed on the declaration of compliance. Furthermore, if the applicant designs or modifies the small unmanned aircraft, they must retain the supporting information for 2 years after they submit the declaration of compliance. The FAA has modified the text of the regulatory requirements for record retention as they were proposed in the NPRM to provide clarity.

NAMIC and the Small UAV Coalition supported the proposal to require the holder of a declaration of compliance to retain records for a minimum of 2 years. In contrast, two individual commenters opposed the 2-year record retention requirement, arguing that it should be longer. One of these commenters wrote that, to accommodate lawyers and lawsuits, the Agency should extend the record retention period to match the statute of limitations, which the commenter stated is 10 years. The other commenter similarly suggested that records be retained for the length of all statutes of limitation, because the recordkeeping requirements will benefit the injured party. This commenter also stated that the NPRM did not provide a reason for treating the document retention and inspection requirements for the declaration of compliance and the means of compliance differently. The commenter asserted that if the method of proving compliance cannot be investigated and verified, “the Certificates of Declaration are suspect.” The Agency finds that the record retention requirements are appropriate: It is not necessary to retain records that are the bases for declarations of compliance longer than 2 years, although the FAA notes that individuals may find it in their interest to retain the records for a longer period of time.

The Small UAV Coalition also commented in support of the proposal to require the holder of a means of compliance retain records for as long as the means of compliance remains acceptable to the FAA. Commenting on the proposed retention requirement for substantiating data related to custom means of compliance, an individual commented that, so long as the manufacturers are the only entities using their own custom means of compliance, it makes sense for them to keep substantiating data “with no caveats.” The commenter stated, “however, given that other manufacturers may rely on [another]

manufacturer’s custom means of compliance . . . the rule should provide some means whereby a creator of a custom means of compliance can notify those who use it that they will no longer utilize it.” Data would then either be deleted or transferred to entities that wish to continue using the means of compliance. The commenter noted that, without this exception, a person who creates and submits for FAA acceptance a means of compliance must bear the cost of maintaining substantiating data related to that means of compliance even if the manufacturer no longer makes use of it.

An individual commenter expressed support for the proposed amendment to require any person holding an FAA-accepted declaration of compliance to make available to the Administrator, on request, the declaration of compliance and any other document, record, or report required to be kept. The commenter suggested the FAA clarify that only the person(s) required to keep the record must produce the record.

The proposed language sufficiently affirms that the person who is required to keep the record must be the one to produce the record on request. Further, the Agency adopts the record retention requirements as proposed, with minor clarifying amendments to ensure sufficient information is available to the FAA on request. These requirements are consistent with the level of oversight that is appropriate for small unmanned aircraft eligible to conduct operations in accordance with Category 2 or Category 3.

VII. Category 4: Operations Based on Airworthiness

The proposed rule included only three categories of aircraft that could conduct operations over people under part 107. In response, several commenters stated the Agency had not considered the reliability of aircraft. Other commenters stated a small UAS issued an airworthiness certificate should be allowed to operate over people.

The Agency designed part 107 to encompass small UAS that were not certificated, allowing for expansion of UAS operations in the NAS without requiring airworthiness certification. In response to commenters’ suggestions, this rule considers reliability of small UAS by establishing a fourth category of small unmanned aircraft eligible to operate over people. This final rule allows small unmanned aircraft issued an airworthiness certificate under part 21 to operate over people in accordance with part 107. An appropriate airworthiness certificate would be one

which does not prohibit operations over people or over moving vehicles. Operating limitations may be specified in the approved Flight Manual or as otherwise specified by the Administrator. Certification is how the FAA manages risk through safety assurance. It provides the FAA confidence that a proposed product or operation will meet FAA safety expectations to protect the public. Certification affirms that FAA requirements have been met. Small unmanned aircraft that have obtained airworthiness certification will be allowed to operate over people and over moving vehicles in accordance with part 107, so long as the operating limitations applicable to that aircraft do not prohibit those operations. Consistent with other regulatory frameworks, such as part 91 and part 135, the owner is responsible for the maintenance and records retention requirements for small unmanned aircraft operated in accordance with Category 4 under part 107, unless the owner has entered into an agreement with another entity to operate the small unmanned aircraft. It is expected that most operators of Category 4 small unmanned aircraft operated under part 107 will also be the owner, or operating under direction of the owner. In this case, the owner is responsible for compliance with the Category 4 small unmanned aircraft maintenance and records retention requirements. However, to maintain flexibility for those owners of a Category 4 small unmanned aircraft who wish to enter in to a lease agreement with another entity for the operation of their small unmanned aircraft without the owner's intervention or control, this rule provides the means for the responsibility for the maintenance requirements and retention of records to be clearly defined in such an agreement. If so specified in the agreement, the FAA would hold the operator responsible for compliance with the Category 4 small unmanned aircraft maintenance and records retention requirements. An agreement between an owner and an operator may be in the form of a written lease or contract, verbal agreement, or other agreement. If any agreement is found invalid or unenforceable, then the owner has the responsibility to meet these requirements. The provisions of any agreement should address, at a minimum, the requirements of § 107.140(c).

The UAS Program Leader for the Memphis Fire Department stated the FAA or the manufacturer should certify small UAS that are reliable aircraft for

use in operations over people. AIA asked the Agency to consider the probability of a small unmanned aircraft hitting a moving vehicle or a human. A commenter wrote that there are currently no clear data on this topic and such data is critical to industry and public acceptance of this rule. AIA stated the Agency should consider the risk of UAS operations as consistent with the risks posed by traditional manned aviation as well as the other risks that the public faces daily. Airworthiness certification is not necessary for operations over people; as a result, the proposed rule did not require it for operations under any of the three proposed categories of operation.

Flytcam Motion Pictures surmised the risk of unmanned aircraft mishap would be higher with increased operations and suggested the creation of a fourth category that would include all the systems outside Category 3. Rising Tide Cinema proposed three classes of small UAS: Operations that occur under waiver, small UAS with technological advantages approved by the FAA, and a third category of small UAS with an "airworthiness release." Another commenter recommended several specific requirements for small UAS type certification, including a "demonstrated hover stability rating," pilot notification, and cybersecurity requirements. Drone Safe Communities suggested manufacturer requirements for protocol to apply during a loss of signal experience.

The Agency agrees with the commenters that demonstrable reliability should be an alternative path for operations over people. This rule includes several updates to regulatory text to allow aircraft with airworthiness certification to operate under part 107 and to be eligible to operate over people. This rule also removes the phrase, "[e]xcept for aircraft subject to the provisions of part 107" from § 21.1, to clarify small UAS may seek airworthiness certification even if part 107 applies to the intended aircraft operation. This final rule includes a new provision, § 107.2, which clarifies that, notwithstanding the change to § 21.1, small unmanned aircraft operating under part 107 are not required to obtain airworthiness certification. Except where the airworthiness certification is used as a basis for operating over people in accordance with Category 4, the provisions of part 21 will continue to be inapplicable to small unmanned aircraft subject to part 107. This final rule also revises § 107.1 to clarify that part 107 does not apply to any operation that an

operator elects to conduct under part 91 with a small unmanned aircraft that has been issued an airworthiness certificate: an operator may conduct small unmanned aircraft operations under either part 107 or part 91 when the operation and small unmanned aircraft meet the applicable requirements.

A. Remote Pilot in Command Operating Requirements for Category 4

To operate under Category 4, the remote pilot in command must use a small unmanned aircraft that has an FAA-issued airworthiness certificate. Operating limitations may be specified in the approved Flight Manual or as otherwise specified by the Administrator and must not prohibit operations over people or moving vehicles. When using a small unmanned aircraft with an airworthiness certificate issued under part 21, remote pilots must operate in accordance with all operating limitations, which the FAA specifies for each aircraft when issuing the airworthiness certificate. Operating limitations are prescribed to ensure that the aircraft is operated within an acceptable level of risk to maintain the safety of the NAS and to protect persons and property on the ground. To ensure this safety, remote pilots must adhere to any operating limitations, especially those specific to operations over people. Any noncompliance with operating limitations increases risk.

Additionally, in response to comments, remote pilots are prohibited from operating a small unmanned aircraft as a Category 4 operation in sustained flight over open-air assemblies unless the operation meets the requirements of § 89.110 or § 89.115(a). Sustained flight over an open-air assembly includes hovering above the heads of persons gathered in an open-air assembly, flying back and forth over an open-air assembly, or circling above the assembly in such a way that the small unmanned aircraft remains above some part the assembly. The FAA may waive compliance with this requirement as appropriate. For more information on this requirement, please see Sections VI.E. and XIV.B.

B. Small Unmanned Aircraft System Requirements and Continued Airworthiness for Category 4

The aircraft must be maintained or altered in a manner using the methods, techniques, and practices prescribed in the current manufacturer's maintenance manual or Instructions for Continued Airworthiness prepared by its manufacturer, or other methods, techniques, and practices acceptable to the Administrator. Additionally, the

small unmanned aircraft must be inspected in accordance with either the manufacturer's instructions or instructions acceptable to the Administrator. The small unmanned aircraft must also be maintained or altered using parts of such a quality that the condition of the aircraft will be at least equal to its original or properly altered condition.

The person performing any maintenance, preventive maintenance, or alterations must use the methods, techniques, and practices prescribed in the current manufacturer's maintenance manual or Instructions for Continued Airworthiness that are acceptable to the Administrator, or other methods, techniques, and practices acceptable to the Administrator. In addition they must have the knowledge, skill, and appropriate equipment to perform the work. While this rule does not require the person performing maintenance to hold a mechanic certificate, it is incumbent on the owner or operator to ensure that maintenance occurs in a manner that ensures that the small unmanned aircraft remains in a condition eligible to be operated over people in accordance with Category 4. If the small unmanned aircraft is operated, and subsequently crashes due to improperly performed maintenance, the small unmanned aircraft owner or operator could be held responsible. The person performing the maintenance must have the basic skills and knowledge to follow the manufacturer's instructions and use the tools that the manufacturer recommends. Or, if adequate instructions are not available, or if an alternative process is desired, then the maintenance provider may use instructions acceptable to the Administrator in lieu of the manufacturer's instructions.

Many of these requirements are similar to the requirements of part 43 that apply to maintenance of aircraft. The FAA has long relied on maintenance providers' compliance with these requirements to ensure the aircraft remains in an airworthy condition. In this regard, the requirements ensure the small unmanned aircraft retains the capabilities and characteristics the small unmanned aircraft had at the time of certification and that the certification determination remains valid. The conclusion that the aircraft will remain safe is critical in determining the aircraft is suitable for operating over people in accordance with Category 4, as it is consistent with the risk-based framework the Agency uses in establishing the appropriate policy for small UAS operations over people.

C. Maintenance Records

This rule requires the owner or operator to retain maintenance records for aircraft eligible for operations under Category 4 for at least 1 year from when the work is performed, or until the maintenance is repeated or superseded by other work. Furthermore, the owner or operator must retain and transfer records documenting the status of life-limited parts, compliance with airworthiness directives, and inspection status of the small unmanned aircraft when ownership of the small unmanned aircraft transfers. The records must be specific to the small unmanned aircraft and be made available to the Administrator on request. All records of maintenance, preventive maintenance, and alterations performed on the small unmanned aircraft must be documented in a manner acceptable to the Administrator. The records must contain the description of the work performed, the date the work was completed, and the name of the person who performed the work.

The FAA will use these records to verify that the small unmanned aircraft has been maintained in a manner that assures it remains in a condition eligible for operations over people in accordance with Category 4. In addition, while the Agency does not establish a process of requiring a small unmanned aircraft be removed from service, repaired, and returned to service by a certificated mechanic, the small unmanned aircraft must be properly maintained to ensure it remains in a safe condition. Appropriate record-keeping will verify compliance with this requirement.

When a remote pilot operates a small unmanned aircraft in accordance with part 107 that has been issued an airworthiness certificate under part 21, the requirements of part 43 and part 91 do not apply. However, a small unmanned aircraft that has been issued an airworthiness certificate may also be eligible to operate under part 91, under certain circumstances. This rule contains necessary updates to the regulatory text, to reflect the applicability of operating rules. Due to the differences in the regulations about how aircraft must be maintained under each suite of operating rules, it may be difficult for an owner or operator to switch back and forth between operating rules. In particular, a small unmanned aircraft that has been operated and maintained in accordance with part 107 may find it difficult to show compliance with the requirements of part 43 and 91. To address this concern, an owner or operator can elect to comply with the

relevant part 43 and 91 requirements, even while operating in accordance with part 107. Under these circumstances, electing to comply with the relevant part 43 and 91 requirements may help facilitate moving back and forth between operational parts, if desired, because the requirements of parts 43 and 91 are more stringent than those of § 107.140 with regard to maintenance and airworthiness.

VIII. Operations Over Moving Vehicles

A. Proposed Prohibition and Comments Received

The Agency proposed to prohibit the operation of small unmanned aircraft over people in moving vehicles; however, the proposed rule stated the FAA could waive the proposed prohibition if a person demonstrates the small unmanned aircraft operation could occur safely under the terms of a waiver. In the proposed rule, the Agency stated the moving vehicle operating environment is dynamic and the remote pilot in command could not control it directly. The Agency considered, however, allowing the operation of small unmanned aircraft over people in moving vehicles without a waiver and sought public comment on whether it should take this action.

Many comments addressed operations of small UAS over people who are in moving vehicles. Several comments supported the prohibition and said the FAA should not consider allowing such operations without a waiver. A few comments only addressed the proposal to allow small unmanned aircraft operations over people in moving vehicles through the part 107 waiver process. Most commenters opposed the prohibition and said the FAA should allow small unmanned aircraft operations over moving vehicles without a waiver in all or limited circumstances.

Some commenters, including the CAPA, the Association of American Railroads, the Minnesota Department of Transportation (MnDOT), IAAPA, and EPIC, supported the prohibition as proposed in the NPRM. Both the Association of American Railroads and IAAPA asked the Agency to clarify what constitutes a moving vehicle and further requested clarity about whether the prohibition would apply to trains and amusement park rides.

IAAPA urged the Agency "to prohibit the flight of any unauthorized small UAS over fixed site amusement parks," citing concerns over small unmanned aircraft operating over amusement park rides. IAAPA stated operators who receive a waiver will be more familiar

with the higher level of risk associated with operating over an amusement park. IAAPA asked the Agency to recognize the need to prohibit flight over, and in close proximity to, amusement parks by clarifying that amusement park rides are “moving vehicles” for purposes of the prohibition. Alternatively, the commenter asked the Agency to address the prohibition through Section 2209 of the FAA Extension, Safety, and Security Act of 2016.⁶³ The commenter asserted the kinetic energy of a small unmanned aircraft hitting an exposed individual on even a relatively slow-moving ride poses a substantial safety risk to the rider who is hit, to those around him or her, and potentially to all the riders on a ride.

Chicago’s First Lady Cruises wrote that the inconvenience of the current regulation is outweighed by reasonable safety and liability concerns. The commenter noted that their open-air vessels provide their customers with unobstructed views of the Chicago skyline and could be considered an open-air assembly of people.

Several commenters supported the prohibition on operations over moving vehicles as long as it remains subject to waiver. MnDOT recommended the FAA require applicants for a waiver explain how they considered the safety of the combinations of altitude, speed, and distance from a roadway exist to avoid distracting drivers.⁶⁴ One commenter recommended the FAA differentiate between operations over people in moving vehicles with knowledge of the operation (e.g., vehicles being filmed) and operations over people in moving vehicles without knowledge of the operation (e.g., vehicles on public roads). Another individual commenter suggested the Agency only allow operations of small unmanned aircraft over moving vehicles with a waiver, hands-on training, and rules preventing

operation over roadways where vehicles travel above certain speeds. The commenter said testing would be necessary to determine appropriate speeds, and would likely be similar to the testing conducted for this NPRM to set UAS categories, considering the likelihood of harm to bystanders that may occur at various speeds. The commenter also stated a small unmanned aircraft that causes a driver of a car or truck to lose control of a vehicle would create much greater havoc than that contemplated by this NPRM.

Some commenters recommended a prohibition against hovering or sustained flight over moving vehicles. NAMIC said it recognizes sustained operation of a small unmanned aircraft over moving vehicles can present safety issues and should not be permitted without a waiver, but “temporarily transiting over roads with moving vehicles during normal operations” should be permitted. A couple of commenters stated small unmanned aircraft operations should only be permitted without a waiver for purposes of transiting over moving vehicles or when the flight is done at certain angle, for example, perpendicular to the roadway or at a 90-degree angle. One commenter said any prohibition on hovering or sustained flights over moving vehicles should not apply to lifesaving or search-and-rescue efforts.

In contrast, many comments opposed the prohibition on small unmanned aircraft operations over moving vehicles and recommended the FAA allow such operations without a waiver. Most of these commenters cited at least one of the following reasons: (1) A small unmanned aircraft that malfunctions is unlikely to collide with a moving vehicle operating below it because both vehicles are in motion; (2) in the event of a collision, the risk of injury to people inside the moving vehicle is low because they are protected by the structure of the car; and (3) the risk of distraction to drivers is low. Commenters stated the small unmanned aircraft will operate directly overhead and therefore not be visible to the drivers, who must focus on distractions that are equal to or greater than a small unmanned aircraft operating overhead. Commenters also stated the FAA failed to consider the benefits of allowing small unmanned aircraft operations over moving vehicles and failed to provide sufficient evidence or data to support the Agency’s stated concerns regarding risks to people in vehicles. Commenters asserted a blanket restriction on small unmanned aircraft operations over moving vehicles would severely limit

small unmanned aircraft operations, especially in urban areas, and will negatively impact various industries, public safety operations, and emerging technologies. A few commenters noted helicopters and ultralight vehicles routinely operate over moving vehicles and present a greater risk to people in moving vehicles than small unmanned aircraft operating overhead. Other commenters opposed the prohibition due to concerns with the burden on the FAA and small UAS operators of using the part 107 waiver process to allow the operations.

Commenters also pointed to the difficulty of having to interrupt an operation by landing the unmanned aircraft, crossing the roadway, then resuming the operation. Utah Department of Transportation (UDOT) noted that, to avoid operating over moving vehicles, it closes lanes of traffic to conduct bridge, sign, and other infrastructure inspections via UAS, causing delays and incurring cost to society. Several commenters, including DJI, suggested allowing operations of small unmanned aircraft over moving vehicles without a waiver using a risk-based approach and to consider factors such as the speed and density of traffic, minimum altitude requirements, the location, type, and speed limit on the roadway or site being overflown, and the weight of the small unmanned aircraft. A few commenters suggested the rule include weather restrictions.

Some commenters recommended allowing such operations only in certain circumstances. A commenter recommended requiring operators to comply with reporting requirements, such as reporting property damage to local and State departments of motor vehicles. Commenters generally supported allowing operations over low-speed and low-density traffic when vehicles are in closed or restricted sites. Commenters also recommended that small unmanned aircraft operations be permitted over moving vehicles if the drivers are part of, or are aware of and consent to, the operations or when the operators are “professionally trained, certified, and insured.” A few commenters who support such operations at construction sites asserted the nature of heavy equipment at such sites, the added protection of personal protective equipment, and the additional training for workers and operators would mitigate the risks of the operation. A commenter recommended viewing each operating environment on a case-by-case basis to allow operations where deemed safe and responsible, based on a variety of factors.

⁶³ Section 2209 requires “the Secretary of Transportation to establish a process to allow applicants to petition the Administrator of the Federal Aviation Administration to prohibit or restrict the operation of an unmanned aircraft in close proximity to a fixed site facility.” The FAA Extension, Safety and Security Act of 2016, Public Law 114–190, sec. 2209, 130 Stat. 615, 633–635 (2016). The FAA has determined that operations over moving vehicles can be conducted safely when following the requirements of this rule. A separate rulemaking action will address the process by which entities can submit a request to the FAA to restrict the airspace over a fixed site.

⁶⁴ The commenter cited the following Oregon Department of Transportation study, which investigated driver distraction caused by UAS: Hurwitz, D., Olsen, M., & Barlow, Z. (2018) “Driver Distraction Due to Drones,” *Oregon Department of Transportation (ODOT)*, Salem, OR, 1–100, available at http://www.davidhurwitz.org/wp-content/uploads/2019/02/Driving_Distraction_due_to_Drones.pdf.

B. Response to Comments for Determination

The Agency agrees with the commenters who stated operations over people in moving vehicles could be conducted safely, subject to certain conditions. Although small unmanned aircraft operations over moving vehicles may present additional risks due to the potential speeds of such vehicles, the Agency has determined operations of small unmanned aircraft over people who are inside moving vehicles can be conducted safely, under limited circumstances. Therefore, this rule will allow small unmanned aircraft operations over people inside moving vehicles subject to specific conditions. The rule contains a new section describing the conditions under which small unmanned aircraft may be operated over people inside moving vehicles.

This rule allows operations over people inside moving vehicles under the following conditions. First, the small unmanned aircraft operation must meet the requirements for a Category 1, 2, or 3 operation under subpart D. Second, regardless of the category of operation, the operation must meet either of the following conditions: (1) The operation must be within or over a closed- or restricted-access site where any human being located inside a moving vehicle within the closed- or restricted-access site is on notice that a small unmanned aircraft may fly over them, or (2) if the operation is not within or over a closed- or restricted-access site, the small unmanned aircraft must not maintain sustained flight over moving vehicles.

The application of the requirements of Categories 1, 2, or 3 will reduce the risk of injury to human beings. The weight limitation and exposed rotating parts prohibition for Category 1 and the injury severity limitations and exposed rotating parts prohibition for Categories 2 and 3 reduce the risk of injury to human beings located in or on moving vehicles, as well as the severity of damage to a moving vehicle if an impact occurs. Having a single set of conditions for Categories 1, 2, and 3 to operate over moving vehicles also simplifies the requirement while achieving an acceptable level of safety.

Category 4 small UAS may be eligible to operate over moving vehicles as long as the applicable operating limitations in the FAA-approved Flight Manual or as otherwise specified by the Administrator do not prohibit such operation. For the reasons described in the discussion of Category 4 in Section VII. of this preamble, operation of a

Category 4 small unmanned aircraft over a person in a moving vehicle is consistent with the level of safety that operations of small unmanned aircraft under Categories 1, 2, and 3 achieve.

For the purpose of this rule, the Agency considers a vehicle to be any means of transportation, regardless of whether it is motorized. For example, cars, trucks, buses, trains, motorcycles, scooters, and rollercoasters are all vehicles. In addition, non-motorized means of transportation such as bicycles would also be considered vehicles because they have the potential to move at speeds the Agency did not contemplate when establishing the requirements for operations over people. Watercraft such as sightseeing vessels, motorboats, and personal watercraft are also vehicles for the purpose of this rule.

The closed- or restricted-access site restrictions that apply to some operations over moving vehicles are similar to the restrictions for Category 3 operations over people and will apply to *all* operations over moving vehicles. For example, a Category 2 operation over people is not restricted to closed- or restricted-access sites, but if the operation involves operations over moving vehicles, then this restriction will apply. When operating within a closed- or restricted-access site, no limitations apply concerning the duration of sustained flight or hover over any moving vehicle. Small unmanned aircraft operations over moving vehicles within or over closed- or restricted-access sites have the most flexibility for operating over moving vehicles.

As with the operating limitations that apply to operations pursuant to Category 3, as discussed in Section VI.E., remote pilots must ensure no inadvertent or unauthorized access to the closed- or restricted-access site can occur. Such a site could be an area that contains physical barriers, personnel, or both, to ensure no inadvertent or unauthorized access is possible.

In addition, this rule requires that a remote pilot verify that people operating vehicles within the closed- or restricted-access site are provided notice that a small unmanned aircraft may operate over them within the site, to enhance the situational awareness of the people operating vehicles within the site. Public notices, signage, and flagging are some effective means of notifying people within the site, as are written notices posted at the entry point to the restricted area or a briefing between the small unmanned aircraft operator and the vehicle operators. When a person operating a vehicle receives a letter or

contract stating small unmanned aircraft operations may occur over him or her, this would serve as sufficient actual notice, no matter the amount of time that passes between receipt of the information and the small unmanned aircraft operation, as long as the receipt of the notice occurs before the operation begins. Small UAS operators should provide verbal notice in addition to a written notice in cases in which a verbal notification is necessary to ensure the information is received and understood. Operators may want to consider whether providing written notification could be helpful to meet operators' own evidentiary needs. The notice should describe precautions or other recommended actions to ensure safety during a small unmanned aircraft operation. The remote pilot in command must verify that people in or on vehicles within the closed- or restricted-access site have received notice.

If the operation over moving vehicles takes place outside a closed- or restricted-access site, the small unmanned aircraft is prohibited from sustained flight over moving vehicles. This prohibition applies to holding above, hovering, or maintaining sustained flight above moving vehicles. This requirement should ensure only momentary exposure to any moving vehicle in which occupants do not have the benefit of awareness and coordination that operators of vehicles on closed- or restricted-access sites have. Limiting the amount of time the small unmanned aircraft operates over moving vehicles reduces the likelihood of an impact with a moving vehicle. Small unmanned aircraft operators who want to conduct sustained operations over moving vehicles not in a closed- or restricted-access site must apply for a certificate of waiver.

The remote pilot in command remains responsible for ensuring the operation does not create a hazard to anyone, including a person in a moving vehicle. The FAA will rely on fulfillment of this responsibility especially when the small unmanned aircraft crosses an active roadway or waterway, as the Agency declines to limit crossing roadways to particular angles, such as perpendicular to the roadway, or at certain altitudes. The remote pilot in command is best suited to evaluate the moving vehicle environment to determine a safe manner for crossing an active roadway or waterway to not present a hazard to the moving vehicles underneath. The remote pilot in command should consider the type of roadway or waterway; the types of vehicles; the small unmanned aircraft design and performance characteristics;

obstructions to flight such as buildings, trees, powerlines, roadway signs; and any other aspect of the operating environment that could influence the safety of the operation.

The Agency also agrees with the commenters who supported the availability of waivers of the prohibition on operating small unmanned aircraft over moving vehicles. This rule will allow an applicant to seek a waiver from these provisions by adding § 107.145 to the list of provisions subject to waiver in § 107.205. Small UAS operators may receive waivers to allow them to deviate from the conditions for operating small unmanned aircraft over moving vehicles as long as they can demonstrate that the operation can occur safely pursuant to the terms of a certificate of waiver.

IX. Operations at Night

A. Proposed Requirements and Comments Received

The NPRM proposed to permit routine operations of small UAS at night, subject to specific requirements. The FAA proposed to amend § 107.29 to permit operations at night when: (1) The small unmanned aircraft has an anti-collision light that is visible for 3 statute miles, and (2) the remote pilot in command has completed an updated knowledge test or recurrent training, as applicable, to ensure familiarity with the risks and appropriate mitigations for nighttime operations. Additionally, the FAA proposed adding the anti-collision lighting requirement to the list of regulations subject to waiver in § 107.205.

Many commenters supported the proposal to allow small UAS operations at night without a waiver. Comments in favor of routine night operations significantly outnumbered comments in opposition to the proposed change. Several commenters expressed concern about the risk of midair collisions between manned and unmanned aircraft. Commenters referred to the inherent lack of situational awareness in night operations and stated remote pilots were insufficiently trained to address adequately the complexity of the airspace. After reviewing these concerns about midair collisions and situational awareness, the FAA determined several existing operating requirements of part 107 combined with the requirements of this final rule provide a sufficient level of safety to allow for night operations. Similar to the NPRM, the final rule requires that remote pilots operating at night equip their small unmanned aircraft with an anti-collision light visible for 3 statute miles, but adds the requirement for the

anti-collision lights to flash at a rate sufficient to avoid a collision.

Many commenters appeared to misunderstand the purpose of anti-collision lighting. The purpose of anti-collision lighting is not for the remote pilot to maintain visual line of sight and see the orientation of their small unmanned aircraft, but for the awareness of other pilots operating in the same airspace. Section 107.29(b) already requires that anti-collision lighting be visible for 3 statute miles for civil twilight operations to help prevent midair collisions.

AMOA and AAMS, commenting jointly, questioned whether the FAA had examined the available sightings data and confirmed its reliability as its basis for expanding small UAS operations at night. The commenter noted that data collected from 1998–2017 indicates 36% of all helicopter air medical flights were conducted at night and 49% of the accidents from 1998–2017 occurred during night operations, and that routine night operations could put air medical flights at greater risk. The commenter asserted the FAA did not adequately address the potential threats posed by increased small unmanned aircraft activity in the NPRM, particularly to helicopter air medical flights.

The FAA analyzed available data, including thousands of waivers allowing night operations, and determined allowing routine small UAS operations at night, subject to compliance with certain requirements, will be safe. Although the FAA reviews small unmanned aircraft sighting reports, the FAA did not rely on those reports as justification for this rule, because many of those reports are unverifiable due to a lack of detailed information provided by the reporter of a small unmanned aircraft sighting. Because small UAS operations under part 107 are limited to 400ft AGL and below, the effect on helicopters of night operations is minimal. Although the introduction of routine night operations could introduce more complexity to the airspace,⁶⁵ compliance with sufficient mitigations will provide for safe operations.

In addition, other risk mitigation measures limiting the risk of midair collisions at night exist: Fewer general aviation aircraft fly at the altitudes in which small unmanned aircraft operate. Manned aircraft have restrictions on minimum safe altitudes, which places

the majority of operations well above the 400 ft AGL limit for part 107 operations. Pilots authorized to operate manned aircraft below 400 ft AGL during daylight hours can visually see the terrain and obstacles to navigate the airspace. At night, these visual cues do not exist and many general aviation aircraft that could operate during daylight at lower altitudes lack sophisticated equipment like night vision goggles, a radar altimeter, Forward Looking Infrared, Radar, or a Heads Up Display, typically found on military or emergency service aircraft. Because general aviation aircraft may lack electrical systems such as aircraft lighting, or other necessary safety features, operating such aircraft at night would cause a significant increase in the level of risk of the operation.

NAAA voiced concern about pilot difficulty of spotting a small unmanned aircraft while the pilot is operating at a very low altitude in what is already a high task load environment. They pointed to a 2015 test conducted by the Colorado Agricultural Aviation Association, which determined that it was difficult for pilots who conduct agricultural aviation operations to detect and track a small unmanned aircraft at the same time as maneuvering their aircraft for agricultural operations. Pilots operating manned aircraft at low altitudes would experience difficulty in identifying small unmanned aircraft operating at night, but, as discussed previously, numerous mitigations exist to decrease the likelihood of a midair collision. With regard to the report made by the Colorado Agricultural Aviation Association, while the study provided data, the report only tested four pilots operating during daylight hours. In addition, the Agency disagrees with NAAA's determination that night operations would be difficult to identify, as operating with an anti-collision light at night would increase the visibility of the small unmanned aircraft.

Several commenters expressed concern about the risk small unmanned aircraft pose for commercial aircraft. The period of flight in which a manned, commercial aircraft is at or below 400 ft AGL is just prior to landing and seconds after takeoff. These phases of flight occur in the immediate vicinity of the runway, an area of airspace in which small UAS operations under part 107 are prohibited from flying without authorization. The requirement for anti-collision lights that are visible for 3 statute miles and that have a flash rate sufficient to avoid a collision, along with the existing requirements to maintain visual line of sight, give way

⁶⁵ See: *U.S. Helicopter Safety Team (USHST) Report Helicopter Safety Enhancements*; October 3, 2017. http://www.ushst.org/Portals/0/PDF/USHST%20LOCI%20UIMC%20LALT%20Final%20Report_2017Oct3.pdf.

to manned aircraft, and obtain authorization to operate in controlled airspace are all practical mitigations to address the risks posed by small UAS operations at night.

B. Knowledge Requirements for Remote Pilots Conducting Operations at Night

Only remote pilots who complete an updated aeronautical knowledge test or updated training will meet the remote pilot qualification requirements to act as pilot in command of a small UAS at night. As with all persons who received their remote pilot certificate prior to the enactment of this rule, part 61 pilots previously holding a remote pilot certificate will also need to complete the updated training before acting as pilot in command of a small UAS at night.

The Agency proposed to revise the regulations to require that the remote pilot complete a knowledge test or training concerning small UAS operations at night. This rule finalizes those additions, as proposed.

Applicants who are eligible to obtain a remote pilot certificate must complete an updated knowledge test prior to conducting operations at night. This rule also requires existing holders of a part 107 remote pilot certificate to complete updated training prior to operating as a remote pilot at night.

The updated knowledge test and training will assess applicants' and pilots' knowledge of risks and situations that are not present during daylight operations. The new testing and training will include questions on anti-collision light requirements, when the anti-collision light is allowed to be dimmed, how to determine aircraft position, obstacle avoidance with lack of visual cues, what aircraft may be conducting low level night operations, night physiology, circadian rhythm effects, and other topics. Through this education, the remote pilot will have the knowledge to operate a small UAS at night safely and implement the appropriate protocols and tools to mitigate risks they have identified for their operation.

The updated testing and recurrent training required to conduct night operations will be made available on the FAA website on March 1, 2021. This date provides a 15 day period for new applicants or current Remote Pilot Certificate holders to complete the updated testing or training, as applicable, for those who seek to conduct night operations on the effective date of this rule.

After the effective date of this rule, remote pilots operating under a waiver received prior to the effective date will be allowed to continue to operate at

night under the provisions of that waiver without meeting the updated recurrent training requirement for a period of 60 days. All night waivers issued prior to the effective date of this rule that authorize deviation from § 107.29 Daylight Operation terminate on May 17, 2021. This date provides time for waiver holders to come into compliance with this rule and allow the holder to request a new certificate of waiver, if applicable, prior to the termination date.

Several commenters suggested the night operation testing and training be separate from the general part 107 training. One commenter suggested the FAA offer incentive licensing endorsements, in which a certain minimum score on the night operations section of the part 107 knowledge test would allow the remote pilot to operate a small UAS at night. Some commenters, including Airlines for America (A4A), recommended the FAA impose a nighttime practical training requirement for remote pilot certification, particularly for pilots who do not hold a part 61 certificate or related nighttime endorsement. The inclusion of night operations does not introduce a level of complexity to the operations conducted under part 107 that would necessitate practical training. A single curriculum for both the aeronautical knowledge test and recurrent training will cover all necessary topics for operations under part 107. To operate at night, all remote pilots must either take the updated initial knowledge test or complete the applicable recurrent training that includes the new subject areas on night operations. In this regard, it is necessary to standardize the training and testing; incentive licensing endorsements the FAA issues for other skills are not appropriate for knowledge testing or training. The standardization this rule provides is appropriate for small UAS operations at night.

A few commenters requested the Agency decline to require pilots who have certificates under part 61 to complete recurrent training specific to night operations. The Agency disagrees. Small UAS operations at night have operational needs and safety requirements that differ from manned aircraft operations at night. This rule requires part 61 pilots to take the recurrent training in its entirety, including those sections pertinent to night operations, despite having taken manned-aircraft-specific nighttime training for their part 61 certification. Several commenters made suggestions regarding the content of the test and course material. Some commenters,

including AOPA, AMOA, and AAMS, suggested the initial testing, initial training, and recurrent training for night operations emphasize collision avoidance with other unmanned aircraft and manned aircraft. They asked whether the additional testing for night operations will specifically address limited depth perception and difficulty of perceiving reference points during night operations. Under this rule, in addition to the existing testing and training that addresses collision avoidance, additional subject areas will address night physiology, lighting requirements, and night illusions from the perspective of the remote pilot.

One commenter suggested the FAA produce a study guide with subject matter specific to small UAS operations at night. The FAA plans to publish a revised Small Unmanned Aircraft Systems Airman Certification Standard (ACS) and a revised iteration of Advisory Circular (AC) 107-2 to address changes pertaining to the certification of small UAS remote pilots. This AC will also provide updated guidance for conducting small UAS operations in accordance with part 107. In response to the suggestion that the FAA produce a UAS-specific study guide with subject matter relevant to operating at night, the FAA has updated the Remote Pilot—Small Unmanned Aircraft Systems Study Guide (FAA-G-8082-22), and renamed it Small Unmanned Aircraft Systems Operating Handbook (FAA-H-8083-24).⁶⁶ Furthermore, applicants may supplement through self-study, which could include taking an industry-offered online training course, an in-person training course, or any combination thereof.

One commenter suggested the Agency require one or more visual observers who have taken the night vision test to participate in operations at night. The visual line of sight requirement in part 107, combined with other requirements, is sufficient to address the risk associated with night operations; therefore, this rule does not require a night vision test for remote pilots or visual observers. One commenter said the proposal would impose more cost on the operator and increase the barriers to UAS night operations. Another stated the additional testing and training requirements would not improve the safety of night operations. This rule establishes the recurrent training process, the completion of which will be free of cost to remote pilots. This rule

⁶⁶ See "Part 107 Knowledge Test Suggested Study Materials," available at *FAA Policy Document Library*, at https://www.faa.gov/uas/resources/policy_library/.

does not impose any changes to the costs of the initial knowledge test.

C. Anti-Collision Lighting

The NPRM stated the small size of most small unmanned aircraft (as compared to their manned counterparts), combined with reduced visibility during darkness, favors requiring anti-collision lighting to reduce the risk involved with small UAS operations at night. The Agency stated it anticipated the presence of anti-collision lights would provide other aircraft with awareness of a small unmanned aircraft's presence. As stated in the NPRM, the anti-collision light is not the sole means of avoiding midair collisions between a manned aircraft and a small unmanned aircraft. Prior to and throughout the operation, this rule requires the remote pilot to ensure the anti-collision lights are operating, are visible for 3 statute miles, and have a flash rate sufficient to avoid a collision at the operating location. The anti-collision light also does not relieve the remote pilot from complying with the remaining requirements of part 107, which include yielding right of way to all other aircraft. Although the risk of a midair collision at night is low due to the altitude and volume of aircraft operating at night, additional risk mitigation measures are appropriate for the safety of other aircraft that may be operating at night. The requirement to have an anti-collision light for night operations is also consistent with the requirements in part 107 for small UAS operations during civil twilight.

1. Flash Rate

As noted in the proposed rule, the FAA's requirement for anti-collision lights for twilight operations under the final rule for part 107 was based on the daylight operations requirements for ultralight vehicles.⁶⁷ Such vehicles may only operate during civil twilight hours as long as they are equipped with "an operating anti-collision light visible for at least 3 statute miles."⁶⁸ When promulgating that requirement, the FAA clarified that such anti-collision lights are "any flashing or stroboscopic device that is of sufficient intensity so as to be visible for at least 3 statute miles."⁶⁹ Given the comments received in response to the NPRM, this rule provides additional clarification concerning the anti-collision light

requirement. As demonstrated by the comparison to ultralight anti-collision lights above, requiring anti-collision lights for operations during both civil twilight and at night to flash, rather than be static, is appropriate. This rule requires anti-collision lights used in accordance with § 107.29 to flash at a sufficient rate to avoid a collision.

Many commenters expressed support for the proposed anti-collision lighting requirement, with some commenters recommending changes or additions to the requirement. Some commenters opposed the requirement. Several commenters addressed specific characteristics of the anti-collision lighting, including flash rate.

The Helicopter Association International (HAI), along with A4A, AGC, NAAA, the Experimental Aircraft Association (EAA), and the American Association of Airport Executives (AAAE), stressed the need for standardization in unmanned aircraft anti-collision lighting, with respect to flash rate, signature, visibility requirement, intensity, type of lighting, and configuration. A few commenters recommended the FAA work with industry to develop standards specific to small unmanned aircraft or rely on existing standards for manned aircraft. A commenter recommended clarifying the requirement in the proposed rule.

While the NPRM only proposed small unmanned aircraft have an anti-collision light, the Agency has since determined the anti-collision lights should flash. In addition to the requirement for the light to be visible for 3 statute miles, anti-collision lighting with a sufficient flash rate to avoid a collision will aid in creating awareness to all pilots of the presence of the small unmanned aircraft.

Under this rule, the remote pilot is responsible for ensuring the anti-collision lights are operating, are visible for 3 statute miles, and have a flash rate sufficient to avoid a collision at the operating location, both prior to conducting and during each night operation. The performance-based requirements for anti-collision lighting—with regard to intensity, flash rate, fields of coverage, and other relevant characteristics—will ensure the small unmanned aircraft is sufficiently visible to other aircraft. The remote pilot may rely on manufacturer statements indicating the anti-collision lighting is visible for 3 statute miles and has a flash rate that is sufficient to comply with the requirements of this rule. However, the remote pilot ultimately remains responsible for verifying that anti-collision lighting is operational, visible for 3 statute miles, and has a flash rate

sufficient to avoid a collision at the operating location.

The FAA does not require manned aircraft pilots to distinguish between the lights for airplanes and rotorcraft, or antennas and windmills, but only to avoid those obstacles. This requirement, therefore, will result in the small unmanned aircraft becoming more conspicuous to other operators, regardless of whether other operators identify it as a small unmanned aircraft. A manned aircraft pilot would be most likely to distinguish movement of external lighting against a stagnant, dark background rather than specific lighting characteristics.

2. Design of Anti-Collision Lights

The Agency proposed to require small unmanned aircraft operating at night to have an anti-collision lighting component visible for 3 statute miles, rather than a light that fulfills prescriptive design criteria. The proposed rule requested comments regarding whether a specific color or type requirement should apply to the anti-collision light, as well as an explanation of how a prescriptive standard might ensure safety of the small UAS operations.

The FAA received numerous comments addressing a color requirement for the anti-collision lights. Comments in support of performance-based requirements for anti-collision lights outnumbered those in favor of more prescriptive requirements. Many commenters opposed the idea of specific anti-collision lighting color or type requirements, including Small UAV Coalition, AUVSI, News Media Coalition, the U.S. Chamber of Commerce, APPA, EEI, and NRECA, commenting jointly; the People's Republic of China; DJI; Skydio; and numerous individuals.

Commenters opposed to a specific color standard generally noted a prescriptive requirement could stifle innovation without providing any safety benefits. A number of individual commenters stated no specific color or type of lighting should be required, as the FAA has not included such a requirement for waivers that permit operations at night. DJI commented that a different, or additional, lighting requirement from those provided in the part 107 waivers would require manufacturers to develop new designs and equipment without apparent benefit. Both DJI and the People's Republic of China asked for scientific data in the event the Agency requires specific colors for anti-collision lights.

Several commenters explicitly supported requiring some kind of color

⁶⁷ 81 FR 42064, 42103 (citing 14 CFR 103.11, which states no person may operate an ultralight vehicle except between the hours of sunrise and sunset, but permitting operations during certain periods of twilight).

⁶⁸ 14 CFR 103.11(b)(1).

⁶⁹ 47 FR 38770, 38773 (September 2, 1982).

or type requirement for anti-collision lights. Some commenters suggested requirements for plain red and white lights would suffice, but emphasized the FAA should not require color definitions as detailed as those codified at § 23.1397. AOPA noted the proposed rule does not identify whether the Agency considers white strobe lights, red beacon lights, or if any color or lighting configuration as sufficient for anti-collision lights that are visible for at least 3 statute miles. Another commenter similarly recommended a red (front) and white (rear) color pattern. Several commenters recommended following the existing practices of manned aviation operators regarding the colors of lights. Other commenters recommended the FAA impose specific colors or color patterns for certain situations, such as when an aircraft descends or experiences an operational system failure. One commenter recommended the FAA consider requiring colors that are compatible with color-blindness. NIOSH stated specifying an anti-collision light color would improve safety, given that color is a significant factor for improving the visibility of an object.

Prescriptive color requirements would unnecessarily restrict design. Since August of 2016, the FAA has issued over 4,000 waivers that permit operations at night. While none of these waivers include color or type requirements, many of these small unmanned aircraft utilize white anti-collision lights to meet the 3 statute mile visibility requirement. No commenters explained how a prescriptive color requirement would mitigate the risk of operations at night. Overall, requiring a specific color or type of light is unnecessary. This rule's performance-based requirement is appropriate for the level of risk associated with night operations and allows for flexibility as technology evolves.

The NAAA stated some small unmanned aircraft may be equipped with anti-collision lights that are not compatible with the Night Vision Goggles (NVG) that agricultural pilots typically wear. In these cases, the pilot would not see the small unmanned aircraft at night while looking through the NVG. The FAA recognizes the NVG incompatibility with certain lighting may be an issue for agriculture and medical helicopters. Existing operational regulations specific to the use of NVGs for manned pilots limit hazards to manned aircraft, making specific color or design elements for small unmanned aircraft unnecessary.

While this rule does not require specific characteristics of the anti-collision lighting, remote pilots remain obligated, before each operation, to consider the environment in which they are operating, particularly in areas that are known to have regular agricultural operations at night.⁷⁰

3. Waivers

The NPRM proposed making the anti-collision lighting requirement for small UAS night operations subject to waiver and invited comments on this aspect of the proposal. The Agency stated it would consider granting a certificate of waiver allowing nighttime small unmanned aircraft operations without an anti-collision light visible for 3 statute miles if an applicant demonstrates sufficient measures to mitigate the risk associated with the proposed operation. As discussed later in this section, allowing waivers of the anti-collision lighting requirement will accommodate unique operational circumstances without reducing safety.

EPIC opposed allowing waivers of the anti-collision lighting requirement for small UAS operations at night, noting concerns about security, privacy, and the potential for nefarious use. Neither this rule nor any potential waivers from the anti-collision requirement authorize the use of small unmanned aircraft for criminal activities. All persons requesting a waiver from the anti-collision requirement must include a description of the proposed operation and explain how they will mitigate any risks. The FAA will only issue waivers for operations that can occur safely.

AMOA and AAMS, commenting jointly, asked the Agency to clarify under what conditions it would grant a waiver of the anti-collision lighting requirement. The FAA expects waiver applicants to establish a deviation from the anti-collision lighting requirement would not reduce the level of safety of the operation. The FAA declines to prescribe specific criteria that would apply to all applications for waiver, as doing so would be impractical. In response to comments suggesting the FAA should develop separate processes for law enforcement and first responders, the FAA declines to create a separate process for a particular subset of part 107 operators.

D. Position Lighting Not Required

The proposed rule did not provide a requirement for position lighting. The

Agency invited comments from the public, however, on whether it should require position lighting, in addition to the anti-collision lighting.

Several commenters, including AOPA, EPIC, and AMOA and AAMS, commenting jointly, recommended requiring position lighting for night operations. Several of these commenters said the position lighting should be similar to those found on manned aircraft. AOPA noted that night operations are inherently challenging and visual line of sight would be better maintained with lights that aid in determining directional movement of the aircraft. EPIC agreed that small unmanned aircraft position lighting would be important for collision avoidance and to convey the position of the small unmanned aircraft to manned aircraft. The Director of the Autonomous Aerial Systems Office at the University of Montana encouraged the FAA to require position lighting in addition to anti-collision lighting that is consistent with current navigational standards, stating this requirement would improve safety in see-and-avoid situations in addition to improving remote pilots' situational awareness of aircraft position.

Many commenters supported the FAA's decision to not require position lighting for small unmanned aircraft. For example, DJI stated position lighting should not be required "because in many circumstances the remote pilot has the ability to determine the position, direction and orientation of the drone in other ways at night." DJI also noted it might be helpful at times to turn off the position lighting to capture the type of data required for the operation without interference of these lights, which are typically more visible to the on-board camera or sensor than other lights because they are located at the ends of motor arms. Several commenters noted that, although position lighting may provide a visual reference to determine the location of the small unmanned aircraft, it may not provide accurate information about the orientation of the small unmanned aircraft in flight.

Position lighting might assist a remote pilot in meeting the applicable visual line-of-sight requirements in § 107.31(a), such as knowing the unmanned aircraft's location, attitude, altitude, and direction of flight. However, this rule does not require position lighting because it is not the only means by which a remote pilot could meet these requirements. Although position lighting is not necessary for safe operation, a remote pilot may use position lighting if he or she determines

⁷⁰ See 14 CFR 107.49(a), which requires remote pilots in command to assess the operating environment and consider risks to persons and property in the immediate vicinity of the intended operation, prior to each operation.

it would be the best solution for safe operation.

E. Miscellaneous Night Operations Considerations

AMOA and AAMS also noted the NPRM does not discuss testing for the acuity of a remote pilot's night vision and said they believe remote pilots should be required to attest annually to this visual capability. As discussed in the 2016 final rule, operations under part 107 do not require airman medical certificates, given the low risk associated with small UAS operations, the limited operational range of visual line of sight operations, and the requirement that the remote pilot may operate only within their capabilities.⁷¹ As stated in the part 107 final rule, even with normal vision, a small unmanned aircraft might be so small that the operational space must be reduced to meet the visual line-of-sight requirements of § 107.31. Furthermore, the FAA prohibits a person from manipulating the flight controls of a small UAS or acting as a remote pilot in command or visual observer if he or she knows or has reason to know that he or she has a physical or mental condition that would interfere with the safe operation of a small UAS.⁷²

Some commenters requested the rule include additional requirements on the remote pilot, on the small unmanned aircraft, or on the operating environment for operations at night. MAC said regulations allowing night operations must ensure the safety of all aircraft operations in both the airport environment and the NAS. They also said the FAA should establish measures to identify clearly a small unmanned aircraft at similar distances to those that apply to manned aircraft. Exclusions from these requirements could include the use of small UAS for the purposes of airport safety, security, and operation activities, especially in situations of emergency response. A commenter suggested requiring remote pilots perform their intended night operations during the day prior to execution, map out the flight path, and ensure awareness of any obstacles. Commenters requested altitude restrictions, speed restrictions, and distance or operational radius limitations for night operations. A commenter also suggested requiring the remote pilot to have a radio on the appropriate frequency to detect any air traffic in the area. The current regulations under part 107, combined with the requirements in this final rule, contain adequate restrictions for

operations at night.⁷³ As discussed earlier, as of September 2020, the FAA has issued over 4,000 waivers allowing nighttime small UAS operations since August 2016. These operations have been conducted safely and the Agency does not have data indicating that the restrictions in this rule would be inadequate.

A commenter believed the FAA should require that remote pilots operating at night be AMA members, register their small unmanned aircraft with the FAA, and use "tracking" lighting for both day and night operations. The FAA requires registration for all small unmanned aircraft that operate under part 107. This requirement is sufficient for providing the FAA an avenue for oversight. Furthermore, as noted earlier, remote pilots are not prohibited from using position (or "tracking") lighting to assist in meeting the visual line-of-sight requirement; however, for the reasons stated above, this rule does not require position lighting.

NAAA recommended all small UAS be equipped with "ADS-B In-like" technology. NAAA and an individual commenter both suggested all small UAS operating under part 107 be equipped with technology that would allow them to sense the presence of and avoid manned aircraft. Part 107 requires remote pilots to maintain visual line of sight of the small unmanned aircraft at all times and give the right of way to all aircraft. Manned aircraft are not required to be equipped with ADS-B Out in all classes of airspace. For example, ADS-B Out is not required in Class G airspace. Therefore, requiring ADS-B In for small unmanned aircraft would not be sufficient in all circumstances to aid the remote pilot in detecting manned aircraft. Given this existing requirement, requiring ADS-B In-like technology is not necessary.

NAAA also suggested, to operate safely at night, small unmanned aircraft should have a registered N-number on an indestructible and unmovable plate attached to the small unmanned aircraft and should have an electronic identification and tracking technology so that it can be tracked by law enforcement. The registration and marking requirements as implemented by the Registration and Marking Requirements for Small Unmanned Aircraft rule, and amended by the External Marking Requirements for Small Unmanned Aircraft interim final rule, are sufficient for operations conducted under part 107. The Agency

declines to impose additional registration requirements that would apply to operations at night, as no safety benefit would result from such requirements.

F. Effect on Human Activity

The NPRM invited comments on whether characteristics or effects of anti-collision lighting at low altitude could have an effect on normal human activities, and if so, potential mitigations or alternatives the FAA should consider. Some commenters stated anti-collision lighting could affect human activities.

NIOSH stated, "[i]t is reasonable to assume that in some situations anti-collision lights could distract people" who are working and that, depending on their activities, this effect could have significant safety risks. NIOSH said it is not aware of any evidence supporting a mitigation strategy and recommended "exploring potential mitigation methods that follow the hierarchy of controls." This rule does not require use of the hierarchy of controls for small UAS operations at night because considering every possible scenario or assessing how distracting anti-collision lights may be to non-participants is not possible. Anti-collision lighting in night operations is a critical component in making small unmanned aircraft sufficiently conspicuous when operating under part 107. The safety need for such lighting outweighs the concerns these comments present.

Motorola Solutions stated anti-collision lighting at low altitudes could affect normal human activities associated with lights coming from unidentified sources and with unknown justification. The commenter said operations performed by public safety officers can mitigate the effect of unidentified unmanned aircraft light sources by replacing or augmenting the anti-collision lights with other lights such as those officers use for public safety operations. Requiring specific colors or additional lights for certain types of operations will not reduce the effect on human activity.

Droneport Texas, LLC said anti-collision lighting might startle or distract those engaged in normal human activities. To mitigate such distractions, the commenter recommended a remote pilot be allowed to reduce the intensity of the anti-collision lights that are "observable uniquely from the bottom side" of the aircraft and change them from flashing to a steady display. This rule requires all anti-collision lights to flash at a rate sufficient to avoid a collision. Furthermore, the remote pilot may use their discretion to determine

⁷¹ 81 FR 42064, 42159–42160.

⁷² 14 CFR 107.17.

⁷³ See 14 CFR 107.19, 107.31, 107.37, 107.41, 107.43, 107.49, 107.51.

the circumstances under which they could safely reduce the intensity of, but not extinguish, the anti-collision lighting.

DJI commented that, to mitigate the effects of anti-collision lighting on human activities, the FAA could encourage lights be placed on top of the small unmanned aircraft where it is most visible to manned traffic above and less bothersome to people below; however, DJI said it is unaware of complaints from the public about lighting, so such guidance should not be made a requirement. This rule does not include any prescriptive design criteria for anti-collision lighting. However, no provision of this rule precludes the placement of anti-collision lights on the top of a small unmanned aircraft.

One commenter suggested anti-collision lights could have an effect on the public due to light pollution and visual disturbances caused by the high intensity light and said the strobe effect could distract manned aircraft. Another commenter stated the purpose of the anti-collision lighting requirement is to call attention to the small unmanned aircraft, “in effect to distract the viewer.” The commenter further stated that, depending on the frequency and density of operations, blinking or strobe lights could disturb people engaging in traditional outdoor activities or even normal activities in their homes. The Agency anticipates anti-collision lighting will be no more distracting to individuals engaging in outdoor activities at night than the light from various other artificial sources. Red and white lights are often used at night, on vehicle headlights and taillights, street lights, school bus strobes, and other sources. The benefits of allowing small UAS operations at night in accordance with these requirements outweigh the potential drawback of distracting people on the ground. The FAA has carefully considered these concerns, however, and has prepared a finding of the categorical exclusion that applies to this rule, which assesses light emissions and visual impacts, and is available in the public docket for this rulemaking.

One commenter asked the FAA to consider allowing municipalities to designate certain public, open spaces as night flight zones. One commenter opposed operations at night and the use of anti-collision lighting over parklands and “Dark Sky” communities where municipalities restrict artificial lighting and suggested the FAA follow restrictions on train horns and allow communities to request prohibitions of night operations within the municipality. This commenter further noted the FAA has responsibilities

under the Department of Transportation Act, Sec. 4(f), for any lighting if it impairs in any way night skies, vistas, and contemplative recreation in protected areas such as wilderness and parks.

The National Conference of State Legislatures and the National Association of Counties stated the importance of State and local authorities’ ability to regulate UAS on a State and county level. One commenter suggested allowing different UAS regulations in different states. Other commenters expressed concerns about local entities placing requirements on the airspace and operating requirements.

States and municipalities may use their police powers, such as those relating to land use, zoning, privacy, anti-voyeurism, trespass, and law enforcement operations, to address small UAS operations in the community. Through their land use and zoning power, municipalities have authority to determine the placement of aircraft takeoff and landing areas within the community. However, municipalities do not have authority to enact operational restrictions on aviation safety or the efficiency of the navigable airspace, including regulation of unmanned aircraft flight altitude, flight paths or operational bans. The applicability of the Department of Transportation Act, Section 4(f), is discussed in the supporting documentation for the categorical exclusion documentation, which is included in the public docket for this rulemaking.

All aircraft operations in the navigable airspace, whether manned or unmanned, and whether during the day or at night, are regulated by the Federal government. Congress has long vested the FAA with authority to regulate the areas of airspace use, management, and efficiency; air traffic control; safety; navigational facilities; and aircraft noise at its source.⁷⁴ In addition, a citizen of the United States has a statutory public right of transit through the navigable airspace.⁷⁵ The FAA is aware of the International Dark-Sky Association and its work in encouraging communities, parks, and protected areas to preserve and protect dark sites through responsible lighting policies and public education. Designated dark sky communities would be free to request UAS operators minimize nighttime operations, citing their community’s dedication to the preservation of the sky through the implementation and enforcement of outdoor lighting

ordinances to promote responsible lighting and dark sky stewardship. However, under the Federal statutory and regulatory framework, communities would not have the authority to prohibit small UAS operations at night or regulate small unmanned aircraft lighting.

X. Part 107 Remote Pilot Knowledge Testing and Training

The NPRM proposed to maintain the initial knowledge test requirement and initial training requirement for persons seeking to obtain a remote pilot certificate with a small UAS rating.⁷⁶ However, with respect to recency of experience requirements, the FAA proposed to require recurrent training every 24 calendar months in lieu of the recurrent knowledge testing.⁷⁷ Additionally, the NPRM proposed to add a knowledge area covering operations at night for the initial knowledge test, initial training, and recurrent training. The NPRM also proposed to revise the list of knowledge areas for remote pilots, requiring inclusion of the same list of knowledge areas on both the initial knowledge test and the recurrent training for pilots who hold a remote pilot certificate under § 107.65(b). As for pilots who already hold a pilot certificate under part 61 as described in § 107.65(c), the NPRM proposed to require the initial and recurrent training to cover identical knowledge areas. For the reasons discussed below, the Agency adopts these proposed amendments without change.

A. Recurrent Training and Aeronautical Knowledge Recency

Prior to this final rule, § 107.65(a) and (b) required persons to complete either an initial aeronautical knowledge test or a recurrent aeronautical knowledge test within the previous 24 calendar months prior to operating a small UAS. This final rule revises § 107.65(b) to allow remote pilots to take recurrent training instead of a recurrent aeronautical knowledge test. People who hold a part 61 pilot certificate (other than a student pilot certificate) who have completed a

⁷⁶ Under § 107.61, to be eligible to apply for a remote pilot certificate, a person must pass an initial aeronautical knowledge test covering the areas of knowledge specified in § 107.73(a). Alternatively, if a person holds a pilot certificate (other than a student pilot certificate) issued under part 61 and meets the flight review requirements specified in § 61.56, that person may complete initial training covering the areas of knowledge specified in § 107.74(a).

⁷⁷ Recurrent training was already an option for any person holding a pilot certificate (other than a student pilot certificate) issued under part 61 provided the person also meets the flight review requirements specified in § 61.56.

⁷⁴ See 49 U.S.C. 40103, 44502, and 44701–44738.

⁷⁵ See 49 U.S.C. 40103(a)(2).

flight review within the previous 24 calendar months in accordance with § 61.56 may continue, under § 107.65(c), to complete either initial or recurrent training covering the areas of knowledge specified in § 107.74.

Recurrent training ensures remote pilots maintain ongoing familiarity with small UAS operations and the provisions of part 107. Moreover, remote pilots can complete recurrent training online, which provides a less costly option and results in the remote pilot maintaining a level of knowledge comparable to receiving recurrent testing. The FAA's use of online training enables the FAA to adapt the training as necessary as technology or regulations change.

The rule continues to allow an eligible person who holds a part 61 pilot certificate (other than a student pilot certificate) to complete training on the knowledge areas specified in § 107.74 when seeking a remote pilot certificate.⁷⁸ Furthermore, the rule allows all remote pilots to complete recurrent training online every 24 calendar months, in place of a recurrent knowledge test. The rule amends the aeronautical knowledge test and training requirements for remote pilots provided in §§ 107.73 and 107.74 to include a new knowledge area related to operating a small UAS at night. For more information about the testing and training on the night operations knowledge area, please see Section IX.B.

This final rule requires the initial knowledge test and the recurrent training cover identical areas of knowledge under § 107.73. Similarly, for eligible part 61 pilots, the initial training and recurrent training will cover the same knowledge areas under § 107.74. The FAA is concurrently updating the part 107 Airman Certification Standards (ACS), the initial aeronautical knowledge test, the part 107 certification course for eligible part 61 pilots, and the recurrent training.⁷⁹ The updated aeronautical knowledge test and updated training replaces the current knowledge test and training after the effective date of the rule. Both the updated aeronautical knowledge test and the updated training will be available on March 1, 2021.

NASAO asked that the recurrent education make pilots aware of updates to operating rules, rather than retesting the initial knowledge test. One commenter believed there should be a

“grading scale” to ensure pilots have stayed current on operations and regulations. Another commenter agreed that it was likely that operators would need to take refresher training, but suggested that if an individual scores above a certain level on their initial knowledge test, the FAA exclude that person from having to take recurrent training. Several commenters objected to the current 24-month interval for the testing and recurrent training process. Commenters recommended a range of intervals for recurrent training from 36 months to 5 years, or eliminating altogether for “professional operators.”

Part 107 requires the recurrent training to cover applicable regulations relating to small UAS rating privileges, limitations, and flight operation. As a result, recurrent training will ensure remote pilots are aware of current and updated operating rules. While a high score on an initial aeronautical knowledge test may demonstrate initial competency, knowledge is perishable and degrades over time. Online recurrent training allows remote pilots to maintain critical knowledge and keep abreast of dynamic issues, including changes to regulations, that arise while ultimately completing the updated knowledge requirements related to operating small UAS. Additionally, the Agency finds the 24-month interval an appropriate time period. This recurrent training interval is consistent with the requirement for manned aircraft pilots meeting the requirement to complete a flight review as required by § 61.56. On completion of this recurrent training, a printable completion certificate is available to demonstrate aeronautical knowledge recency in accordance with the revisions to § 107.65. The FAA provides educational material on the FAA website about updates to operating rules. AOPA commented that the FAA should not be the exclusive provider of the required knowledge training because there are numerous training courses offered by industry that might be more effective and better meet the needs of the unmanned aircraft operator. Another commenter asked the FAA to clarify what training would qualify.

The Coalition of Airline Pilots Association suggested the FAA require all small UAS operators to meet the same operational recency and testing requirements that are currently in place for manned commercial airman certificates. ALPA noted that a person who manipulates the flight controls of a small UAS should be a certified pilot and pass a knowledge test, but objected that the proposed requirement would allow an individual to be granted a remote pilot certificate without

assurance of practical experience with a small UAS. Several commenters recommended specific practical training requirements, including flight training for operations over people and at night. One commenter believed an unprepared remote pilot may have to resort to manual flight operation and may not be qualified for that operation. AUVSI commented that any mandatory training involving operations over people should be competency-based. They also recommended the FAA consider how industry initiatives could support a new training requirement to help ensure that small UAS operations occur safely and in accordance with the rules. Another commenter wrote a higher level of training should be required to operate a small UAS commercially.

The Agency continues to find that formal training, a practical test for the issuance of a part 107 remote pilot certificate, and testing requirements similar to those for part 61 commercial pilot certificates, are not necessary. As discussed in the 2016 final rule, the limitations of many small unmanned aircraft (e.g., size, ease of landing, lack of people on board), combined with the operational restrictions of part 107, minimize the need for flight proficiency testing or formal training. A prescriptive formal training requirement is not necessary for part 107 operations. Instead, this rule allows remote pilot certificate applicants to attain the necessary aeronautical knowledge through any number of different methods, including self-study, enrolling in a training seminar or online course, or through one-on-one instruction with a trainer familiar with small UAS operations and part 107. This performance-based approach is preferable because it allows individuals to select a method of study that works best for them.⁸⁰ The FAA maintains this rationale for operations over people and night operations. While the introduction of operations over people and night operations may introduce additional complexity to the NAS, the FAA developed the design and operational requirements of this rule to balance the risk associated with the incremental integration of small UAS. This rule discusses those risk mitigations in more detail in Sections VI and IX, respectively.

The FAA understands formal training would be overly burdensome to an applicant. By requiring a person to only take a knowledge test for certification, allowing online recurrent training, and not requiring formal training, the FAA anticipates that this will result in cost

⁷⁸ In order to be eligible to obtain a remote pilot certificate under § 107.65(c), the person must satisfy the flight review requirements of § 61.56.

⁷⁹ https://www.faa.gov/training_testing/testing/acs/.

⁸⁰ 81 FR 42064, 42160–42161.

savings for remote pilots, as discussed in the regulatory impact analysis. In addition, requiring formal training and a practical test would not be consistent with the original framework of part 107.⁸¹ The FAA does not find it necessary to require practical testing to obtain a remote pilot certificate. This approach is consistent with the risk-based framework the 2016 final rule established.⁸²

One commenter expressed concern that requiring the recurrent training to be identical to the initial training for part 61 pilots would be duplicative. Commenters asked the FAA to review the areas already covered in the Private Pilot Airman Certification Standards and keep duplicative or conflicting subject areas to a minimum. Another commenter suggested that part 61 should include certification to be a remote pilot.

As discussed previously, knowledge degrades over time and requiring recurrent training provides assurances that experienced remote pilots remain aware of the specifics of operating a small UAS. Additionally, as noted in the NPRM, the FAA finds it necessary to ensure consistency in remote pilots' knowledge of the topic areas for the safe operation of small UAS. To compensate for the differences between manned aircraft and small unmanned aircraft, the list of knowledge areas includes topics that are specific to small UAS operations. For example, determining the performance of a manned aircraft is distinct from the manner in which a pilot should determine the performance of a small UAS; in this regard, the preflight check requirements of § 107.49 are distinct from those codified in part 91 and in other, similar regulations specific to manned aircraft.

Several commenters objected to the cost associated with the initial knowledge test and other commenters recommended the FAA lower the test costs. However, one commenter wrote that everyone who owns a small UAS should have to pass the initial knowledge test and recurrent testing to eliminate the threat of people flying dangerously. One commenter objected to having to pay a third party for recurrent testing. Some commenters wrote that section 44809 of the FAA Reauthorization Act of 2018 requires the FAA to develop a test for recreational operations that can be administered online and that this should be extended to part 107 remote pilot certification, thereby reducing the cost to \$50

associated with the initial knowledge test.

The FAA clarifies that part 107 does not mandate formal training to obtain a remote pilot certificate, and any cost that a part 107 applicant incurs for formal training is at their discretion. Additionally, on March 1, 2021 the FAA will provide free, online recurrent training to all remote pilots. The FAA enters into contracts for testing delivery through a third party vendor. The FAA's rationale to contract the initial test through knowledge testing centers remains the same as it was in the 2016 final rule.⁸³ This delivery model allows the FAA to enter into a contract that provides a zero cost model to the U.S. government and to the taxpayers. The testing vendor has many locations throughout the United States that are close to large and small population centers, therefore the requirement to take a knowledge test at a testing location is not an undue burden on applicants. The third party vendor is allowed to charge the contract rate to administer a knowledge test; however, that amount is not to exceed \$160. The FAA Reauthorization Bill of 2018 requirement for the FAA to have an online test for limited recreational operators does not apply to part 107 remote pilot certification.

B. Other Comments Related to Initial Testing or Recurrent Training

Several commenters expressed concern about the risks of people without certification or training operating small UAS. Other commenters, referencing certification of pilots and mandatory registration for equipment, stated that all operators should be licensed regardless of size or weight of small unmanned aircraft. The FAA agrees that persons operating small UAS in the NAS should have appropriate aeronautical safety knowledge, knowledge of applicable rules, and knowledge of airspace constraints before operating in the NAS. Part 107 rules require that all small unmanned aircraft are registered and operated by a certificated remote pilot. The FAA currently requires initial testing or training before the issuance of a remote pilot certificate with a small UAS rating for operations under part 107.

Multiple commenters requested that both testing and training be provided online, with several commenters specifically recommending that the initial knowledge test be available online. The FAA agrees that in-person recurrent testing under part 107 is no

longer necessary for part 107 certificate holders. Therefore, to meet the recency requirements under § 107.65, any person who holds a part 107 certificate may maintain recency of experience by completing an online training course. For security reasons, the initial knowledge testing must be done in person, similar to the regulatory framework for training under part 61.

A commenter suggested that test questions for each online test be pulled randomly from a larger set of questions so an applicant cannot take the same test over and over until the applicant achieves a score of 100 percent and would be required to learn the material. The part 107 knowledge tests are created from a large bank of questions that were specifically drafted for small UAS remote pilot certification. Although it is possible that a person could take the part 107 knowledge test enough times that they would eventually see all of the questions, and possibly get them all correct, this is not very probable especially given the mandatory 14-day waiting period required before a person can retake the knowledge test after a failure.⁸⁴ In addition, a person who is not prepared for the test, and does not have a working knowledge of the material, will have a very low probability of passing the test. The FAA will continue to administer knowledge testing in the same form and manner that has proven effective for many years.

A commenter recommended the FAA define minimum standards for training that would allow certain people to conduct operations without requiring a waiver to operate over people or at night. This rule adopts routine night operations and operations over people without the need for waivers. Additionally, under part 107, the FAA does not maintain minimum standards for training like those in part 61. For example, an applicant for a remote pilot certificate with a small UAS rating does not have to show that they have received formal training from a certified instructor on the National Airspace System. As there are two pathways for remote pilot certification, an applicant will have either met a minimum testing standard via a knowledge test or they will have taken training which will also test their knowledge. All persons who hold a remote pilot certificate will also need to maintain currency by taking currency training every 24 months from the month in which they take and pass the knowledge test or training for certification. The updated knowledge areas for the testing and training

⁸¹ For further discussion of rationale, please see 84 FR 3856, 3891–3892; 81 FR 42064, 42160–42171.

⁸² 81 FR 42161.

⁸³ 81 FR 42064, 42169–70.

⁸⁴ Section 107.71.

requirements are the minimum standard for small UAS operations conducted under part 107.

Some commenters proposed the Agency tailor the part 107 knowledge test to specific types of operators or certain topics and have different tests based on the type of operation. A few commenters recommended the part 107 knowledge test be redesigned to better test commercial small UAS pilots piloting skills and safe operations. These commenters noted the part 107 knowledge test appeared to derive from manned pilot standards and the Pilot Handbook of Aeronautical Knowledge (PHAK), which the commenters argued do not apply directly to small UAS flights. Another commenter asked for knowledge and testing specific to small UAS operations over people, such as first aid training. A commenter suggested the FAA have two separate knowledge tests: A basic test for hobbyists and small businesses, etc., and a more complex test for large commercial operations, large, fixed-wing small unmanned aircraft, or those flying in urban areas or all over the country.

All test questions were developed specifically for the part 107 remote pilot certification. Some of the required test questions, however, are also applicable to manned aircraft, such as questions related to airspace regulations that apply to all aircraft. The FAA carefully evaluated the knowledge test areas to ensure they remain comprehensive. The small UAS Airman Certification Standards and knowledge test contain each of the topics required for knowledge and testing, and the Agency does not consider remote pilot first aid training a necessary requirement for such low-risk operations. The requirements are the same for anyone flying under part 107; therefore, the knowledge and training should be the same for all certificated remote pilots under part 107.

Some commenters suggested passing the part 107 knowledge test or the level of the remote pilot's training and experience should permit them certain privileges. A commenter wrote that passing the part 107 test should grant part 107 pilots the ability to fly over people and beyond line of sight. A commenter requested the FAA add levels of additional authorization for a remote pilot to fly over people, carry payloads, or fly at night based on their levels of training and experience added as ratings to the certificate. One commenter stated that part 61 pilots should have more "capability and freedom," as they have already demonstrated their responsibility by

obtaining a part 61 certificate. Another commenter asked the FAA to educate businesses that use remote pilots without a part 107 certificate to conduct commercial small UAS operations.

The FAA declines to add authorizations or ratings to the remote pilot certification in this final rule. A person who holds a remote pilot certificate is afforded all privileges of the certificate. The FAA has taken the approach of tailoring its requirements for night operations and operations over people with the expectation that all part 107 pilots have the same level of certification. The Agency did not propose authorizing routine beyond visual line of sight operations in this rulemaking; therefore, adding authorizations or ratings to address such operations is beyond the scope of the rule. Additionally, part 107 does not prohibit payload-bearing operations, but the small unmanned aircraft and any payload must be less than 55 pounds and must follow all applicable regulations for safe operation. Remote pilots who operate a small UAS under part 107 without an FAA-issued pilot certificate are subject to the FAA's Compliance and Enforcement Policy. Additional educational material is available on the FAA website.⁸⁵

XI. Other Amendments to Part 107

A. Presentation of Remote Pilot in Command Certificate

The Agency proposed to add to § 107.7 the requirement for remote pilots to present their remote pilot in command certificate with a small UAS rating as well as a form of identification to authorized individuals on request. This update aligns the text of § 107.7 with § 61.3(l). The existing rule requires the remote pilot in command, owner, or person manipulating the controls of the small UAS to present to the Administrator, on request, the remote pilot certificate with small UAS rating and any other document, record, or report required under part 107. The proposed change to § 107.7 expanded the list of authorized individuals who might request the information, to include authorized representatives of the National Transportation Safety Board (NTSB) or Transportation Security Administration (TSA); or any Federal, State, or local law enforcement officer. Under the proposed rule, the form of identification would include any identification containing the person's photograph, signature, date of birth, and permanent mailing address.

⁸⁵ <https://www.faa.gov/uas>.

Several commenters expressed support for the proposed changes to § 107.7. These commenters stated the proposal aligns with § 61.3(l) requirements, would help enforce a safe UAS operating environment, or would aid investigations into violations of Federal and State rules. Other commenters indicated § 107.7 should include modifications or additional requirements. Individual commenters recommended the FAA allow for the use of electronic credentials to facilitate compliance with the requirement in a convenient manner. The Agency declines to allow electronic credentials as a form of identification, as the lack of standardization in electronic credentials in the United States eliminates the ability of authorized persons to verify the identity of the remote pilot. A commenter also encouraged the Agency to allow a passport to be used as an identification document even though it does not include a mailing address. According to this commenter, allowing the use of a passport would more closely match the part 61 identification regulation.⁸⁶ Part 61 and the text the Agency proposed for § 107.7 differ because part 61 does not require identification for the purpose of § 61.3(l) to include a mailing address. Although part 107 requires a mailing address for the purpose of being eligible to take a knowledge test under part 107,⁸⁷ the Agency has determined a mailing address is not necessary for adequate identification of a remote pilot in command under § 107.7. This rule, therefore, contains a revision to the regulatory text to permit forms of identification that do not contain a mailing address for the purpose of presenting identification in accordance with § 107.7.

Two commenters suggested the FAA require the remote pilot in command to present his or her certificate and identification only when it is safe to do so, and does not pose a danger or hazard to persons, property, or public safety. The FAA declines to impose requirements based on prescriptive circumstances. However, authorized officials should allow ample time for the remote pilot to provide a form of identification and remote pilot certificate in a safe manner.

NFL, MLB, NASCAR, and NCAA, in a joint submission, expressed their support for the proposed changes to

⁸⁶ Section 61.3(l) requires presentation of an airman certificate or other, specific type of certificate along with "photo identification as described in [§ 61.3(a)(2)]." Section 61.3(a)(2) does not specifically require the form of photo identification include the person's mailing address.

⁸⁷ See 14 CFR 107.67(b).

§ 107.7, noting it is essential that local law enforcement officials have the authority to request remote pilot certificates because local law enforcement provides security services at the sporting events. The sports organizations also recommended adding private security officials who work with local law enforcement to enforce a temporary flight restriction or section 2209 designation to the list of individuals authorized to request remote pilot certificates and identification. Federal, State, and local law enforcement officers hold the appropriate authority to verify the identity of a remote pilot. The Agency declines to speculate on the division of authority within Federal, State, and local law enforcement organizations.

A few commenters opposed the FAA's proposal to require UAS operators to present their pilot certification and identification to officials outside the FAA on request. These commenters supported the requirement to present their credentials to an FAA official who understands the regulations, but noted officials outside the FAA are not trained or supervised by the FAA, and were concerned about their ability to properly handle situations involving small UAS operations as a result. Another commenter suggested the small UAS operator should be required to present the documents if an incident occurs. Other individual commenters did not oppose the proposed provision, but recommended that the FAA work on educating law enforcement officials about who may operate UAS, and where, how and when they may operate. NASAO asked for clarification regarding Federal, State, or local officials requesting proof of an operator's license and requested the Agency provide a clearer definition of the intent for enforcement.

The Electronic Frontier Foundation (EFF) and the News Media Coalition commented that remote pilots in command should only be required to present their credentials when officials have reasonable suspicion that the remote pilot in command is engaging in criminal activity or violating FAA regulations. EFF asserted the proposed rule conflicts with existing Fourth Amendment law and to bring the proposal in line with the FAA's rationale, EFF recommended the Agency amend § 107.7 to include the reasonable suspicion standard. The News Media Coalition indicated it does not oppose providing law enforcement with their certification papers under narrow and well-defined circumstances. However, the Coalition expressed concern that blanket authorization for

local law enforcement to demand immediate presentation of papers would interfere with journalists' First Amendment rights to lawfully gather the news without unwarranted government interference. The Coalition also recommended that the FAA provide law enforcement with training on the regulations to avoid government overreach.

To maintain the safety and security of the airspace, it is vital to know who is operating in the NAS.⁸⁸ The FAA implements these regulatory inspection requirements as a measure to ensure this safety and security. The amended regulation neither abrogates the protections of the Fourth Amendment nor the responsibility to comply with it. The ability to identify remote pilots provides critical information to the Administrator, the NTSB, and law enforcement officials charged with ensuring public safety. Moreover, the amended regulation aligns the list of authorized individuals in § 107.7 with not only § 61.3(l), but other longstanding FAA regulations with similar requirements.⁸⁹ The FAA has continuously conducted outreach efforts with Federal, State, and local law enforcement on small UAS operations. Additionally, the FAA has the Law Enforcement Assistance Program (LEAP), which provides, as appropriate, aviation-related support and education to law enforcement agencies.

B. UAS Exemption-Holders

The existing text of § 107.1 excludes from the applicability of part 107 remote pilots who hold an exemption for a UAS operation pursuant to section 333 of Public Law 112–95. The text identifies the remote pilot as the person who is excluded from the applicability of part 107. This identification is imprecise, as the text should identify the excluded party as the exemption-holder, rather than the remote pilot. In addition, on October 5, 2018, the President signed the FAA Reauthorization Act of 2018. The statute codified within title 49 of the United States Code the authority previously provided in section 333 of Public Law 112–95. As a result, the citation within § 107.1(b)(3) should reflect 49 U.S.C. 44807 as the exemption authority. The NPRM proposed rephrasing the text of § 107.1(b)(3), accordingly. The Agency did not receive any comments on this change and adopts it, as proposed.

⁸⁸ See Section III., Background A. Related FAA and DOT Actions 4. Secure Operations of Small Unmanned Aircraft Systems.

⁸⁹ 14 CFR 65.49, 65.89, 65.95, 65.111.

C. Remote Pilot in Command

Section 107.19 outlines the responsibilities of the remote pilot in command under part 107. Following the promulgation of part 107, the FAA identified the need for a minor edit to paragraph (c) of § 107.19, which currently requires each remote pilot in command to “ensure the small unmanned aircraft will pose no undue hazard to other people, other aircraft, or other property in the event of a loss of control of the aircraft for any reason.” The Agency proposed to amend the phrase “loss of control of the aircraft” to say “loss of control of the small unmanned aircraft,” for clarity.⁹⁰ The Agency did not receive any comments on this change and adopts it, as proposed.

D. Operation of Multiple Small UAS

The proposed rule included an amendment to the existing text of § 107.35, which prohibits contemporaneous operation of more than one small unmanned aircraft. Following the promulgation of part 107, the FAA realized the use of the term “operate” in § 107.35 could result in the perception that a single company or operator was prohibited from employing more than one remote pilot in command and conducting more than one small UAS operation at the same time. The proposed change to this section will allow companies to run two or more simultaneous small UAS operations, provided each aircraft is under the control of its own remote pilot in command.

Two commenters addressed the proposed change to § 107.35. ALPA supported the proposed change, saying it clarifies the difference between flight operations by a company and the remote pilot in command. ALPA also strongly supported the restriction that each small UAS remote pilot only be in control of one small unmanned aircraft at any given time. The Small UAV Coalition said it does not object to this provision; however, it noted that the prohibition is subject to a waiver under § 107.205. The Agency adopts the amendatory language, as proposed.

XII. Section 44807 Statutory Findings

To determine whether certain UAS may operate safely in the NAS pursuant to 49 U.S.C. 44807, the Secretary must find that the operation of the UAS would not create a hazard to users of the NAS or the public. The Secretary must also determine whether a certificate under 49 U.S.C. 44703 (“Airman certificates”) or section 44704 (“Type

⁹⁰ 84 FR 3856, 3893.

certificates, production certificates, and airworthiness certificates, and design and production organization certificates”), or a certificate of waiver or certificate of authorization, is required for the operation of UAS, which includes small UAS subject to this rule. In the NPRM, the Secretary proposed to determine, using a risk-based approach, that small UAS operations under this rule would operate safely in the NAS; the individual findings that section 44807 requires are as follows.

A. Hazards to Users of the NAS or the Public

Section 44807(b)(1) requires the Secretary to determine which types of small UAS operations do not create a hazard to users of the NAS or the public. In the NPRM, the Secretary proposed to find that small UAS operations subject to this rule would not create a hazard to users of the NAS or the public. The FAA invited comments on this proposed finding.

Several commenters expressed general concerns about introducing small UAS into the NAS. Other commenters were concerned about potential risks that small UAS would pose to the manned aircraft operating at the same low level altitude. HAI, American Airlines, A4A, NAAA all stated they supported the expansion of small UAS operations, but requested the FAA specifically consider the potential risk of small UAS operations to manned aircraft, particularly those operating in low-altitude airspace. American Airlines referred the FAA to its comments submitted to the docket for the Safe and Secure Operations of Small Unmanned Aircraft Systems ANPRM for a discussion on its safety and security concerns. AMOA and AAMS, commenting jointly, also expressed concern that the proposed rule does not fully acknowledge the collision risk posed by an increase in UAS operations to low-altitude manned aircraft and “relies too heavily and without adequate foundation on the skills of the UAS remote pilot to avoid conflict.” NAAA noted UAS present a hazard to low-flying pilots similar to that presented by birds, which is significant because, according to NAAA, aircraft-wildlife strikes are the second leading cause of aviation related fatalities.

Drone Safe Communities stated the NPRM fails to address “the risks posed by unauthorized UAS operations by negligent or malicious users.” As such, the commenter asserted the FAA should focus on including unauthorized users in its analysis and in developing counter UAS technologies to enforce

UAS regulations and integrate UAS into the NAS. The commenter criticized the FAA for providing guidance that tells facility owners to call local law enforcements during such sightings rather than dealing with these disruptions as an agency, especially because local enforcement agencies may not have the resources to deal with such risks.

In contrast to commenters who felt the FAA did not adequately consider the risks associated with introducing small UAS operations to the NAS, Precision Hawk stated the FAA was “singularly focused” on such risks, while failing to consider all the benefits small UAS operations would bring related to worker safety. This commenter noted that small UAS offer multiple opportunities to enhance employee and public safety and save lives by obviating the need for manned aircraft flight in particularly hazardous mission situations.

Through this rule, the Secretary addresses commenters’ safety concerns and suggestions for considering increased opportunities that small UAS operations present. The requirements of part 107 mitigate the risks to manned aircraft by requiring the remote pilot to maintain visual line of sight of the small unmanned aircraft and to give way to manned aircraft at all times. In addition, this rule includes requirements that mitigate the risks associated with an increase in small UAS operations. For example, the anti-collision lighting required for nighttime operations, as discussed in detail in Section IX, increases operators’ awareness of a small UAS operating within the same airspace. Moreover, this rule publishes concurrently with the final rule for Remote Identification of Unmanned Aircraft Systems, which addresses the security considerations raised. The FAA has developed relationships of mutual interest with law enforcement to address the safety and security concerns prompted by the proliferation of small UAS operations. To facilitate the safe integration of small UAS, the Agency must develop regulatory pathways for operation. This rule is an important step in enabling safe operations by balancing the risk of those operations with operational and design requirements that mitigate it. As previously discussed in Section IV.A.1., the safety record of 175 waiver holders, as of September 2020, to conduct operations over people have reported no injuries to persons on the ground and no damage to property on the ground exceeding \$500.00. Considering the safety record of these waivers for operations over people, the available safety data supports the

determination that operations over people can occur safely in accordance with this rule.

B. Certificate Requirements

Additionally, 49 U.S.C. 44807(b)(2) requires the Secretary to determine whether small UAS operations subject to this proposed rule pose a safety risk sufficient to require airworthiness certification or airman certification. The Secretary proposed to find, pursuant to 49 U.S.C. 44807(b)(2), that airworthiness certification is unnecessary for small UAS subject to this proposed rule and that a certificate under 49 U.S.C. 44703 should remain a requirement.

AMOA and AAMS, commenting jointly, stated the lack of discussion in the NPRM section pertaining to Section 44807 Statutory Findings made it difficult to determine what the significance of this proposed requirement will be. They sought clarification on what this requirement would mean for part 107 pilots, inquiring whether remote pilots would need medical certificates or be listed in the national pilot database.

The findings of the Secretary are based on compliance with the requirements outlined in this rule. The requirements and limitations of part 107, as amended by this rule, indicate small UAS operations can occur safely without the small UAS having an airworthiness certificate. For example, under the existing requirements of part 107, a remote pilot must conduct a pre-flight inspection in accordance with § 107.49. The remote pilot would, if operating over people, ensure that the aircraft meets the eligibility requirements to operate over people, as discussed in the preamble of this rule. Similarly, operations at night may only occur after the remote pilot has taken the updated knowledge test or training that includes content on night operations and when the small unmanned aircraft maintains an illuminated and flashing anti-collision light. This rule does not require pilots conducting operations under part 107 to hold a medical certificate. Remote pilots who hold a part 107 certificate, however, will remain included in the national pilot database; such inclusion is a necessary means of oversight. Moreover, the Secretary finds small UAS operations can occur safely under part 107 as long as the remote pilot holds a remote pilot certificate, pursuant to § 107.12.

XIII. Other Considerations

A. Liability

Several commenters suggested the FAA should require UAS operators hold valid liability insurance or require that operators be liable for property damage or personal injury arising out of an accident involving UAS, especially for operations of small UAS at night. Some commenters stated the FAA should set the minimum coverage standards. Another commenter addressed product liability, stating manufacturers should not be liable for the misuse of their products.

In response to commenters' suggestions that there be an insurance requirement for operations over people or at night, the FAA notes that it lacks jurisdiction to mandate the purchase of liability insurance. Similarly, OST also lacks authority to impose liability insurance requirements on small UAS operations covered by this rule because those operations do not rise to the level of air transportation.⁹¹ However, the Department emphasizes that remote pilots who offer these types of services are responsible for the operation, and could be held liable for any injury or damage that could result. Prudent remote pilots should evaluate their existing insurance policies to determine whether they have appropriate coverage for these operations.

Finally, this rule did not propose operators obtain insurance coverage for operations subject to this rule. The Agency considers comments concerning insurance and liability as outside the scope of the rule.

B. Privacy

Commenters cited privacy issues as reasons for opposing the proposed rule. The FAA acknowledges that privacy issues could be a concern with operations over people; however, the proposed performance-based rule focuses on the risk of injury involved with operations over people and does not address privacy issues. EPIC believed that the unrestricted use of small unmanned aircraft over protests could have a chilling effect on free speech. They also stated people over whom a small unmanned aircraft flies should receive advance warning, both at public events and in closed or restricted-access sites. Similarly, the

News Media Coalition wrote that restrictions on operations over people raise First Amendment concerns, such as when police departments set a perimeter around an accident or incident site that prevents a fly-over. An individual commenter recommended that the FAA conduct an information campaign to reduce the concerns the public might have related to privacy.

Although the Agency is not authorized to impose regulations based on privacy concerns, the FAA has collaborated with the public, stakeholders, and other agencies with authority and subject matter expertise in privacy law and policy. As stated in the 2016 final rule, the FAA's mission is to provide the safest, most efficient aerospace system in the world, and does not include regulating privacy or free speech.⁹² Privacy issues are outside the focus and scope of the rule. The FAA emphasizes, however, that this rule does not relieve the operator from complying with other laws or regulations that are applicable to the purposes for which the operator is using the small UAS.

C. Noise From Unmanned Aircraft

Several commenters state that noise was potentially an issue with operations over people. The comments were mostly general, citing concerns about nighttime operations disturbing sleep, noise that might be created in recreational areas that people visit to get away from noise, and that small UAS should generally be banned in residential areas. A few suggestions were more specific, such as limiting small UAS operations to an unspecified straight-line distance from structures and people to alleviate noise and privacy concerns, prohibiting operations within 30 feet of people, allowing operations over roadways to lessen impacts on noise-sensitive locations like schools and hospitals, and education of remote pilots as to local noise ordinances for nighttime operation. A few commenters conclude that compared to current ambient noise levels of cars, large aircraft, and "heavy lift UAS," small UAS operations would not contribute noticeably to noise. One commenter states that the FAA said the Agency did not have authority over noise; that statement is an incorrect reading of the proposed rule.

The FAA primarily manages aircraft source noise as a matter of aircraft certification rather than operational restrictions. The FAA is aware that limited data are available quantifying the acoustics of most unmanned aircraft and almost none relating to the effect on people when unmanned aircraft of any

size are operated in close proximity. When the FAA promulgated part 107, it determined that it would not impose any noise requirements (in the form of testing individual aircraft) because of the limited size of small unmanned aircraft and the scope of operations that were allowed under that part. In the years since the adoption of part 107, however, the number of UAS operating has increased, the FAA has granted operational waivers, and the Agency is now expanding part 107 operations outside of the initial operational box. The expansion of the number of unmanned aircraft and their operations has outpaced FAA certification actions to measure and analyze noise from these aircraft, and the FAA has recently added UAS to its noise reporting portal workflow in response to increasing public awareness and concern for UAS operations near them. The FAA continues to seek and collect available noise data on more unmanned aircraft models, however, the efforts have faced challenges due to the rapid expansion of operations under part 107 with unmanned aircraft that are not required to be certificated under part 36.

When an aircraft is presented for type certification under part 21, the FAA undertakes noise certification in accordance with part 36 standards. To date, the Agency has treated unmanned aircraft as either small airplanes or rotorcraft depending on their means of flight. Manufacturers who seek type certification for unmanned aircraft—either because they exceed the 55 pound weight limit of part 107 or seek to operate outside part 107 limits (such as under part 91 or part 135)—are tested and their noise levels measured, but the few already certificated have resulted in only incremental increases in the FAA's noise database on these aircraft. In addition, as larger unmanned aircraft are added to the fleet, there is increased potential for noise impacts. Accordingly, the FAA has begun to apply more relevant test procedures and noise limits for new unmanned aircraft models presented for type certification under part 21.⁹³

The forecasted proliferation of unmanned aircraft that weigh less than 55 pounds has led the FAA to assess its future ability to analyze and understand the noise impacts of unmanned aircraft. As the operating environment expands to include more operations over people that are not directly participating in the operation, the FAA will need to address

⁹¹ As discussed in the part 107 final rule, air carriers (which are not included in this rule) are subject to liability insurance requirements. 81 FR 42064 at 42074–75. See 49 U.S.C. 41112 (noting that the Secretary may issue a certificate to a citizen of the United States to provide air transportation as an air carrier only if the citizen complies with the Secretary's orders and regulations governing the filing of an insurance policy or self-insurance plan).

⁹² 81 FR 42064 at 42190–42192.

⁹³ These standards are being applied to individual certification projects as they are presented and found appropriate, with the complementary intent of informing future standards of general applicability for UAS noise in part 36.

eventual test procedures and the criteria for determining which of these aircraft would require noise testing. Current part 36 certification test procedures and noise standards were not developed for aircraft that are designed to take off, land, or operate (including hover) close to people not directly participating in the operation.

The FAA has broad authority to address the noise of all aircraft.⁹⁴ This authority applies whether the aircraft are presented for traditional type certification under part 21 or, as small unmanned aircraft may, seek some other operational authority such as special airworthiness certification.

Consequently, the FAA has begun to consider proposing test requirements and noise limits for unmanned aircraft that are not type certificated under part 21. The FAA is aware that expanding noise requirements beyond the category of traditional type certification applicants may have broad impacts on aircraft models newly subject to noise certification requirements. The FAA is also aware that a new regulatory framework might be necessary to identify the aircraft that would be included in noise certification, the limits of the noise they would be allowed to generate, and what entities would be responsible for testing and compliance, such as the manufacturer or the end user. Because this is a complex topic and will need to focus on issues of testing and certification that have yet to be proposed, the FAA has chosen not to promulgate any certification requirements as part of this rulemaking, but is considering future rulemaking actions that will present the available data and noise concerns for full public input.

D. Other Comments

Several comments were not explicitly relevant to the requirements of the proposed rule. For example, several commenters requested the FAA modify the requirements for small UAS operations under part 107, to address operations at or over National Parks and to reduce the number of “no-fly zones.” Other commenters suggested amending the requirements applicable to operating beyond visual line-of-sight, altitude restrictions, and speed limits under part 107. Some commenters suggested imposing equipage and design requirements, including transponders and “lock down mechanisms.” A few commenters believed certificated pilots should have more freedom to fly where they want. Another commenter opined small UAS should be able to fly

“whenever and wherever,” except near airports and other sensitive places. One commenter wrote that everyone should have some type of certificate indicating “they know the rules of the airspace,” and it should be easy for these small UAS pilots to fly close to airports.

This rule expands operations over people and at night, as proposed, with the addition of allowing operations over moving vehicles. The Agency did not propose to amend other restrictions codified in part 107, such as the requirement that the small unmanned aircraft remain within visual line of sight and restrictions regarding airspace in which the operation occurs. Likewise, the proposed rule did not consider requiring equipage such as transponders or mechanisms to stop a small unmanned aircraft from operating. While the Agency may consider amending existing limitations or requirements in future rulemakings, these matters are outside the scope of the NPRM for this rule.

One commenter stated the Agency should not finalize the proposed rule until manufacturers design a jet engine that would not result in loss of engine performance if it ingests a small unmanned aircraft. This comment is beyond the scope of the proposed rule, as this rule did not propose to develop engine certification standards for manned aircraft.

A commenter wrote that commercial pilots and “licensed pilots” must not be granted operating privileges different from those allowed any individual or hobbyist operator. This rule only addresses operations conducted under part 107, which does not differentiate between the types of operations conducted. As a result, this comment is outside the scope of the NPRM for this rule.

Although this rule does not apply to operations that flyers conduct under 49 U.S.C. 44809 (“Exception for Limited Recreational Operations of Unmanned Aircraft”), the FAA received comments concerning recreational operations. Several commenters, indicating they are recreational operators or hobbyists, stated the proposed regulations are unreasonable, do nothing to improve safety, would stifle innovation of technology and sales of UAS, and would destroy the recreational UAS market. First Person View Freedom Coalition (FPVFC) recommended the FAA waive certain requirements in this rule for recreational pilots and their small UAS. Others recommended FAA establish a different set of rules for recreational operators than commercial operators. Part 107 does not specify purposes of operation to which the part applies. All

persons operating under part 107 must meet all requirements of part 107 for the operation. To the extent that FPVFC suggests the rule should not apply to recreational operations, this comment is out of scope because any person operating a small UAS for recreational purposes may operate under the Limited Exception for Recreational Aircraft, as long as the operation fulfills all criteria of 49 U.S.C. 44809(a).

E. Regulatory Analysis—Benefits and Costs

Several commenters provided comments on the general and specific benefits and costs of the proposed rule. Commenting generally on the benefits of the commercial UAS industry, AUVSI stated, “investment in the commercial UAS industry is growing significantly and is projected to increase rapidly in the coming years, contributing to the U.S. economy and creating tens of thousands of jobs.” AUVSI also quoted a Department of the Interior (DOI) observation that, “[a]cross nearly 19,000 drone flights flown to date, [DOI] has observed a rule of thumb that a drone can complete a given task in 1/7th the time and at 1/10th the cost of traditional means of accomplishing the same task.”

The FAA thanks AUVSI for providing statistics pertaining to the Department of the Interior UAS program. The FAA continues to work toward the integration of unmanned aircraft in the NAS and enabling economic opportunity for manufacturers of unmanned aircraft, part 107 operators, and providers of UAS-related services.

Deseret UAS pointed to a Morgan Stanley report which estimates that the market for Urban Air Mobility (UAM) could be at \$1.5 trillion by 2040. The commenter also pointed to a Goldman Sachs report which estimates that the global UAM is expected to surpass \$100 billion in the next 5 years. The commenter stated that operations over people and at night are necessary for UAM.

The FAA recognizes the market potential for UAM, and is in the process of type certification for six urban air mobility aircraft.⁹⁵ While these aircraft would operate over people and at night, it would not be under part 107 regulations. As currently written, part 107 regulates the operation and certification of unmanned aircraft weighting less than 55 pounds (including payload), thus UAM aircraft

⁹⁵ <https://www.aviationtoday.com/2020/01/14/six-urban-air-mobility-aircraft-well-along-type-certification-faas-merkle-says/>.

⁹⁴ See 49 U.S.C. 44715(a) and (b).

would not operate in accordance with part 107.

CDA stated that the NPRM failed to properly weigh risk against benefits and that the public benefits of expanding commercial UAS operations has had, and will continue to have, a significant economic impact on the United States. CDA reported that with UAS activity rising from \$40 million in 2012 to a projected annual impact of \$31–\$46 billion in 2026, the benefits are substantial.

The FAA continues rulemaking efforts to provide relief from part 107 regulations by allowing operations that pose minimal risk. Accordingly, this rulemaking enables small UAS operations at night, over people, and over moving vehicles, therefore encouraging economic activity to occur that would otherwise only take place through a more costly and time-consuming waiver process.

The Consumer Technology Association (CTA) states it is imperative for the FAA to strike the appropriate risk-based balance between innovation and safety. CTA asserted that the cost-benefit analysis contained in the NPRM does not adequately account for many benefits associated with small UAS operations over people, including lives that could be saved by less restrictive rules governing small UAS operations over people. CTA asserted that it “is undisputed that sUAS operations—whether search and rescue, medical supply delivery, or other—will save a substantial number of lives and pose a risk of injury to the public.” CTA said these factors must be balanced when evaluating whether to restrict small UAS operations over people and, to date, such an analysis has not been undertaken. CTA encouraged the FAA to revisit the cost-benefit analysis to account for such benefits properly. CTA also noted that the FAA is required to consider “all costs and benefits of available regulatory alternatives” (under Executive Order 12866) and to support its analysis by “the best available science” and to “identify and use the best, most innovative, and least burdensome tools for achieving regulatory ends” (under Executive Order 13563). CTA asserted that, although the NPRM lessens regulatory burdens, the FAA did not meet these required standards, because less restrictive alternatives exist and because the safety “analysis” includes “presumptions not supported by scientific data.”

In its comments, DJI similarly pointed to lives saved by UAS. Based on news reports, DJI estimated that small UAS have saved at least 227 people “from

life-threatening peril” in situations involving floods, fires, and missing persons. DJI also stated that it has learned from its customers that UAS make dangerous jobs—such as tower inspections, roof inspections, and firefighting—substantially safer. DJI wrote that regulations with a near-zero tolerance for minor risk will stifle innovation, impede beneficial operations, and be a net loss to public safety. CDA and an individual commenter similarly said that the risk-benefit calculus should account for the risks associated with the activities that commercial small UAS operations would replace—*i.e.*, the FAA should compare the safety benefit of using a small UAS rather than risking a human life.

In response to these commenters, in the part 107 final rule published in June 2016, the FAA qualitatively discussed the safety benefits and cost savings resulting from the substitution of small unmanned aircraft for manned activities, such as climbing towers or inspecting infrastructure, and for activities traditionally performed by manned aircraft. Thus, many of the safety benefits identified by commenters were enabled on publication of the part 107 final rule. Nevertheless, this final rule will aid rescue personnel to perform operations with more efficiency and expediency since they will no longer be required to avoid operations over people and over moving vehicles, so long as the operations are conducted with eligible small unmanned aircraft.

Also, the FAA agrees that enabling small UAS operations at night will result in lives saved. This final rule eliminates the burden of first obtaining a waiver before operating a small UAS at night, potentially enabling rescue operations that would otherwise not occur. DJI reports that 15 out of 65 rescues over a one-year period occurred at night using drones with thermal imaging capability.

The AMOA and AAMS, commenting jointly, noted that the FAA’s cost-benefit discussion did not address the increased risk of proliferating numbers of small unmanned aircraft to low-altitude manned aircraft, such as rotorcraft. The commenter asked if FAA has concluded that there is no increased risk of harm to manned aircraft, crews, and passengers should the NPRM be finalized.

The FAA agrees that this final rule will result in an increase in the number of small unmanned aircraft operating in the airspace, particularly at night. However, this risk is mitigated by existing regulations finalized in the 2016 rule. Regulations contained in part

107 stipulate that: (1) Small unmanned aircraft must yield the right of way to all other users of the NAS and requires that the small unmanned aircraft always be the one to initiate an avoidance maneuver to avoid collision with any other user of the NAS, and (2) the operation of a small unmanned aircraft cannot be so close to another aircraft as to create a collision hazard.

Some commenters wrote that section 44809 of the FAA Reauthorization Act of 2018 requires FAA to develop a test for recreational operations that can be administered online and that this should be extended to part 107 remote pilot certification, thereby reducing the cost associated with the initial knowledge test.

The FAA notes that an application for a certificate must be in a form and manner prescribed by the Administrator under 49 U.S.C. 44702. A person who seeks to obtain a remote pilot certificate, with a small UAS rating that does not hold a part 61 certificate (other than a student pilot certificate) must take the part 107 aeronautical knowledge test at an approved knowledge testing center. Because of the need for testing security and applicant identification, part 107 initial knowledge testing for certification cannot be administered through an online testing platform. The requirement for a knowledge test applicant to verify their identity in person at a test center will remain, as will the requirement for a test proctor. Both of these requirements are consistent with part 107 and other regulatory frameworks for knowledge testing. The FAA Reauthorization Bill of 2018 requirement for the FAA to have an online test for limited recreational operators does not statutorily extend to part 107 remote pilot certification. The FAA clarifies that part 107 does not mandate formal training to obtain a remote pilot certificate, and any cost that a part 107 applicant incurs is at their discretion. The FAA contracts its testing delivery through a third party vendor that allows the FAA to enter into a contract that provides a zero cost model to the U.S. government and to the taxpayers. The testing vendor has many locations throughout the United States that are close to large and small population centers, therefore the requirement to take a knowledge test at a testing location is not an undue burden on applicants.

An individual commenter pointed out that the FAA notes the safety risk of the proposed rule to the public in the benefits section of the regulatory analysis, and then invites comments to speculate on the associated costs. Absent those comments, the commenter

asserted, “the FAA assumes its safety precautions will be sufficient.” The commenter also pointed out that the FAA said it may revise its regulatory impact analysis based on the data and comments it receives on the safety risks of the proposed rule. The commenter believed that the cost-benefit analysis could change “tremendously” if this negative externality were included. Another commenter acknowledged that there is a public need for the intended regulation, to encourage innovation and growth, but argued that it must be balanced against safety concerns. The commenter believed FAA has not addressed safety concerns in-depth. Specifically, the commenter said FAA has not established guidelines on how it will take account of life into its regulatory analysis. With respect to operations over people, the commenter said the FAA cannot focus on kinetic energy alone as an indicator of overall risk because it will not reflect real-world risks and disincentivize advancements in UAS technology that would otherwise increase safety. The commenter argued that FAA needs to factor in operational and technical mitigations in addition to kinetic energy. Another commenter encouraged the FAA to find a balance between safety and the cost of qualification for rules requiring qualification of manufactured UAS. The commenter asserted that inflated certification/qualification costs will serve as a barrier to entry that will stunt innovation.

The FAA acknowledges the commenters’ concerns. However, the performance based requirements contained in this rule for the manufacture of small UAS would mitigate the risk of injury to individuals. Specifically, the four categories established by this rule mitigate the risks associated with operations over people. The lowest risk category, Category 1, sets a weight limit of 0.55 pounds for the small unmanned aircraft and everything otherwise attached and prohibits exposed rotating parts that could cause lacerations. Categories 2 and 3 similarly prohibit the small unmanned aircraft from having any exposed rotating parts that could cause lacerations, in addition to injury severity limits and prohibition on safety defects. Finally, in response to commenters’ concerns that the FAA did not sufficiently consider reliability or probability, this final rule includes Category 4, which would allow small UAS with an airworthiness certificate to operate over people. While the FAA requested public comment for data concluding that the injury severity

limits should be changed, no such comments with supporting data were provided. The FAA acknowledges commenter concerns that inflated qualification/certification costs will serve as a barrier to entry that will stunt innovation. However, the FAA is confident that innovative manufacturers are capable of recovering the costs associated with designing aircraft that will mitigate risk of injury to persons on the ground.

One commenter asked whether the analysis for the remote pilot operating instructions included instructions in multiple languages. The commenter suggested that, to address operational safety fully, manuals could provide instructions in multiple languages, which may change the FAA’s page estimates for the remote pilot operating instructions. The commenter noted that requiring instructions in multiple languages would impose additional costs on manufacturers but would also provide benefits to operations and perhaps increase safety of the public.

The FAA values the commenters’ concerns that manufacturers would need to provide remote pilot operating instructions in multiple languages. The FAA is not requiring the applicant to provide remote pilot operating instructions in a particular format, nor is it prescribing the method for making the instructions available. For example, an applicant could choose to provide the remote pilot operating instructions as part of the packaging of a small UAS, make them available electronically, or provide them in some other way. Applicants with products currently on the market are free to choose whether to incorporate the instructions into existing materials, or create a new set of instructions that are specific to operations over people.

ASSURE commented on the cost of test methods related to operations over people. The commenter estimated that it would cost manufacturers between \$30,000 and \$35,000 to execute Transport Canada’s Anthropomorphic Test Devices (ATD) tests and report results for certain multirotor and fixed-wing platforms “up to the practical limitations of launchers that may or may not be able to reach vehicle terminal velocities especially for vehicles weighing more than 5lb and fixed-wing platforms.” ASSURE stated that, while Transport Canada’s approach is a “solid first attempt at approaching a consistent and standardized use of automotive test techniques and injury metrics,” the approach requires refinement that could potentially reduce costs and align with the ASSURE Task A14 injury metrics. ASSURE also wrote that the NPRM’s

performance-based metrics “may cost similar amounts of funding before standardized injury metrics are established for energy based test methods.” ASSURE stated that energy-based test methods have been used for some of the Pathfinder Programs; however, the test methods have little correlation to skull fracture, head injury or neck injury that is required to assess injury severity due to the wide variety of vehicle and individual impact orientations that could potentially result for small unmanned aircraft impacts.

The FAA thanks ASSURE for their comments and notes that ASSURE estimates the cost for a manufacturer to conduct its own means of compliance testing to be \$55,000.⁹⁶ This cost includes approximately \$35,000 for an ATD Hybrid III head and neck, \$16,800 for a National Instruments data acquisition system, \$1,400 for MiniTech extrusions and hardware, and approximately \$950 for additional materials and supplies. While the FAA-provided test method that was also used during the Pathfinder Programs did not directly correlate to a particular type of injury risk, the method meets the requirements of a means of compliance for the injury severity limits. A commenter noted that the FAA provides a comprehensive regulatory evaluation to help determine the benefits, costs, and cost savings, but said the Agency could do more to facilitate a plan to evaluate the proposed rule once it is issued. Specifically, the commenter recommended that FAA conduct two evaluations of the NPRM to see if the rule generates cost savings as predicted in the economic analysis and maintains overall safety. The first evaluation would focus on implementation (to ensure the resources and requirements of the rule are being implemented) and the second evaluation would focus on the impact of the rule to determine whether it achieved its intended outcomes. The commenter also stated that safety standards and injury measures should be identified, collected, and assessed to measure outcomes accurately, and that the rule should be periodically reviewed as technology continues to change.

The FAA values the commenter’s suggestion to evaluate this rule after publication. In response, the FAA notes that post reviews of rulemakings and regulations are conducted in response to Congressional and presidential requirements, or directives. The Section

⁹⁶ http://www.assureuas.org/projects/deliverables/a14/ASSURE_A14_Final_Report_UAS_Ground_Collision_Severity_Evaluation_2017-2019.pdf. Testing method is described in Appendix C of Annex A: pp 204–208.

610 review (required by the Regulatory Flexibility Act)⁹⁷ is one such review that occurs every ten years. The purpose of this review is to reexamine whether (1) the expected outcomes of the regulation have been achieved; (2) the Agency should retain, amend, or rescind the regulation; and/or (3) the actual benefits and costs of the implemented regulation correspond with estimates prepared at the time the regulation was issued. Reviews could occur more frequently as a result of petitions from parties affected, or in light of changes to specific technologies, industries or underlying standards.

DJI asserted generally that regulations that increase the cost of equipment or operational approvals will disproportionately impact small business.

The FAA acknowledges DJIs comment that regulations can disproportionately impact costs to small businesses. According to the Small Business Administration (SBA), smaller firms bear a regulatory cost 36 percent greater than the cost of regulatory compliance carried by larger firms.⁹⁸ These cost burdens include compliance, reporting, and recordkeeping.⁹⁹ According to part 107 waiver analysis conducted by AUVSI, from the time the part 107 rule was finalized in June 2016 through March 2020, the FAA granted 4,144 waivers.¹⁰⁰ A vast majority of the waivers were for § 107.29, daylight operations (3,813 waivers granted), followed by § 107.39 operations over people (125 waivers granted). These two categories account for 95 percent of the waivers granted to date, and demonstrates the desire among entities to be able to conduct these types of operations. The AUVSI analysis indicates that a majority of the waivers granted were for entities with fewer than 10 employees that generate a revenue of under \$1 million annually. While this final rule creates additional

costs to operators, it also creates cost savings. These cost savings and the enabling activities allowed by this rule are anticipated to outweigh costs imposed on smaller and larger entities alike.

Approximately 23 commenters, including the National Agricultural Aviation Association and the Golden Gate Bridge Highway and Transportation District, said either that they approve of an insurance requirement for small UAS operators or that operators should be liable in the case of an accident. Approximately 16 of the 23 commenters said that insurance should be required. Seven of these commenters specified that insurance should be required for small UAS operations over people or at night. One of those commenters said that the FAA should set the minimum coverage standards. Two commenters believed FAA should require \$1 million in insurance. One commenter said that manufacturers should not be liable for the misuse of their products.

XIV. Effective and Compliance Dates

A. Implementation Timeline for Night Operations and Recurrent Training Requirements

Operations over people are permitted on the effective date of this rule, as long as the small UAS meets all eligibility requirements for the appropriate category. For example, an unmanned aircraft weighing less than 0.55 pounds, including everything attached, and with no exposed rotating parts that would cause a laceration may operate on the effective date. Section V discusses the requirements for Category 1 small unmanned aircraft. Similarly, as discussed in Section VII, small UAS with an airworthiness certificate issued under part 21 would be able to operate under part 107 on the effective date of the rule, provided the operating limitations for the small UAS do not prohibit operations over people.

Given that Categories 2 and 3 require a multi-step process to meet the eligibility requirements, the FAA does not anticipate that many, if any, small UAS will be able to operate immediately on the effective date. Means of compliance applicants may submit the means of compliance to the FAA either by email or through the U.S. mail. Applicants may submit their declaration of compliance through an online portal on the FAA website. On receipt, the FAA would review the submitted declaration of compliance for acceptance and notify the applicants of their acceptance status. Incomplete declarations of compliance will not be

accepted. Section VI discusses the requirements for Categories 2 and 3. With regard to the operations over people waivers issued prior to the effective date of this rule, the FAA will review these on a case-by-case basis and determine next steps as appropriate.

On the effective date of this rule, persons are permitted to conduct operations at night, provided they successfully complete the updated initial aeronautical knowledge test, initial training, and recurrent training, as applicable, which addresses the requirements of operating at night and that the small unmanned aircraft has lighted anti-collision lighting visible for at least 3 statute miles that has a flash rate sufficient to avoid a collision. Section IX.B. of this preamble provides a discussion of this requirement. The updated knowledge area on night operations for initial and recurrent training will be available on March 1, 2021, and will be accessible through the FAA website. The initial aeronautical knowledge test will have the updated knowledge area on night operations and will be available on March 1, 2021 at the knowledge testing centers. However, remote pilots without a waiver from § 107.29 will need to wait until March 16, 2021 before operating at night.

Sixty days after the effective date of the rule, no person may operate a small UAS at night in accordance with a certificate of waiver issued prior to the effective date of the rule. Existing waivers from § 107.29 granted prior to the effective date will terminate 60 days after the effective date of the rule. Similarly, on the effective date of this rule, pilots will be subject to the recurrent training requirement finalized in this rule, rather than the recurrent knowledge test. Remote pilots conducting operations in accordance with a current night waiver will need to complete the updated night operations knowledge area either by retaking the initial aeronautical knowledge test or completing the recurrent online training within 60 days from the effective date of this rule. The other amendments described in Section XI will also take effect on the effective date of this rule. The FAA did not receive any comments specific to the effective and compliance dates of this final rule, with the exception of comments that discussed coordination with the Remote Identification final rule, as discussed in the following section.

B. Compliance With Remote Identification

The NPRM noted the FAA planned to finalize its policy concerning remote identification of UAS before finalizing

⁹⁷ Public Law 96–354, 94 Stat. 1164, 1169 (Sept. 16, 1980) codified at 5 U.S.C. 610. These reviews are referred to as Section 610 reviews.

⁹⁸ Nicole V. Crain and W. Mark Crain, “The Impact of Regulatory Costs on Small Firms,” *U.S. Small Business Administration, September 2010*. Page. iv. [https://www.sba.gov/sites/default/files/The%20Impact%20of%20Regulatory%20Costs%20on%20Small%20Firms%20\(Full\).pdf](https://www.sba.gov/sites/default/files/The%20Impact%20of%20Regulatory%20Costs%20on%20Small%20Firms%20(Full).pdf). Accessed January 22, 2020.

⁹⁹ U.S. Chamber of Commerce Foundation. *The Regulatory Impact on Small Business: Complex. Cumbersome. Costly. Final Report. March 2017*. https://www.uschamberfoundation.org/smallbizregs/assets/files/Small_Business_Regulation_Study.pdf. Accessed January 22, 2020.

¹⁰⁰ https://www.auvsi.org/sites/default/files/PDFs/Waiver%20Update%20Mar%202020_v3_PDF%20%281%29.pdf. https://public.tableau.com/shared/RBFRZM9PP?:display_count=y&:origin=viz_share_link&:showVizHome=no#1. Accessed April 10, 2020.

the proposed changes in this rulemaking that pertain to operations over people and operations at night. Concurrent with publication of this final rule, this edition of the **Federal Register** also includes the Remote ID final rule.

Several commenters, including A4A, Vigilant, and NAAA, suggested implementing the requirements of the Remote ID rule before finalizing this rule. APPA, EEI, and NRECA, commenting together, agreed the FAA should expedite the release of a Remote ID rulemaking. However, APPA, EEI, and NRECA were concerned the utility industry would not benefit from the “advances” of small UAS operations over people due to the delays associated with the Remote ID rulemaking. A commenter believed this rule should be delayed until the FAA has implemented remote identification requirements and increased the number of operations over people waivers with the goal of gathering more data.

The NFL, MLB, NASCAR, and NCAA commented that the FAA should deploy a comprehensive “Remote ID framework” as soon as possible. The sports organizations strongly encouraged the “agency’s efforts to implement a Remote ID requirement for all drones that present any risk of use at a sporting event.” API believed that without the capability of remote identification and tracking, the FAA and law enforcement will face serious challenges in locating offenders. EPIC argued that the open-air assembly prohibition should apply to all categories, and not just Category 3. It specifically stated that a “modified version” of this prohibition should apply to all operations over people.

In response to these comments, and others, this final rule prohibits sustained flight over open-air assemblies for Categories 1, 2, and 4, unless the operation is conducted using a standard remote identification unmanned aircraft or a remote identification broadcast module in compliance with § 89.110 or § 89.115(a) (remote identification operational and broadcast requirements for standard remote identification unmanned aircraft or unmanned aircraft with remote identification broadcast modules). The FAA may waive this requirement as appropriate. However, conditions of any waiver issued may require the operator to notify local law enforcement prior to the operation. All small unmanned aircraft operations are subject to remote identification requirements upon the applicable remote identification compliance date, as specified in the Remote Identification for Unmanned Aircraft final rule. Airzus, Inc. believed

that, until remote identification or other operational awareness efforts are codified, the FAA should consider the success of the LAANC system as a “model for how self-reporting technologies can aid in furthering economic growth in the industry, while still emphasizing safety and flight awareness.” A commenter recommended a public portal for reporting intended operations involving flights over people or at night without the need for special permission. Several commenters suggested requiring remote pilots to file a flight plan prior to operating over people: Flytcam suggested pilots should submit the locations and times of their operations into the DroneZone.¹⁰¹ Concerned the elimination of waivers would erode the FAA’s ability to identify operators of small UAS, a commenter recommended requiring an “electronic license plate—basically a simple signal that broadcasts identifying information.”

DJI and AUVSI both commented that there should be no more delay, stating the Agency should issue Remote ID and this rulemaking simultaneously to keep pace with the integration of small UAS into the NAS. DJI, along with several individuals, wanted the rules allowing Category 1 operations to finalize as soon as possible, noting they should be excluded from Remote ID requirements as they would likely impose negligible risk.

As discussed previously, the FAA is publishing the Remote ID final rule simultaneously with this final rule, with the added open-air assembly prohibition as described in this section.

XV. Regulatory Notices and Analyses

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 and Executive Order 13563 direct that each Federal agency shall propose or adopt a regulation only on a reasoned determination that the benefits of the intended regulation justify its costs. In addition, DOT rulemaking procedures in subpart B of 49 CFR part 5 instruct DOT agencies to issue a regulation on a reasoned determination that benefits exceed costs. Second, the Regulatory Flexibility Act of 1980 (Pub. L. 96–354) requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (Pub. L. 96–39) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, this Trade Act requires

¹⁰¹ <https://faadronezone.faa.gov/>.

agencies to consider international standards and, where appropriate, that they be the basis of U.S. standards. Fourth, the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local, or tribal governments, in the aggregate, or by the private sector, of \$100 million or more annually (adjusted for inflation with base year of 1995). The FAA has provided a more detailed Regulatory Impact Analysis of this final rule in the docket of this rulemaking. This portion of the preamble summarizes the FAA’s analysis of the economic impacts of this rule.

In conducting these analyses, FAA has determined that this rule: (1) Has benefits that justify its costs, (2) is an economically “significant regulatory action” as defined in section 3(f) of Executive Order 12866, (3) is not “significant” as defined in DOT’s Regulatory Policies and Procedures; (4) will have a significant economic impact on a substantial number of small entities; (5) will not create unnecessary obstacles to the foreign commerce of the United States; and (6) will not impose an unfunded mandate on state, local, or tribal governments, or on the private sector by exceeding the threshold identified previously. These analyses are summarized in this section.

A. Regulatory Evaluation

1. Assumptions and Data

The analysis of benefits and costs for the regulatory evaluation is based on the following assumptions.

- The analysis is conducted in 2020 constant dollars. Year 1 of the period of analysis, which would correlate with the effective date of the final rule, is used as the base year.
- The FAA uses a 10-year period of analysis to capture the recurring effects of the rule.
- The FAA uses a three percent and seven percent discount rate for the costs and benefits as prescribed by OMB in Circular A–4.¹⁰²
- The costs and cost savings of this rule are based on the fleet forecast for small UAS published in the Federal Aviation Administration’s FAA Aerospace Forecast 2020–2040.¹⁰³ Additionally, fleet forecasts for Category

¹⁰² OMB Circular A–4 (Sept. 17, 2003), <https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A4/a-4.pdf>.

¹⁰³ FAA Aerospace Forecast Fiscal Years 2020–2040 at 52, available at http://www.faa.gov/data_research/aviation/aerospace_forecasts/media/FY2020-40_FAA_Aerospace_Forecast.pdf.

1 small UAS and Category 4 small UAS are derived to more accurately reflect costs and cost savings for the final rule.

- Under the final rule, a means of compliance must be accepted by the FAA before it could be used by applicants to build UAS for operations over people and moving vehicles. Means of compliance are developed by persons or organizations to describe methods by which a UAS could be designed and produced to meet the performance requirements of this rule. The FAA anticipates that other entities, such as UAS manufacturers, could also submit a means of compliance to the FAA for acceptance and will incur additional costs. Further details on the costs to develop means of compliance are provided in the Regulatory Impact Analysis of this final rule in the docket of this rulemaking.

- The FAA estimates 31 existing models may satisfy the performance-based requirements of the rule for Categories 2 and 3 small UAS operations over people with little or no modification.¹⁰⁴ Applicants of these models would be subject to the cost of submitting a declaration of compliance to the FAA. The FAA estimates that applicants would likely submit declarations of compliance for eight additional models in each of the subsequent years of the analysis.

- The FAA assigns the United States Department of Transportation guidance on the hourly value of time and hourly value of travel time savings equal to \$27.89 for the analysis period.¹⁰⁵

- The FAA notes the analysis of this rule reflects industry conditions that predate the public health emergency concerning the coronavirus disease 2019 (COVID-19). While there is currently a

lack of data to forecast the timing of recovery relative to implementation of the rule, the analysis provides information on the types of impacts that may be experienced in the future as the economy returns to baseline levels. The FAA also notes the expanded operations enabled by this rule will benefit the economy and provide regulatory relief for remote pilots.

2. Summary of Benefits

This rule will further integrate small UAS into the NAS by enabling operations over people and nighttime operations. These operations will benefit the economy and encourage innovation and growth across a variety of sectors, such as construction, education, infrastructure inspection, insurance, marketing, and event, film and sports photography.

Today, remote pilots who comply with part 107 can fly a small unmanned aircraft within a safe distance from people, but are not able to operate over people who are not participating in the operation. Without this rule, the only entities allowed to operate small unmanned aircraft over people in the NAS are public entities holding an active certificate of waiver or authorization (COA), entities with an FAA-issued exemption, entities that hold a waiver to the prohibition on operations over people provision of part 107, or small UAS that have received an airworthiness certificate from the FAA that does not prohibit operations over people who also operate with a COA. This rule will allow individuals to conduct operations of a small UAS over people in the NAS and at night under part 107, so long as the activity is conducted with a small UAS that

complies with the provisions. The FAA quantifies cost savings from this rule in the following section along with a summary of important unquantified savings.

3. Summary of Costs and Savings

The costs of this rule include the FAA converting the administration of recurrent tests to administration of training; manufacturers conducting testing, analysis, or inspection to comply with the requirements relevant to manufacturing a small UAS for operations over people; and, remote pilots studying additional subject matter related to activities enabled by the final rule. The cost savings of this rule includes relief provided through online training for remote pilots, and relief from time expended by the FAA for processing waivers.

The FAA bases the analysis of this rule on a fleet forecast for small unmanned aircraft that includes base, low, and high scenarios. Accordingly, this analysis provides a range of net impacts from low to high based on these forecast scenarios. The FAA considers the base scenario as the primary estimate of net impacts of this rule. For the primary estimate, over a 10-year period of analysis this rule will result in present value net cost savings (savings less costs) of \$688.27 million at a three percent discount rate, with annualized net cost savings of \$80.69 million. At a seven percent discount rate, this rule will result in present value net cost savings of \$551.31 million, with annualized net cost savings of \$78.49 million. The following table summarizes the quantified costs and cost savings of this rule for the three forecast scenarios.

TABLE 2—COSTS AND SAVINGS OF FINAL RULE BY FORECAST SCENARIO
[\$Millions]*

Forecast scenario	10-Year present value (3%)	Annualized (3%)	10-Year present value (7%)	Annualized (7%)
<i>Base Scenario—Primary Estimate:</i>				
Costs	146.44	17.17	119.98	17.08
Cost Savings	(834.71)	(97.85)	(671.28)	(95.58)
Net Cost Savings	(688.27)	(80.69)	(551.31)	(78.49)
<i>Low Scenario:</i>				
Costs	102.96	12.07	85.32	12.15
Cost Savings	(616.60)	(72.28)	(501.51)	(71.40)

¹⁰⁴ The proposed rule assumed a cutoff weight of 4.4 lbs based on the Micro UAS Aviation Rulemaking Committee (ARC) final report. Since publication of the ARC final report, the FAA has granted 109 waivers for operations of small UAS over people (as of 3/2/2020). These waivers give insight as to the type of vehicles conducting

operations over people and show that a majority of the waivers granted have been for UA weighing 11.68 pounds or less. The part 107 aircraft registry was analyzed for the number of models in this weight range. Based on this analysis, 31 of the models registered (for those models in the registry that could be identified by model), weighed 11.68

pounds or less. A copy of the ARC's final report is available in the public docket for this rulemaking.

¹⁰⁵ Time savings is estimated to be median hourly wage plus benefits as described in the U.S. Department of Transportation Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis (Sept. 27, 2016).

TABLE 2—COSTS AND SAVINGS OF FINAL RULE BY FORECAST SCENARIO—Continued
[\$Millions]*

Forecast scenario	10-Year present value (3%)	Annualized (3%)	10-Year present value (7%)	Annualized (7%)
Net Cost Savings	(513.64)	(60.21)	(416.19)	(59.26)
<i>High Scenario:</i>				
Costs	207.17	24.29	169.27	24.10
Cost Savings	(1,158.84)	(135.85)	(927.41)	(132.04)
Net Cost Savings	(951.67)	(111.56)	(758.14)	(107.94)

* **Table notes:** Columns may not sum to total due to rounding. Savings are shown in parenthesis to distinguish from costs.

The following tables summarize provision category for the three forecast quantified costs and cost savings by scenarios.

TABLE 3.a—COSTS AND SAVINGS OF FINAL RULE BY PROVISION CATEGORY (\$MILLIONS)*
[Base scenario—Primary estimate]

Category	10-Year present value (at 3%)	Annualized (at 3%)	10-Year present value (at 7%)	Annualized (at 7%)
Costs:				
Standards Development Costs for MOC	3.18	0.37	2.88	0.41
Applicant Costs for Testing and DOC	4.39	0.51	3.76	0.54
Remote Pilot Costs—Additional Content for Tests	138.57	16.24	113.06	16.10
FAA Costs	0.31	0.04	0.28	0.04
Total Costs	146.44	17.17	119.98	17.08
Cost Savings:				
Remote Pilot Savings—Training in lieu of Testing	(593.73)	(69.60)	(479.17)	(68.22)
Part 107 Operators—Reduced Waiver Requests	(209.58)	(24.57)	(167.10)	(23.79)
FAA—Reduced Waiver Processing	(31.40)	(3.68)	(25.01)	(3.56)
Total Cost Savings	(834.71)	(97.85)	(671.28)	(95.58)
Net Cost Savings	(688.27)	(80.69)	(551.31)	(78.49)

* **Table notes:** For this and the following tables, columns may not sum to total due to rounding. Savings are shown in parenthesis to distinguish from costs.

TABLE 3.b—COSTS AND SAVINGS OF FINAL RULE BY PROVISION CATEGORY (\$MILLIONS)
[Low scenario]

Category	10-Year present value (at 3%)	Annualized (at 3%)	10-Year present value (at 7%)	Annualized (at 7%)
Costs:				
Standards Development Costs for MOC	3.18	0.37	2.88	0.41
Applicant Costs for Testing and DOC	4.39	0.51	3.76	0.54
Remote Pilot Costs—Additional Content for Tests	95.09	11.15	78.40	11.16
FAA Costs	0.31	0.04	0.28	0.04
Total Costs	102.96	12.07	85.32	12.15
Cost Savings:				
Remote Pilot Savings—Training in lieu of Testing	(443.11)	(51.95)	(362.47)	(51.61)
Part 107 Operators—Reduced Waiver Requests	(151.01)	(17.70)	(121.04)	(17.23)
FAA—Reduced Waiver Processing	(22.48)	(2.63)	(18.00)	(2.56)
Total Cost Savings	(616.60)	(72.28)	(501.51)	(71.40)
Net Cost Savings	(513.64)	(60.21)	(416.19)	(59.26)

TABLE 3.c—COSTS AND SAVINGS OF FINAL RULE BY PROVISION CATEGORY (\$MILLIONS)
[High scenario]

Category	10-Year present value (at 3%)	Annualized (at 3%)	10-Year present value (at 7%)	Annualized (at 7%)
Costs:				
Standards Development Costs for MOC	3.18	0.37	2.88	0.41
Applicant Costs for Testing and DOC	4.39	0.51	3.76	0.54
Remote Pilot Costs—Additional Content for Tests	199.30	23.36	162.35	23.12
FAA Costs	0.31	0.04	0.28	0.04
Total Costs	207.17	24.29	169.27	24.10
Cost Savings:				
Remote Pilot Savings—Training in lieu of Testing	(822.92)	(96.47)	(659.49)	(93.90)
Part 107 Operators—Reduced Waiver Requests	(291.98)	(34.23)	(232.90)	(33.16)
FAA—Reduced Waiver Processing	(43.95)	(5.15)	(35.02)	(4.99)
Total Cost Savings	(1,158.84)	(135.85)	(927.41)	(132.04)
Net Cost Savings	(951.67)	(111.56)	(758.14)	(107.94)

The FAA also expects this rule will provide industry with important unquantified savings and efficiencies from reduced operational costs. The FAA did not identify data to quantify

these operational cost savings due to the wide variety of small UAS applications and operations enabled by this rule. In addition, the rule provides flexibility and scalability through performance-

based requirements that will support future industry innovation. The following table summarizes unquantified savings from the final rule.

TABLE 4—UNQUANTIFIED SAVINGS

Savings	Summary
Clearing people from areas of operations.	Reduced burden and costs for certain operators that will no longer need to clear people from an area of operation to avoid flight over people.
Circuitous routes	Reduced operational costs for certain operators that will no longer need to perform circuitous routing to avoid flight over people.
Fly over moving vehicles	Operational flexibility and reduced costs for certain operators that will no longer need to avoid operations over moving vehicles.
Special conditions in waivers	In addition to the administrative cost savings from operating without waivers (<i>i.e.</i> , reduced costs of submitting and processing waiver requests), certain operators may receive reduced operating costs from avoided special conditions often included in waivers that will not be required under this rule.

Operations of small UAS over people may result in an increased risk to safety. Although the FAA expects the probability of injuries that may occur from operations of small UAS over people is low, when that low probability is multiplied by an increased number of operations, some additional risk of injury exists. This final rule’s performance-based requirements establish four categories of small UAS operations defined primarily by level of risk of injury posed. Compliance with the eligibility and operational requirements that apply to these categories mitigates the risks of operating over people.

B. Regulatory Flexibility Act

The Regulatory Flexibility Act of 1980 (Pub. L. 96–354) (RFA) establishes “as a principle of regulatory issuance that agencies shall endeavor, consistent with the objectives of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale

of the businesses, organizations, and governmental jurisdictions subject to regulation. To achieve this principle, agencies are required to solicit and consider flexible regulatory proposals and to explain the rationale for their actions to assure that such proposals are given serious consideration.” The RFA covers a wide-range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions.

Agencies must perform a review to determine whether a rule will have a significant economic impact on a substantial number of small entities. If the Agency determines that it will, the Agency must prepare a regulatory flexibility analysis as described in the RFA.

Agencies must perform a review to determine whether a rule will have a significant economic impact on a substantial number of small entities. If the Agency determines that it will, Section 604 of the Act requires agencies

to prepare a Final Regulatory Flexibility Analysis describing the impact of final rules on small entities.

The FAA has determined this final rule will have a significant economic impact on a substantial number of small entities. Therefore, under the requirements in Section 604 of the RFA, the Final Regulatory Flexibility Analysis must address:

- (1) A statement of the need for, and objectives of, the rule;
- (2) A statement of the significant issues raised by the public comments in response to the initial regulatory flexibility analysis, a statement of the assessment of the Agency of such issues, and a statement of any changes made in the proposed rule as a result of such comments;
- (3) The response of the Agency to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration in response to the proposed rule, and a detailed statement of any change made to the proposed rule

in the final rule as a result of the comments;

(4) A description of and an estimate of the number of small entities to which the rule will apply or an explanation of why no such estimate is available;

(5) A description of the projected reporting, recordkeeping and other compliance requirements of the rule, including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for preparation of the report or record; and,

(6) A description of the steps the Agency has taken to minimize the significant economic impact on small entities consistent with the stated objectives of applicable statutes, including a statement of the factual, policy, and legal reasons for selecting the alternative adopted in the final rule and why each one of the other significant alternatives to the rule considered by the Agency which affect the impact on small entities was rejected.

Based on these requirements, the FAA has prepared the following Final Regulatory Flexibility Analysis.

(1) A statement of the need for, and objectives of, the rule.

The FAA publishes this rule pursuant to the authority set forth in 49 U.S.C. 44807. Section 44807 directs the Secretary of Transportation to determine whether “certain unmanned aircraft systems may operate safely in the national airspace system.” If the Secretary determines that certain unmanned aircraft systems may operate safely in the NAS, then the Secretary must “establish requirements for the safe operation of such aircraft systems in the national airspace system, including operation related to research, development, and testing of proprietary systems.”¹⁰⁶

The FAA also publishes this rule pursuant to 49 U.S.C. 40103(b)(1) and (2), which charge the FAA with issuing regulations: (1) To ensure the safety of aircraft and the efficient use of airspace; and (2) to govern the flight of aircraft for purposes of navigating, protecting and identifying aircraft, and protecting individuals and property on the ground. In addition, 49 U.S.C. 44701(a)(5) charges the FAA with prescribing regulations that the FAA finds necessary for safety in air commerce and national security. Lastly, 49 U.S.C. 46105(c) allows the Administrator to issue immediate orders to address an emergency related to safety in air commerce.

This rule is an important step in further integrating small UAS operations into the NAS. The FAA’s overall objective in this rule is to ensure safety while encouraging new uses of small UAS in the NAS. This rulemaking finalizes performance-based requirements to allow small UAS to operate over people or at night under part 107 without obtaining a waiver or exemption. Currently under part 107, a remote pilot must obtain a waiver or exemption explicitly allowing operations over people or at night. As of February 14, 2020, the FAA has received 9,698 requests for waiver to permit operation at night, 3,555 requests to permit operating over people, and 1,623 requests to permit operating over people at night.¹⁰⁷ For operations over people, the FAA’s performance-based requirements establish four categories of small UAS operations defined primarily by level of risk of injury posed.

Additional eligibility requirements and operating limitations beyond those already in part 107 apply to certain categories of small UAS to mitigate the risks associated with each category.

This rule also removes the requirement for completing a recurrent aeronautical knowledge test at a knowledge testing center and replaces it with a requirement for online training. As a result, the remote pilot in command who does not also hold a certificate issued under part 61 would be relieved of costs associated with recurrent knowledge testing every 24 calendar months. This rule also requires a remote pilot applicant to either pass a knowledge test or complete online training containing knowledge areas on night operations, before undertaking these types of operations.¹⁰⁸

(2) A statement of the significant issues raised by the public comments in response to the initial regulatory flexibility analysis, a statement of the assessment of the Agency of such issues, and a statement of any changes made in the proposed rule as a result of such comments.

¹⁰⁷ As of April 6, 2020, part 107 Non-Airspace Waivers totaled 36,130. Of these, 15,777 have been disapproved and 4,155 have been approved. Of the remaining waivers, 15,067 are in process, with another 1,131 withdrawn.

¹⁰⁸ Testing or training is contingent upon whether the remote pilot applicant is a part 61 or non-part 61 remote pilot. Non-part 61 remote pilot applicants are required to pass an initial knowledge test to be able to conduct night operations; part-61 remote pilot applicants have the flexibility to successfully complete either the knowledge test or online training to be able to conduct operations at night. For those individuals that have already received a remote pilot airman’s certificate, online knowledge training is required before conducting night operations.

While there were no public comments specific to the initial regulatory flexibility analysis, one commenter asserted regulations that increase the cost of equipment or operational approvals will disproportionately impact small business. The FAA acknowledges that regulations disproportionately impact costs to small businesses, and cites an SBA sponsored study stating small firms bear a regulatory cost 36 percent greater than the cost of regulatory compliance carried by larger firms.¹⁰⁹ These cost burdens include compliance, reporting, and recordkeeping.¹¹⁰ In this particular rule, it follows that smaller applicants for a declaration of compliance will be disproportionately affected versus their larger counterparts in terms of costs associated with means of compliance testing. For the final rule, these costs are estimated to average between \$11,000 to \$26,000.

Other entities affected by the final rule are entities/operators of small UAS. AUVSI conducted an analysis on part 107 waivers issued by entity size. This analysis shows that over 87 percent of the waivers issued were issued to entities with fewer than 10 employees.¹¹¹ Assuming that the share of small entities granted waivers is similar to the distributional share of all entities operating under part 107, this final rule will have a positive impact on small entities by allowing night operations, operations over people, and operations over moving vehicles without waiver.

(3) The response of the Agency to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration in response to the proposed rule, and a detailed statement of any change made to the proposed rule in the final rule as a result of the comments.

The Chief Counsel for Advocacy of the Small Business did not submit comments to the proposed rule.

¹⁰⁹ Nicole V. Crain and W. Mark Crain, “The Impact of Regulatory Costs on Small Firms,” *U.S. Small Business Administration*, September 2010. Page. iv. [https://www.sba.gov/sites/default/files/The%20Impact%20of%20Regulatory%20Costs%20on%20Small%20Firms%20\(Full\).pdf](https://www.sba.gov/sites/default/files/The%20Impact%20of%20Regulatory%20Costs%20on%20Small%20Firms%20(Full).pdf). Accessed January 22, 2020.

¹¹⁰ U.S. Chamber of Commerce Foundation. *The Regulatory Impact on Small Business: Complex, Cumbersome, Costly. Final Report. March 2017.* https://www.uschamberfoundation.org/smallbizregs/assets/files/Small_Business_Regulation_Study.pdf. Accessed January 22, 2020.

¹¹¹ For those waivers that AUVSI was able to find information on entity size, 1,365 were issued to entities with less than ten employees; 107 were issued to entities with 10 to 99 employees; 67 were issued to entities with 100 to 999 employees; 20 were issued to entities with 1,000 to 9,999 employees, and 3 waivers were issued to entities with 100,000 or more employees.

¹⁰⁶ 49 U.S.C. 44807(c).

(4) A description of and an estimate of the number of small entities to which the rule will apply or an explanation of why no such estimate is available.

This final rule impacts applicants seeking acceptance of a declaration of compliance from the FAA for small UAS eligible to conduct operations over people. The FAA analyzed the part 107 unmanned aircraft registry for aircraft weighing less than or equal to 11.68

pounds, which aligns with the weight of small unmanned aircraft that have been granted waivers for operating over people.¹¹² The registry indicates that small unmanned aircraft in this weight class are comprised of 31 different models which are built by eleven different manufacturers that are located in three different countries.¹¹³ Using the AUVSI business size standard, one manufacturer is identified as small

(fewer than 50 employees); two manufacturers are identified as medium (50–499 employees); and five manufacturers are identified as large (more than 499 employees). Entity size was not known for three of the manufacturers.¹¹⁴ The table below shows key statistics for the eleven manufacturers by country of origin.

TABLE 5—SELECT STATISTICS FOR PART 107 UNMANNED AIRCRAFT WEIGHING 11.68 POUNDS OR LESS

Manufacturer country of origin	Number of manufacturers	Number of models	Entity size *	Number of UA in FAA registry	Share of UA <=11.68 lbs (%)
China	4	18	2 large, 1 medium, 1 unknown	226,785	86.6
France	1	3	unknown	4,649	1.8
United States	6	10	3 large, 1 medium, 1 small, 1 unknown	30,572	11.7
Total	11	31	5 large, 2 medium, 1 small, 3 unknown	262,006	100.0

* Source: AUVSI Air Platform Data. AUVSI defines entity size as follows: Large entities have more than 500 employees; medium entities have between 50 and 499 employees; small entities have less than 50 employees.

Note: This information is based on records in the unmanned aircraft registry as of October 2019 that weigh 11.68 pounds or less. The remaining records did not contain readily identifiable make/model information and are excluded from the analysis.

The final rule enables entities to conduct operations over people and at night using eligible small UAS. Part 107 waiver analysis by AUVSI shows that between June 2016 and March 2020, a total of 4,144 waivers have been granted by the FAA.¹¹⁵ A vast majority of the waivers granted are for § 107.29, daylight operations (3,813 waivers granted), followed by § 107.39 operations over people (125 waivers granted). These two waiver categories account for 95 percent of the waivers granted to date, and demonstrates the desire among entities to be able to conduct these types of operations. The AUVSI analysis shows a majority of the waivers granted have been for entities with fewer than 10 employees that generate a revenue of under \$1 million annually.

The final rule impacts the entire population of part 107 remote pilots, many of whom work for small entities or own their own business, by requiring all part 107 remote pilots to be tested or knowledge checked on additional subject matter. The rule also relieves a subset of the remote pilot population (i.e., non-part 61 remote pilots) from the recurrent knowledge testing requirement. Instead of taking recurrent knowledge testing, this affected group

will take recurrency training every 24 calendar months to maintain the privileges of the remote pilot airmen certificate. This is expected to create a cost savings for approximately 90% of the current remote pilot population.

(5) A description of the projected reporting, recordkeeping and other compliance requirements of the rule, including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for preparation of the report or record.

In order for the FAA to accept a declaration of compliance, this rule requires the applicant to declare that a small UAS meets applicable performance-based safety requirements by using a means of compliance by test, analysis, or inspection, or any combination of these options accepted by the FAA. An applicant could perform any necessary tests contained in the means of compliance in-house or they could rent a testing facility with the necessary equipment to show compliance with the injury limitation based on the transfer of kinetic energy on impact. The applicant would certify the results from this means of compliance testing on its declaration of compliance to the FAA. The FAA

estimates approximately eleven entities could be affected by compliance requirements in year 1 of the rule. Using the AUVSI business size standard for UAS manufacturers, one manufacturer is identified as small (fewer than 50 employees); two manufacturers are identified as medium (50–499 employees); and five manufacturers are identified as large (more than 499 employees). Entity size could not be determined for three of the manufacturers. The rule also requires applicants of small UAS eligible for Category 2 or Category 3 operations to make available to the Administrator an FAA-accepted declaration of compliance and any other document, record, or report that the final rule requires, on request. The rule provides record retention requirements for manufacturers who submit either a declaration of compliance or a means of compliance to the FAA. With today's minimal cost of producing electronic documents and mass storage hardware devices, the FAA expects applicants would keep all relevant documents, records, or reports required in an electronic format and properly back up their storage systems. Therefore, this requirement would add minimal to no costs to the applicants because they

¹¹² https://www.faa.gov/uas/commercial_operators/part_107_waivers/waivers_issued/. As of 3/2/2020, 109 waivers have been granted for operations over people. A majority of these waivers were for unmanned aircraft weighing 11.68 pounds or less.

¹¹³ Source: AUVSI Air Platform Database (accessed April 2020).

¹¹⁴ The Small Business Administration has not defined the number of employees that would indicate that a manufacturer of small UAS is a small entity. The NAICS code for Unmanned Aircraft Manufacturing is 336411, which falls under the broad category of "Aircraft Manufacturing." SBA defines entities with NAICS 336411 as small if it employs 1,500 employees or less. Based on the SBA definition all entities are small ones.

¹¹⁵ https://www.auvsi.org/sites/default/files/PDFs/Waiver%20Update%20Mar%202020_v3_PDF%20%281%29.pdf, https://public.tableau.com/shared/RBFRZM9PP?:display_count=y&:origin=viz_share_link&:showVizHome=no#1. Accessed April 10, 2020. June 2016 marks the date for the publication of the final part 107 rule.

would already have computer systems, with sufficient memory available, to store and produce the documents this rule requires.

For Categories 2 and 3, this rule requires an applicant to label a small unmanned aircraft with each category for which the small UAS is eligible to operate. The applicant must ensure that the label is in English, legible, prominent, and affixed onto the small unmanned aircraft by some permanent means. In addition, remote pilots are required to ensure their small unmanned aircraft are properly labeled before conducting any operations over people. The FAA believes the cost of adding the labeling information for the category for which the small UAS is eligible to operate would be minimal, given that small unmanned aircraft typically come with a label containing information such as the name of the manufacturer, serial number, and model name or number. If the label has worn out due to use or age, the remote pilot could satisfy the rule by using a permanent marker, or etching the category into the body of the small unmanned aircraft.

The rule requires a small UAS applicant to establish and maintain a product support and notification process to notify the public and the FAA of any safety issues that would render the aircraft ineligible for operations over people. The FAA believes manufacturers of small UAS would have such a system already developed and in place to handle their warranties and to inform users of their small UAS about new developments and new products they are bringing to the marketplace. This rule does not require the owner of a small UAS to send in a warranty card or provide the manufacturer any personal contact information. Therefore, the FAA believes the cost of this requirement would be minimal. The FAA notes an applicant could be an individual that modifies a small UAS and then sells it. According to the rule, this individual would also be required to have a notification and support process in place. The FAA envisions this process would be scaled to production, so the individual who sells a single aircraft could establish a much smaller scale process. For example, the applicant could simply email the owner of the small UAS and advise them of any safety issues. The FAA also believes for a small-scale manufacturer or a modifier, the requirement to maintain a product support and notification process would also result in minimal costs.

The rule requires owners or operators of small UAS issued an airworthiness certificate under part 21 operating under part 107 to retain records of all maintenance performed on their aircraft and records documenting the status of life-limited parts, compliance with airworthiness directives, and inspection status of the aircraft. The records must be kept for the time specified in § 107.140 and must be available to the FAA and NTSB on request. This requirement only affects operations conducted under Category 4, and would result in minimal costs.

(6) A description of the steps the Agency has taken to minimize the significant economic impact on small entities consistent with the stated objectives of applicable statutes, including a statement of the factual, policy, and legal reasons for selecting the alternative adopted in the final rule and why each one of the other significant alternatives to the rule considered by the Agency which affect the impact on small entities was rejected.

The FAA considered both more and less costly alternatives as part of its NPRM because the RFA requires the Agency to consider significant regulatory alternatives that meet the Agency's statutory objectives and minimize the costs to small entities. The FAA rejected the costlier alternatives due to policy considerations and the undue burden imposed on small UAS operators. The less costly alternatives and the FAA's reasons for either rejecting those alternatives, or adopting them for the final rule, are discussed below. In addition, the FAA discusses performance-based means of compliance that may provide additional flexibility and minimize costs to small entities.

The FAA considered hands-on remote pilot flight training as part of the requirements for operating a small unmanned aircraft over people. The FAA has determined that it is unnecessary to require additional knowledge testing or training for operations over people beyond the initial testing and initial or recurrent training requirements of part 107. Questions and training specific to operations over people may be added to the testing and training in the existing areas of knowledge in §§ 107.73 and 107.74 without the need for an additional knowledge area. As stated previously, the FAA declines to require practical training for part 107 remote pilots. Additionally, the FAA does not find it necessary to tailor the subject areas to specific small UAS, because existing systems vary widely.

Furthermore, the remote pilot is already required to comply with all applicable regulations, including the preflight familiarization and inspection requirements, to ensure that their small UAS is in proper working condition prior to operation.

The FAA considered allowing Category 3 operations on a closed- or restricted-access site without requiring notice that the operation was taking place. The FAA rejected this alternative due to the increased severity of an injury resulting from a small unmanned aircraft impacting a person with up to 25 ft-lbs of kinetic energy.

The FAA considered proposing a Category 4 to include operations in which a small UAS may operate over people, including flights over crowds or dense concentrations of people, if: (1) The manufacturer of the small UAS certifies the aircraft satisfies the same impact energy threshold as small UAS eligible to conduct Category 3 operations; (2) the small UAS complies with industry consensus standards; and (3) the operation is conducted in compliance with a documented risk mitigation plan. The FAA rejected this alternative due to the increased severity of an injury resulting from a small unmanned aircraft impacting a person with up to 25 foot-pounds of kinetic energy. However, comments to the proposed rule stated that demonstrable reliability of the small UAS should be an alternative path for operations over people. The FAA agrees. Therefore, this final rule includes a fourth category to allow small UAS that have been issued an airworthiness certificate under part 21 to operate over people under part 107, so long as the operating limitations of that airworthiness certification do not prohibit operations over people.

The FAA considered incorporating the standards of §§ 23.1401 or 27.1401 ("Anti-collision light system") for night operations under part 107. Part 107 does not contain aircraft certification rules or standards, and the FAA concludes the reduced risk small UAS operations pose does not warrant application of such standards. In addition, the diverse range of aircraft that may operate under part 107 render prescriptive lighting requirements for all types of operations at night impractical. Prescriptive lighting requirements would be overly burdensome for both the FAA and manufacturers of small UAS, because they would be forced to make tradeoffs that affect both the weight of the aircraft and the aircraft's power source and supply. In response to comments to the proposed rule, the FAA always intended that the anti-collision lights for both civil twilight and night operations

should flash, rather than be static. Costs for anti-collision lights that flash at a sufficient rate to avoid a collision were included in the 2016 final rule.

C. International Trade Impact Assessment

The Trade Agreements Act of 1979 (Pub. L. 96–39), as amended by the Uruguay Round Agreements Act (Pub. L. 103–465), prohibits Federal agencies from establishing standards or engaging in related activities that create unnecessary obstacles to the foreign commerce of the United States. Pursuant to these Acts, the establishment of standards is not considered an unnecessary obstacle to the foreign commerce of the United States, so long as the standard has a legitimate domestic objective, such as the protection of safety, and does not operate in a manner that excludes imports that meet this objective. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards. The FAA has considered the ongoing work of international organizations and other countries. No international standards currently exist for the types of operations the FAA finalizes in this rule. In addition, this final rule would not create any obstacle to foreign commerce. The FAA will maintain its awareness of other countries' and international organizations' work in developing potential standards relevant to UAS operations.

D. Unfunded Mandates Assessment

Title II of the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires each Federal agency to prepare a written statement assessing the effects of any Federal mandate in a proposed or final agency rule that may result in an expenditure of \$100 million or more (in 1995 dollars) in any one year by State, local, and tribal governments, in the aggregate, or by the private sector; such a mandate is deemed to be a “significant regulatory action.” The FAA currently uses an inflation-adjusted value of \$155 million in lieu of \$100 million.

This rule does not contain a mandate that would result in expenditure by State, local, or Tribal governments or impose costs on the private sector of more than \$155 million annually.¹¹⁶ As a result, the requirements of Title II of

the Unfunded Mandates Reform Act of 1995 do not apply.

E. Paperwork Reduction Act

The Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)) requires that the FAA consider the impact of paperwork and other information collection burdens imposed on the public. According to the 1995 amendments to the Paperwork Reduction Act (as implemented by 5 CFR 1320.8(b)(2)(vi)), an agency may not collect or sponsor the collection of information, nor may it impose an information collection requirement, unless it displays a currently valid Office of Management and Budget (OMB) control number.

This rule adds a new information collection, which includes the estimated burdens for the declaration of compliance, means of compliance, the development of remote pilot operating instructions, and recordkeeping to reflect compliance with applicable maintenance requirements. This rule eliminates information collection requirements from the 2016 final rule as a result of changes to the recurrent knowledge testing requirements. As previously discussed, this rule may also reduce the number of waiver applications that the FAA receives.

A detailed discussion of each of these information-collection requirements is included in this section. As required by the Paperwork Reduction Act of 1995, the FAA has submitted these information collection amendments to OMB for its review.¹¹⁷

1. Declaration of Compliance and Means of Compliance

Summary: The information collection addresses the submission of the declaration of compliance and the means of compliance to the FAA for the purpose of demonstrating that the small UAS fulfills the applicable standards for Category 2 and 3 operations. It also addresses applicants' compliance with the record retention requirements associated with submitting justification to establish compliance.

The declaration of compliance must include the following information:

- The applicant's name, physical address, and email address.
- The small UAS make and model name, and series, if applicable and serial number or range of serial numbers.
- Whether the declaration of compliance is an initial declaration or

an amended declaration, and if amended, the reason for resubmittal.

- A process for notifying customers of conditions that could render the small UAS ineligible for operations over people.

- A certification that the applicant has demonstrated that the small unmanned aircraft satisfies the applicable requirements through an accepted means of compliance and will permit the Administrator to inspect its facilities, technical data, and any manufactured small UAS.

The means of compliance demonstrates through test, analysis, or inspection that the small UAS is eligible for operations pursuant to Category 2 or 3 or both. The applicant submitting the means of compliance must include the following information:

- The name of the person or entity submitting the means of compliance, the name of the main point of contact for communications with the FAA, the physical address, email address, and other contact information.

- A detailed description of the means of compliance.

- An explanation of how the means of compliance establishes achievement of the requirements identified in either § 107.120(a)(1) and (2) for Category 2 small unmanned aircraft or § 107.130(a)(1) and (2) for Category 3 small unmanned aircraft so that any small unmanned aircraft system designed, produced, or modified in accordance with such means of compliance meets those requirements.

- Any substantiating material the person wishes the FAA to consider as part of the request.

- A means of compliance submitted for acceptance by the FAA must include testing and validation procedures for persons responsible for the production or modification of the Category 2 or Category 3 small unmanned aircraft system to demonstrate how the small unmanned aircraft system meets the requirements of either § 107.120(a)(1) and (2) for Category 2 small unmanned aircraft or § 107.130(a)(1) and (2) for Category 3 small unmanned aircraft.

Use: The FAA will use the declaration of compliance and means of compliance to either accept or not accept that the manufacturer has demonstrated compliance with the requirements applicable to Category 2 or 3 or both operations.

¹¹⁶ The Unfunded Mandates Reform Act of 1995 defines “Federal private sector mandate” as “any provision in legislation, statute, or regulation that . . . would impose an enforceable duty upon the private sector . . . or would reduce or eliminate the

amount of authorization of appropriations for Federal financial assistance that will be provided to the private sector for the purposes of ensuring compliance with such duty.” Public Law 104–4 section 658 (1995).

¹¹⁷ The recordkeeping requirements prescribed by § 107.140(c)(2) through (5) will be submitted to OMB for review upon publication of this final rule.

Estimated Annual Burden: The table below shows the annual information collection burden in hours.

TABLE 6—ANNUAL BURDEN ESTIMATE FOR DECLARATION OF COMPLIANCE AND MEANS OF COMPLIANCE
[In hours]

Year	Initial	Pages	Hours per page	Hourly burden
1	32.55	50	1	1,628
2	8.40	50	1	420
3	8.40	50	1	420
Total .....	.....	.....	.....	2,468

The cost for the information collection on an hourly basis is a fully-burdened wage of \$96.92, for an annual cost of \$157,737 in year 1 and \$40,706 in each of years 2 and 3 for the small UAS manufacturers to submit their declarations. Over the 3-year analysis period, the total cost is approximately \$239,150 in 2020 dollars.

2. Remote Pilot Operating Instructions

Summary: The information collection addresses the manufacturer’s recordkeeping associated with the development and maintenance of remote pilot operating instructions for

small UAS operating over people. The remote pilot operating instructions must address, at a minimum, all of the following:

- A system description that includes the required small UAS components, any system limitations, and the declared category or categories of operation.
- Modifications that will not change the ability of the small UAS to meet the requirements for the category or categories of operation the small UAS is eligible to conduct.
- Instructions for how to verify and change the mode or configuration of the small UAS, if they are variable.

Use: To operate a small unmanned aircraft safely over people, remote pilots would be responsible for knowing what category of operations their small UAS are eligible to conduct, and what technical and operational limitations apply to the operations. Accordingly, this rule requires manufacturers to provide remote pilot operating instructions with product-specific information.

Estimated Annual Burden: The table below shows the annual information collection burden in hours.

TABLE 7—THREE-YEAR BURDEN ESTIMATES FOR REMOTE PILOT OPERATING INSTRUCTIONS
[In hours]

Year	Operating instructions	Pages	Hours per page	Hourly burden
1	31	6	25	4,650
2	8	6	25	1,200
3	8	6	25	1,200
Total .....	.....	.....	.....	7,050

The cost per hour for the information collection is a wage of \$96.92, for an annual cost of \$450,678 in year 1 and \$116,304 in each of years 2 and 3 for small UAS manufacturers to develop and maintain remote pilot operating instructions. Over the 3-year analysis period, the total cost is approximately \$683,286 in 2020 dollars.

3. Labeling of Unmanned Aircraft

Summary: Because a small UAS could be qualified to conduct more than one category of operations over people, this rule requires manufacturers to label small unmanned aircraft with each category of operations the small UAS is eligible to conduct. For example, a small UAS that is eligible to conduct both

Category 2 and Category 3 operations would be labeled with both categories, as follows: “Cat. 2, 3” or “Category 2, 3.” The label could be painted onto, etched into, or affixed to the aircraft by some other permanent means.

Use: There are two purposes for the label. For the remote pilot, the purpose of the label is to list the categories of operations over people the small UAS is eligible to conduct, as indicated on the manufacturer’s declaration of compliance. The other purpose of the label is for the FAA and law enforcement agencies to determine whether an operation is consistent with the requirements of the regulation. The labeling requirement will help remote

pilots know what category of operations their small unmanned aircraft is eligible to conduct, and what technical and operational limitations apply to the operations. The labeling requirement will also assist the FAA in its oversight role because labeling provides an efficient means for an inspector to evaluate whether an operation is consistent with the category or categories of operation the small unmanned aircraft may conduct. Because Category 3 operations entail unique operating limitations, the label on small unmanned aircraft eligible to conduct Category 3 operations will indicate to remote pilots that they must

¹¹⁸ The labeling requirement is not the sole means by which a remote pilot in command will be aware of the operating limitations applicable to Category 3 operations. Remote pilots in command must

maintain awareness of updated regulations, as required by proposed §§ 107.73(a) and 107.74(a) in this rule. As a result, initial aeronautical knowledge testing and recurrent training implemented after the

effective date of this final rule would include operations over people as a subject area on both the test and training.

adhere to the applicable operating limitations.¹¹⁸

Estimated Annual Burden: The table below shows the annual information collection burden in hours.

TABLE 8—THREE-YEAR BURDEN ESTIMATES FOR LABELING UNMANNED AIRCRAFT
[In hours]

Year	Number of platforms	Hours per redesign	Hourly burden
1	31	2	62
2	8	2	16
3	8	2	16
Total .....	.....	.....	94

The FAA assumes that manufacturers will redesign labels already affixed to the unmanned aircraft, and that the label redesign and redesign approval will take a maximum of two hours at an hourly wage of \$96.92, for an annual cost of \$6,009 in year 1 and \$1,551 in each of years 2 and 3. Over the 3-year analysis period, the total cost is approximately \$9,110 in 2020 dollars.

4. Maintenance Records

Summary: Owners of small UAS issued an airworthiness certificate under part 21 must retain records of all maintenance performed on their aircraft and records documenting the status of life-limited parts, compliance with airworthiness directives, and inspection status of the aircraft. The records must be kept for the time specified in § 107.140, and they must be available to

the FAA and law enforcement personnel upon request.

Use: These records will be used to validate that the aircraft has been maintained in a manner that assures that it remains in a condition eligible to be operated over people in accordance with Category 4.

Estimated Annual Burden: The table below shows the annual information collection burden in hours.

TABLE 9—THREE-YEAR BURDEN ESTIMATES FOR RECORDKEEPING ASSOCIATED WITH MAINTENANCE

Year	Number of respondents	Affected small UAS	Hourly burden (0.5 per small UAS)
1	1	100	50
2	2	200	100
3	3	300	150
Total .....	.....	.....	300

Rows and Columns may not sum to total due to rounding.

The FAA expects remote pilots will engage in maintenance record upkeep and documentation. The fully-burdened hourly wage for a remote pilot is estimated to be \$47.66.¹¹⁹ Multiplying the total combined hourly burden of 300 hours by the fully burdened hourly wage of \$47.66 yields a total cost of approximately \$14,298 in 2020 dollars for the three year period.

The FAA will publish separate notice in the **Federal Register** seeking comment regarding this new information collection.

F. International Compatibility and Cooperation

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to conform to ICAO Standards and Recommended Practices to the

maximum extent practicable. The FAA has reviewed the corresponding ICAO Standards and Recommended Practices and has identified no differences with these regulations.

G. Environmental Analysis

FAA Order 1050.1F identifies FAA actions that are categorically excluded from preparation of an environmental assessment or environmental impact statement under the National Environmental Policy Act in the absence of extraordinary circumstances. The FAA determined that the categorical exclusion in FAA Order 1050.1F, paragraph 5–6.6.f. applies to this action. The FAA conducted analysis as part of its evaluation of this action to support the application of the categorical exclusion. The FAA has determined that none of the

extraordinary circumstances in FAA Order 1050.1F, paragraph 5–2 exist.

The FAA has placed a copy of supporting documentation in the docket for this rule.

XVI. Executive Order Determinations

A. Executive Order 13132, Federalism

The FAA has analyzed this rule under the principles and criteria of Executive Order 13132, Federalism.¹²⁰ The Agency has determined that this action will not have a substantial direct effect on the States, or the relationship between the Federal Government and the States, or on the distribution of power and responsibilities among the various levels of government, and, therefore, does not have federalism implications.

¹¹⁸ The labeling requirement is not the sole means by which a remote pilot in command will be aware of the operating limitations applicable to Category 3 operations. Remote pilots in command must maintain awareness of updated regulations, as required by proposed §§ 107.73(a) and 107.74(a) in

this rule. As a result, initial aeronautical knowledge testing and recurrent training implemented after the effective date of this final rule would include operations over people as a subject area on both the test and training.

¹¹⁹ SeAverage is based on information found at <https://www.thedroneu.com/blog/part-107-faq-drone-license/>. Accessed 6/17/2020.

¹²⁰ 64 FR 43255 (Aug. 4, 1999).

B. Executive Order 13211, Regulations that Significantly Affect Energy Supply, Distribution, or Use

The FAA analyzed this rule under Executive Order 13211, Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use.¹²¹ The Agency has determined that it will not be a “significant energy action” under the executive order and is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

C. Executive Order 13609, Promoting International Regulatory Cooperation

Executive Order 13609, Promoting International Regulatory Cooperation, promotes international regulatory cooperation to meet shared challenges involving health, safety, labor, security, environmental, and other issues and to reduce, eliminate, or prevent unnecessary differences in regulatory requirements.¹²² The FAA has analyzed this action under the policies and agency responsibilities of Executive Order 13609 and has determined that this action will have no effect on international regulatory cooperation. The European Union Aviation Safety Agency commented that it is available for discussion and alignment of regulations, concerned that the proposed regulations could “set Europe and the US on different regulatory courses.” One commenter expressed concern that Canada’s current limitations on small UAS operations near people, buildings, or animals must not be adopted by the FAA. One commenter wrote that “we need a training standard that is applicable across the globe,” in order to ensure harmonization of the certification requirements.

The FAA participates in international discussions and regulatory meetings, but does not assume that all international regulations should be identical. Each State has its own individual and unique characteristics that shape its regulatory framework. The U.S. is working closely with its international partners to harmonize International Civil Aviation Organization (ICAO) policy. The FAA has determined that the safety requirements of this rule are not overly restrictive and allow operations over people with reasonable limits on those operations to mitigate risk and provide a level of safety for operations of small UAS within the airspace of the United States.

D. Executive Order 13175, Consultation and Coordination With Indian Tribal Governments

Consistent with Executive Order 13175, Consultation and Coordination with Indian Tribal Governments,¹²³ and FAA Order 1210.20, American Indian and Alaska Native Tribal Consultation Policy and Procedures,¹²⁴ the FAA ensures that Federally Recognized Tribes (Tribes) are given the opportunity to provide meaningful and timely input regarding proposed Federal actions that have the potential to have substantial direct effects on one or more Indian tribes, on the relationship between the Federal Government and Indian tribes, or on the distribution of power and responsibilities between the Federal Government and Indian tribes; or to affect uniquely or significantly their respective Tribes. At this point, the FAA has not identified any substantial direct effects or any unique or significant effects on tribes resulting from this rule. As the FAA contemplated in the 2016 final rule, the FAA has conducted outreach to tribes and responded to those tribes seeking information about small UAS operations conducted within their territory.

The FAA continues to develop its involvement with tribes within the broader UAS integration effort.¹²⁵ In particular, the FAA has partnered with the Choctaw Nation in a pilot program under which State, local, and tribal governments test and evaluate the integration of civil and public UAS operations into the low-altitude NAS to promote the safe operation of UAS and enable the development of UAS technologies and their use in agriculture, commerce, emergency management, human transportation, and other sectors.¹²⁶

The FAA has also conducted outreach to tribes to ensure they are familiar with the provisions of part 107 and that they are aware of FAA’s plans for additional rulemakings to integrate UAS into the NAS. As part of that outreach, the FAA has:

- Provided material on the 2016 final small UAS rule to participants at the mid-year conference of the National Congress of American Indians (Spokane, Washington, June 27–30, 2016);
- Presented at a workshop at the National Tribal Transportation

Conference (Anaheim, California October 4, 2016);

- Responded to inquiries from the Shoshone-Bannock Tribes and Muscogee (Creek) Nation regarding use of UAS (September and October 2016);
- Presented information on UAS at a meeting of the Tribal Transportation Self-Governance Program Negotiated Rulemaking Meeting (Shawnee, Oklahoma, October 18, 2016); and
- Presented information on UAS for public safety at the Osage Nation 2019 Public Safety Drone Conference (Tulsa, Oklahoma, November 5, 2019).

The FAA will continue to respond to tribes that express interest in or concerns about UAS operations, and will engage in government-to-government consultation with tribes as appropriate, in accordance with Executive Orders and FAA guidance.

E. Executive Order 13771, Reducing Regulation and Controlling Regulatory Costs

This rule is an Executive Order 13771 deregulatory action. Details on the estimated cost savings of this rule can be found in the rule’s economic analysis.

XVII. Additional Information

A. Availability of Rulemaking Documents

An electronic copy of rulemaking documents may be obtained from the internet by—

- Searching the Federal eRulemaking Portal at <https://www.regulations.gov>;
- Visiting the FAA’s Regulations and Policies web page at https://www.faa.gov/regulations_policies or
- Accessing the Government Publishing Office’s web page at <https://www.fdsys.gov>.

Copies may also be obtained by sending a request to the Federal Aviation Administration, Office of Rulemaking, ARM–1, 800 Independence Avenue SW, Washington, DC 20591, or by calling (202) 267–9677. Commenters must identify the docket or notice number of this rulemaking.

All documents the FAA considered in developing this rule, including economic analyses and technical reports, may be accessed from the internet through the Federal eRulemaking Portal referenced earlier.

B. Small Business Regulatory Enforcement Fairness Act

The Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA) requires FAA to comply with small entity requests for information or advice about compliance with statutes

¹²³ 65 FR 67249 (Nov. 6, 2000).

¹²⁴ FAA Order No. 1210.20 (Jan. 28, 2004), available at <http://www.faa.gov/documentLibrary/media/1210.pdf>.

¹²⁵ 81 FR 42064, 42189.

¹²⁶ Federal Aviation Administration, UAS Integration Pilot Program (May 7, 2018), available at https://www.faa.gov/uas/programs_partnerships/uas_integration_pilot_program/.

¹²¹ 66 FR 28355 (May 18, 2001).

¹²² 77 FR 26413 (May 4, 2012).

and regulations within its jurisdiction. A small entity with questions regarding this document may contact its local FAA official, or the person listed under the **FOR FURTHER INFORMATION CONTACT** heading at the beginning of the preamble. To find out more about SBREFA on the internet, visit http://www.faa.gov/regulations_policies/rulemaking/sbre_act/.

List of Subjects

14 CFR Part 11

Administrative practice and procedure, Reporting and recordkeeping requirements.

14 CFR Part 21

Aircraft, Aviation safety, Exports, Imports, Reporting and recordkeeping requirements.

14 CFR Part 43

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

14 CFR Part 107

Aircraft, Airmen, Aviation safety, Reporting and recordkeeping requirements, Security measures, Signs and symbols.

The Amendment

In consideration of the foregoing, the Federal Aviation Administration amends chapter I of title 14, Code of Federal Regulations as follows:

PART 11—GENERAL RULEMAKING PROCEDURES

■ 1. The authority citation for part 11 continues to read as follows:

Authority: 49 U.S.C. 106(f), 106(g), 40101, 40103, 40105, 40109, 40113, 44110, 44502, 44701–44702, 44711, 46102, and 51 U.S.C. 50901–50923.

■ 2. Amend § 11.201(b) by revising the entry “Part 107” to read as follows:

§ 11.201 Office of Management and Budget (OMB) control numbers assigned under the Paperwork Reduction Act.

* * * * *

(b) * * *

14 CFR part or section identified and described	Current OMB control No.
* * *	* * *
Part 107	2120–0005, 2120–0021, 2120–0027, 2120–0767, 2120–0768, 2120–0775.
* * *	* * *

PART 21—CERTIFICATION PROCEDURES FOR PRODUCTS AND ARTICLES

■ 3. The authority citation for part 21 continues to read as follows:

Authority: 42 U.S.C. 7572; 49 U.S.C. 106(f), 106(g), 40105, 40113, 44701–44702, 44704, 44707, 44709, 44711, 44713, 44715, 45303.

■ 4. Amend § 21.1 by revising paragraph (a) introductory text to read as follows:

§ 21.1 Applicability and definitions.

(a) This part prescribes—

* * * * *

PART 43—MAINTENANCE, PREVENTATIVE MAINTENANCE, REBUILDING, AND ALTERATION

■ 5. The authority citation for part 43 continues to read as follows:

Authority: 42 U.S.C. 7572; 49 U.S.C. 106(f), 106(g), 40105, 40113, 44701–44702, 44704, 44707, 44709, 44711, 44713, 44715, 45303.

■ 6. Amend § 43.1 by revising paragraph (b)(3) to read as follows:

§ 43.1 Applicability.

* * * * *

(b) * * *

(3) Any aircraft that is operated under part 107 of this chapter, except as described in § 107.140(d).

* * * * *

PART 107—SMALL UNMANNED AIRCRAFT SYSTEMS

■ 7. The authority citation for part 107 is revised to read as follows:

Authority: 49 U.S.C. 106(f), 40101 note, 40103(b), 44701(a)(5), 46105(c), 46110, 44807.

■ 8. Revise § 107.1 to read as follows:

§ 107.1 Applicability.

(a) Except as provided in paragraph (b) of this section, this part applies to the registration, airman certification, and operation of civil small unmanned aircraft systems within the United States. This part also applies to the eligibility of civil small unmanned aircraft systems to operate over human beings in the United States.

(b) This part does not apply to the following:

- (1) Air carrier operations;
- (2) Any aircraft subject to the provisions of 49 U.S.C. 44809;
- (3) Any operation that the holder of an exemption under section 333 of Public Law 112–95 or 49 U.S.C. 44807 elects to conduct pursuant to the exemption, unless otherwise specified in the exemption; or

(4) Any operation that a person elects to conduct under part 91 of this chapter with a small unmanned aircraft system that has been issued an airworthiness certificate.

■ 9. Add § 107.2 to read as follows:

§ 107.2 Applicability of certification procedures for products and articles.

The provisions of part 21 of this chapter do not apply to small unmanned aircraft systems operated under this part unless the small unmanned aircraft system will operate over human beings in accordance with § 107.140.

■ 10. Amend § 107.3 by adding the definition of “Declaration of compliance” in alphabetical order to read as follows:

§ 107.3 Definitions.

* * * * *

Declaration of compliance means a record submitted to the FAA that certifies the small unmanned aircraft conforms to the Category 2 or Category 3 requirements under subpart D of this part.

* * * * *

■ 11. Amend § 107.5 by revising the section heading and paragraph (b) to read as follows:

§ 107.5 Falsification, reproduction, or alteration.

* * * * *

(b) The commission by any person of an act prohibited under paragraph (a) of this section is a basis for any of the following:

- (1) Denial of an application for a remote pilot certificate or a certificate of waiver;
- (2) Denial of a declaration of compliance;
- (3) Suspension or revocation of any certificate, waiver, or declaration of compliance issued or accepted by the Administrator under this part and held by that person; or
- (4) A civil penalty.

■ 12. Revise § 107.7 to read as follows:

§ 107.7 Inspection, testing, and demonstration of compliance.

(a) A remote pilot in command, owner, or person manipulating the flight controls of a small unmanned aircraft system must—

- (1) Have in that person’s physical possession and readily accessible the remote pilot certificate with a small UAS rating and identification when exercising the privileges of that remote pilot certificate.
- (2) Present his or her remote pilot certificate with a small UAS rating and identification that contains the

information listed at § 107.67(b)(1) through (3) for inspection upon a request from—

- (i) The Administrator;
- (ii) An authorized representative of the National Transportation Safety Board;
- (iii) Any Federal, State, or local law enforcement officer; or
- (iv) An authorized representative of the Transportation Security Administration.

(3) Make available, upon request, to the Administrator any document, record, or report required to be kept under the regulations of this chapter.

(b) The remote pilot in command, visual observer, owner, operator, or person manipulating the flight controls of a small unmanned aircraft system must, upon request, allow the Administrator to make any test or inspection of the small unmanned aircraft system, the remote pilot in command, the person manipulating the flight controls of a small unmanned aircraft system, and, if applicable, the visual observer to determine compliance with this part.

(c) Any person holding an FAA-accepted declaration of compliance under subpart D of this part must, upon request, make available to the Administrator:

(1) The declaration of compliance required under subpart D of this part; and

(2) Any other document, record, or report required to be kept under the regulations of this chapter.

(d) Any person holding an FAA-accepted declaration of compliance under subpart D of this part must, upon request, allow the Administrator to inspect its facilities, technical data, and any manufactured small UAS and witness any tests necessary to determine compliance with that subpart.

■ 13. Amend § 107.19 by revising paragraph (c) to read as follows:

§ 107.19 Remote pilot in command.

* * * * *

(c) The remote pilot in command must ensure that the small unmanned aircraft will pose no undue hazard to other people, other aircraft, or other property in the event of a loss of control of the small unmanned aircraft for any reason.

* * * * *

■ 14. Amend § 107.29 by revising the section heading and paragraphs (a) and (b) and adding paragraph (d) to read as follows:

§ 107.29 Operation at night.

(a) Except as provided in paragraph (d) of this section, no person may

operate a small unmanned aircraft system at night unless—

(1) The remote pilot in command of the small unmanned aircraft has completed an initial knowledge test or training, as applicable, under § 107.65 after March 1, 2021; and

(2) The small unmanned aircraft has lighted anti-collision lighting visible for at least 3 statute miles that has a flash rate sufficient to avoid a collision. The remote pilot in command may reduce the intensity of, but may not extinguish, the anti-collision lighting if he or she determines that, because of operating conditions, it would be in the interest of safety to do so.

(b) No person may operate a small unmanned aircraft system during periods of civil twilight unless the small unmanned aircraft has lighted anti-collision lighting visible for at least 3 statute miles that has a flash rate sufficient to avoid a collision. The remote pilot in command may reduce the intensity of, but may not extinguish, the anti-collision lighting if he or she determines that, because of operating conditions, it would be in the interest of safety to do so.

* * * * *

(d) After May 17, 2021, no person may operate a small unmanned aircraft system at night in accordance with a certificate of waiver issued prior to March 16, 2021 under § 107.200. The certificates of waiver issued prior to March 16, 2021 under § 107.200 that authorize deviation from § 107.29 terminate on May 17, 2021.

■ 15. Revise § 107.35 to read as follows:

§ 107.35 Operation of multiple small unmanned aircraft.

A person may not manipulate flight controls or act as a remote pilot in command or visual observer in the operation of more than one unmanned aircraft at the same time.

■ 16. Revise § 107.39 to read as follows:

§ 107.39 Operation over human beings.

No person may operate a small unmanned aircraft over a human being unless—

(a) That human being is directly participating in the operation of the small unmanned aircraft;

(b) That human being is located under a covered structure or inside a stationary vehicle that can provide reasonable protection from a falling small unmanned aircraft; or

(c) The operation meets the requirements of at least one of the operational categories specified in subpart D of this part.

■ 17. Amend § 107.49 by revising paragraphs (d) and (e) and adding paragraph (f) to read as follows:

§ 107.49 Preflight familiarization, inspection, and actions for aircraft operation.

* * * * *

(d) If the small unmanned aircraft is powered, ensure that there is enough available power for the small unmanned aircraft system to operate for the intended operational time;

(e) Ensure that any object attached or carried by the small unmanned aircraft is secure and does not adversely affect the flight characteristics or controllability of the aircraft; and

(f) If the operation will be conducted over human beings under subpart D of this part, ensure that the aircraft meets the requirements of § 107.110, § 107.120(a), § 107.130(a), or § 107.140, as applicable.

■ 18. Effective March 1, 2021, amend § 107.61 by revising paragraph (d) to read as follows:

§ 107.61 Eligibility.

* * * * *

(d) Demonstrate aeronautical knowledge by satisfying one of the following conditions, in a manner acceptable to the Administrator:

(1) Pass an initial aeronautical knowledge test covering the areas of knowledge specified in § 107.73; or

(2) If a person holds a pilot certificate (other than a student pilot certificate) issued under part 61 of this chapter and meets the flight review requirements specified in § 61.56, complete training covering the areas of knowledge specified in § 107.74.

■ 19. Effective March 1, 2021, amend § 107.63 by revising paragraph (a)(2) to read as follows:

§ 107.63 Issuance of a remote pilot certificate with a small UAS rating.

* * * * *

(a) * * *

(2) If a person holds a pilot certificate (other than a student pilot certificate) issued under part 61 of this chapter and meets the flight review requirements specified in § 61.56, a certificate of completion of an initial training course under this part that covers the areas of knowledge specified in § 107.74.

* * * * *

■ 20. Effective March 1, 2021, revise § 107.65 to read as follows:

§ 107.65 Aeronautical knowledge recency.

A person may not exercise the privileges of a remote pilot in command with small UAS rating unless that person has accomplished one of the

following in a manner acceptable to the Administrator within the previous 24 calendar months:

- (a) Passed an initial aeronautical knowledge test covering the areas of knowledge specified in § 107.73;
- (b) Completed recurrent training covering the areas of knowledge specified in § 107.73; or
- (c) If a person holds a pilot certificate (other than a student pilot certificate) issued under part 61 of this chapter and meets the flight review requirements specified in § 61.56, completed training covering the areas of knowledge specified in § 107.74.

(d) A person who has passed a recurrent aeronautical knowledge test in a manner acceptable to the Administrator or who has satisfied the training requirement of paragraph (c) of this section prior to March 1, 2021 within the previous 24 calendar months is considered to be in compliance with the requirement of paragraph (b) or (c) of this section, as applicable.

- 21. Effective March 1, 2021, revise § 107.73 to read as follows:

§ 107.73 Knowledge and training.

An initial aeronautical knowledge test and recurrent training covers the following areas of knowledge:

- (a) Applicable regulations relating to small unmanned aircraft system rating privileges, limitations, and flight operation;
- (b) Airspace classification, operating requirements, and flight restrictions affecting small unmanned aircraft operation;
- (c) Aviation weather sources and effects of weather on small unmanned aircraft performance;
- (d) Small unmanned aircraft loading;
- (e) Emergency procedures;
- (f) Crew resource management;
- (g) Radio communication procedures;
- (h) Determining the performance of the small unmanned aircraft;
- (i) Physiological effects of drugs and alcohol;
- (j) Aeronautical decision-making and judgment;
- (k) Airport operations;
- (l) Maintenance and preflight inspection procedures; and
- (m) Operation at night.

- 22. Effective March 1, 2021, revise § 107.74 to read as follows:

§ 107.74 Small unmanned aircraft system training.

Training for pilots who hold a pilot certificate (other than a student pilot certificate) issued under part 61 of this chapter and meet the flight review requirements specified in § 61.56 covers the following areas of knowledge:

- (a) Applicable regulations relating to small unmanned aircraft system rating privileges, limitations, and flight operation;
- (b) Effects of weather on small unmanned aircraft performance;
- (c) Small unmanned aircraft loading;
- (d) Emergency procedures;
- (e) Crew resource management;
- (f) Determining the performance of the small unmanned aircraft;
- (g) Maintenance and preflight inspection procedures; and
- (h) Operation at night.

Subpart D—[Redesignated as Subpart E]

- 23. Redesignate subpart D as subpart E.
- 24. Add new subpart D to read as follows:

Subpart D—Operations Over Human Beings

Sec.

- 107.100 Applicability.
- 107.105 Limitations on operations over human beings.
- 107.110 Category 1 operations.
- 107.115 Category 2 operations: Operating requirements.
- 107.120 Category 2 operations: Eligibility of small unmanned aircraft and other applicant requirements.
- 107.125 Category 3 operations: Operating requirements.
- 107.130 Category 3 operations: Eligibility of small unmanned aircraft and other applicant requirements.
- 107.135 Labeling by remote pilot in command for Category 2 and 3 operations.
- 107.140 Category 4 operations.
- 107.145 Operations over moving vehicles.
- 107.150 Variable mode and variable configuration of small unmanned aircraft.
- 107.155 Means of compliance.
- 107.160 Declaration of compliance.
- 107.165 Record retention.

§ 107.100 Applicability.

This subpart prescribes the eligibility and operating requirements for civil small unmanned aircraft to operate over human beings or over moving vehicles in the United States, in addition to those operations permitted by § 107.39(a) and (b).

§ 107.105 Limitations on operations over human beings.

Except as provided in §§ 107.39(a) and (b) and 107.145, a remote pilot in command may conduct operations over human beings only in accordance with the following, as applicable: § 107.110 for Category 1 operations; §§ 107.115 and 107.120 for Category 2 operations; §§ 107.125 and 107.130 for Category 3

operations; or § 107.140 for Category 4 operations.

§ 107.110 Category 1 operations.

To conduct Category 1 operations—

- (a) A remote pilot in command must use a small unmanned aircraft that—
 - (1) Weighs 0.55 pounds or less on takeoff and throughout the duration of each operation under Category 1, including everything that is on board or otherwise attached to the aircraft; and
 - (b) Does not contain any exposed rotating parts that would lacerate human skin upon impact with a human being.

(c) No remote pilot in command may operate a small unmanned aircraft in sustained flight over open-air assemblies of human beings unless the operation meets the requirements of either § 89.110 or § 89.115(a) of this chapter.

§ 107.115 Category 2 operations: Operating requirements.

To conduct Category 2 operations—

- (a) A remote pilot in command must use a small unmanned aircraft that—
 - (1) Is eligible for Category 2 operations pursuant to § 107.120(a);
 - (2) Is listed on an FAA-accepted declaration of compliance as eligible for Category 2 operations in accordance with § 107.160; and
 - (3) Is labeled as eligible to conduct Category 2 operations in accordance with § 107.120(b)(1).

(b) No remote pilot in command may operate a small unmanned aircraft in sustained flight over open-air assemblies of human beings unless the operation meets the requirements of either § 89.110 or § 89.115(a) of this chapter.

§ 107.120 Category 2 operations: Eligibility of small unmanned aircraft and other applicant requirements.

(a) To be eligible for use in Category 2 operations, the small unmanned aircraft must be designed, produced, or modified such that it—

- (1) Will not cause injury to a human being that is equivalent to or greater than the severity of injury caused by a transfer of 11 foot-pounds of kinetic energy upon impact from a rigid object;
- (2) Does not contain any exposed rotating parts that would lacerate human skin upon impact with a human being; and
- (3) Does not contain any safety defects.

(b) The applicant for a declaration of compliance for a small unmanned aircraft that is eligible for use in Category 2 operations in accordance with paragraph (a) of this section, must meet all of the following requirements

for the applicant's unmanned aircraft to be used in Category 2 operations:

(1) Display a label on the small unmanned aircraft indicating eligibility to conduct Category 2 operations. The label must be in English and be legible, prominent, and permanently affixed to the small unmanned aircraft.

(2) Have remote pilot operating instructions that apply to the operation of the small unmanned aircraft system. The applicant for a declaration of compliance must make available these instructions upon sale or transfer of the aircraft or use of the aircraft by someone other than the applicant who submitted a declaration of compliance pursuant to § 107.160. Such instructions must address, at a minimum—

(i) A system description that includes the required small unmanned aircraft system components, any system limitations, and the declared category or categories of operation;

(ii) Modifications that will not change the ability of the small unmanned aircraft system to meet the requirements for the category or categories of operation the small unmanned aircraft system is eligible to conduct; and

(iii) Instructions for how to verify and change the mode or configuration of the small unmanned aircraft system, if they are variable.

(3) Maintain a product support and notification process. The applicant for a declaration of compliance must maintain product support and notification procedures to notify the public and the FAA of—

(i) Any defect or condition that causes the small unmanned aircraft to no longer meet the requirements of this subpart; and

(ii) Any identified safety defect that causes the small unmanned aircraft to exceed a low probability of casualty.

§ 107.125 Category 3 operations: Operating requirements.

To conduct Category 3 operations, a remote pilot in command—

(a) Must use a small unmanned aircraft that—

(1) Is eligible for Category 3 operations pursuant to § 107.130(a);

(2) Is listed on a current declaration of compliance as eligible for Category 3 operations in accordance with § 107.160; and

(3) Is labeled as eligible for Category 3 operations in accordance with § 107.130(b)(1);

(b) Must not operate the small unmanned aircraft over open-air assemblies of human beings; and

(c) May only operate the small unmanned aircraft above any human being if operation meets one of the following conditions:

(1) The operation is within or over a closed- or restricted-access site and all human beings located within the closed- or restricted-access site must be on notice that a small unmanned aircraft may fly over them; or

(2) The small unmanned aircraft does not maintain sustained flight over any human being unless that human being is—

(i) Directly participating in the operation of the small unmanned aircraft; or

(ii) Located under a covered structure or inside a stationary vehicle that can provide reasonable protection from a falling small unmanned aircraft.

§ 107.130 Category 3 operations: Eligibility of small unmanned aircraft and other applicant requirements.

(a) To be eligible for use in Category 3 operations, the small unmanned aircraft must be designed, produced, or modified such that it—

(1) Will not cause injury to a human being that is equivalent to or greater than the severity of the injury caused by a transfer of 25 foot-pounds of kinetic energy upon impact from a rigid object;

(2) Does not contain any exposed rotating parts that would lacerate human skin upon impact with a human being; and

(3) Does not contain any safety defects.

(b) The applicant for a declaration of compliance for a small unmanned aircraft that is eligible for use in Category 3 operations in accordance with paragraph (a) of this section, must meet all of the following requirements for the applicant's small unmanned aircraft to be used in Category 3 operations:

(1) Display a label on the small unmanned aircraft indicating eligibility to conduct Category 3 operations. The label must be in English and be legible, prominent, and permanently affixed to the small unmanned aircraft.

(2) Have remote pilot operating instructions that apply to the operation of the small unmanned aircraft system. The applicant for a declaration of compliance must make available these instructions upon sale or transfer of the aircraft or use of the aircraft by someone other than the applicant who submitted a declaration of compliance pursuant to § 107.160. Such instructions must address, at a minimum—

(i) A system description that includes the required small unmanned aircraft system components, any system limitations, and the declared category or categories of operation;

(ii) Modifications that will not change the ability of the small unmanned

aircraft system to meet the requirements for the category or categories of operation the small unmanned aircraft system is eligible to conduct; and

(iii) Instructions for how to verify and change the mode or configuration of the small unmanned aircraft system, if they are variable.

(3) Maintain a product support and notification process. The applicant for a declaration of compliance must maintain product support and notification procedures to notify the public and the FAA of—

(i) Any defect or condition that causes the small unmanned aircraft to no longer meet the requirements of this subpart; and

(ii) Any identified safety defect that causes the small unmanned aircraft to exceed a low probability of fatality.

§ 107.135 Labeling by remote pilot in command for Category 2 and 3 operations.

If a Category 2 or Category 3 label affixed to a small unmanned aircraft is damaged, destroyed, or missing, a remote pilot in command must label the aircraft in English such that the label is legible, prominent, and will remain on the small unmanned aircraft for the duration of the operation before conducting operations over human beings. The label must correctly identify the category or categories of operation over human beings that the small unmanned aircraft is qualified to conduct in accordance with this subpart.

§ 107.140 Category 4 operations.

(a) *Remote pilot in command requirements.* To conduct Category 4 operations—

(1) A remote pilot in command—

(i) Must use a small unmanned aircraft that is eligible for Category 4 operations pursuant to paragraph (b) of this section; and

(ii) Must operate the small unmanned aircraft in accordance with all operating limitations that apply to the small unmanned aircraft, as specified by the Administrator.

(2) No remote pilot in command may operate a small unmanned aircraft in sustained flight over open-air assemblies of human beings unless the operation meets the requirements of either § 89.110 or § 89.115(a) of this chapter.

(b) *Small unmanned aircraft requirements for Category 4.* To be eligible to operate over human beings under this section, the small unmanned aircraft must—

(1) Have an airworthiness certificate issued under part 21 of this chapter.

(2) Be operated in accordance with the operating limitations specified in

the approved Flight Manual or as otherwise specified by the Administrator. The operating limitations must not prohibit operations over human beings.

(3) Have maintenance, preventive maintenance, alterations, or inspections performed in accordance with paragraph (c)(1) of this section.

(c) *Maintenance requirements for Category 4.* The owner must (unless the owner enters into an agreement with an operator to meet the requirements of this paragraph (c), then the operator must) meet the requirements of this paragraph (c):

(1) Ensure the person performing any maintenance, preventive maintenance, alterations, or inspections:

(i) Uses the methods, techniques, and practices prescribed in the manufacturer's current maintenance manual or Instructions for Continued Airworthiness that are acceptable to the Administrator, or other methods, techniques, and practices acceptable to the Administrator;

(ii) Has the knowledge, skill, and appropriate equipment to perform the work;

(iii) Performs the maintenance, preventive maintenance, or alterations on the small unmanned aircraft in a manner using the methods, techniques, and practices prescribed in the manufacturer's current maintenance manual or Instructions for Continued Airworthiness prepared by its manufacturer, or other methods, techniques, and practices acceptable to the Administrator;

(iv) Inspects the small unmanned aircraft in accordance with the manufacturer's instructions or other instructions acceptable to the Administrator; and

(v) Performs the maintenance, preventive maintenance, or alterations using parts of such a quality that the condition of the aircraft will be at least equal to its original or properly altered condition.

(2) Maintain all records of maintenance, preventive maintenance, and alterations performed on the aircraft and ensure the records are documented in a manner acceptable to the Administrator. The records must contain the description of the work performed, the date the work was completed, and the name of the person who performed the work.

(3) Maintain all records containing—

(i) The status of life-limited parts that are installed on, or part of, the small unmanned aircraft;

(ii) The inspection status of the aircraft; and

(iii) The status of applicable airworthiness directives including the method of compliance, the airworthiness directive number, and revision date. If the airworthiness directive involves recurring action, the record must contain the time and date of the next required action.

(4) Retain the records required under paragraphs (c)(2) and (3) of this section, as follows:

(i) The records documenting maintenance, preventive maintenance, or alterations performed must be retained for 1 year from when the work is completed or until the maintenance is repeated or superseded by other work.

(ii) The records documenting the status of life-limited parts, compliance with airworthiness directives, and inspection status of the small unmanned aircraft must be retained and transferred with the aircraft upon change in ownership.

(5) Ensure all records under paragraphs (c)(2) and (3) of this section are available for inspection upon request from the Administrator or any authorized representative of the National Transportation Safety Board (NTSB).

(d) *Compliance with parts 43 and 91 of this chapter.* Compliance with part 43 and part 91, subpart E, of this chapter fulfills the requirements in paragraphs (b)(4) and (c) of this section.

§ 107.145 Operations over moving vehicles.

No person may operate a small unmanned aircraft over a human being located inside a moving vehicle unless the following conditions are met:

(a) The operation occurs in accordance with § 107.110 for Category 1 operations; § 107.115 for Category 2 operations; § 107.125 for Category 3 operations; or § 107.140 for Category 4 operations.

(b) For an operation under Category 1, Category 2, or Category 3, the small unmanned aircraft, throughout the operation—

(1) Must remain within or over a closed- or restricted-access site, and all human beings located inside a moving vehicle within the closed- or restricted-access site must be on notice that a small unmanned aircraft may fly over them; or

(2) Must not maintain sustained flight over moving vehicles.

(c) For a Category 4 operation, the small unmanned aircraft must—

(1) Have an airworthiness certificate issued under part 21 of this chapter.

(2) Be operated in accordance with the operating limitations specified in the approved Flight Manual or as

otherwise specified by the Administrator. The operating limitations must not prohibit operations over human beings located inside moving vehicles.

§ 107.150 Variable mode and variable configuration of small unmanned aircraft systems.

A small unmanned aircraft system may be eligible for one or more categories of operation over human beings under this subpart, as long as a remote pilot in command cannot inadvertently switch between modes or configurations.

§ 107.155 Means of compliance.

(a) *Establishment of compliance.* To meet the requirements of § 107.120(a) for operations in Category 2, or the requirements of § 107.130(a) for operations in Category 3, the means of compliance must consist of test, analysis, or inspection.

(b) *Required information.* An applicant requesting FAA acceptance of a means of compliance must submit the following information to the FAA in a manner specified by the Administrator:

(1) *Procedures.* Detailed description of the means of compliance, including applicable test, analysis, or inspection procedures to demonstrate how the small unmanned aircraft meets the requirements of § 107.120(a) for operations in Category 2 or the requirements of § 107.130(a) for operations in Category 3. The description should include conditions, environments, and methods, as applicable.

(2) *Compliance explanation.* Explanation of how application of the means of compliance fulfills the requirements of § 107.120(a) for operations in Category 2 or the requirements of § 107.130(a) for operations in Category 3.

(c) *FAA acceptance.* If the FAA determines the applicant has demonstrated compliance with paragraphs (a) and (b) of this section, it will notify the applicant that it has accepted the means of compliance.

(d) *Rescission.* (1) A means of compliance is subject to ongoing review by the Administrator. The Administrator may rescind its acceptance of a means of compliance if the Administrator determines that a means of compliance does not meet any or all of the requirements of this subpart.

(2) The Administrator will publish a notice of rescission in the **Federal Register**.

(e) *Inapplicability of part 13, subpart D, of this chapter.* Part 13, subpart D, of

this chapter does not apply to the procedures of paragraph (a) of this section.

§ 107.160 Declaration of compliance.

(a) *Required information.* In order for an applicant to declare a small unmanned aircraft is compliant with the requirements of this subpart for Category 2 or Category 3 operations, an applicant must submit a declaration of compliance for acceptance by the FAA, in a manner specified by the Administrator, that includes the following information:

- (1) Applicant's name;
- (2) Applicant's physical address;
- (3) Applicant's email address;
- (4) The small unmanned aircraft make and model name, and series, if applicable;
- (5) The small unmanned aircraft serial number or range of serial numbers that are the subject of the declaration of compliance;
- (6) Whether the declaration of compliance is an initial declaration or an amended declaration;
- (7) If the declaration of compliance is an amended declaration, the reason for the re-submittal;
- (8) The accepted means of compliance the applicant used to fulfill requirements of § 107.120(a) or § 107.130(a) or both;
- (9) A declaration that the applicant—
 - (i) Has demonstrated that the small unmanned aircraft, or specific configurations of that aircraft, satisfies § 107.120(a) or § 107.130(a) or both, through the accepted means of compliance identified in paragraph (a)(8) of this section;
 - (ii) Has verified that the unmanned aircraft does not contain any safety defects;
 - (iii) Has satisfied § 107.120(b)(3) or § 107.130(b)(3), or both; and
 - (iv) Will, upon request, allow the Administrator to inspect its facilities, technical data, and any manufactured small unmanned aircraft and witness any tests necessary to determine compliance with this subpart; and
- (10) Other information as required by the Administrator.

(b) *FAA acceptance.* If the FAA determines the applicant has demonstrated compliance with the requirements of this subpart, it will notify the applicant that it has accepted the declaration of compliance.

(c) *Notification of a safety issue.* Prior to initiating rescission proceedings pursuant to paragraphs (d)(1) through (3) of this section, the FAA will notify the applicant if a safety issue has been identified for the declaration of compliance.

(d) *Rescission.* (1) No person may operate a small unmanned aircraft identified on a declaration of compliance that the FAA has rescinded pursuant to this subpart while that declaration of compliance is rescinded.

(2) The FAA may rescind a declaration of compliance if any of the following conditions occur:

- (i) A small unmanned aircraft for which a declaration of compliance was accepted no longer complies with § 107.120(a) or § 107.130(a);
- (ii) The FAA finds a declaration of compliance is in violation of § 107.5(a); or
- (iii) The Administrator determines an emergency exists related to safety in accordance with the authority in 49 U.S.C. 46105.

(3) If a safety issue identified under paragraph (c) of this section has not been resolved, the FAA may rescind the declaration of compliance as follows:

(i) The FAA will issue a notice proposing to rescind the declaration of compliance. The notice will set forth the Agency's basis for the proposed rescission and provide the holder of the declaration of compliance with 30 calendar days from the date of issuance of the proposed notice to submit evidentiary information to refute the proposed notice.

(ii) The holder of the declaration of compliance must submit information demonstrating how the small unmanned aircraft meets the requirements of this subpart within 30 calendar days from the date of issuance of the proposed notice.

(iii) If the FAA does not receive the information required by paragraph (d)(3)(ii) of this section within 30 calendar days from the date of the issuance of the proposed notice, the FAA will issue a notice rescinding the declaration of compliance.

(4) If the Administrator determines that an emergency exists in accordance with paragraph (d)(2)(iii) of this section, the FAA will exercise its authority under 49 U.S.C. 46105(c) to issue an order rescinding a declaration of compliance without initiating the process in paragraph (d)(3) of this section.

(e) *Petition to reconsider the rescission of a declaration of compliance.* A person subject to an order of rescission under paragraph (d)(3) of this section may petition the FAA to reconsider the rescission of a declaration of compliance by submitting a request to the FAA in a manner specified by the Administrator within 60 days of the date of issuance of the rescission.

(1) A petition to reconsider the rescission of a declaration of compliance must demonstrate at least one of the following:

(i) A material fact that was not present in the original response to the notification of the safety issue and an explanation for why it was not present in the original response;

(ii) The FAA made a material factual error in the decision to rescind the declaration of compliance; or

(iii) The FAA did not correctly interpret a law, regulation, or precedent.

(2) Upon consideration of the information submitted under paragraph (e)(1) of this section, the FAA will issue a notice either affirming the rescission or withdrawing the rescission.

(f) *Inapplicability of part 13, subpart D, of this chapter.* Part 13, subpart D, of this chapter does not apply to the procedures of paragraphs (d) and (e) of this section.

§ 107.165 Record retention.

(a) A person who submits a declaration of compliance under this subpart must retain and make available to the Administrator, upon request, the information described in paragraph (a)(1) of this section for the period of time described in paragraph (a)(2) of this section.

(1) All supporting information used to demonstrate the small unmanned aircraft meets the requirements of §§ 107.120(a), for operations in Category 2, and 107.130(a), for operations in Category 3.

(2) The following time periods apply:

(i) If the person who submits a declaration of compliance produces a small unmanned aircraft, that person must retain the information described in paragraph (a)(1) of this section for two years after the cessation of production of the small unmanned aircraft system for which the person declared compliance.

(ii) If the person who submits a declaration of compliance designs or modifies a small unmanned aircraft, that person must retain the information described in paragraph (a)(1) of this section for two years after the person submitted the declaration of compliance.

(b) A person who submits a means of compliance under this subpart must retain and make available to the Administrator, upon request, and for as long as the means of compliance remains accepted, the detailed description of the means of compliance and justification showing how the means of compliance meets the requirements of §§ 107.120(a), for operations in Category 2, and 107.130(a), for operations in Category 3.

■ 25. Amend § 107.205 by revising paragraph (b) and adding paragraph (j) to read as follows:

§ 107.205 List of regulations subject to waiver.

* * * * *

(b) Section 107.29(a)(2) and (b)—Anti-collision light required for operations at night and during periods of civil twilight.

* * * * *

(j) Section 107.145—Operations over moving vehicles.

Issued under the authority provided by 49 U.S.C. 106(f), 40101 note; and 44807, in Washington, DC.

Elaine L. Chao,
Secretary, Department of Transportation.

Steve Dickson,
Administrator, Federal Aviation Administration.

[FR Doc. 2020-28947 Filed 1-8-21; 4:15 pm]

BILLING CODE 4910-13-P