U.S. Department of Transportation
FEDERAL AVIATION ADMINISTRATION

INTEGRATION OF POWERED-LIFT: PILOT CERTIFICATION AND OPERATIONS; MISCELLANEOUS AMENDMENTS RELATED TO ROTORCRAFT AND AIRPLANES

Regulatory Impact Analysis

November 2024

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List of Abbreviations Frequently Used in this Document

Abbreviations and Acronyms used in this Document

ACS – Airman Certification Standards
APD – Aircraft Program Designees
AQP – Advanced Qualification Program
ATC – Air Traffic Control
ATP – Air Transport Pilot
ATO – Air Traffic Organization
CAMP – Continuous Airworthiness Maintenance Program
CFIT – Controlled Flight into Terrain
CFR – Code of Federal Regulations
CLOA – Certificate and Letter of Authority
DPE – Designated Pilot Examiner
GPS – Global Positioning System
GPWS – Ground Proximity Warning Systems
ELT – Emergency Locator Transmitter
ERT – Event Review Team
FDR – Flight Data Recorder
FFS – Full Flight Simulator
FSB – Flight Standardization Board
FSBR – Flight Standardization Board Report
FSIRP – Flight Standards Inspector Resource Program
FSTD – Flight Simulator Training Device
FTD – Flight Training Device
HTAWS – Helicopter Terrain Awareness Warning Systems
ICAO – International Civil Aviation Organization
IFR – Instrument Flight Rules
IMC – Instrument Meteorological Conditions
MDA – Minimum Descent Altitude
MFD – Multifunction Display
MMEL – Master Minimum Equipment List
NAS – National Airspace System
NPRM – Notice of Proposed Rulemaking
NM – Nautical Mile
NSP – National Simulator Program
NTSB – National Transportation Safety Board
PDP – Pilot Development Program
PIC – Pilot in Command
PFD – Primary Flight Display
POI – Principal Operations Inspector
PTS – Practical Test Standards
PV – Present Value
QPS – Qualification Performance Standards
RPA – Rules of Particular Applicability
SARPs – Standards and Recommended Practices

SFAR – Special Federal Aviation Regulation
SIC – Second in Command
SOE – Supervised Operating Experience
SVO – Simplified Vehicle Operations
TAPL – Technically Advanced Powered-Lift
TAWS – Terrain Awareness and Warning System
TC – Type Certificate
TCE – Training Center Evaluators
TCDS – Type Certificate Data Sheet
VFR – Visual Flight Rules
VTOL – Vertical Takeoff and Landing

I. Executive Summary

Operations with powered-lift are anticipated to offer benefits over traditional aircraft in the airplane and rotorcraft categories. A report published by the U.S. Government Accountability Office states that many of the aircraft in this new powered-lift category could be easier to design, simpler to construct, less complicated to maneuver, quieter to fly, and more economical to operate compared to traditional aircraft.[1] Many use cases are envisioned for these aircraft, and this rulemaking is a step toward those use cases coming to realization. The FAA describes just a few of the use cases below.

Smaller versions of these aircraft may reduce travel times in congested areas for passengers by allowing for more efficient transportation compared to existing ground transportation methods. To do so, these aircraft would use vertiports located on top of buildings, at parking facilities, or in other open areas.[2] Such transportation could occur from these locations and then proceed at speeds and ranges similar to turboprops. Some powered-lift could also be capable of transporting heavier loads at higher altitudes and faster cruise speeds than a

[1] Transforming Aviation: Stakeholders Identified Issues to Address for 'Advanced Air Mobility' | U.S. GAO.
[2] Vertiport Assessment and Mobility Operations System (VAMOS!) | T2 Portal (nasa.gov) A vertiport refers to a physical structure for the departure, arrival, and parking/storage of advanced air mobility vehicles. Evaluation factors for vertiports include zoning, land use, transit stations, fire stations, noise, and time-varying factors like congestion and demand.

traditional rotorcraft. Such capability may increase efficiency in transporting crew and material to remote locations such as offshore oilrigs. Other use cases may involve medical response, disaster relief, rescue operations, border patrol, and last-mile logistics.

The introduction of powered-lift as an entirely new category of civilian aircraft creates unique challenges for the training and certification of airmen and the development of operational rules. This final rule is a step toward enabling the ecosystem for this industry to evolve. It applies the appropriate set of rules for a range of certificate-holder operations conducted with powered-lift and for certification of the pilots that would fly them. The intent of the final rule is mitigating risk to the NAS while maintaining its current level of safety.

The SFAR can generally be grouped by those rules affecting airman certification and operating rules under parts 61, 91, 97, 135, 141 and 142.[3] To address the significant operational differences between each powered-lift, the FAA will require the pilot in command (PIC) of a powered-lift to hold a type rating on their pilot certificate for the aircraft. The FAA has determined that requiring persons to hold type ratings for powered-lift will establish the appropriate level of safety by ensuring persons receive adequate training and are tested on the unique design and operating characteristics of each powered-lift.[4] In addition, the final rule adopts several pathways to certificate powered-lift pilots utilizing aircraft with a single flight control and single pilot station, which was not proposed in the NPRM. It also adopts certain alternate provisions to facilitate supervised operating experience in a powered-lift with a single

[3] Part 91 (General Operating and Flight Rules); part 97 (Standard Instrument Procedures); part 135 (Operating Requirements: Commuter and on Demand Operations and Rules Governing Persons on Board Such Aircraft); part 136 (Commercial Air Tours and National Parks Air Tour Management); part 141 (Pilot Schools); and part 142 (Training Centers).

[4] Official FAA forecasts related to the operation of powered-lift in the NAS have yet to be developed. Thus, a forecast for the number of pilots expected to conduct operations under part 135 or part 91 was prepared solely to estimate costs imposed by this SFAR. These costs include adding a type rating for powered-lift to an airman certificate. Forecasts were developed using publicly available data related to orders and options for powered-lift.

set of controls and a single pilot seat and revises current requirements for instructor training to provide a feasible pathway for approved part 135 training programs, pilots, instructors, and check airman operating only with one pilot station and/or set of flight controls.

For certification of airmen with a powered-lift category, instrument, and type rating, the FAA will allow alternative aeronautical experience and logging requirements from those currently reflected in the regulations. Providing further relief than provided for in the proposal, the final rule reduces the commercial pilot-in-command (PIC) flight time in a powered-lift from 50 hours to 35 hours, of which 15 hours may still be in a Level C or higher full flight simulator (FFS).

For the operational rules, the FAA will apply specific airplane, rotorcraft, or helicopter rules to powered-lift, as appropriate. The SFAR now permits the use of helicopter minimums for IFR fuel requirements and VFR visibility requirements for those powered-lift meeting performance criteria. In addition to powered-lift specific rules, this action will also affect some broader aircraft regulations pertaining to practical tests in aircraft that require type ratings, including airplanes and helicopters; training center rotorcraft instructor eligibility, training, and testing requirements; and training center use of rotorcraft in flight instruction.

The following table presents a summary of the estimated monetized costs of this rule, as well as estimates for the pessimistic and optimistic scenarios. The monetized costs include those that would require individuals to hold an airman's certificate with a type rating for the powered-lift flown, costs for the provision of dual-control aircraft or full flight simulators for training, and costs for the minimum fuel reserve requirement. For the primary estimate, over a 10-year period of analysis, this rule would result in present value costs at a two percent discount rate of

approximately $914.2 million, with annualized costs of about $101.8 million using the same discount rate.[5]

Table 1: Monetized Costs of SFAR (Millions $)

Forecast Scenario	10-Year Present Value (2%)	Annualized (2%)
Base - Primary Estimate	$914.2	$101.8
Pessimistic	$865.5	$96.4
Optimistic	$966.1	$107.6

II. Need for Regulation

Industry has developed new powered-lift varying widely in complexity of operation in place of the models of powered-lift contemplated in the 1990s. Today, powered-lift manufacturers are proposing types of operations the FAA had not conceptualized in 1997, such as transporting crew and material to offshore oil rigs, transporting passengers from point-to-point as an air ambulance, transporting passengers in concentrated urban environments, and more complex unmanned[6] operations.[7] The introduction of powered-lift as an entirely new

[5] The appendix presents tables of monetized costs on an annual basis for years 1-10, the time horizon for which costs for the rule are estimated. Monetized costs for the rule stem from the cadence of aircraft deliveries. In the optimistic scenario, aircraft deliveries are forecast to begin in year 1 and continue through year 10. Aircraft deliveries for the base scenario are forecast to occur during years 2-10, and in the pessimistic scenario during years 3-10. As a result, costs for the optimistic scenario accumulate over a period of 10 years versus the base and pessimistic scenarios, over which costs accumulate for a period of 9 years and 8 years, respectively.

[6] The FAA notes that this rulemaking only enables manned operations of powered-lift at this time.

[7] In 1997, the FAA published the Flight Instructor, Ground Instructor, and Pilot School Certification Rules; final rule, 62 FR 16220 (Apr. 4, 1997). This rule introduced the powered-lift category into the airmen certification rules and various other parts of the regulations. In response to commenter concerns, the FAA reasoned that the regulations were necessary because pilot certification standards at that time did not adequately reflect the powered-lift certification requirements and were not drafted with the intent of certificating powered-lift pilots. The FAA emphasized that its regulations must evolve to accommodate advancements in aviation technology and considered the introduction of powered-lift as an aircraft category to be a necessary first step in building a regulatory framework for powered-lift.

category of civilian aircraft creates unique challenges for the training and certification of airmen and the development of operational rules.

It is anticipated that the finalized rule will enable operators to conduct powered-lift operations on a scale that will be commercially viable. In the current state, three problems exist that will prevent this outcome. The first problem is that a safety gap in operations conducted with powered-lift would be introduced to the NAS. The second problem is the existing airmen certification regulations would hinder civilian pilots from obtaining powered-lift ratings in numbers to scale to operations desired by industry. The third problem is the current rating required on an airman certificate to be eligible to operate powered-lift does not address the kinds of powered-lift anticipated for the civilian market. The following paragraphs describe the inadvertent consequences absent this finalized rule.

A. Airman Certification

Although the FAA has existing regulations in part 61 for training and certificating powered-lift flight instructors and pilots, those regulations do not adequately address the unique challenges of introducing a new category of aircraft to civil operations. First, the existing regulations did not anticipate the diversity in design of the powered-lift that are beginning to work through the aircraft certification process. Currently, a pilot is required to hold only a powered-lift category rating on their pilot certificate to operate a powered-lift. The generalized training requirements based on the powered-lift category do not sufficiently address the unique characteristics of each powered-lift that requires specific aircraft training and evaluation to determine pilot competency in flying the aircraft.

Second, the existing aeronautical experience requirements for powered-lift contain challenges for training and certificating the initial groups of powered-lift pilots. Typically, a

person interested in becoming a professional pilot follows an incremental path that builds piloting skills through an iterative series of training with a flight instructor, accumulation of flight experience, and successful completion of a practical test with a designated examiner. A person generally begins as a student pilot under strict limitations, obtains a private pilot certificate with limited privileges, builds flight time as a private pilot, trains and tests for a commercial pilot certificate with expanded privileges, and finally builds flight time as a commercial pilot toward the hours needed for the airline transport pilot certificate, which is necessary to serve as a PIC in certain air carrier operations under parts 121 and 135.

The operation of powered-lift for commercial purposes requires a different approach than the standard building block approach to flight training and certification that has typically worked for other categories of aircraft. This is because a person would face substantial difficulties obtaining the necessary flight training for a powered-lift commercial pilot certificate under the existing regulations due to the low number of existing qualified flight instructors, the lack of any FAA-certificated powered-lift, and the number of hours the current regulations require a person to have in a powered-lift aircraft to be eligible for a commercial pilot certificate. In addition, the regulations for certain commercial operations in part 135 do not contain specific requirements addressing qualifications for powered-lift pilots, which creates a safety gap when compared to the part 135 requirements for pilots of airplanes and helicopters.

The industry's intention to introduce these aircraft immediately into passenger-carrying commercial operations upon aircraft certification necessitates a reevaluation of the existing airman certification regulations for powered-lift and the development of specific regulations for pilots in part 135. The FAA requires, and the public expects, that commercial operations be

conducted with the highest regard for safety and by pilots who have extensive experience flying the particular category of aircraft in which paying passengers will be transported.

B. Operational Requirements

Regulatory requirements that apply to "aircraft" encompass all categories of aircraft, including powered-lift. Accordingly, these provisions currently apply to powered-lift. However, if powered-lift were introduced into the civilian market today, there would be a safety gap due to the lack of specificity in the Code of Federal Regulations regulating powered-lift operations. In other words, rules that are specific to a category or class of aircraft, such as airplanes or helicopters, do not apply to powered-lift. For example, the minimum safety standards established by the FAA specifically for airplanes and rotorcraft operations would not apply to powered-lift. Consequently, the lack of specificity in the regulations, as it relates to powered-lift, creates a safety gap because powered-lift would be able to conduct some operations similar to those conducted with airplanes and rotorcraft, but without adhering to safety standards that airplanes and rotorcraft are required to adhere to.

Provisions in parts 43 (Maintenance, Preventive Maintenance, Rebuilding, and Alteration), 91 (General Operating and Flight Rules), 97 (Standard Instrument Procedures), 135 (Operating Requirements: Commuter and on Demand Operations and Rules Governing Persons on Board Such Aircraft), and 136 (Commercial Air Tours and National Parks Air Tour Management) include regulatory requirements applicable to "aircraft." As previously mentioned, powered-lift are required to adhere to rules specific to "aircraft." However, these parts also have regulations specific to airplanes, helicopters, and/or rotorcraft. For the reasons stated in the previous paragraph, powered-lift would be able to conduct operations under some

of these parts without following a minimum set of safety standards simply because the FAA has not established minimum safety standards for powered-lift.

III. Summary of Final Rule

In this final rule, the FAA finalizes a temporary SFAR alongside a few limited permanent regulatory changes to authorize powered-lift operations safely. The FAA considers a SFAR to be the optimal regulatory pathway to incorporate powered-lift.[8] The FAA has previously used SFARs when it lacks sufficient experience with new operations. SFARs allow for temporary operations under conservative safety approaches, enabling both the FAA and industry to observe these operations and make safety improvements in subsequent permanent changes to the regulations. Therefore, the FAA anticipates this SFAR will allow for data collection and a better understanding of what a comprehensive permanent regulatory framework should encompass.

The FAA conducted a comprehensive review of the operational rules, taking into consideration the anticipated capabilities of powered-lift and the lack of operational data. Each rule was evaluated to determine whether the airplane or the rotorcraft/helicopter provisions would maintain a level of safety for powered-lift operations as is provided in the current rules. Based on this review, the FAA asserts that the finalized provisions will maintain an equivalent level of safety for operations conducted in powered-lift to those conducted in airplanes, rotorcraft, or helicopters.

[8] The FAA considered other options to the finalized rule. These options are discussed in Section "X. Discussion of Alternatives."

By leveraging the established regulatory structure, the FAA will temporarily remove operational barriers and mitigate safety risks for powered-lift operations. Further detail is provided in the final rule preamble.

A. Airman Certification

To maintain a level of safety commensurate with that for airplanes and helicopters, the FAA is finalizing, first, the requirement for pilots to hold a type rating for each powered-lift they seek to operate and, second, qualification requirements for powered-lift pilots serving in part 135 operations. To address the obstacles to airman certification in existing regulations, the FAA is providing alternatives to certain requirements in part 61 to facilitate the training and certification of the initial cadre of powered-lift instructors and powered-lift pilots. Additionally, the final rule will add three options to facilitate pilot certification in a powered-lift with single functioning flight control and a single seat.

1. Type Rating

The powered-lift coming to the civilian market have complex and unique design, flight, and handling characteristics with varying degrees of automation. Because each powered-lift can have different configurations, unique inceptors, diversified flight controls, and complicated and distinctive operating characteristics, the FAA has determined that, unlike airplanes and rotorcraft, it is not feasible to establish classes within the powered-lift category at this time. As such, the FAA will require pilots to hold a type rating for each powered-lift they fly. This will ensure that the PIC has received specific training on the unique aspects of each powered-lift and demonstrated proficiency during a practical test before an examiner.

5. Flight Instructors

The FAA recognizes that, once the first powered-lift achieve type certification, there will be an insufficient number of qualified flight instructors to provide training to the pilots who will need to obtain certificates and ratings necessary to serve in powered-lift operations. For this reason, the FAA will allow certain pilots employed by the manufacturer to obtain the necessary training and experience for powered-lift through the test flights and crew training activities necessary for aircraft certification. Once these manufacturer-employed pilots obtain the necessary ratings, they will form the initial cadre of instructors. These instructors will then conduct certification training in the manufacturer's aircraft for certain instructor personnel at part 141 pilot schools, part 142 training centers, and part 135 operators. These instructors will then develop the training program for the initial powered-lift training at their respective organizations (i.e., under part 135, 141, or 142).

6. Pilots

Even with sufficient qualified flight instructors, the existing airman certification rules for powered-lift present obstacles for persons seeking to accomplish the training and experience necessary to obtain the certificates and ratings for commercial operations. In response to industry concerns, the FAA will allow alternate requirements to meet PIC flight time and cross-country flight time requirements in part 61 and expand the opportunity for pilots to obtain powered-lift ratings at the commercial pilot certificate level through part 135 training programs. In most cases, the alternative requirements would be available only to pilots who already hold a commercial pilot certificate and an instrument rating for another category of aircraft. In addition, although no FSTDs representing powered-lift are currently qualified, the FAA

anticipates near-term qualification of such devices and will allow increased flight training opportunities through simulation.

Further, the FAA asked questions in the NPRM on how pilots could be certificated with an aircraft that only employs a single functioning flight control and single pilot seat. In response to industry, the FAA also added three additional provisions as options for a manufacturer to meet the requirements of part 61 and part 194 in these aircraft.

7. Part 135 Pilot Qualifications

This final rule will enable powered-lift operations in part 135 and makes permanent changes to training and qualification requirements for pilots to align with the requirements established for pilots of airplanes and rotorcraft in part 135, as well as adopts necessary facilitating provisions within the SFAR. These amendments include ATP certification and operating experience in make and model of powered-lift for PICs in commuter operations, part 121 training requirements for pilots who serve in commuter operations in certain powered-lift, and instrument ratings for all powered-lift pilots in part 135 operations. In addition, by allowing a part 135 operator to develop and provide training for powered-lift pilot certification at the commercial pilot level, the FAA will also permit successful completion of part 135 pilot checks to be used to meet the practical test requirements for powered-lift ratings subject to certain conditions.

8. Dual Controls

The FAA noted in its proposal that it was retaining the powered-lift category and proposed alternate aeronautical experience and logging requirements to allow certain groups of pilots to attain the necessary experience required to add those additional ratings to their

certificates. However, pilots would still be required to receive training to obtain the ratings required for a specific powered-lift. Therefore, any in-aircraft flight training would require the powered-lift to have a dual set of controls for flight training as stipulated in § 91.109.

After consideration of the comments received, this final rule adopts three pathways to enable the use of a powered-lift without dual controls for flight training. The first pathway permits flight training in a powered-lift equipped with a single functioning flight control accessible by both the student and instructor. The second pathway permits for powered-lift certificated with a single functioning flight control and single pilot station that 100% of the flight training can be accomplished in a full flight simulator that is combined with in-aircraft solo aeronautical experience. The third pathway permits, based on future advancements in technology, the FAA to issue deviation authority to facilitate flight training in a powered-lift with a single functioning flight control.

9. Impacts to Rotorcraft Training at Part 142 Training Centers

To fully enable powered-lift training using FSTDs at part 142 training centers, the FAA will implement permanent changes that, in addition to establishing requirements for powered-lift, would affect certain part 142 training in FSTDs that represent rotorcraft. These changes will harmonize requirements for airplanes, powered-lift, and rotorcraft in part 142 regarding training in an FSTD that represents large or turbo-jet powered aircraft. Additionally, where certain regulations require an instructor to meet certain aeronautical experience requirements, this final rule adds the option of holding the applicable certificate to account for programs where the FAA has approved reduced aeronautical experience prerequisites (i.e., under part 141 and new part 194). In some instances, a global change to incorporate powered-lift also incorporated

rotorcraft. These changes will provide additional flexibility to training and qualification for rotorcraft instructors, consistent with allowances for airplane instructors, and provide training and testing for rotorcraft instructors that is more specifically focused on rotorcraft, instead of airplanes.

B. Operational Requirements

To mitigate the safety gaps that exist due to the absence of operational regulations specifically applicable to powered-lift, the SFAR will apply specific airplane, rotorcraft, and helicopter rules contained in parts 43, 91, 97, 135, and 136 to powered-lift as appropriate.[9] The FAA conducted a comprehensive review of the operational rules, taking into consideration the anticipated capabilities of powered-lift. Each rule was evaluated to determine whether the airplane or the rotorcraft/helicopter provisions would maintain a level of safety for powered-lift operations as is provided in the current rules. Based on this review, the FAA asserts that the finalized provisions will maintain an equivalent level of safety for operations conducted in powered-lift to those conducted in airplanes, rotorcraft, or helicopters.

For purposes of maintenance, preventive maintenance, rebuilding, and alteration, the FAA will apply the current requirements under part 43, with only two modifications. First, the FAA will apply the preventive maintenance requirements available to certificate holders operating rotorcraft under part 135 in remote areas. Second, in lieu of complying with § 43.15(b), each person performing an inspection required by part 91 on a powered-lift, must inspect "critical parts" in accordance with the aircraft maintenance manual or Instruction for

[9] Part 43 (Maintenance, Preventive Maintenance, Rebuilding, and Alteration); Part 91 (General Operating and Flight Rules); Part 97 (Standard Instrument Procedures); Part 135 (Operating Requirements: Commuter and on Demand Operations and Rules Governing Persons on Board Such Aircraft); and Part 136 (Commercial Air Tours and National Parks Air Tour Management).

Continuous Airworthiness (ICA), or as otherwise approved by the Administrator. The SFAR requires the term "critical part" to have the same meaning as provided in §§ 27.602 and 29.602.

C. International Operations of Powered-Lift

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to conform to International Civil Aviation Organization (ICAO) Standards and Recommended Practices (SARPs) to the maximum extent practicable. This final rule amends part 61 to require powered-lift pilots to have a type rating, which meets the standards outlined in ICAO Annex 1, Personnel Licensing. A powered-lift category and type rating will be completed during a course of approved training (i.e., parts 135, 141, or 142).

As discussed in the preamble for the NPRM, the FAA duly considered implementation of section 2.1.1.4 from ICAOs Annex 1 and declined to disrupt the traditional airman certification framework by the addition of a type rating for a wholly different category of aircraft rating to an existing certificate with a different category rating. The FAA concedes that those regulations do not adequately address the unique challenges of introducing a new category of aircraft to civil operations. Therefore, through this SFAR, the FAA chose to facilitate alternative measures for a pilot to directly receive a powered-lift category rating and a powered-lift type rating. Similar to conditions set forth in ICAO's transitional recommendation, these alternative measures to receive a powered-lift category and type rating would be completed during a course of approved or proposed training curriculum and would take previous experience of an applicant in an airplane or helicopter into account, as appropriate. Additionally, the FAA notes that ICAO Annex 1 does not forego the powered-lift category completely but gives the temporary option of an alternate means for a member state to implement the powered-lift category.

The FAA maintains that while powered-lift vary widely within the respective category, they are essentially a hybrid between an airplane and a helicopter with a distinct foundational set of characteristics.[10] Therefore, assurance of proficiency in those characteristics is an essential element of airman training that may be lost if a type rating, with no minimum flight hour or flight training requirement before testing for such rating,[11] is simply added to an existing airplane or helicopter rating. While these pilots have significant prior experience operating in the NAS by virtue of holding a certificate with an airplane category rating or rotorcraft category, helicopter class rating, the experience is not tailored to powered-lift operations.

Under parts 91 and 135, the FAA requires U.S. operators to comply with ICAO Annex 2, Rules of the Air. ICAO Annex 8, Airworthiness of Aircraft, is silent on powered-lift; however, the FAA designates powered-lift as special class aircraft for type certification in accordance with § 21.17(b) and applies airworthiness criteria that meet an equivalent level of safety to the FAA's existing airworthiness standards and are consistent with the intent of ICAO Annex 8 to the Chicago Convention. Accordingly, U.S. operators of powered-lift that are type-certificated with a standard airworthiness certificate and conduct their operations in accordance with the standards outlined in Annex 2 will be eligible to operate over the high seas and over national territories to the extent that they do not conflict with the rules of the State over which

[10] See 14 CFR 1.1, *Powered-lift* definition: a heavier-than-air aircraft capable of vertical takeoff, vertical landing, and low speed flight that depends principally on engine-driven lift devices or engine thrust for lift during these flight regimes and on nonrotating airfoil(s) for lift during horizontal flight.
[11] 14 CFR 61.63(d).

they are flying.[12] While in foreign airspace, operators must follow the rules and regulations of those countries as specified in §§ 91.703 or 135.3 and ICAO Annex 2.

IV. Baseline

At present, the only operating rules applicable to type-certificated powered-lift are those specific to "aircraft," which introduces a substantial safety gap in parts 91 and 135 operations. This safety gap does not exist for parts 91 and 135 operations conducted with airplanes, helicopters, and rotorcraft because decades of FAA rulemaking has resulted in a continuum of rules establishing minimum safety standards for operations conducted with these aircraft. A similar suite of category-specific rules simply does not exist for powered-lift because these are new and novel aircraft that have yet to be type-certificated for operations in the NAS. Absent this rulemaking, type-certificated powered-lift could operate in the NAS but many of the FAA's safety regulations would not apply to those aircraft—powered-lift would not be required to operate at the level of safety required of operations conducted with airplanes, helicopters, or rotorcraft. For example, the existing right-of-way rules for converging aircraft under § 91.113(d) would not apply to powered-lift, which would create uncertainty and inevitable confusion for other aircraft operators when they encounter a powered-lift in the NAS. The FAA's application of knowledge gained from studying previous aviation accidents and their root causes is done so with the intent of mitigating future powered-lift incidents and accidents, subsequently preventing injury and saving lives.[13] The second problem absent this rulemaking

[12] Incorporation by Reference of ICAO and Annex 2; Removal of Outdated North Atlantic Minimum Navigation Performance Specifications. 82 FR 39660 (Aug. 22, 2017).

[13] Powered-lift are new and novel aircraft that operate similarly to airplanes or rotorcraft depending on flight mode. As the introduction of powered-lift to the NAS evolves, the FAA will work with industry to

is from the challenges presented by the existing airmen certification regulations. Unlike the extensive infrastructure in place for the training and certification of airplane and rotorcraft pilots and instructors, the resources to scale powered-lift training and certification of pilots and instructors is lacking due to the lack of powered-lift flight instructors and FAA-certificated aircraft available for airman training and testing (and operations).[14] Without this rulemaking, civilian pilots would be unable to obtain powered-lift ratings necessary for industry to scale operations intended for these new and novel aircraft once a powered-lift achieves type certification, resulting in stunted operational growth.[15] This would obstruct industry's intention to introduce these aircraft immediately into commercial operations.

The third problem absent this SFAR are the requirements for acting as PIC of a powered-lift operation. Should type-certificated powered-lift become available before this rule is finalized, individuals holding an airman certificate with a powered-lift category rating would be permitted to act as PIC of powered-lift operations. Taking into consideration the variation in operating characteristics for each powered-lift coming to the civilian market, a powered-lift category rating would not adequately prepare an individual to act as PIC of a powered-lift operation.

identify potential hazards and safety problems to mitigate these hazards. At this time, FAA does not have data pertaining to the operation of these aircraft under part 91 or part 135 from which to determine the number of incidents or accidents that may be mitigated or lives that would be saved.

[14] The predominant categories of aircraft (i.e., airplane and rotorcraft) that operate in the NAS today have been in existence for over 80 years. There are currently over 470,000 certificated pilots (other than student pilots) including over 100,000 commercial pilots and 163,000 ATPs. Most importantly, there are over 121,000 certificated flight instructors. These flight instructors form the backbone of the civil airman framework. Currently, the FAA has certificated 759 powered-lift pilots and 365 powered-lift flight instructors.

[15] The only pilots who currently hold powered-lift ratings on their pilot certificates are military pilots who qualified for the rating under § 61.73 based on their military pilot qualifications.

Ensuring every pilot receives a type rating to act as pilot-in-command (PIC) reduces risk in the airspace by ensuring pilots have the skills, knowledge, and judgment to safely operate an aircraft. Discussed below are a few ways ensuring the PIC is properly rated helps mitigate risks.

Enhanced Training and Knowledge: Pilots undergo rigorous training that covers various aspects of flight operations, including aerodynamics, navigation, weather, and emergency procedures. This comprehensive training ensures that pilots are well-prepared to handle different situations that may arise during a flight.

Risk Management: A significant part of obtaining a type rating involves learning about risk management. Pilots are trained to identify potential hazards, assess risks, and implement strategies to mitigate them. This proactive approach helps in preventing accidents and incidents.

Regulatory Compliance: Pilots who complete type training and certification are well-versed in aviation regulations and standards. They ensure that all flight operations comply with these regulations, which helps in maintaining a safe and orderly airspace.

Continuous Learning and Recurrent Training: To maintain proficiency, pilots must undergo recurrent training and assessments. This continuous learning process ensures that pilots stay updated with the latest safety practices and technological advancements.

V. Changes to Regulatory Impact Analysis Since Proposed Rule

The FAA updated its regulatory impact analysis to reflect changes incorporated into the final rule and to provide responses to entities that commented on the regulatory impact analysis. A comprehensive list of changes to the proposal, and their economic impact, are presented in

Section IX. Summary of Economic Impacts of Finalized Rulemaking. The preamble of the final rule provides an in-depth discussion of each of the regulatory text changes.

Presented below is a summary of updates to the monetized costs of the final regulatory impact analysis for the finalized SFAR.[16] These updates are based on comments to the regulatory impact analysis to the SFAR.

- The estimated number of pilots required to operate the powered-lift fleet in the proposed rule did not account for pilot leave and pilot turnover. The forecast is revised to account for these factors.[17]
- The cost due to the impact on useful battery life resulting from the minimum fuel-reserve requirement are monetized for the finalized rulemaking.
- The cost for the provision of dual-control aircraft or full flight simulators for training purposes

V. Key Assumptions and Data Sources

The analysis for the regulatory evaluation is based on the following assumptions and data sources.

- The FAA uses a 10-year period of analysis.[18] The analysis uses 2022 constant dollars. Year 1 of the period of analysis, which would correlate with the effective date of the finalized SFAR, is used as the base year.

[16] Not all changes to the final regulatory impact analysis are monetized. However, they are identified in summary tables contained within this analysis, along with the economic impact of the change.
[17] A commenter to the regulatory impact analysis noted that the number of pilots that would be required to operate the powered-lift entering the fleet was underestimated. The proposed forecast of pilots failed to account for days not worked (such as for sick leave, holidays, vacation, training, etc.,), and pilot turnover.
[18] In addition, the FAA acknowledges uncertainty in estimating incremental impacts of this finalized SFAR since the FAA has yet to type-certificate a powered-lift.

- The analysis provides a range of costs from low to high. The FAA considers the primary estimate of costs to be the base scenario.
- It is estimated that it would cost an individual approximately $22,124 to accomplish the training and testing required for a type rating. The FAA anticipates that in many circumstances, this training and testing would be at the expense of an operator using powered-lift in its operations.
- To forecast the number of pilots required to operate the powered-lift fleet, the FAA used a model published by the NBAA. The model estimates the number of pilots required to operate a fleet of aircraft based on days of operation annually.[19] To account for pilot turnover, a rate of 8.9 percent, annually, is used.[20]
- The estimated battery life for an eVTOL is 1,600 hours.[21] The cost per battery is $60,000.[22]
- It is estimated that 20 dual-control aircraft (at a cost of $3.9 million per aircraft) or 60 full flight simulators (at a cost of $10 million per simulator) will be required for the provision of training.[23]
- Operational rules under parts 91, 97, 135, and 136 that are applicable to aircraft continue to be applicable to powered-lift because powered-lift meet the definition of an aircraft in 14 CFR 1.1. Otherwise powered-lift follows airplane or rotorcraft/helicopter rules in most instances.

[19] 2016-01-nbaa-management-guide PDF (nbaa.org). See Figure 1.5 on page 1-18.
[20] https://www.ntsb.gov/news/events/Documents/aviation_pro-Lovelace-NTSB-Professionalism-Forum.pdf
[21] https://www.sciencedirect.com/science/article/pii/S2542435121002051
[22] https://aerospaceamerica.aiaa.org/features/faith-in-batteries/
[23] Source: NERA Economic Consulting – Expert Report of Christian M. Dippon, PhD on behalf of Supernal. August 14, 2023. This report estimates 50 dual-control aircraft will be required for the provision of training over the ten-year period of the SFAR https://www.regulations.gov/comment/FAA-2023-1275-0062.

- The FAA uses a two percent discount rate to quantify present value costs. The appendix presents present value costs at three percent and seven percent present value discount rates[24]

[24] OMB Circular A-4, *Regulatory Analysis* (2023), https://www.whitehouse.gov/wp-content/uploads/2023/11/CircularA-4.pdf.

VII. Benefits

In the past, when the FAA has found that it lacks sufficient information regarding emerging operations to implement permanent regulations, the use of an SFAR has been an effective way to gain such experience while enabling some degree of operations. Such SFARs have typically temporarily enacted conservative safety approaches to emerging operations, allowing the FAA to observe those operations and subsequently make any requisite safety improvements in a later permanent change to the regulations.

The FAA considered other options to enable operations; however, for reasons discussed in the "Alternate Pathways" section, this SFAR is the most viable option to facilitate a pipeline of powered-lift instructors and pilots to enable powered-lift operations at this time. This approach is consistent with the stated intention of industry to immediately introduce these powered-lift into commercial passenger-carrying operations.

This section discusses the qualitative benefits proposed by this rulemaking and its use of a SFAR to facilitate powered-lift pilot certification and operations.

A. Narrows Safety Gap for Emerging Operations Conducted with Powered-Lift

The SFAR establishes a regulatory structure that narrows a safety gap that would exist for emerging operations conducted with powered-lift absent this final rule. As previously mentioned, absent this rulemaking, type-certificated powered-lift could operate in the NAS but many of the FAA's safety regulations would not apply to those aircraft—powered-lift would not be required to operate at the level of safety required of operations conducted with airplanes, helicopters, or rotorcraft. Generally, the provisions of the SFAR narrow the safety gap by applying the appropriate airplane and helicopter/rotorcraft rules to powered-lift. The FAA conducted a comprehensive review of the operational rules, taking into consideration the

anticipated capabilities of powered-lift and lack of operational data. Each rule was evaluated to determine whether the airplane or the rotorcraft/helicopter provisions would maintain a level of safety for powered-lift operations as is provided in the current rules. Based on this review and commenter input to the proposed SFAR, the FAA asserts that the provisions will maintain an equivalent level of safety for operations conducted in powered-lift to those conducted in airplanes, rotorcraft, or helicopters. For example, the existing right-of-way rules for converging aircraft under § 91.113(d) do not apply to powered-lift operators, which would create uncertainty and inevitable confusion for other aircraft operators when they encounter a powered-lift in the NAS. This uncertainty could lead to incidents or accidents. The SFAR closes that safety gap by clarifying how powered-lift fit into the right-of-way rules. As another example, the existing VFR minimum safe altitudes under § 135.203 do not apply to powered-lift because that regulation currently only applies to airplanes and helicopters. Without the SFAR, part 135 powered-lift operators would not be required to comply with the minimum safe altitudes, thereby creating serious risk for incidents and accidents in the NAS and to people on the ground. The SFAR creates a performance-based approach and applies § 135.203 to powered-lift depending on the aircraft's flight mode, thereby reducing risk of incidents or accidents because powered-lift are now required to comply with the minimum safe altitude requirements. FAA's application of knowledge gained from studying previous aviation accidents and their root causes is done so with the intent of mitigating future powered-lift accidents, subsequently preventing injury and saving lives.[25]

25 Powered-lift are new and novel aircraft that operate similarly to airplanes or rotorcraft depending on flight mode. As the introduction of powered-lift to the NAS evolves, the FAA will work with industry to identify potential hazards and safety problems to mitigate these hazards. At this time FAA does not have data pertaining to the operation of these aircraft under part 91 or part 135 from which to determine the number of accidents that may be mitigated or lives that would be saved.

B. Provides an Alternate Pathway to Airmen Certification

The FAA does not anticipate that the initial powered-lift that obtain type certification will be broadly available for basic airman training and certification at the private pilot level. Rather, manufacturers intend to produce powered-lift for commercial purposes, meaning the initial pilots will be required to hold at least commercial pilot certificates to act as required flight crew members (i.e., PIC or SIC) for compensation or hire. This situation disrupts the building block approach to flight training and certification that has traditionally worked for other categories of aircraft.

As there are no type-certificated civil powered-lift, a person would have difficulty obtaining flight training due to the low numbers of qualified flight instructors, and consequently would not have the required flight time in a powered-lift to be eligible for a commercial pilot certificate.[26] To address the obstacles to airman certification in existing regulations, the FAA is providing alternatives to certain part 61 requirements. These alternatives will facilitate the training and certification of the initial groups of powered-lift instructors and powered-lift pilots.

Such alternatives include allowing an applicant to meet reduced aeronautical cross-country experience, leveraging expertise of instructor pilots at the manufacturer rather than an authorized instructor under part 61, and allowing for the pilot groups in the SFAR to utilize alternate logging requirements when gaining the necessary experience towards their powered-lift ratings.

[26] The biggest obstacle to obtaining a new category rating at the commercial pilot certificate level is the required PIC time in the category because the only way to log PIC time when a person is not yet rated in the aircraft is as the sole occupant. All other logging requirements for PIC time require the pilot to be rated in the aircraft. When a person obtains a rating at the private pilot level, there is no requirement for PIC time, but a student pilot must accomplish 10 hours of solo flight time, which qualifies as PIC time. At the commercial pilot level, for someone not yet rated in the category of aircraft (i.e., someone adding a new category rating), most of the 50 hours of PIC time required in category must be accomplished as solo flight time. See 14 CFR 61.51(e).

In addition, after consideration of the comments received, the FAA is adopting three pathways to enable the use of a powered-lift without dual controls. The first pathway permits flight training in a powered-lift with a single set of flight controls accessible by both student and instructor (e.g., a throwover control). The second pathway permits 100% flight training in an FFS, with solo aeronautical experience in a powered-lift aircraft with a single set of flight controls, subject to certain conditions and limitations set forth in a new appendix to part 194. Finally, the third pathway permits the FAA to issue deviation authority to facilitate flight training in a powered-lift with a single set of flight controls in the NAS based on future advancements in technology.

C. Provides for Data Collection

The SFAR permits the FAA to gather data from powered-lift in civilian operations to better inform permanent regulations. The FAA anticipates gathering data and information through 1) regulatory requirements; 2) regular, formal, and informal interactions with the public, including conferences, data-sharing systems, and outreach initiatives; 3) the ARC to be established in accordance with section 955(c) of the FAA Reauthorization Act; and 4) informal anecdotal information and observations.

The FAA will also gather data and information from amendments to six existing information collections previously approved by the Office of Management and Budget. These information collections are identified below:

- OMB control number 2120-0701: Advanced Qualification Program Subpart Y to 14 CFR 121

- OMB control number 2120-0039: Operating Requirements – Commuter and on-Demand Operations
- OMB control number 2120-0600: Training and Qualification Requirements for Check Airmen and Flight Instructors
- OMB control number 2120-0663: Service Difficulty Report
- OMB control number 2120-0009: Application for Pilot School Certification
- OMB control number 2120-0021: Airman Certificate and/or Rating Application

The data collection will aid the FAA to better understand what a comprehensive permanent regulatory framework should look like.

D. Summary of Benefits

Notwithstanding that benefits of this rule have not been quantified or monetized, the FAA determines that the rule is beneficial. The benefits of the finalized rule and SFAR are summarized below in Table 2.

Table 2: Summary of Benefits of Final Rule

Benefit	Impact
Mitigates Risk and Narrows Safety Gap	• Establishes a regulatory structure that leverages airplane, helicopter, and rotorcraft rules to narrow a safety gap that would otherwise exist absent the rule. • Narrows safety gap for operations conducted with powered-lift to a level equivalent to similar operations conducted with airplanes and rotorcraft.
Data Collection	• Throughout the duration of the SFAR, the FAA will gather data and information to evaluate the temporary requirements to determine the most appropriate permanent rulemaking path for powered-lift. The FAA anticipates gathering data and information through 1) formal information collections, 2) regulatory requirements, 3) regular, formal and informal interactions with the public, including conferences, data-sharing

Benefit	Impact
	systems, and outreach initiatives; and 4) informal anecdotal information and observations.
Alternate pathway to pilot certification	• Introduces an alternate pathway for pilots to obtain powered-lift ratings on their commercial pilot certificates. • The powered-lift industry is nascent, and the timeframe in which commercial operations will become viable is unknown. A certain degree of operational growth is dependent on industry readiness, especially once the regulatory framework is in place via this final rule. It is anticipated that type certification of at least one model of powered-lift would occur within 12 months upon publication of the final rule.
Alternate pathway to pilot certification for powered-lift certificated with a single functioning flight control	• Provides operators that use a powered-lift equipped with a single functioning flight control three alternative pathways to accomplish the required training, testing, and supervised operating experience to meet the pilot certification requirements of part 61 and 194.

VIII. Costs

The costs imposed by the finalized rule provide for the integration of powered-lift into the NAS expeditiously without compromising safety. Generally, this SFAR would impose costs on individuals to have a type rating for the powered-lift flown and on powered-lift operators to adhere to operating rules that mirror requirements that have been applicable to operators of airplanes and rotorcraft for decades.

A. Operating Rules for Type-Certificated Powered-Lift

The SFAR applies certain airplane, helicopter, and rotorcraft operating rules to powered-lift to mitigate the safety gap that would otherwise exist upon type-certificated powered-lift emerging in the NAS. Currently, type-certificated powered-lift could operate under parts 91 and 135 but would only need to comply with rules that apply to "aircraft." This is different from other kinds of type-certificated aircraft, which are subject to many additional rules, such as those applicable to "airplanes," "helicopters," and "rotorcraft." Consequently, without this SFAR, powered-lift operations would not be conducted at an equivalent level of safety as those operations conducted with airplanes, helicopters, or rotorcraft.[27] While operators choosing to conduct operations with powered-lift will incur costs to comply with the operating rules finalized by this SFAR, these costs are on a scale equivalent to those costs incurred by operators that conduct operations with airplanes or rotorcraft under similar regulations.

[27] Data from the U.S. Helicopter Safety Team (a volunteer group of U.S. government and industry stakeholders formed to improve the safety of civil helicopter operations in the NAS) shows that in the 10 years from 2009-2018, the top three causes of fatal U.S. helicopter accidents resulted from: 1) Loss of Control – Inflight (22% of all fatal helicopter accidents), 2) Low Altitude Operations Object Strikes (19% of all fatal helicopter accidents), and inadvertent entry into instrument meteorological conditions (15% of all fatal U.S. helicopter accidents). This rule intends to mitigate the occurrence of these kinds of accidents (and accidents due to other causes) by applying certain operating rules applicable to helicopters to powered-lift. (Source: please see footnote 327 in the preamble for this rule).

The economic impact of each of the operating rules applicable to powered-lift due to this rule and other miscellaneous amendments are presented in Section X. Summary of Economic Impacts of Finalized SFAR.

B. Type Rating Requirement for Persons Seeking to Act as PIC of Powered-Lift

The FAA is finalizing the proposed revision of § 61.31(a) by adding new paragraph (a)(3). This amendment requires a person who acts as PIC of a powered-lift to hold a type rating for the aircraft flown. At present, the FAA does not find it feasible from a safety perspective to generalize the training requirements based solely on the categorization of powered-lift. In other words, the current training requirements wholly applicable to powered-lift based on a single category would not sufficiently address the unique characteristics of each powered-lift that require specific training and an evaluation to determine pilot competency, thus necessitating a type rating. Requiring persons to hold type ratings for powered-lift establishes the appropriate level of safety. The requirement ensures persons receive adequate training and are tested on the unique design and operating characteristics of each powered-lift.

The FAA solicited comments on the incremental cost for adding a type rating to an airman certificate with a powered-lift category rating. A commenter noted the FAA underestimated the population of pilots necessary to operate the fleet of aircraft anticipated to enter the powered-lift fleet.[28] For the cost estimates accompanying this final rule, the FAA has increased the population of pilots that would achieve a powered-lift type rating.[29]

[28] The commenter noted FAA pilot forecast was underestimated because it did not account for pilot leave (such as leave for vacation, sick leave, doctor appointments, and training) nor pilot turnover. The forecast in the proposed SFAR assumed that a pilot would be on duty 5 days a week, 52 weeks per year.

[29] See appendix A for the regulatory impact analysis. Appendix A contains the methodology for the pilot forecast used to estimate the cost for the requirement that a pilot-in-command hold a type rating for the aircraft flown.

To estimate the cost of the type rating requirement, the FAA developed a forecast of the number of pilots that would operate the powered-lift anticipated to enter into service over the period of the SFAR. Next, the pilot forecast was multiplied by the cost of a curriculum leading to an individual holding a type-rating for powered-lift, which is estimated to average approximately $22,124 per pilot.[30] Over the period of analysis, the nominal cost for this requirement is $92.9 million. Present value and annualized costs at a two percent discount rate are $81.2 and $9.0 million, respectively, for the same timeframe. The costs for pilots to be eligible for a type rating are presented annually in the table below.[31]

Table 3: Cost for Type Rating ($Millions) – Primary Estimate

DESCRIPTION	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
# of Ratings		80	99	472	531	612	657	701	523	524	4,199
Cost		$1.77	$2.19	$10.44	$11.75	$13.54	$14.54	$15.51	$11.57	$11.59	$92.90
2% PV											$81.16
2% Annualized											$9.04
This table displays the estimated number of "new" pilots required to operate the fleet of powered-lift anticipated to enter service during any one year of the analysis period. For illustrative purposes, in year 2, 80 type-rated pilots will be required to operate the powered-lift anticipated to enter service during that year; in year 3 an additional 99 type-rate pilots will be required to operate powered-lift entering into service that year.											

C. Minimum Fuel Reserve Requirement

The FAA proposed the 30-minute minimum fuel reserve requirement for airplanes operating under VFR be applicable to powered-lift. Based on commenter input the FAA has changed the minimum fuel reserve requirement for the finalized SFAR. The FAA is providing more flexibility by allowing powered-lift operators to use the helicopter minimum fuel reserve requirements if their powered-lift has the performance capability, as provided in the Aircraft Flight Manual, for the entire flight to conduct a landing in the vertical-lift flight mode. Any

[30] The FAA took a random sampling of training costs posted or advertised on several websites to calculate the average cost for training leading to a type rating (e.g., one website posted a cost of $10,000 to $30,000; a second website posted a cost of $13,495; a third website posted a cost of $25,000). Air travel to a training location is estimated to be $330, and per diem is $155 per night for fourteen nights (for an average cost of $22,124 per rating).
[31] Without this rule, an individual would be required to hold only an airman certificate with a powered-lift category rating to operate powered-lift. This rule requires an individual to incur the cost for achieving a type rating for each powered-lift operated.

powered-lift that cannot meet the performance-based criteria must operate under the airplane fuel reserve requirements.

For purposes of this analysis, it is determined that the powered-lift anticipated to enter the fleet over the 10-year forecast period would be able to meet, at a minimum, the performance-based criteria fuel requirement of 20 minutes established by the final rule.[32] Consequently, the FAA is estimating the cost of a fuel-reserve requirement using the performance-based criteria. However, the FAA emphasizes that the estimated cost for this provision is conservative. This is because the final rule allows for a deviation process as an alternative pathway to the fuel supply requirements. The FAA concludes that the deviation process could be beneficial to those powered-lift using non-traditional fuel sources. It is anticipated that some manufacturers of powered-lift may request a deviation that could allow for lower fuel-reserve requirements. As a result, actual costs for the fuel-reserve requirement could be lower than the estimates presented below.[33]

When the proposed SFAR was published, the FAA lacked data on the cost of fuel reserves for battery-operated powered-lift and requested comment for data or sources to aid with estimating the cost for this provision.[34] In response, a commenter stated that the minimum fuel reserve requirement disrupts optimal battery charging cycles, and as a result decreases useful

[32] In addition, there are deviation provisions that are also available whether operating under § 135.209(a) or (b). *See* § 194.306(rr) and (ss). These deviations allow for the use of the 20-minute fuel-reserve requirement for day and night operations.
[33] The FAA has determined a deviation will be available only to those powered-lift operating over specific routes that have predetermined suitable landing areas available. A suitable landing area under § 194.306(rr) and (ss) is an area that provides the operator reasonable capability to land without causing undue hazard to persons or property. These suitable landing areas must be site-specific, designated by the operator, and accepted by the FAA. This will ensure that any operation conducted with less than the prescriptive VFR fuel supply minimums will be conducted under a controlled environment. The FAA will evaluate each certificate holder's deviation request to determine if the proposed operation will maintain an equivalent level of safety as currently provided in the prescriptive rule.
[34] A majority of powered-lift coming to market are battery operated.

battery life for powered-lift. The commenter provided information that has aided the FAA to monetize the cost of a 20-minute minimum fuel reserve requirement.[35]

Over the ten-year period of analysis, the nominal cost for this requirement is $112.9 million. Over the same period, present value and annualized costs at a two percent discount rate are $96.6 and $10.8 million, respectively. The costs are presented on an annual basis in the table below.

Table 4: Incremental Cost for Increased Frequency of Battery Replacement Resulting from Minimum Fuel Reserve Requirement ($Millions) – Primary Estimate

Base Scenario	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Nominal Cost		$0.37	$1.12	$3.62	$7.67	$11.97	$16.42	$20.86	$24.25	$26.63	$112.91
2% Present Value											$96.57
2% Annualized											$10.75

D. Provision of Dual-Control Aircraft and Full Flight Simulators for Training

To meet the pilot certification requirements of parts 61 and 194, the proposed SFAR required that training be conducted in dual-control powered-lift with controls easily accessible by the student pilot and instructor.[36] For the final rule the FAA provides three alternative pathways from this requirement. The first alternative permits flight training in a powered-lift equipped with a single functioning flight control accessible by both the student and instructor.[37] The second alternative permits for flight training in full flight simulators that is combined with in-aircraft solo aeronautical experience. The third alternative permits the FAA to issue deviation authority to facilitate flight training in powered-lift with a single functioning flight control based on future advancements in technology.

[35] FAA used the commenter-provided model with adjustments. Please see appendix B for a detailed discussion showing the derivation of costs for this provision.

[36] These requirements are similar to those imposed performing training in airplanes and helicopters.

[37] The FAA finds extending mirrored relief to that as provided in § 91.109(a) and (b), and similar to that of EASA would not adversely affect safety for pilots seeking certification under the SFAR.

The FAA provides the alternative pathways to address concerns raised during the notice and comment period of the proposed rule. The concerns stemmed from the general belief by industry that powered-lift were to be type certificated using the airplane category. Thus, manufacturers designed powered-lift with a single set of controls with the understanding that training could be accomplished, in part, using airplanes with dual controls. The FAA lacked information at the time the proposed rule was prepared to estimate the cost for the requirement that training be conducted in a powered-lift equipped with dual controls, and subsequently requested information for the cost of the proposed requirement. One commenter provided an estimate for this requirement based on interviews conducted with industry experts.[38] The same commenter also provided information on the cost of full flight simulators for the provision of training. Information from the commenter has been incorporated into this analysis as a basis for determining costs for the training requirement.

Based on current powered-lift, Beta Alia and Leonardo AW-06, going through the certification process, the FAA determined for this analysis that two entities would pursue the provision of dual-control aircraft for training. Additionally, six commenters that represent manufacturers and training facilities advocated for full training and testing in full flight simulators. The FAA estimates that 10 entities would pursue the provision of full flight simulators for training based on these six manufacturers and training facilities in combination with 10 overall manufacturers identified in the Supernal comment. Based on the commenter's analysis, the FAA determined that powered-lift with dual controls for training and full flight simulators would be front loaded during the first two years coinciding with aircraft deliveries.

[38] Source: NERA Economic Consulting – Expert Report of Christian M. Dippon, PhD on behalf of Supernal. August 14, 2023. https://www.regulations.gov/comment/FAA-2023-1275-0062.

Thus, for the primary estimate it is determined that 20 powered-lift with dual controls and 60 full flight simulators would be available for pilot training, with 50 percent of those units available during year 2 of the 10-year analysis period and the remainder becoming available during year 3.

The commenter also provided information to estimate the cost for the provision of dual control aircraft. The commenter stated that a dual-control powered-lift is approximately 1.5 times the cost of a generic powered-lift. Thus, using publicly available data, the FAA estimated the cost for a generic powered-lift ranges between $1.2 million and $4.0 million, for an average of $2.6 million per aircraft.[39] Subsequently, multiplying the generic cost of a powered-lift ($2.6 million) by 1.5 results in a cost of $3.9 million per dual-control aircraft.

The FAA recognizes that it would be costly for a powered-lift that has already started the type certification process as a single-control aircraft to change course to be reconfigured with dual controls. In the final rule, the FAA acknowledges this dilemma by providing for alternative pathways for pilot training, including the provision for flight training in a full flight simulator combined with in-aircraft solo experience.[40] Toward that end, the FAA has incorporated cost data for full flight simulators from the same commenter that provided cost

[39] https://www2.deloitte.com/us/en/insights/industry/aerospace-defense/advanced-air-mobility-evtol-aircraft.html.

[40] Through these additional pathways, entities are enabled to choose a path that is most economically beneficial while still providing for an acceptable level of safety. It is not feasible for the FAA to quantify the cost of an OEM developing a dual control variant of their powered-lift because OEMs are in different phases of the type certification process, with vastly different powered-lift that have different propulsion and energy systems. Further, the FAA does not have data or estimates of the time and resources it may take for an OEM to develop a dual-control aircraft to take through the type certification process. Additionally, no entity currently working through the certification process provided cost estimates to certificate a dual control version of their powered-lift. Although in certain cases an OEM may incur extra cost to develop a level C FFS, it potentially could be less costly than an OEM restarting the type certification process with a dual control variant of their current powered-lift in production. Therefore, the FAA has only quantified the costs associated with development of a level C FFS and not what it would cost to develop a dual control variant of an OEM's particular powered-lift.

data for powered-lift equipped with dual controls. The commenter provided an estimate of $10 million per unit, with an additional cost of $4.79 million dollars for infrastructure to house the simulators (each structure would be capable of housing three simulators).

Over the ten-year period of the analysis, estimated costs using a two percent present value discount rate are $736.5 million. Annualized costs over the same period are $82.0 million (Appendix C contains detailed cost estimates using a three percent and seven percent discount rate.)

Table 5: Cost for Dual-Control Aircraft and Full Flight Simulators for the Provision of Training ($Mil.) – Primary Estimate

Primary Scenario	Year 1	Year 2	Year 3	Year 4	Total	2% PV
No. of Dual Control Aircraft		10	10		20	
No. of FFS		30	30		60	
No. of Buildings to House FFS		10	10		20	
Cost per Dual Control P/L ($3.9M)		$39.0	$39.0		$78.0	
Cost per FFS ($10 Mil.)		$300.0	$300.0		$600.0	
FFS Infrastructure Cost ($4.79M)		$47.9	$47.9		$95.8	
Total Cost		$386.9	$386.9		$773.8	$736.5
Annualized Cost						$82.0

The FAA notes a vast majority of the powered-lift undergoing FAA certification are flown and powered differently compared to their traditional counterparts. The FAA recognizes that providing alternative pathways for training enables the technology incorporated into these new and novel aircraft to be used advantageously. The FAA expects that entities select the training options most conducive toward economically and safely integrating powered-lift into the NAS.[41]

[41] For example, entities may determine that training using full flight simulators is as beneficial, and perhaps more so, than pursuing the traditional method of training in dual-control aircraft. These benefits arise from the ability to

E. Training Center Eligibility Requirements - § 142.47(a)(5)(ii)

The final rule will permanently amend certain language in § 142.47(a)(5)(ii). In the NPRM, the FAA proposed to impose the same standard for powered-lift and rotorcraft instructors providing training in an FSTD as those required for airplane instructors by replacing the word "airplane" with "aircraft" in § 142.47(a)(5)(ii). The FAA received broad opposition to this change in the inclusion of all powered-lift, because all powered-lift will require a type rating, as opposed to the criteria set forth in § 61.31(a) setting forth when a type rating is required for airplanes and helicopters. The FAA recognizes that the underlying reasons for establishing a type rating for all powered-lift do not substantially align with the reasons an airplane or helicopter may require a type rating under § 61.31, and therefore revised the requirements. Specifically, the final rule will extend the requirements of current § 142.47(a)(5)(ii) to rotorcraft requiring a type rating (as proposed), to "large" powered-lift (i.e., powered-lift of more than 12,500 pounds maximum certificated takeoff weight), and turbojet powered powered-lift.

In the 1996 final rule preamble the FAA simplified and consolidated instructor eligibility requirements into § 142.47 and therefore § 142.51 was no longer needed. The final rule preamble did not indicate the FAA intended to eliminate the requirement for rotorcraft instructors proposed in § 142.51(d). However, when the FAA consolidated the instructor eligibility requirements into § 142.47(a)(5)(ii), the regulation specified "airplane" instead of

create scenarios such as weather conditions, system failures, or emergencies that would otherwise be hazardous to replicate during actual flight lessons. As well, simulators provide a standardized training environment that helps to maintain high safety levels while ensuring that different trainee groups attain similar knowledge levels and skill sets. Flight simulators also have advanced data logging and recording capabilities that enable instructors to monitor pilots' performance in real time. Last, but not least, training using simulators can be more cost-effective than traditional methods as they allow for more organized schedules as several scenarios can be accomplished in shorter timespans.

"aircraft" and, thus, rotorcraft instructors were excluded from the requirements to meet the aeronautical experience requirements for an ATP certificate with a rotorcraft category rating, if providing training in an FSTD representing rotorcraft requiring a type rating. Consequently, a rotorcraft instructor would be eligible to provide training in a FSTD representing a rotorcraft requiring a type rating while holding a commercial pilot certificate in place of the aeronautical experience requirements of an ATP certificate with a rotorcraft category rating. In constructing the new language, the FAA found it inapt to change the language of § 142.47(a)(5)(ii) from "airplane" to "aircraft."

To accommodate this, the FAA would require instructors in airplanes *and* rotorcraft that require a type rating to hold the ATP experience, whereas instructors in powered-lift will be required to hold the ATP experience of § 142.47 when the powered-lift is greater than 12,500 pounds maximum certificated takeoff weight or those that are turbo-jet powered. This has the effect of including all *aircraft* that meet the "traditional" requirement for a type rating: large or turbo-jet powered. After surveying FAA inspectors with oversight of part 142 training centers, the FAA expects that few rotorcraft instructors do not already meet the enhanced requirements in § 142.47(a)(5)(ii). The FAA suggests that finalizing this permanent amendment would merely align industry practice with the regulatory framework and eliminate any possible confusion on the appropriate application of this section. To facilitate integration of this regulatory change while not disrupting current practice for those instructors who may not currently satisfy this standard, the FAA will except instructors that are currently instructing in a FSTD that represent a rotorcraft requiring a type rating from this requirement.

The FAA requested public comment on the proposed amendment to § 142.47(a)(5)(ii). In particular, the FAA requested feedback regarding the feasibility of complying with this

proposed amendment for individuals providing instruction in FSTDs that represent a rotorcraft requiring a type rating, including whether these requirements are ordinarily already satisfied. The FAA did not receive comment on this amendment as it pertains to the regulatory impact analysis.

F. Pilot in Command: Instrument Proficiency Check Requirements - § 135.297(g)(3)

Section 135.297(g) currently sets forth the checking requirements for a PIC authorized to use an autopilot system in place of a second in command (SIC). This section requires an autopilot check to be completed every 12 months during the PIC's instrument proficiency check required by paragraph (a). However, as written, subparagraph (g)(3) is applicable only to airplane PICs. In the proposed SFAR, the FAA asserted that the proficiency standard was applicable to any PIC using an autopilot in lieu of an SIC and therefore proposed a permanent change to apply subparagraph (g)(3) to all aircraft. The FAA notes that helicopter pilots that use an autopilot instead of an SIC must already complete an autopilot check during their instrument proficiency check under (g)(1) and (g)(2) and thus are accomplishing (g)(3). However, to provide sufficient time for existing rotorcraft operators to update their checking programs, if necessary, the FAA proposed a compliance date of six months after the effective date of the final rule.

The FAA requested comments on whether the proposal to change "airplane" to "aircraft" in § 135.297(g)(3) imposes costs that are other than minimal for part 135 certificate holders conducting helicopter operations, and should costs be other than minimal, the FAA requested supporting data detailing the incremental costs to update checking programs. The

FAA did not receive any comments on the alternate provision set forth by §135.297(g), and the final rule adopts the provision as proposed.

G. Equipage Requirements

Commenters noted that equipage requirements proposed by the SFAR add costs for the entities manufacturing and/or operating powered-lift. The FAA acknowledges these equipage requirements create costs that could include, but are not necessarily limited to, the purchase and installation of equipment, the decrease of aircraft performance due to added weight of required equipment, and the cost to perform required maintenance and repairs of equipment.

The FAA emphasizes that equipage requirements finalized by the rulemaking mitigate risk to the NAS with the purpose of averting injuries and fatalities and facilitating data collection in the event of incidents or accidents. For example, emergency locator transponders are essential for reaching survivors quickly to save lives. Likewise, terrain awareness warning systems provide pilots with aural and visual warnings of hazardous proximity to terrain. A final example are cockpit voice recorders and flight data recorders which provide critical insight into events culminating in an accident.

Equipage requirements of § 194.306 require a cockpit voice recorder for aircraft having a passenger seating configuration of six or more (excluding the pilot seat) and for which two pilots are required by certification (or a passenger seating configuration for 10 or for which one pilot is required). At present, there is only one powered-lift coming to market fitting these criteria - the AW-609 which is configured for nine passengers. For aircraft with passenger seating configured for 10 or more passenger seats, equipage requirements also include a flight data recorder. Additionally, for those powered-lift configured with 6 or more passenger seats, an HTAWS or an FAA-approved TAWS A/HTAWS hybrid system is required. At present, there

are no powered-lift configured for 10 or more passengers undergoing FAA certification. Emergency locator transmitters are required on powered-lift under § 194.302(w) regardless of seating configuration.[42] The FAA concedes that the equipage requirements impose costs, but that these costs are on a scale equivalent to those imposed on manufacturers and operators of airplanes and rotorcraft that are required to follow similar requirements.

H. Advanced Qualification Program

As discussed in the NPRM, the FAA determined that the same safety standard imposed in § 135.3(b) for commuter operations involving airplanes for which two pilots are required by type certification should apply to powered-lift requiring two pilots by type certification.[43] The safety standard requires these kinds of operations to comply with subparts N and O of part 121, which are multiengine airplane specific. However, the FAA is not revising part 121 at this time to accommodate powered-lift as part 121 operations are not anticipated during the period of the SFAR.[44] Therefore, to facilitate an appropriate level of training and checking for certificate holders conducting commuter operations under part 135 with powered-lift requiring two pilots by the type certificate, the final rule finalizes § 194.247(b) to create an alternative means of

[42] The cost for select equipment as provided on the internet and FAA rulemakings is as follows: Emergency Locator Transmitter - $600. (source: https://www.ainonline.com/aviation-news/general-aviation/2015-09-21/acr-unveils-low-cost-406-mhz-elt-345); cockpit voice recorder (includes the incremental cost for the proposed 25 hour requirement); $25,000 (source: https://www.regulations.gov/document/FAA-2023-2270-0002); HTAWS $7,389. (source: https://sarasotaavionics.com/avionics/htaws-for-gtn-series#:~:text=GarminPart%20%23:%20010%2D00878,$7%2C389.00). The FAA emphasizes that equipage costs may be different than those presented here. Additionally, the costs for installation, a reduction in fuel efficiency due to added weight to the aircraft, and maintenance are not included. The costs are similar to those imposed on manufacturers and operators of airplanes and rotorcraft.

[43] Specifically, the NPRM discussed the intention of reducing accidents and incidents related to human performance in commuter operations and ensuring a balanced mix of training and checking to enhance public and passenger safety. 88 FR at 39010.

[44] To note, ALPA supported the FAA's decision not to amend part 121 to accommodate powered-lift operations, stating that considerable data must be collected and analyzed before expanding into part 121 operations.

compliance with § 135.3(b).[45] Thus, for these operations, the FAA will require that certificate holders comply with subpart Y of part 121.[46]

The flexible, performance-based standard of an AQP will best suit the SFAR's novel training paradigm for powered-lift through integration of safety program data, scenario-based training and evaluations, crew resource management (CRM) training, customization to the certificate holder's unique demographic and flight operation, and innovative instructional methods and technology.[47]

The FAA recognizes that establishing an AQP may place a burden on operators.[48] However, it's important to recognize that these burdens are offset by the significant benefits offered by an AQP. Whether a training program falls under subparts N and O to part 121; subparts E, G, and H to part 135; or subpart Y to part 121, the financial burden of adding a new category of aircraft, such as powered-lift, to a certificate holder's operations is similar. This is because all training programs require a front-end analysis of the certificate holder's operation, aircraft, line environment, and job functions for each duty position. Additionally, the regulations

[45] As intended with the temporary nature of the SFAR in general, as additional information becomes available on the training and checking necessary to effectuate safety for certain part 135 commuter powered-lift operations, the FAA may revise this standard.

[46] Upon further review it was found that §§ 121.903(c) and 121.921(a) contain the word airplane. Notwithstanding language was added to § 194.247(b)(1) to enable subpart Y without regulatory limitation by the word airplane vs aircraft so it will be applicable to powered-lift.

[47] The FAA received one comment specifically pertaining to the amendments proposed in § 194.247. The commenter opposed the requirement to adhere to subpart Y to part 121stating that it is excessive and burdensome because the programs require more time, larger staffing, and higher costs than other training programs. The commenter suggested that powered-lift part 135 operators should adhere to the same regulations as helicopter part 135 operators. The FAA considered this comment in the pendency of the rulemaking, but proceeds with the adoption of this amendment, as explained in depth in the preamble to the final rule.

[48] The FAA reviewed the time expended on reporting requirements for OMB information collections required by part 121 certificate holders under subparts N&O versus the reporting requirements under subpart Y to part 121. Under subparts N&O the estimated time expended on reporting requirements averaged 13.6 hours per carrier annually. In comparison, participants in an AQP expend an average of 24 hours annually on reporting requirements.

require the development of FAA-approved operational manuals and training and qualification of all instructors and evaluators in adding a new category of aircraft to a certificate. The process of adding a new aircraft category requires data collection and analysis processes for both the initial and final approval of training programs and the issuance of the appropriate operation specifications.

The FAA notes that since publication of the rule in 2005, 24 certificate holders, to date, have voluntarily chosen to implement the AQP over the standards in subparts N and O to part 121.[49],[50] This is indicative that certificate holders have determined the benefit of implementing an AQP exceeds its costs. Unlike traditional training programs, which use maneuver-based training and evaluation and often segment simulation events in a manner that fails to realistically build up the accident error chain, AQP scenario-based training and evaluation more closely simulate the actual flight conditions known to cause most fatal carrier accidents. This approach aligns training and evaluation with known causes of human error, focusing on both crew and individual performance as well as integrating flight training with CRM skill training. Moreover, AQP offers greater efficiency to operators by allowing for proficiency-based training, as opposed to prescriptive programmed hours. At this time, of the ten projects undergoing type-certification at the FAA, only one requires two pilots by type certification (the AW-609), and thus would be the only project subject to subpart Y to part 121.

[49] https://www.federalregister.gov/documents/2005/09/16/05-18342/advanced-qualification-program
[50] FAA Training and Simulation Branch. The FAA recognizes that establishing an AQP may place a burden on operators. However, it is important to recognize that these burdens (e.g., detailed job task analysis, increased evaluator and trainer requirements, development of performance measurement tools and qualification standards) are offset by the significant benefits offered by an AQP.

I. Paperwork Reduction Act: Information Collection Burden[51]

The FAA estimated the burden imposed on affected entities to comply with information collections linked to the proposed rule.[52] OMB previously approved each of the collections under other rulemakings. The burden imposed on affected entities to comply with the information collections is considered minimal cost. The FAA provided a detailed estimate for each of the information collections in the NPRM.[53]

J. Summary of Total Costs

The final rule will promote the safe integration of powered-lift into the NAS. It will apply a set of airplane, helicopter, and rotorcraft rules to powered-lift that will establish minimum safety standards for operations conducted with these aircraft. Without this final rule, type-certificated powered-lift would be able to conduct operations under parts 91 and 135 but would only have to comply with rules that apply to "aircraft," which would result in a large safety gap because there are myriad rules that apply to "airplanes," "helicopters," and "rotorcraft" that would not otherwise apply to powered-lift.

While operators choosing to conduct operations with powered-lift will incur costs to comply with regulations finalized by this rule, these costs would be on a scale equivalent to

[51] 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 (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.

[52] The six information collections linked to this proposal are: 1) OMB Control Number 2120-0039 Operating Requirements: Commuter and On-Demand Operations; 2) OMB Control Number 2120-0600 Training and Qualification Requirements for Check Airmen and Flight Instructors; 3) OMB Control Number 2120-0663 Service Difficulty Report; 4) OMB Control Number 2120-0009 Application for Pilot School Certification; 5) OMB Control Number 2120-0021 Certification: Pilots and Flight Instructors, and 6) OMB-212-0701 Advanced Qualification Program (AQP), subpart Y to part 121.

[53] See section "IX. F. Paperwork Reduction Act." Note that the information collection for OMB 2120-0707 was inadvertently omitted from the proposed rule.

those incurred by operators choosing to conduct operations with airplanes or rotorcraft under similar regulations. Likewise, costs imposed on individuals that choose to accomplish the required training and testing required to hold an airman's certificate with a type rating in the powered-lift category will be on a scale equivalent to those incurred by individuals accomplishing training and testing to hold an airman's certificate with a type rating in the airplane or rotorcraft category. In other words, the costs imposed on operators and individuals that choose to comply with regulations finalized by this rule would be no more burdensome than the costs incurred by entities and individuals complying with corresponding airplane and rotorcraft regulations that have been developed over time and are already in effect.

This analysis provides a range of costs from low to high based on these scenarios. The FAA considers the primary estimate of costs to be the base scenario. The table below presents a summary of the primary analysis of the monetized incremental cost for the final rule. The monetized costs include costs that would require individuals to hold an airman's certificate with a type rating for the powered-lift flown, costs for the minimum fuel reserve requirement, and costs for the provision of dual-control aircraft or full flight simulators for training,. The regulatory impact analysis also identifies costs that will be imposed by the finalized SFAR but have not been monetized.

For the primary estimate, over a 10-year period of analysis, this rule would result in present value costs $914.2 million at a two percent discount rate with annualized costs of about $101.8 million.

Table 6: Monetized Costs of Final Rule (Millions $) – Primary Estimate*

Forecast Scenario	10-Year Present Value (2%)	Annualized (2%)

Base - Primary Estimate	$914.2	$101.8
Pessimistic	$865.5	$96.4
Optimistic	$966.1	$107.6

*Discount rates are provided per Office of Management and Budget (OMB) guidance.

IX. Uncertainties

The following table identifies those uncertainties that may impact this analysis.

Table 7: Uncertainties

Category	Uncertainty	Impact
Onset of Operations	• The pace and scale at which operators introduce these novel aircraft into commercial operations is subject to demand for aircraft that can perform the intended operations, the ability for powered-lift manufacturers to provide them, and airmen with appropriate ratings to fly them.	• Should the demand for the kinds of operations slated for powered-lift not come to fruition or be at a level lower than anticipated, the costs and benefits affiliated with those operations will be less than envisioned.
Fleet Forecast	• The timing for the introduction of powered-lift into the NAS is subject to type certification of these aircraft by the FAA. To date, the FAA has not type-certificated an aircraft in the category of powered-lift.[54]	• Should aircraft deliveries be reduced, delayed, or cancelled, the costs and benefits that would otherwise have accrued from their introduction into the NAS will be affected accordingly.
Infrastructure	• It is uncertain whether the physical infrastructure to support the type of operations intended for powered-lift will be in place as type-certificated powered-lift enter the market.	• Should the infrastructure not be in place to support a full complement of powered-lift operations, the accumulation of the benefits and costs affiliated

[54] As of January 31, 2023, the FAA announced the availability of the proposed airworthiness criteria for the Joby Aero Inc., Model JAS4-1 powered-lift and the Archer Aviation Inc. Model M001. The documents propose airworthiness criteria the FAA finds appropriate and applicable for each powered-lift design. The airworthiness criteria for Joby Aero Inc. Model JAS4-1 have since been finalized and was published on March 8, 2024. The final airworthiness criteria for the Joby Aero, Inc., Model JAS4-1 is at the following link: https://www.federalregister.gov/documents/2024/03/08/2024-04690/airworthiness-criteria-special-class-airworthiness-criteria-for-the-joby-aero-inc-model-jas4-1.; The proposed airworthiness criteria for Archer Aviation Inc. Model M001 is at the following link: https://www.federalregister.gov/documents/2022/12/20/2022-27445/airworthiness-criteria-special-class-airworthiness-criteria-for-the-archer-aviation-inc-model-m001

Category	Uncertainty	Impact
		with those operations will be understated.

X. Summary of Economic Impacts of Finalized SFAR

In general, the rules finalized by this SFAR fall into two categories. The first category constitutes those rules that facilitate the training and certification of the initial groups of powered-lift instructors and powered-lift pilots. The second category constitutes those rules that apply certain airplane, helicopter, and rotorcraft operating rules to powered-lift to mitigate the safety gap that would otherwise exist upon type-certificated powered-lift emerging in the NAS.

The FAA expects this rule will result in several important benefits and enhancements to support the safe integration of powered-lift operations in U.S. airspace. These benefits are described in the table below.

Table 8: Summary of Benefits of Final Rule

Benefit	Impact
Mitigates Risk and Narrows Safety Gap	• Establishes a regulatory structure that leverages airplane, helicopter, and rotorcraft rules, subject to some performance-based standards, to narrow a safety gap that would otherwise exist absent the proposed rule. • Narrows safety gap for operations conducted with powered-lift to a level equivalent to similar operations conducted with airplanes and rotorcraft.
Data Collection	• Enables the FAA to adopt temporary requirements to enable the safe certification of powered-lift pilots and the safe integration of powered-lift operations. Throughout the duration of the SFAR, the FAA would gather data and information to evaluate the temporary requirements and determine the most appropriate permanent rulemaking path for powered-lift. The FAA anticipates gathering data and information through 1) formal information collections, 2) regulatory requirements, and 3) informal anecdotal information and observations.
Alternate pathway to pilot certification	• Introduces an alternate pathway to train and certificate initial powered-lift pilots and flight instructors thus providing the opportunity for commercial operations to occur at an earlier date than without the final SFAR.
Alternate pathway to pilot certification for powered-lift	• Provides operators that use a powered-lift equipped with a single functioning flight control three alternative pathways to accomplish the required training, testing, and supervised

Benefit	Impact
certificated with a single functioning flight control	operating experience to meet the pilot certification requirements of parts 61 and 194.

While operators choosing to conduct operations with powered-lift will incur costs to comply with regulations finalized by this SFAR, these costs will be on a scale equivalent to those incurred by operators choosing to conduct operations with airplanes or rotorcraft under similar regulations. Likewise, costs imposed on individuals that choose to accomplish the training and testing required to hold an airman's certificate with a type rating in the powered-lift category would be on a scale equivalent to those incurred by individuals accomplishing training and testing to hold an airman's certificate with a type rating in the airplane or rotorcraft category. In other words, the costs imposed on operators and individuals that choose to comply with regulations finalized by this rule will be no more burdensome than the costs incurred by entities and individuals complying with corresponding airplane and rotorcraft regulations currently in effect. Additionally, the FAA has provided some performance-based options in certain rules that could reduce the burden on industry as compared to the comparable prescriptive requirements of the proposed rule.

Monetized costs in the final rule include incremental costs for requiring pilots to hold a type rating for each powered-lift flown, incremental costs for the minimum battery reserve requirement, and costs for the provision of dual-control aircraft or full flight simulators for training purposes. The costs imposed by the final rule provide for the integration of powered-lift into the NAS expeditiously without compromising safety and promotes the evolution of activities that can occur with powered-lift.

The table below identifies those amendments added or changed from the proposed rule. The first column of the table identifies the affected part; the second column reflects the change from the proposal; the third column identifies the economic impact of the change. In many instances, the final rule permits operating rules for helicopters for powered-lift, as long as the powered-lift can meet certain performance-based criteria, in place of the more conservative airplane rules that were proposed**.** In other instances, the operating rules permit the FAA to authorize deviations, which provides even greater operational flexibility. This largely means that amendments to operating rules as finalized will still impose costs to the various entities affected, but the costs will be to a lesser degree than as proposed.

Table 9: Table of Amendments Changed from Proposed Rule to Final Rule

Section	Description of Change	Impact
Part 1 *Definitions and Abbreviations*	§ 1.1 *General definitions* A change to the baseline definition of autorotation was not proposed in the NPRM. For the final rule the definition of autorotation is revised to include powered-lift. The revised definition is as follows: Autorotation means a rotorcraft or powered-lift flight condition in which the lifting rotor is driven entirely by action of the air when the rotorcraft or powered-lift is in motion.	No economic impact.
Part 91 *General Operating and Flight Rules*	*§ 91.113 Right-of-way-rules: Except water operations* In the proposal, powered-lift was designated to use right-of-way rules for other powered aircraft. The proposal designated the change to be temporary for the duration of the SFAR. For the final rule, the change is permanent.	Imposes a regulatory burden on operators of powered-lift on a scale equivalent to costs imposed on operators of airplanes or rotorcraft.
Part 91 *General Operating and Flight Rules*	*§ 91.903 Policy and procedures.* Adds any rule listed in subpart J of part 91 as modified by subpart C of part 194 to those that the Administrator may issue a certificate of waiver authorizing the operation of aircraft in deviation from those rules. This change was not proposed by the SFAR.	Provides relief from provisions proposed by SFAR
Part 135 *Operating Requirements: Commuter and on Demand Operations and Rules Governing Persons on*	*§ 135.100 Flight crewmember duties* Permanent technical amendment to include hover taxi and air taxi in the definition of "taxi" for purposes of § 135.100 This change is a revision from the proposed definition.	No economic impact.

Section	Description of Change	Impact
Board Such Aircraft		
Part 135 *Operating Requirements: Commuter and on Demand Operations and Rules Governing Persons on Board Such Aircraft*	*§ 135.165 (d) Communication and navigation equipment: Extended over-water or IFR operations* The NPRM did not address § 135.165(d). The final rule corrects the cross-reference in § 135.165(d) to reference the current location of the definition for "commuter operation" to part 110 rather than part 119.[55]	No economic impact.
Part 135 *Operating Requirements: Commuter and on Demand Operations and Rules Governing Persons on Board Such Aircraft*	*§ 135.339 (e) Initial and transition training and checking: Check airmen (aircraft), check airmen (simulator)* *§ 135.340 (e) Initial and transition training and checking: Flight instructors (aircraft), flight instructors (simulator)* The NPRM did not propose revisions to § 135.339 and § 135.340. The final rule revises certain training regulations to account for training in powered-lift that are not equipped with dual controls.	Provides relief from existing regulations
Part 136 *Commercial Air Tours and National Pars Air Tour Management*	*§ 136.75(a) Equipment and requirements* The NPRM did not propose changing § 136.75(a) to reference single-engine rotorcraft. The final rule adds the term "single-engine" in front of "rotorcraft." FAA did not intend for this rule to apply to all rotorcraft.	In the Update to Air Carrier Definitions rule, when appendix A was moved to subpart D "single-engine" was inadvertently omitted. As a result, the applicability of required flotation equipment was mistakenly expanded to all rotorcraft, instead of only single-engine rotorcraft.
Part 142 *Training Centers*	*§ 142.47 Training center instructor eligibility requirements* The NPRM did not propose any changes to the minimum aeronautical experience requirements in the final rule adds the qualification option of holding a commercial pilot certificate with the appropriate ratings or an unrestricted ATP with the appropriate ratings to account for those pilots who hold a certificate but may not meet the specific aeronautical experience requirements of part 61 due to decreased minimum experience requirements in part 141 and part 194. The FAA emphasizes that meeting the aeronautical experience requirements as currently required remains an option without holding the certificate itself, as well.	Provides relief from existing regulations allowing aeronautical experience or a commercial certificate in place of aeronautical experiencer set forth in § 61.129 or §§§ 61.159, 61.161, 61.163,

[55] 76 FR 7482, Feb. 10, 2011.

Section	Description of Change	Impact
	Additionally, the final SFAR designates that the aeronautical experience requirements are applicable only to powered-lift weighing greater than 12,500 pounds or a turbojet powered (In the proposed SFAR, the aeronautical experience requirements were applicable powered-lift of all weight classes.)	
Part 194	§ *194.103 Definitions* The NPRM did not include FAA test pilots or aviation safety inspectors (ASIs) in the population of pilots able to utilize the alternate requirements set forth by part 194. The final rule adds FAA test pilots and FAA ASIs to the alternate requirements for test pilots.	Provides relief from existing regulations.
Part 194	§ 194.203 *Alternate qualification requirements for certain flight instructors* The NPRM did not include FAA test pilots or aviation safety inspectors (ASIs) in the population of pilots able to utilize the alternate requirements set forth by part 194. The final rule adds FAA safety inspectors and FAA test pilots to the initial cadre of individuals eligible to receive training from an instructor pilot at a powered-lift manufacturer that does not hold a flight instructor certificate under part 61.	Provides relief existing regulations.
Part 194	§ 194.209 *Additional qualification requirements for certain pilots serving as second-in-command* The NPRM did not account for persons receiving flight training in powered-lift type certificated for more than one pilot. The final rule allows for an applicant receiving training under §§ 194.221, 194.223, 194.229, and 194.231 to serve as second-in-command in a powered-lift type certificated for more than one required pilot flight crewmember while not otherwise meeting the requirements of § 61.55(a)(1) (a)(2) and (b)(2).	Provides relief existing regulations
Part 194	§ 194.213 *Alternate endorsement requirements for certain persons seeking a powered-lift rating* The NPRM did not include FAA test pilots or aviation safety inspectors (ASIs) in the population of pilots able to utilize the alternate requirements set forth by part 194. The final rule adds instructor pilots for manufacturers of experimental powered-lift, FAA test pilots, and FAA aviation safety inspectors to those persons that may provide the required logbook or training record endorsements under parts 61 and 194 for a commercial pilot certificate with a powered-lift category, instrument, or type rating, or for a flight instructor certificate with powered-lift rating.	Provides relief from existing regulations.
Part 194	New § 194.216 *Alternate aeronautical experience pilot-in-command flight time in a powered-lift for a commercial pilot certificate with a powered-lift category rating* The NPRM did not propose any relief to § 91.129(e)(2)(i), which requires 50 hours of PIC time in a powered-lift. The final rule reduces the amount of	Provides relief from existing regulations.

Section	Description of Change	Impact
	required PIC in a powered-lift time from 50 hours down to 35 hours for pilots under the SFAR. The NPRM proposed to only permit pilots at approved training programs to credit a maximum of 15 hours in an FSTD toward the PIC flight time requirement of § 61.129(e)(2). This final rule permits any applicant under the SFAR to credit a maximum of 15 hours towards the 35-hour PIC flight time requirement of § 194.216(a).	
Part 194	§ 194.217 *Test pilots, FAA test pilots, or aviation safety inspectors: Alternate aeronautical experience and logging requirements for a commercial pilot certificate with a powered-lift category rating.* The NPRM did not include FAA test pilots or aviation safety inspectors (ASIs) in the population of pilots able to utilize the alternate requirements set forth by part 194. This final rule adds FAA test pilots and FAA aviation safety inspectors to those applicants that may use alternate aeronautical experience and logging requirements for a commercial pilot certificate with a powered-lift ratings	Provides relief from existing regulations
Part 194	§ 194.219 *Instructor pilots: Alternate aeronautical experience and logging requirements for a commercial pilot certificate with a powered-lift category rating* The NPRM did not include FAA test pilots or aviation safety inspectors (ASIs) in the population of pilots able to utilize the alternate requirements set forth by part 194. The final rule adds FAA test pilots and FAA safety inspectors to those persons that can receive the manufacturer's training curriculum from instructor pilots for experimental powered-lift manufacturers.	Provides relief from existing regulations.
Part 194	§ 194.221 *Initial cadre of instructors: Alternate aeronautical experience and logging requirements for a commercial pilot certificate with a powered-lift category rating.* The NPRM proposed to permit certain pilots to log up to 40 hours of PIC flight time as sole manipulator of the controls when the person is not rated. This final rule reduces the number of hours that may be logged from 40 hours to 25 hours to account for the reduction in required PIC flight time in a powered-lift.	Provides relief from provisions proposed by SFAR
Part 194	§ 194.223 *Pilots receiving training under an approved training program: Alternate requirements for a commercial pilot certificate with a powered-lift category rating.* The NPRM proposed to permit certain pilots to log up to 40 hours of PIC flight time as sole manipulator of the controls when the person is not rated. The final rule reduces the number of hours an applicant for a commercial pilot certificate with a powered-lift category rating is required to log as pilot-in-command time towards § 61.129(e)(2)(i) from 40 hours to 25 hours when the applicant is the sole manipulator of the controls of a powered-lift for which the pilot is not rated	Provides relief from provisions proposed by SFAR.

Section	Description of Change	Impact
Part 194	§ 194.225 *Test pilots, FAA test pilots, and aviation safety inspectors: Alternate aeronautical experience and logging requirements for an instrument powered-lift rating.* The NPRM did not include FAA test pilots or aviation safety inspectors (ASIs) in the population of pilots able to utilize the alternate requirements set forth by part 194. The final rule adds FAA test pilots and FAA aviation safety inspectors to those eligible for relief regarding alternate aeronautical experience and logging requirements for an instrument powered-lift rating	Provides relief from existing regulations
Part 194	*New* §194.243 *Pilot certification through completion of training, testing, and checking part 135* The NPRM did not contemplate retraining requirements for unsatisfactory performance on part 135 checks in lieu of a practical test. The final rule adds clarification and procedures if an applicant fails a check.	Provides relief from provisions proposed by SFAR
Part 194	§194.247 *Pilot qualification requirements to operate powered-lift under part 135* The NPRM referenced the Aircraft Flight Manual as determining when two pilots are required. The final rule corrects the reference to the type certificate as dictating when two pilots are required. The NPRM proposed to require a certificate holder conducting commuter operations with powered-lift in which two pilots are required to comply with subpart Y to part 121. The final rule specifies notwithstanding applicability to airplanes in § 121.903(c) and § 121.921(a) to allow all regulations within subpart Y (AQP) to part 121 to be applicable to powered-lift	Technical Amendment
Part 194	New § 194.253 *Alternate requirements for powered-lift without fully functional dual controls used in flight training* The NPRM did not propose any relief to current regulations requiring that a powered-lift must have dual controls for flight training. The final rule allows powered-lift without fully functional dual controls to be used for flight training provided the primary flight controls are instantly accessible by both the applicant and the instructor. Additionally, a person may apply for a powered-lift category rating, type rating, and instrument powered-lift rating for a powered-lift with single controls under an approved part 135, 141, or 142 training program by meeting the part 61 requirements or corresponding alternate requirement set forth by part 194.	Provides relief from existing regulations
Part 194	*§ 194.301 Applicability* Provides clarification that sections or paragraphs within sections under parts 91 and 135 that refer to specific categories of aircraft, and that are not referenced in the SFAR tables to § 194.302 or § 194.306, do not apply to powered-lift.	Technical amendment. No economic impact
§ 194.302 (con't) *Provisions under part 91 of this chapter applicable to powered-lift.*	*§ 91.119 Minimum safe altitudes: General.* The NPRM proposed not allowing powered-lift to use the helicopter/rotorcraft criteria stipulated in § 91.119. The final rule allows some powered-lift to use the helicopter/rotorcraft provisions as long as they meet the performance-based criteria allowing powered-lift to operate at an altitude lower than airplanes.	Provides relief from provisions proposed by SFAR

Section	Description of Change	Impact
194.302 (con't) *Provisions under part 91 of this chapter applicable to powered-lift.*	*Adds § 91.151(b) Fuel requirements for flights in VFR conditions* The NPRM proposed not allowing powered-lift to use the helicopter/rotorcraft criteria stipulated in § 91.151. The final rule allows for powered-lift operating in vertical-lift flight mode to adhere to a less restrictive fuel requirement when flying VFR.	Provides relief from provisions proposed by SFAR
194.302 (con't) *Provisions under part 91 of this chapter applicable to powered-lift.*	*§ 91.155 Basic VFR weather minimums* The NPRM proposed not allowing powered-lift to use the helicopter/rotorcraft criteria stipulated in § 91.155. The final rule allows for powered-lift to use helicopter flight visibility requirements when being operated in the vertical-lift mode of flight.	Provides relief from provisions proposed by SFAR
194.302 (con't) *Provisions under part 91 of this chapter applicable to powered-lift*	*Adds § 91.157(b)(3), (b)(4), and (c) Special weather minimums* The NPRM proposed not allowing powered-lift to use the helicopter/rotorcraft criteria stipulated in § 91.157. The final rule allows helicopter exceptions to be applied to powered-lift operating in vertical-lift flight mode when those aircraft are operated at a speed that allows the pilot to see any other traffic or obstructions in time to avoid a collision.	Provides relief from provisions proposed by SFAR
194.302 (con't) *Provisions under part 91 of this chapter applicable to powered-lift.*	*Adds §§ 91.167(a)(3) and (b)(2)(i), IFR fuel requirements, and 91.169(b)(2)(ii) and (c)(1)(ii) IFR flight plans* The NPRM proposed not allowing powered-lift to use the helicopter/rotorcraft criteria stipulated in § 91.167 and § 91.169. The final rule allows powered-lift authorized to conduct copter procedures and that can land in the vertical-lift flight mode to use fuel (§ 91.167) or weather minimums (§ 91.169) established for helicopters.	Provides relief from provisions proposed by SFAR
194.302 (con't) *Provisions under part 91 of this chapter applicable to powered-lift.*	*Adds § 91.175(f)(2)(iii) Takeoff and landing under IFR* The NPRM proposed not allowing powered-lift to use the helicopter/rotorcraft criteria stipulated in § 91.175. The final rule allows powered-lift authorized to use copter procedures and that can land in the vertical-lift flight mode to use takeoff minimums established for helicopters.	Provides relief from provisions proposed by SFAR
194.306 Provisions under part 135 of this chapter applicable to powered-lift.	*Amends § 135.93(c)(1) Minimum altitudes for use of autopilot* The NPRM proposed not allowing powered-lift to use the helicopter/rotorcraft criteria stipulated in § 135.93. The final rule provides a performance-based alternative to enroute requirements specified in § 135.93.	Provides relief from provisions proposed by SFAR
194.306 (con't) *Provisions under part 135 of this chapter applicable to powered-lift.*	§ 135.158 *Pitot heat indication systems* The NPRM proposed applying the requirements of § 135.158 (pitot heat indication systems) to powered-lift. The final rule applies § 135.158 to powered-lift but allows for the indication system in powered-lift to be something other than an amber light when a pitot system is not operating.	Provides relief from provisions proposed by SFAR
194.306 (con't)	*Adds § 135.168(b)(1) Emergency equipment: Overwater rotorcraft operations*	Provides relief from provisions proposed by SFAR.

Section	Description of Change	Impact
Provisions under part 135 of this chapter applicable to powered-lift.	The NPRM proposed applying the requirements of § 135.168(b)(1) to powered-lift. For the final rule, the life preserver required by § 135.168(b)(1) need not be worn but must be readily available for its intended use and easily accessible to each occupant when the powered-lift is a multiengine aircraft operated at a weight that will allow it to climb, with the critical engine inoperative or while experiencing a critical change of thrust, at least 50 feet a minute, at an altitude of 1,000 feet above the surface.	
194.306 (con't) *Provisions under part 135 of this chapter applicable to powered-lift.*	*Added § 135.181(a)(2) and § 135.181(b)* Provides clarification that performance requirements for aircraft operated over-the-top or in IFR conditions applies to those powered-lift that do not have a critical engine but can experience a critical change of thrust.	Clarifying amendment. No economic impact
194.306 (con't) *Provisions under part 135 of this chapter applicable to powered-lift.*	*Amends § 135.183(c)* Revised to add the term "critical change of thrust" to the performance requirements for multiengine land aircraft carrying passengers as follows: aircraft operated at a weight that will allow it to climb, with the critical engine inoperative, *or while experiencing a critical change of thrust*, at least 50 feet a minute, at an altitude of 1,000 feet above the surface.	Clarifying amendment. No economic impact
194.306 (con't) *Provisions under part 135 of this chapter applicable to powered-lift.*	*Amends § 135.203(b)* The NPRM requirements are amended for the final rule to create a performance-based rule allowing powered-lift to use an altitude lower than specified for airplanes. This provision is adopted when operating in the vertical-lift flight mode.	Provides relief from provisions proposed by SFAR
194.306 (con't) *Provisions under part 135 of this chapter applicable to powered-lift.*	*Amends § 135.205(b).* The NPRM requirements are amended for the final rule to create a performance-based rule allowing powered-lift to use visibility requirements lower than specified for airplanes. This provision is adopted when operating in the vertical-lift flight mode.	Provides relief from provisions proposed by SFAR
194.306 (con't) *Provisions under part 135 of this chapter applicable to powered-lift.*	*Amends § 135.209(a).* The NPRM requirements are amended for the final rule to allows for deviations from VFR Fuel Supply for specific routes with one or more predetermined suitable landing areas if the FAA finds the operation can be conducted safely. *Adds § 135.209(b)* The NPRM requirements are amended for the final rule to allow for a 20-minute minimum for VFR fuel requirement applicable to powered-lift with the performance capability, as provided in the Aircraft Flight Manual. (Deviations allowed).	Provides relief from provisions proposed by SFAR
194.306 (con't) *Provisions under part 135 of this chapter*	*Amends § 135.221(b)* The NPRM requirements are amended for the final rule to allow the use of alternate airport weather minimums authorized for helicopters to be applied to	Provides relief from provisions proposed by SFAR

Section	Description of Change	Impact
applicable to powered-lift.	powered-lift if they are authorized to conduct Copter Procedures and can land in the vertical-lift flight mode.	
194.306 (con't) *Provisions under part 135 of this chapter applicable to powered-lift.*	*Applies § 135.223(a)(3) IFR Alternate airport requirements*. The NPRM requirements are amended for the final rule to allow powered-to use the 30-minute fuel requirements specified for helicopters in § 135.223(a)(3) if the powered-lift is authorized to conduct Copter Procedures and can conduct a landing in the vertical-lift flight mode for the entire flight.	Provides relief from provisions proposed by SFAR
194.306 (con't) *Provisions under part 135 of this chapter applicable to powered-lift.*	*Applies § 135.227(d)* The FAA corrected cross-references pertaining to the proposed SFAR section and removed a reference to "critical surfaces" because it is no longer required.	Technical Amendment
194.306 (con't) *Provisions under part 135 of this chapter applicable to powered-lift.*	*Adds § 135.229(b)(2)(ii)* The final rule allows powered-lift taking off or landing in vertical-lift flight mode and equipped with landing lights oriented in a direction that enables the pilot to see an area to be used for landing or takeoff marked by reflective material. Otherwise powered-lift must take off or land at an airport with boundary or runway marker lights. The FAA clarified that the intent of this section is to apply in both the takeoff and landing context. The NPRM referenced powered-lift landing or taking off in vertical-lift flight mode, but inadvertently excluded additional language regarding takeoff.	Technical Amendment.
194.306 (con't) *Provisions under part 135 of this chapter applicable to powered-lift.*	*Revises § 135.609 VFR ceiling and visibility minimums for Class G Airspace when conducting VFR helicopter air ambulance.* The NPRM proposed not allowing powered-lift to use the helicopter/rotorcraft criteria stipulated in § 135.609. For the final rule, airplane minimums will be applied when the powered-lift is operated in wing-borne flight mode. Helicopter minimums will be applied when the powered-lift is operating in vertical-lift flight mode.	Provides relief from provisions proposed by SFAR
194.306 (con't) *Provisions under part 135 of this chapter applicable to powered-lift.*	*Revises § 135.613 Approach/departure IFR transitions* The NPRM proposed not allowing powered-lift to use the helicopter/rotorcraft criteria stipulated in § 135.613. The final rule revises § 135.613(a)(2) revised and adds § 135.613(b) to allow powered-lift that are operating in the vertical-lift flight mode to use helicopter minimums.	Provides relief from provisions proposed by SFAR
194.306 (con't) *Provisions under part 135 of this chapter applicable to powered-lift.*	*Adds § 135.615(b) VFR flight planning* The NPRM proposed not allowing powered-lift to use the helicopter/rotorcraft criteria stipulated in § 135.615. The final rule allows powered-lift operated in the vertical-lift flight mode during enroute operations to use the terrain and obstacle clearance requirements minimums described in § 135.615(b)	Provides relief from provisions proposed by SFAR
194.308 *Applicability of national air tour safety standards under part 136*	Amends §§ 136.9(b)(3), 136.11(a)(2), and 136.75(c) The NPRM did not use the term "critical change of thrust." The final rule adds the term "critical change of thrust" to ensure those novel aircraft that may not have a critical engine be required to demonstrate the same	Clarifying amendment. No economic impact.

Section	Description of Change	Impact
of this chapter to powered-lift	performance requirements as those stipulated for aircraft with a critical engine.	
194.308 (con't) *Applicability of national air tour safety standards under part 136 of this chapter to powered-lift*	*Revises § 136.11 to be applicable to powered-lift regardless of flight mode* *For the final rule, § 136.11(a)(1) is added to* require floats for single-engine powered-lift. *Revises § 136.11(b)(2*) Requires flotation system to be armed when the powered-lift is over water beyond the shoreline whether operating in vertical-lift flight mode or wing-borne flight mode.	Imposes a burden on operators of powered-lift on a scale no greater than the burden placed on operators of helicopters.
194 New Appendix A	*New Appendix A* The NPRM did not allow for training in powered-lift with one set of controls. For the final rule, pilots may train in powered-lift with one set of control. Appendix A prescribes the minimum requirements to apply for a pilot training program leading to a powered-lift category rating; a powered-lift type rating; and an instrument powered-lift rating using powered-lift with one set of controls.	Provides relief from existing regulations.

XI. Discussion of Alternatives

The FAA considered engaging in permanent rulemaking to address the introduction of powered-lift in civilian operations. However, the FAA lacks sufficient information at this time regarding emerging operations to implement permanent regulations. The FAA has found the use of an SFAR has been an effective way to gain such experience while enabling some degree of operations; therefore, the FAA finds that the use of an SFAR is the most viable option at this time. Utilizing the SFAR will allow the FAA to observe operations and subsequently make any requisite safety improvements in a later permanent change to the regulations.

One alternative considered for the SFAR was the appropriate duration for its effectiveness. After contemplating various effectivity time periods, the FAA determined ten years to be an appropriate length of time. The FAA considered several factors in selecting ten years as the appropriate duration for this SFAR. One consideration included the time it will take to initiate operations upon effective date of the final rule, considering the type certification

status of the powered-lift that are commercially viable. The FAA also considered the appropriate length of time to collect operational data after operators initiate commercially viable operations, and then the time necessary to complete a subsequent rulemaking consistent with the notice and comment requirements of the Administrative Procedure Act to propose and implement permanent regulations.

Another alternative considered for this SFAR was to permit any person who meets the qualifications to serve as an authorized instructor under parts 135, 141, or 142 to receive training at a powered-lift manufacturer. However, recognizing the diversity in flight time and experience across such a broad group of instructors, the FAA decided that there were insufficient risk mitigations to ensure an appropriate level of safety would be maintained by permitting such an expansive group of individuals to receive training at the manufacturer in place of the approved training under parts 135, 141, or 142. The FAA concluded that, where a manufacturer does not hold an air agency certificate, it is necessary to confine the training population to a more select group of individuals. These individuals should be the most qualified instructors at a part 135 operator, part 141 pilot school, or part 142 training center, and certain FAA personnel. Therefore, the FAA proposed in § 194.221(a) to permit persons who are authorized to serve as initial check pilots, chief instructors, assistant chief instructors, or training center evaluators to receive the training for powered-lift ratings at a manufacturer. The FAA notes that, similar to manufacturers of airplanes and rotorcraft, a powered-lift manufacturer who obtains an air agency certificate to provide flight training (i.e., a part 141 pilot school certificate or part 142 training center certificate) would be permitted to offer training to a broader group of individuals.

XII. Comments Received

The FAA invited interested persons to participate in this rulemaking by submitting written comments, data, or views on the regulatory impact analysis for the proposal. Specifically, the FAA requested information and data that could be used to quantify the incremental benefits and costs of the finalized rule. The FAA also requested information on the assumptions and uncertainties discussed in the regulatory impact analysis. Presented below is a summary of those comments.

Many commenters stated that the costs of the proposal could be as much as four times greater than what was presented in the regulatory impact analysis. The FAA thanks the commenters for their input and acknowledges not all costs of the proposed rule were monetized due to a lack of information to develop informed estimates. The FAA stated in the proposal that individuals and entities choosing to operate powered-lift would incur incremental costs to do so, but on a scale no greater than the costs imposed on individuals and entities choosing to operate airplanes and rotorcraft under existing regulations. The FAA concedes that the analysis of the proposal could have better emphasized that not all costs were monetized. For the analysis of the final rule, the FAA has incorporated information received during the notice and comment period and as a result has revised the monetization of the rule's costs.

A commenter stated it engaged NERA Economic Consulting to assist with estimating the total cost of the NPRM. The analysis concluded that the proposed rules would impose social costs of approximately $961.85 million over the 10-year regulation period. The estimate included $695.8 million attributable to the cost of full flight simulators (FFS) and associated infrastructure based on industry data indicating that each manufacturer would require six FFSs. The same analysis also concluded that the proposed 45-minute fuel reserve requirement would

cost approximately $127.8 million due to disruptions in optimized charging cycles, leading to reduced battery life and more frequent battery replacement. The same commenter also provided information estimating the cost for manufacturers to provide dual-control aircraft for the purpose of training, and information for the number of individuals that would be required to operate the fleet of aircraft anticipated to enter the fleet over the 10-year period of the SFAR.

The FAA values the many comments submitted on the costs of the regulatory impact analysis for the proposed SFAR, and especially those comments containing information or data that can be used to monetize costs. Based on information received from one of the commenters the FAA has revised the regulatory impact analysis for the finalized SFAR to reflect the monetization of costs the minimum fuel reserve requirement and the cost for the provision of dual control aircraft for training. In addition, the forecast for pilots required to operate the powered-lift anticipated to enter the fleet has been revised upward based on commenter input.[386]

A commenter stated that applying a discount factor to future year training costs was unnecessary because the costs are already based on present-day costs.

The FAA notes that Federal agencies, including the FAA, follow guidance on the development of regulatory analysis provided by the Office of Management and Budget in Circular A-4.[56] Circular A-4 requires estimated costs and benefits of rules to be presented in constant, undiscounted dollars, and discounted dollars.[57] Discounting provides an accurate

[56] OMB Circular A-4 (whitehouse.gov). The link provided is to the current version of Circular A-4. The current version was released after the proposed SFAR was published. The analysis for the finalized powered-lift SFAR includes the present value discount rates used in the proposed SFAR in order more easily assess the change in costs between the proposed and finalized SFAR.
[57] Circular A-4 has been revised since publication of the proposed SFAR.

assessment of benefits and costs that occur at different points in time or over different time horizons.

Some commenters that stated the FAA did not accurately reflect the cost of flight time. One commenter stated the cost of the powered-lift category add-on for each pilot involved in the FSB should be included because this cost would be to meet a requirement in excess of the ICAO SARPs for pilot certification.

In response, the FAA notes that while an FSB is typically established for large jet and propeller aircraft, the requirement for an FSB is not exclusive to these kinds of aircraft. Accordingly, the costs for the FAA to establish an FSB are not included in the regulatory impact analysis for this final rule because the requirement existed prior to this rule. Additionally, the FAA has taken into consideration the guidance outlined in ICAO Doc. 10103, specifically Chapter 2 §2.1, Annex I – Personnel Licensing. The FAA will ensure a sufficient level of safety while considering these recommendations; however, the FAA has chosen not to implement these measures at this time. The FAA will undertake measures to align with ICAO standards, as practicable, at such time when ICAO's recommendations become standards.

A commenter stated that accounting for 10 days of training to obtain a category add-on and type rating was not sufficient and that it would take several months.

The FAA appreciates the comment and understands why there may be confusion between what is already required by regulations versus new requirements as a result of this final rule. Prior to the final rule, regulations existed that prescribed the requirements for an individual to achieve a commercial pilot certificate with a powered-lift category rating. Since only the incremental costs of rules are evaluated, only the cost of achieving the type rating is estimated.

Furthermore, the FAA further asserts that the SFAR provides relief to individuals seeking a powered-lift type rating by providing an alternative pathway to certification. The alternative pathway allows for an airman that holds a commercial pilot certificate with an airplane or rotorcraft rating to be eligible for a powered-lift type rating.

Commenters stated that the regulatory impact analysis did not properly account for the resources and timeline implications associated with its implementation, as well as the impact of potential entry into service delays due to an unprecedented use of aircraft for pilot certification. A commenter contends that if the FAA proceeds with the notice and comment rulemaking for each device's Qualification Performance Standards, the RIA should be updated to reflect associated costs including opportunity costs of delayed entry-into-service.

As stated previously in the preamble for this final rule, the FAA agrees that the proper allocation of resources to this issue is critical to the success of this SFAR and the powered-lift industry and that rule effectivity is largely dependent on the Agency's ability to support implementation. AAM and powered-lift operations are part of the Administrator's foremost priorities; accordingly, the FAA is allocating resources to ensure that industry has the tools and regulatory structure necessary to successfully initiate powered-lift certification and operations. Additionally, as it pertains to FAA pilots, this final rule adds FAA test pilots and ASIs into the population of pilots that may utilize the alternate experience requirements as set forth by part 194 to further develop a pool of fully certificated and rated powered-lift pilots.

XIII. Appendices

Appendix A: Powered-Lift Fleet Forecast, Pilot Forecast, and Estimated Cost for Type Ratings

Disclaimer: The pilot forecasts presented are prepared solely for estimating costs for this final rulemaking.

The kinds of operations envisioned for the majority of powered-lift include low altitude, dense urban environments, and congested airspace where there will be little room for error. To address the significant operational differences between each powered-lift, this final rule requires the PIC of a powered-lift to hold a type rating for the aircraft flown. This appendix provides the methodology for estimating the costs for individuals to add a powered-lift type rating to their airman certificate.

As a result of a comment to the proposed rule, the FAA has revised the methodology for estimating the cost for individuals to add a type rating to an airman certificate. The commenter noted that the estimated number of pilots required to achieve the type rating was underestimated because it failed to account for pilot leave and pilot turnover.[58] The FAA agrees that a more accurate forecast model for pilots required to operate the aircraft entering the fleet should include variables for pilot leave and pilot turnover. Consequently, the revised forecast incorporates a model published by the National Business Aviation Association (NBAA) which incorporates these variables.[59]

To estimate a range for the cost for pilots to achieve a type rating, a forecast for the powered-lift fleet was developed for three scenarios -- a baseline scenario, an optimistic scenario, and a pessimistic scenario. The scenarios are based on powered-lift orders and options

[58] The commenter noted that sick leave, vacation leave, holiday leave, and leave for training and exams was not considered as part of a pilot's work year. As well, turnover due to retirements and pilots leaving for other business opportunities was not accounted for.

[59] 2016-01-nbaa-management-guide PDF (nbaa.org). See Figure 1.5 on page 1-18.

placed by U.S. air carriers as reported in the June 2022 Advanced Air Mobility Reality Index (AAMRI).[60]

For the optimistic fleet forecast scenario, orders placed by each air carrier were spread equally over the first five years after deliveries were projected to begin; thereafter, the options were spread equally over the remaining years of the SFAR.[61] The base scenario assumes that the deliveries shown in the optimistic scenario are delayed by one year, and the pessimistic scenario assumes deliveries shown in the optimistic scenario are delayed two years. Presented below is the powered-lift fleet forecast for the three scenarios.

Table A1: Powered-Lift Deliveries Forecast – U.S. Air Carriers[62]

Scenario	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Optimistic	42	48	241	251	271	271	270	152	139	139
Base	---	42	48	241	251	271	271	270	152	139
Pessimistic	---	---	42	48	241	251	271	271	270	152

As previously noted, the FAA used an NBAA model to forecast pilots required to operate the powered-lift expected to enter the fleet over the ten-year period of the SFAR. The NBAA model aids operators to determine the number of pilots required to operate a fleet of aircraft based on several inputs, including fleet size, days of operation per year for each aircraft, and the number of days a pilot is available annually.[63] However, the model does not include an

[60] AAM Reality Index. Accessed June 2022. The AAMRI tracks powered-lift ordered orders and options placed by air carriers, and the year deliveries are expected to begin.
[61] For illustrative purposes, assume that a carrier placed orders for 200 powered-lift for delivery starting in year 2 of the 10-year timeframe proposed for the SFAR, with options for 100 additional powered-lift. The forecast for this carrier would consist of 40 aircraft delivered in each of years 2 through 6 (for a total of 200 orders), and 25 aircraft delivered in each of years 7 through 10 (for a total of 100 options).
[62] Minor changes were made to the proposed powered-lift deliveries forecast due to rounding. In total, the optimistic deliveries forecast increased by four aircraft, going from 1,820 aircraft in the proposed SFAR to 1,824 aircraft in the final SFAR.
[63] https://nbaa.org/wp-content/uploads/2018/01/2016-01-nbaa-management-guide.pdf.

input for pilot turnover, which the FAA estimates to be 8.9 percent annually.[64] The 8.9% is applied to "Returning pilots" (row 9) to account for pilots that separate from an employer, such as for retirement or other business opportunities. The estimated cost for type ratings on an annual basis is total type certifications required multiplied by $22,124 (row 12 * $22,124).[65] The table below presents the results for the optimistic scenario.

Table A2: Cost for Pilots to Achieve Type Rating ($Mil) – Optimistic Scenario

Row	DESCRIPTION	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
1	Aircraft deliveries	42	48	241	251	271	271	270	152	139	139
2	Workdays/pilot	234	234	234	234	234	234	234	234	234	234
3	Subtotal days unavailable	41	41	41	41	41	41	41	41	41	41
4	Days available for duty	193	193	193	193	193	193	193	193	193	193
5	Number of crew seats	42	48	241	251	271	271	270	152	139	139
6	Operating days per year	365	365	365	365	365	365	365	365	365	365
7	Flight crew days per year	15,330	17,520	87,965	91,615	98,915	98,915	98,550	55,480	50,735	50,735
8	New pilots required	80	91	456	475	513	513	511	288	263	263
9	Returning pilots		80	171	627	1,102	1,615	2,128	2,639	2,927	3,190
10	Cumulative Pilots	80	171	627	1,102	1,615	2,128	2,639	2,927	3,190	3,453
11	Attrition (8.9%) (roundup)		8	16	56	99	144	190	235	261	284
12	Type Certifications Required	80	99	472	531	612	657	701	523	524	547
13	Cost for Type Ratings ($Mil.)	$1.77	$2.19	$10.44	$11.75	$13.54	$14.54	$15.51	$11.57	$11.59	$12.10

Table notes:
Row 1: Powered-lift Delivery Forecast
Row 2: 52 weeks × 4.5 days/week
Row 3: Unavailable days: 41 days to include 15 vacation days, 11 holidays, 5 sick days, and 10 days for physicals and training
Row 4: Row 2 - Row 3
Row 5: Assume 1 pilot required per aircraft
Row 6: Assume 365 days of operation/aircraft annually
Row 7: Row 5 × Row 6
Row 8: Row 7 ÷ Row 4
Row 9: Prior year total for Row 10
Row 10: Row 8 + Row 9
Row 11: Row 9 × 8.9%. Source: www.ntsb.gov/news/events/Documents/aviation_pro-Lovelace-NTSB-Professionalism-Forum.pdf
Row 12: Row 8 + Row 11
Row 13: (Row 12 × $22,124)/1,000,000

[64] See section VI. Key Assumptions and Data Sources.
[65] The average cost for training leading to a type rating is estimated to be $22,124. This estimate is based on the average cost of training posted to three websites at the time the proposed SFAR was published (one website advertised a cost of $10,000 to $30,000; a second website advertised a cost of $13,495; a third website advertised a cost of $25,000), plus air travel to a training location (estimated to be $330), and per diem of $155 per night for fourteen nights (for a cost of $,2170). These estimates are considered conservative since they are affiliated with training in large transport category aircraft. The powered-lift currently undergoing type-certification are smaller.

The base scenario and pessimistic scenario for the number of type ratings required and their cost is the optimistic scenario shifted out by one year for the base scenario, and out by two years for the pessimistic scenario. The forecasts for all three scenarios are presented below at a two percent discount rate.

Table A3: Cost for Pilots to Achieve Type Rating ($Mil) – By Scenario

Scenario	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Type Ratings Required											
Optimistic Scenario	80	99	472	531	612	657	701	523	524	547	4,746
Base Scenario		80	99	472	531	612	657	701	523	524	4,199
Pessimistic Scenario			80	99	472	531	612	657	701	523	3,675
Cost/Type Rating ($Mil.)	$0.0221	$0.0221	$0.0221	$0.0221	$0.0221	$0.0221	$0.0221	$0.0221	$0.0221	$0.0221	$0.0221
Optimistic ($Mil)	$1.77	$2.19	$10.44	$11.75	$13.54	$14.54	$15.51	$11.57	$11.59	$12.10	$105.00
2% Present Value	$1.74	$2.11	$9.84	$10.85	$12.26	$12.91	$13.50	$9.88	$9.70	$9.93	$92.71
2% PV Annualized											$10.32
Base ($Mil)		$1.77	$2.19	$10.44	$11.75	$13.54	$14.54	$15.51	$11.57	$11.59	$92.90
2% Present Value		$1.70	$2.06	$9.65	$10.64	$12.02	$12.65	$13.24	$9.68	$9.51	$81.16
2% PV Annualized											$9.04
Pessimistic ($Mil)			$1.77	$2.19	$10.44	$11.75	$13.54	$14.54	$15.51	$11.57	$81.31
2% Present Value			$1.67	$2.02	$9.46	$10.43	$11.79	$12.41	$12.98	$9.49	$70.24
2% PV Annualized											$7.82

Appendix B: Powered-Lift Battery Forecast

The FAA requested comment for costs that were not monetized in the regulatory impact analysis for the proposed SFAR. In response to that request, a commenter provided an estimate for the cost of increased battery replacements due to the minimum fuel reserve requirements. proposed by the SFAR. Building on the information provided by the commenter and information on the internet, the FAA has monetized the cost for the incremental battery replacements using the forecast for hours flown as presented in the preliminary regulatory impact analysis. This appendix presents the derivation of those costs.

In the proposed SFAR, the FAA estimated the hours of utilization per aircraft for the first year an aircraft enters service to be 1,186 hours.[66] For each follow-on year after initial entry into service, utilization per aircraft is estimated to be 2,190 hours annually.[67] A table showing the hours flown per aircraft based on year of entry into service is presented below.

Table B1: Powered-lift Utilization per Aircraft for Entry into Service (EIS) Year and Follow- on Years

EIS Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total Hours per Aircraft
1	1,186	2,190	2,190	2,190	2,190	2,190	2,190	2,190	2,190	2,190	20,896
2		1,186	2,190	2,190	2,190	2,190	2,190	2,190	2,190	2,190	18,706
3			1,186	2,190	2,190	2,190	2,190	2,190	2,190	2,190	16,516
4				1,186	2,190	2,190	2,190	2,190	2,190	2,190	14,326
5					1,186	2,190	2,190	2,190	2,190	2,190	12,136
6						1,186	2,190	2,190	2,190	2,190	9,946
7							1,186	2,190	2,190	2,190	7,756
8								1,186	2,190	2,190	5,566
9									1,186	2,190	3,376
10										1,186	1,186

How to read this table: The first cell in each row with the value 1,186 is the Entry into Service Year for new aircraft entering the fleet and depicts the number of hours flown during the initial year. For the follow-on years, the hours flown is 2,190 hours per aircraft.

For this analysis it is determined that the life of an eVTOL battery with a 10 minute reserve limit is 2,000 hours.[68] To account for a 20-minute reserve requirement, the battery life of 2,000 hours is decreased by 20 percent, for a battery life of 1,600 hours (for an incremental loss of 400 hours per battery). To calculate the incremental cost of the fuel reserve requirement,

[66] Since aircraft are assumed to be delivered throughout the year, some will have been flown a full 12 months (January through December) while others may only have been operated the month of December; thus, the average utilization for aircraft entering the fleet are reduced accordingly.

[67] https://www.faa.gov/sites/faa.gov/files/regulations_policies/policy_guidance/benefit_cost/econ-value-section-3-capacity.pdf

[68] Source: Challenges and key requirements of batteries for electric vertical takeoff and landing aircraft - ScienceDirect. This work identifies the primary battery requirements for eVTOL in terms of specific energy and power, fast charging, cycle life, and safety, revealing that eVTOL batteries have more stringent requirements than electric vehicle batteries in all aspects. This report states with sufficient fast charging, eVTOL batteries can operate around 1,600 hours per year (corresponding to 1,600 equivalent full cycles of a 200 Wh/kg battery). In the same report it is estimated that a battery with a 10-minute reserve time would have 2,000 cycle hours. FAA assumes for this analysis that the 1,600 hours is inclusive of a reserve that would allow for 20 minutes of additional flight time, and if not for the reserve requirement the battery life would be extended and additional 400 hours for a useful battery life of 2,000 hours. FAA asserts that information regarding battery life as it pertains to eVTOL powered-lift is sparse and many factors could affect battery useful life.

the number of batteries required to operate one aircraft on an annual basis taking into account the minimum fuel reserve requirement is subtracted from the number of batteries required to operate one aircraft annually without requiring a minimum fuel-reserve requirement. The estimates are presented below.

Table B2: Batteries Required per Aircraft per Year
(Battery Life of 2,000 Hours with a 10-Minute Fuel Reserve)

Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total Batteries Required per Aircraft (Years 1-10)
1	0.59	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	10.45
2		0.59	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	9.35
3			0.59	1.10	1.10	1.10	1.10	1.10	1.10	1.10	8.26
4				0.59	1.10	1.10	1.10	1.10	1.10	1.10	7.16
5					0.59	1.10	1.10	1.10	1.10	1.10	6.07
6						0.59	1.10	1.10	1.10	1.10	4.97
7							0.59	1.10	1.10	1.10	3.88
8								0.59	1.10	1.10	2.78
9									0.59	1.10	1.69
10										0.59	0.59
Total											55.21

Table B3: Batteries Required per Aircraft per Year
(Battery Life of 1,600 Hours – 20-minute Fuel Reserve Requirement)

Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total Batteries Required per Aircraft (Years 1-10)
1	0.74	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	13.06
2		0.74	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	11.69
3			0.74	1.37	1.37	1.37	1.37	1.37	1.37	1.37	10.32
4				0.74	1.37	1.37	1.37	1.37	1.37	1.37	8.95
5					0.74	1.37	1.37	1.37	1.37	1.37	7.59
6						0.74	1.37	1.37	1.37	1.37	6.22
7							0.74	1.37	1.37	1.37	4.85
8								0.74	1.37	1.37	3.48
9									0.74	1.37	2.11
10										0.74	0.74
Total											69.01

Table B4: Increase in Batteries Required per Aircraft due to Minimum Fuel Reserve Requirement (Table B3 minus Table B2)

Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total Batteries Required per Aircraft (Years 1-10)
1	0.15	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	2.61

2		0.15	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	2.34
3			0.15	0.27	0.27	0.27	0.27	0.27	0.27	0.27	2.06
4				0.15	0.27	0.27	0.27	0.27	0.27	0.27	1.79
5					0.15	0.27	0.27	0.27	0.27	0.27	1.52
6						0.15	0.27	0.27	0.27	0.27	1.24
7							0.15	0.27	0.27	0.27	0.97
8								0.15	0.27	0.27	0.70
9									0.15	0.27	0.42
10										0.15	0.15
Total	0.15	0.42	0.70	0.97	1.24	1.52	1.79	2.06	2.34	2.61	13.80

The next step to monetize the incremental cost of the fuel reserve requirement is to multiply like cells from Table B4 (the incremental batteries required per aircraft on an annual basis) and Table B5 (the fleet forecast presented by year of entry into service). The results of this calculation are shown in Table B6. Lastly, the incremental number of batteries required due to the fuel-reserve requirement is multiplied by $60,000 (the average cost for a battery). [69]

Table B5: Cumulative Fleet Totals by Year of Entry into Service (Optimistic Scenario)

Entry into Service Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
1	42	42	42	42	42	42	42	42	42	42
2		48	48	48	48	48	48	48	48	48
3			241	241	241	241	241	241	241	241
4				251	251	251	251	251	251	251
5					271	271	271	271	271	271
6						271	271	271	271	271
7							270	270	270	270
8								152	152	152
9									139	139
10										139
Cumulative Fleet	42	90	331	582	853	1,124	1,394	1,546	1,685	1,824

Note: How to read this table: The number of aircraft that entered service during year 1 of the forecast period is the contents of the cell located at the intersection of the row labeled "1" and the column labeled "Year 1." This cell shows that 42 aircraft entered service during Year 1. For purposes of this analysis, it is assumed that once an aircraft enters service it remains in the fleet until the end of the 10-year forecast period. Thus, row 1 reflects that the 42 aircraft that entered the fleet in year 1 remained in the fleet through year 10. Likewise, the number of aircraft that entered service during Year 2 is the value at the intersection of the row labeled "2" and the column labeled "Year 2," for a total of 48 aircraft. These 48 aircraft remain in the fleet for the remaining years of the forecast

[69] https://aerospaceamerica.aiaa.org/features/faith-in-batteries/. For this analysis an average of $60,000 was used based on the cited article that stated a UAM battery would cost between $40,000 to $80,000.

period (in other words, years 3 through 10). By the end of year 2 there were 90 aircraft in the fleet (the summation of all rows in the column "Year 2"). In total, 1,824 aircraft entered the fleet over the 10-year period of the SFAR.

Table B6: Incremental Batteries Required Due to Minimum Fuel Reserve – Optimistic Fleet Scenario

Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
1	6.2	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	109.7
2		7.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	112.2
3			35.7	66.0	66.0	66.0	66.0	66.0	66.0	66.0	497.5
4				37.2	68.7	68.7	68.7	68.7	68.7	68.7	449.5
5					40.2	74.2	74.2	74.2	74.2	74.2	411.1
6						40.2	74.2	74.2	74.2	74.2	336.9
7							40.0	73.9	73.9	73.9	261.8
8								22.5	41.6	41.6	105.8
9									20.6	38.1	58.7
10										20.6	20.6
Total	6.2	18.6	60.4	127.8	199.5	273.7	347.7	404.1	443.8	481.9	2,363.8

Lastly, the values in Table B6 are multiplied by $60,000, the estimated cost per battery. The result is the incremental cost to operators for the 20-minute fuel reserve requirement imposed by the SFAR. The results for the base scenario are the optimistic scenario results pushed one year to the right. The results for the pessimistic scenario are the optimistic scenario results pushed two years to the right.

Table B7: Incremental Costs Due to Fuel Reserve Requirements ($Mil)

Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
1	$0.4	$0.7	$0.7	$0.7	$0.7	$0.7	$0.7	$0.7	$0.7	$0.7	$6.6
2		$0.4	$0.8	$0.8	$0.8	$0.8	$0.8	$0.8	$0.8	$0.8	$6.7
3			$2.1	$4.0	$4.0	$4.0	$4.0	$4.0	$4.0	$4.0	$29.9
4				$2.2	$4.1	$4.1	$4.1	$4.1	$4.1	$4.1	$27.0
5					$2.4	$4.5	$4.5	$4.5	$4.5	$4.5	$24.7
6						$2.4	$4.5	$4.5	$4.5	$4.5	$20.2
7							$2.4	$4.4	$4.4	$4.4	$15.7
8								$1.4	$2.5	$2.5	$6.3
9									$1.2	$2.3	$3.5
10										$1.2	$1.2
Optimistic	$0.4	$1.1	$3.6	$7.7	$12.0	$16.4	$20.9	$24.2	$26.6	$28.9	$141.8

Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Base		$0.4	$1.1	$3.6	$7.7	$12.0	$16.4	$20.9	$24.2	$26.6	$112.9
Pessimistic			$0.4	$1.1	$3.6	$7.7	$12.0	$16.4	$20.9	$24.2	$86.3

The results contained in Table B7 are presented below using a present value discount rate of two percent.

Table B8: Incremental Costs Due to Fuel Reserve Requirements ($Mil)

Scenario	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Optimistic											
2% PV	$0.37	$1.07	$3.41	$7.08	$10.84	$14.58	$18.16	$20.70	$22.28	$23.72	$122.22
2% Annl.											$13.61
3% PV	$0.36	$1.05	$3.31	$6.81	$10.33	$13.75	$16.96	$19.14	$20.41	$21.51	$113.65
3% Annl.											$13.32
7% PV	$0.35	$0.98	$2.96	$5.85	$8.53	$10.94	$12.99	$14.11	$14.48	$14.70	$85.89
7% Annl.											$12.23
Base											
2% PV		$0.36	$1.05	$3.35	$6.95	$10.63	$14.30	$17.81	$20.29	$21.84	$96.57
2% Annl.											$10.75
3% PV		$0.35	$1.02	$3.22	$6.62	$10.02	$13.35	$16.47	$18.58	$19.81	$89.45
3% Annl.											$10.49
7% PV		$0.33	$0.91	$2.76	$5.47	$7.98	$10.23	$12.14	$13.19	$13.54	$66.54
7% Annl.											$9.47
Pessimistic											
2% PV			$0.35	$1.03	$3.28	$6.81	$10.42	$14.02	$17.46	$19.89	$73.26
2% Annl.											$8.16
3% PV			$0.34	$0.99	$3.12	$6.42	$9.73	$12.96	$15.99	$18.04	$67.61
3% Annl.											$7.93
7% PV			$0.30	$0.85	$2.58	$5.11	$7.45	$9.56	$11.35	$12.33	$49.53
7% Annl.											$7.05

Appendix C: Dual-Control Trainers and Full Flight Simulators

The main body of the RIA contains a discussion of the monetized costs for the provision of dual-control powered-lift and full flight simulators and presents those costs at a two percent

present value discount rate. The tables below present the monetized costs at a two percent, three percent, and seven percent discount rate. The present value and annualized costs for each scenario are provided below.

Table C1: Cost for Dual-Control Aircraft and Full Flight Simulators for the Provision of Training ($Mil.)

Optimistic Scenario	Year 1	Year 2	Year 3	Year 4	Total	2% PV	3% PV	7% PV
No. of Powered-Lift	10	10			20			
No. of FFS	30	30			60			
No. of Bldgs	10	10			20			
Cost per P/L ($3.9M)	$39.0	$39.0			$78.0			
Cost per FFS ($10 Mil.)	$300.0	$300.0			$600.0			
Cost/Bldg. ($4.79M)	$47.9	$47.9			$95.8			
Total Cost	$386.9	$386.9			$773.8	$751.2	$740.3	$699.5
Annualized Cost						$83.6	$86.8	$99.6

Primary Scenario	Year 1	Year 2	Year 3	Year 4	Total	2% PV	3% PV	7% PV
No. of Powered-Lift		10	10		20			
No. of FFS		30	30		60			
No. of Bldgs		10	10		20			
Cost per P/L ($3.9M)		$39.0	$39.0		$78.0			
Cost per FFS ($10 Mil.)		$300.0	$300.0		$600.0			
Cost/Bldg. ($4.79M)		$47.9	$47.9		$95.8			
Total Cost		$386.9	$386.9		$773.8	$736.5	$718.7	$653.7
Annualized Cost						$82.0	$84.3	$93.1

Pessimistic Scenario	Year 1	Year 2	Year 3	Year 4	Total	2% PV	3% PV	7% PV
No. of Powered-Lift			10	10	20			
No. of FFS			30	30	60			
No. of Bldgs			10	10	20			
Cost per P/L ($3.9M)			$39.0	$39.0	$78.0			
Cost per FFS ($10 Mil.)			$300.0	$300.0	$600.0			
Cost/Bldg. ($4.79M)			$47.9	$47.9	$95.8			
Total Cost			$386.9	$386.9	$773.8	$722.0	$697.8	$611.0
Annualized Cost						$80.4	$81.8	$87.0

Appendix D: Summary Tables of Economic Impacts of Proposed Rule

The three tables below are reproduced from the NPRM for convenience and provide a qualitative summary for the economic impact of the regulations proposed at that time. The first table, table D1, provides the economic impact of proposed temporary provisions as presented in the preamble to the NPRM. The second table, table D2, provides the economic impact of the proposed permanent provisions as presented in the preamble to the NPRM. The final table in the series, Table D3 provides the economic impact for the operating rules and other miscellaneous amendments as proposed in the preamble to the NPRM

Table D1: Proposed SFAR – Economic Impact of Proposed Temporary Provisions for Airmen Certification and Training

Topic, Affected CFR §, and Proposed SFAR	**Current Requirement**	**Proposed Alternate Requirement for Temporary Provision**	**Economic Impact**
Cross-country time **14 CFR § affected** 61.1(b) **Proposed SFAR §** 194.201	To log cross-country time in a powered-lift, the flight must include at least a straight-line distance of more than 50 nautical miles	Allows a person to log cross-country time in a powered-lift when the flight includes at least a straight-line distance of more than 25 nautical miles.	Relieving - no additional regulatory costs
Qualification requirements for part 135 flight instructors **14 CFR § affected.** 61.3(d)(2) 61.3(d)(3)(ii) 61.167(a)(2) 61.195(b)(1) **Proposed SFAR §** 194.201	A part 61 flight instructor may log PIC flight time for all flight time while serving as the authorized instructor in an operation if the instructor is rated to act as PIC of the aircraft	Allows a person who does not hold a part 61 flight instructor certificate to log PIC flight time for all flight time while serving as a flight instructor under an approved training program under part 135 if the person is rated to act as PIC of the powered-lift	Relieving - no additional regulatory costs

Topic, Affected CFR §, and Proposed SFAR	Current Requirement	Proposed Alternate Requirement for Temporary Provision	Economic Impact
Logging requirements for flight instructors under an approved training program **14 CFR § affected** 61.51(a)(3) **Proposed SFAR §** 194.207(c)	A part 61 flight instructor may log PIC flight time for all flight time while serving as the authorized instructor in an operation if the instructor is rated to act as PIC of the aircraft	Allows a person who does not hold a part 61 flight instructor certificate to log PIC flight time for all flight time while serving as a flight instructor under an approved training program under part 135 if the person is rated to act as PIC of the powered-lift	Relieving - no additional regulatory costs
Practical tests in powered-lift that are incapable of performing certain tasks **14 CFR § affected** 61.45(b) **Proposed SFAR §** 194.207(a) and (b)	An applicant for a certificate or rating may use an aircraft with operating characteristics that preclude the applicant from performing all the tasks required for the practical test, but the certificate or rating will be issued with an appropriate limitation	Allows an examiner who conducts a practical test in a powered-lift that is unable to perform all the tasks required for the practical test to waive any task for which the FAA has provided waiver authority and enables the issuance of powered-lift ratings without limitations	Relieving - no additional regulatory costs
Flight training on tasks for which the FAA has provided waiver authority **14 CFR § affected** 61.107(a), (b)(5) 61.127(a), (e) **Proposed SFAR §** 194.207(c) 194.251	An applicant for a private pilot certificate or a commercial pilot certificate with a powered-lift category rating must receive flight training on the areas of operation listed in §§ 61.107(b)(5) or 61.127(e), as appropriate to the certificate sought	Relieves an applicant from the requirement to receive flight training on a task specified in an area of operation if the task cannot be performed in the powered-lift, as determined by the FAA's issuance of waiver authority for the task on a practical test	Relieving - no additional regulatory costs
Additional qualification requirements for certain pilots serving as SIC	A person serving as SIC of an aircraft type certificated for more than one required pilot flight crewmember or in operations requiring an	Adds an SIC qualification requirement for persons who obtain a powered-lift category rating by passing a practical test during which the	Relieving - no additional regulatory costs.

Topic, Affected CFR §, and Proposed SFAR	Current Requirement	Proposed Alternate Requirement for Temporary Provision	Economic Impact
14 CFR § affected 61.55 **Proposed SFAR §** 194.209	SIC pilot flight crewmember must meet the qualification requirements contained in § 61.55	examiner waived a required task. To serve as SIC of a powered-lift that is capable of performing the waived task, the person must receive training from an authorized instructor on the task and an endorsement certifying that the person has satisfactorily demonstrated proficiency of the task, subject to certain exceptions	
Eligibility requirements for a person seeking a powered-lift type rating **14 CFR § affected** 61.63(d) and (e) **Proposed SFAR §** 194.211	An applicant seeking an aircraft type rating concurrently with an aircraft category rating must hold or concurrently obtain an appropriate instrument rating unless the aircraft is not capable of instrument maneuvers and procedures	Relieves an applicant seeking a powered-lift type rating concurrently with a powered-lift category rating from the requirement to concurrently obtain a powered-lift instrument rating, which would require three practical tests simultaneously. Instead, allows the applicant to complete the instrument rating practical test and the instrument portion of the type rating practical test later by issuing a "VFR only" limitation on the powered-lift type rating, which would remain valid for 2 calendar months[70]	Relieving - no additional regulatory costs
Aeronautical experience and logging requirements for a commercial pilot certificate with a powered-lift category rating **14 CFR § affected** 61.129(e)	Section 61.129(e) contains the aeronautical experience requirements for a person seeking a powered-lift category rating on a commercial pilot certificate. Section 61.51(e) contains the requirements for logging PIC flight time.	Establishes alternate experience and logging requirements that remove current regulatory burdens and facilitate commercial pilot certification in the powered-lift category for the following groups of pilots: (1) test pilots and instructor pilots, (2) initial cadre of instructors	Removes regulatory burdens to facilitate commercial pilot certification in the powered-lift category for an initial cadre of pilots and flight instructors. No additional regulatory costs.

[70] A person holding a private pilot certificate is not required to remove the "VFR Only" limitation if the limitation applies to a powered-lift type that is not a large aircraft or turbojet-powered.

Topic, Affected CFR §, and Proposed SFAR	Current Requirement	Proposed Alternate Requirement for Temporary Provision	Economic Impact
61.51(e) **Proposed SFAR §** 194.215; 194.217 – 194.223; 194.233		for an approved training program under part 135, 141, or 142, and (3) persons completing an approved training program under part 135, 141, or 142. See Table 4 in section V.C of this preamble for additional information.	
Aeronautical experience and logging requirements for a powered-lift instrument rating **14 CFR § affected** 61.65(f) 61.51(e) **Proposed SFAR §** 194.215; 194.225 – 194.231; 194.235	Section 61.65(f) contains the aeronautical experience requirements for a person seeking an instrument-powered-lift rating. Section 61.51(e) contains the requirements for logging PIC flight time.	Establishes alternate experience and logging requirements that remove current regulatory burdens and facilitate the ability to obtain an instrument-powered-lift rating for the following groups of pilots: (1) test pilots and instructor. pilots, (2) initial cadre of instructors for an approved training program under part 135, 141, or 142, and (3) persons completing an approved training program under part 135, 141, or 142.	Removes regulatory burdens to facilitate commercial pilot certification in the powered-lift category for an initial cadre of pilots and flight instructors. No additional regulatory costs imposed.
Cross-country aeronautical experience requirements for a private pilot certificate with a powered-lift category rating **14 CFR § affected** 61.109(e)(2)(i), (e)(5)(ii) **Proposed SFAR §** 194.237	Requires an applicant for a private pilot certificate with a powered-lift category rating to complete (1) a cross-country flight of over 100 nautical miles total distance, and (2) a solo cross-country flight of 150 nautical miles total distance with one segment of the flight consisting of a straight-line distance of more than 50 nautical miles	Establish alternate cross country experience requirements that allow an applicant for a private pilot certificate with a powered-lift category rating to complete certain cross-country flights with reduced nautical mile distances.	Relieving - no additional regulatory costs
PIC and SIC operating limitations and pairing requirement in operations	Requires SIC of a fixed-wing program aircraft with fewer than 100 hours of flight time as SIC flying in the aircraft	Applies fixed-wing program aircraft pairing requirement to SICs operating powered-lift.	Imposes a regulatory burden on subpart K to part 91 operators conducting powered-lift operations on a scale no

Topic, Affected CFR §, and Proposed SFAR	Current Requirement	Proposed Alternate Requirement for Temporary Provision	Economic Impact
under subpart K to part 91. **14 CFR § affected** 91.1055(a) **Proposed SFAR §** 194.245(a)	make and model and, if a type rating is required, in the type aircraft being flown, to have the PIC, if not an appropriately qualified check pilot, make all takeoffs and landings in the situations listed in (a)(1) and (a)(2)		greater than that imposed on operators conducting operations with airplanes or rotorcraft.
Commuter operations with airplanes requiring two pilots by type certification **14 CFR § affected** 135.3(b) **Proposed SFAR §** 194.247(b)	Requires certificate holders that conduct commuter operations under part 135 with airplanes in which two pilots are required by type certification rules of chapter I to comply with subparts N and O to part 121, instead of subparts E, G, and H to part 135	Adds a requirement for certificate holders conducting commuter operations under part 135 with powered-lift requiring two pilots by the aircraft flight manual to comply with subpart Y to part 121, the Advanced Qualification Program (AQP). PICs would also be required to receive other instruction, facilitated discussion, and training, including scenario-based training, as part of their initial, recurrent, and upgrade ground training	Imposes a regulatory burden on part 135 operators conducting commuter operations requiring two pilots by the aircraft flight manual to comply with subpart Y to part 121, (AQP). This burden would be on a scale no greater than those borne by operators conducting airplane operations that choose to comply with subpart Y to part 121.
PIC operating experience requirements in commuter operations **14 CFR § affected** 135.244(a)(1)-(a)(4) **Proposed SFAR §** 194.247(c)	Requires PIC in commuter operations to complete the applicable operating experience listed in (a)(1)-(a)(4) in the make and basic model of aircraft to be flown	Makes operating experience requirements in (a)(1)-(a)(4) inapplicable to powered-lift PICs and establishes 20-hour PIC operating experience requirement in each make and basic model of powered-lift to be flown.	Imposes a regulatory burden on part 135 operators conducting powered-lift operations on a scale no greater than that imposed on like operators conducting operations with multiengine turbine-engine powered aircraft
Initial, transition, and upgrade ground training for pilots **14 CFR § affected** 135.345(b)(6)(iv)	Requires initial, transition, and upgrade ground training for pilots for each aircraft type to include knowledge and procedures for operating airplanes during ground icing conditions, including the areas listed	Establishes that initial, transition, and upgrade ground training under § 135.345 for powered-lift pilots must include instruction in § 135.345(b)(6)(iv), as applicable	Imposes a regulatory burden on part 135 operators conducting powered-lift operations on a scale no greater than those imposed on like operators conducting operations with airplanes

Topic, Affected CFR §, and Proposed SFAR	Current Requirement	Proposed Alternate Requirement for Temporary Provision	Economic Impact
Proposed SFAR § 194.247(d)	in (b)(6)(iv)(A)-(G), if the certificate holder expects to authorize takeoffs in ground icing conditions		
Pilot certification through completion of training, testing, and checking under part 135 **14 CFR § affected** N/A **Proposed SFAR §** 194.243	No current requirement	Allows part 119 certificate holders authorized to conduct part 135 operations to establish and implement certain training curriculums to satisfy training and experience requirements by facilitating alternate eligibility standards for pilots who may be trained under such curricula and using competency checks and proficiency checks required by part 135 to satisfy practical test requirements	Enabling. No additional costs imposed unless part 119 certificate holders authorized to conduct part 135 operations choose to do so with powered-lift.
Qualification requirements for chief instructors, assistant chief instructors, and check instructors **14 CFR § affected** 141.35(a)(1) 141.36(a)(1) 141.37(a)(2)(ii) **Proposed SFAR §** 194.241(a)	Requires a chief instructor, assistant chief instructor, and a check instructor (for checks and tests that relate to a flight training course) to hold (1) a commercial pilot certificate or ATP certificate with the appropriate aircraft category and class ratings, and (2) a flight instructor certificate with the appropriate category and class ratings	Relieves persons seeking designation as a chief instructor, assistant chief instructor, or check instructor (for checks and tests that relate to flight training) in a course of training for a powered-lift from the requirement to hold a class rating on the pilot certificate and flight instructor certificate	Relieving - no additional regulatory costs
Qualification requirements for check instructors for checks and tests that relate to ground training **14 CFR § affected** 141.37(a)(3)(ii)	Requires a check instructor (for checks and tests that relate to ground training) to hold ground instructor certificate or a flight instructor certificate with the appropriate category and class ratings	Relieves persons seeking designation as a check instructor (for checks and tests that relate to ground training) in a course of training for a powered-lift from the requirement to hold a class rating on the flight instructor certificate	Relieving - no additional regulatory costs

Topic, Affected CFR §, and Proposed SFAR	Current Requirement	Proposed Alternate Requirement for Temporary Provision	Economic Impact
Proposed SFAR § 194.241(b)			

Table D2: Proposed SFAR – Economic Impact of Proposed Permanent Provisions for Airmen Certification and Training

Provision and 14 CFR § affected	Summary of Proposed Permanent Provisions for Airmen Certification and Training	Economic Impact
Certificates and ratings issued under part 61 **14 CFR § affected** 61.5(b)(7)	Adds powered-lift to the list of aircraft type ratings that may be placed on a pilot certificate when an applicant satisfactorily accomplishes the training and certification requirements for the rating sought. Relocates the SIC pilot type rating from the list of aircraft type ratings to an independent provision.	Technical amendment. No additional regulatory costs.
Type rating requirements **14 CFR § affected** 61.31(a)	Adds powered-lift to the list of aircraft for which a PIC must hold a type rating.	Imposes costs on individuals accomplishing a powered-lift type rating on a scale no greater than that imposed on individuals accomplishing a type rating for an airplane or helicopter
SIC qualifications **14 CFR § affected** 61.55(a)	Adds a provision to cross-reference the proposed SIC qualification requirements in the SFAR that would apply only to persons seeking to serve as SIC of a powered-lift that is capable of performing tasks that the person was never trained or tested on.	Technical amendment – no additional regulatory costs.
Additional aircraft ratings **14 CFR § affected** 61.63(h) 61.165(g)	Removes provisions that enable a pilot to apply for a category and class rating that is limited to a specific make and model of experimental aircraft based on flight time that was logged between September 1, 2004, and August 31, 2005. Because persons have had over 15 years to obtain a limited rating under these provisions, FAA anticipates that these provisions are obsolete.	Technical amendment – no additional regulatory costs.
Use of an FFS or FTD	Requires a person completing the entire practical test in a Level C or higher FFS to obtain a powered-lift type rating	Imposes a regulatory burden on individuals accomplishing a powered-

Provision and 14 CFR § affected	Summary of Proposed Permanent Provisions for Airmen Certification and Training	Economic Impact
14 CFR § affected 61.64(e), (f)	with a PIC limitation unless the person has 500 hours of flight time in the type of powered-lift.	lift type rating in an FFS on a scale no greater than that imposed on individuals accomplishing a type rating in an FFS for airplanes or helicopters
Private Pilot Aeronautical experience: Powered-lift category rating **14 CFR § affected** 61.109(e)(5)	Requires a person seeking a powered-lift category rating on a private pilot certificate to obtain 10 hours of solo flight time in a powered-lift.	Removes the allowance for time accrued in solo flight to be accomplished in an airplane. This may be a potential cost should a pilot have intended to use an airplane to accrue hours of solo flight time.
ATP Aeronautical experience: Powered-lift category rating **14 CFR § affected** 61.163(c)	Permits flight time logged under SIC PDP to be credited towards 1,500 hours of total time required for an ATP certificate with a powered-lift category rating.	Enabling. No additional regulatory costs.
ATP privileges and limitations **14 CFR § affected** 61.167(a)(2)	Adds reference to the ATP experience requirements of § 61.163 to enable a person who holds an ATP certificate with a powered-lift category rating to have instructional privileges consistent with those afforded to ATP certificate holders with airplane and helicopter ratings.	Enabling. No additional regulatory costs.
Crewmember experience and minimum equipment list requirements for program aircraft **14 CFR § affected** 91.1053(a)(2)(i) 91.1115(b)(1)	Requires that type rating for PIC operating powered-lift in program operations under subpart K of part 91 not be limited to VFR only. Adds powered-lift and other aircraft to regulation prescribing instruments and equipment that may not be included in the Minimum Equipment List	Clarifying amendments. No additional regulatory burden.
PIC qualifications for certain part 135	Adds requirement to hold an ATP certificate with a powered-lift category rating and an appropriate type rating	Imposes a regulatory burden on subpart K to part

Provision and 14 CFR § affected	Summary of Proposed Permanent Provisions for Airmen Certification and Training	Economic Impact
passenger-carrying operations **14 CFR § affected** 135.243(a)	not limited to VFR for that powered-lift, when serving as PIC in: (1) on-demand passenger-carrying turbojet-powered powered-lift operations; (2) on-demand operations in a powered-lift having a passenger seating configuration, excluding crewmember seats, of ten or more; and (3) powered-lift commuter operations other than turbojet-powered powered-lift	91 operators conducting powered-lift operations on a scale no greater than that imposed on like operators conducting operations with airplanes or rotorcraft
PIC qualifications to conduct VFR and IFR operations under part 135 **14 CFR § affected** 135.243(b) and (c)	Requires the PIC of a part 135 VFR operation in a powered-lift to hold a commercial pilot certificate with appropriate category ratings, an appropriate type rating not limited to VFR, and an instrument-powered-lift rating or an ATP certificate with a powered-lift category rating Requires the PIC of a part 135 IFR operation in a powered-lift to hold a commercial pilot certificate with appropriate category ratings, a type rating for the aircraft not limited to VFR, and an instrument-powered-lift rating or an ATP certificate with a powered-lift category rating	Imposes a regulatory burden on part 135 operators conducting powered-lift operations on a scale no greater than that imposed on like operators conducting operations with airplanes or rotorcraft
SIC qualifications under part 135 **14 CFR § affected** 135.245(c)	Adds requirements for maintaining instrument experience for powered-lift SICs that operate under IFR	Imposes a regulatory burden on part 135 operators conducting powered-lift operations on a scale no greater than that imposed on like operators conducting operations with airplanes or rotorcraft
Initial and recurrent pilot testing requirements in part 135 operations **14 CFR § affected** 135.293(a)(9), (b), and (c)	Adds testing requirement for powered-lift pilots on specific procedures to recognize and avoid hazardous visibility conditions Adds competency check requirement to be conducted in the type of powered-lift in which the pilot will serve Requires competency check in a powered-lift to include a demonstration of the pilot's ability to maneuver the powered-lift solely by reference to instruments; safely maneuver the powered-lift into VMC following an inadvertent encounter with IMC; and, for non-IFR-certificated powered-lift, requires performance of maneuvers appropriate to the powered-lift's installed equipment, the certificate holder's operations specifications, and the operating environment	Imposes a regulatory burden on part 135 operators conducting powered-lift operations on a scale no greater than that imposed on like operators conducting operations with airplanes or rotorcraft

Provision and 14 CFR § affected	Summary of Proposed Permanent Provisions for Airmen Certification and Training	Economic Impact
PIC instrument proficiency check requirements under part 135 **14 CFR § affected** 135.297(c)(1), (g)(3)	Modifies instrument proficiency check requirements to align powered-lift, rotorcraft, and airplane PIC IPC requirements Modifies PIC IPC requirements when using autopilot instead of an SIC in powered-lift and rotorcraft, to align with IPC requirements when using autopilot instead of an SIC in an airplane	Imposes a regulatory burden on part 135 operators conducting powered-lift or rotorcraft operations on a scale no greater than that imposed on like operators conducting operations with airplanes
Training center certificate holder training specifications **14 CFR § affected** 142.11(d)(2)(iii)	Adds training specification requirements for powered-lift flight simulators and flight training devices	Enabling. No additional regulatory costs unless a part 142 training center chooses conduct training with powered-lift flight simulators and flight training devices.
Training center instructor eligibility requirements **14 CFR § affected** 142.47(a)(5)(ii) 142.47(c)(2)(ii)	Adds requirement that instructors providing instruction in flight simulators or flight training devices that represent aircraft requiring a type rating, or in a curriculum leading to an ATP certificate or adding a rating to an ATP certificate, meet the aeronautical experience requirements of §§ 61.159, 61.161, or 61.163 Clarifies scope of knowledge tests that instructors must satisfactorily complete	Imposes a regulatory burden on part 142 training centers conducting powered-lift training on a scale no greater than that imposed on like training centers conducting training with airplanes or rotorcraft
Training center instructor training and testing requirements **14 CFR § affected** 142.53(b)(2)(i) 142.53(b)(3)(i)	Adds allowance for instructors instructing in a flight simulator for an ATP certificate or type rating to meet one of three requirements	Imposes a regulatory burden on part 142 training centers conducting powered-lift training on a scale no greater than that imposed on like training centers conducting training with airplanes or rotorcraft
Flight instruction aircraft requirements for training centers	Adds exception for training centers to use aircraft with controls not easily reached from both pilot stations if the certificate holder determines the flight instruction can be conducted in a safe manner	Provides relief to part 142 training centers conducting powered-lift training on a scale equivalent to that provided to training centers

Provision and 14 CFR § affected	Summary of Proposed Permanent Provisions for Airmen Certification and Training	Economic Impact
14 CFR § affected 142.57(c)		conducting training with airplanes or rotorcraft

Table D3 is a summarization of the economic impact of the proposed provisions for operating rules and other miscellaneous amendments proposed by the SFAR.

Table D3: Summary of the Economic Impact of Operating Rules and other Miscellaneous Provisions from the Proposed Rule

Section	Proposed Amendments to Operating Rules and Other Miscellaneous Provisions	Economic Impact
Part 43 *Maintenance, Preventive Maintenance, Rebuilding, & Alterations*	§ 43.3(h) *Persons authorized to perform maintenance, preventive maintenance, rebuilding, and alterations* § 43.15(b) *Additional performance rules for inspections*	Relieving - no additional regulatory costs Imposes a regulatory burden on operators conducting powered-lift operations on a scale no greater than that imposed on like operators conducting operations with rotorcraft
Part 91 *General Operating and Flight Rules*	§ 91.9(a)(b) *Civil aircraft flight manual* § 91.103(b)(1) *Preflight action* § 91.109 *Flight instruction; Simulated instrument flight* § 91.151 *Fuel requirements for flight in VFR conditions* § 91.167 *Fuel requirements for flight in IFR conditions* § 91.205(b)(11) *Anti-collision lights* § 91.205(b)(14) *Shoulder harness, restraint system* § 91.207 *Emergency locator transmitters* § 91.215 *ATC transponder and altitude reporting equipment and use* § 91.219 *Altitude alerting system or device* § 91.223 *Terrain awareness and warning* § 91.313 *Shoulder harness, restraint system* § 91.409 *Inspection programs* § 91.411 *Altimeter system and altitude reporting* § 91.501 *Applicability* § 91.503 *Flying equipment and operating information* § 91.505 *Aircraft flight manual* § 91.507 *Equipment required for over-the-top or night VFR ops* § 91.509 *Survival equipment* § 91.511 *Communications and navigation*	Imposes a regulatory burden on part 91 operators conducting powered-lift operations on a scale no greater than that imposed on like operators conducting operations with airplanes or rotorcraft

Section	Proposed Amendments to Operating Rules and Other Miscellaneous Provisions	Economic Impact
	§ 91.513 *Emergency equipment* § 91.517 *Passenger information, seatbelts/non-smoking* § 91.519 *Oral briefing* § 91.521 *Safety equipment requirements* § 91.523 *Requirements for storage of carry-on baggage* § 91.525 *Requirements for storage of cargo* § 91.527 *Requirements for operating in icing conditions* § 91.529 *Flight engineer requirements* § 91.531 *Second-in-command requirements* § 91.533 *Flight attendant requirements* § 91.603 *Aural speed warning device* § 91.605 *Transport category civil airplane weight limitations* § 91.609 *Flight data recorders and cockpit voice recorders* § 91.613 *Materials for compartment interiors* § 91.1041 *Proving and validation tests* § 91.1045 *HTAWS and thunderstorm detection equipment* § 91.1065 *Initial and recurrent pilot testing requirements*	
Part 91 *General Operating and Flight Rules*	§ 91.107(a)(3) *Use of restraint systems* § 91.205(d)(3) *U.S. airworthiness certificates: Instrument and equipment reqts.* § 91.213 *Inoperative instruments and equipment*	Provides relief to part 91 operators of powered-lift on a scale equivalent to the relief provided to part 91 operators of airplanes or rotorcraft
Part 91 *General Operating and Flight Rules*	§ 91.113 (d)(2) and (3) *Right-of-way rules* § 91.126(b)(1), (b)(2) *Operating in Class G: Direction of Turns* § 91.129 *Operations in Class D airspace – approaches* § 91.131 *Operations in Class B airspace* § 91.155 *Basic VFR weather minimums* § 91.157 *Special VFR weather minimums* § 91.169 *IFR flight plan: Information required* § 91.175 *Takeoff and landing under IFR* § 91.515 *Rules for appropriate flight altitudes* § 91.611 *Authorization for ferry flight with one engine – Not allowed by SFAR* § 91.1037 L*imitations; destination and alternate airports* § 91.1039 *IFR takeoff, approach, and landing minimums*	Imposes a regulatory burden on part 91 operators conducting powered-lift operations on a scale no greater than that imposed on like operators conducting operations with airplanes or rotorcraft.
Part 91 *General Operating and Flight Rules*	§ 91.126 (c)(1) *Operating in Class G airspace* - Flap *Settings* § 91.129 *Operations in Class D airspace – minimum altitudes* § 91.129 *Operations in Class D airspace – departures* § 91.129 *Operations in Class D airspace – noise abatement*	Imposes a regulatory burden on part 91 operators conducting powered-lift operations on a scale no greater than that imposed on like operators conducting operations with airplanes or rotorcraft.

Section	Proposed Amendments to Operating Rules and Other Miscellaneous Provisions	Economic Impact
Part 97 *Standard Instrument Procedures*	§ 97.3. *Copter procedures*	Enabling
Part 135 *Operating Requirements Commuter and On-Demand Operations and Rules Governing Persons on Board such Aircraft*	§ 135.4 *Applicability of rules for eligible on-demand operations* § 135.23(r)(7) *Manual contents* § 135.93 *Minimum altitudes for use of autopilot* § 135.100 *Flight crewmember duties* § 135.159(a)(2)(3) *Helicopter exceptions are not allowed* § 135.181 A*ircraft operated over-the-top or in IFR conditions* § 135.183 *Land aircraft operated over water* § 135.203 *VFR: Minimum altitudes* § 135.205 *VFR: Visibility requirements* § 135.207 *VFR: Helicopter surface reference requirements* § 135.221 *Alternate airport weather minimums* § 135.361 *Applicability* § 135.363 *General* § 135.379 *Large transport category airplanes. Turbine engine powered: Takeoff limitations* § 135.381 *Large transport category airplanes. Turbine engine powered: En-route limitations: One engine inoperative* § 135.383 *Large transport category airplanes. Turbine engine powered: En-route limitations: Two engines inoperative* § 135.385 *Large transport category airplanes. Turbine engine powered: En-route limitations: Landing limitations* § 135.387 *Large transport category airplanes. Turbine engine powered: En-route limitations: Landing limitations: Alternate airports* § 135.389 *Large non-transport category airplanes: Takeoff limitations* § 135.391 *Large non-transport category airplanes. En-route limitations: One engine inoperative* § 135.393 *Large non-transport category airplanes. Landing limitations: En-route limitations: Destination airports* § 135.395 *Large non-transport category airplanes. Landing limitations: En-route limitations: Alternate airports* § 135.397 *Small transport category airplanes performance operating limitations* Subpart L	Imposes a regulatory burden on part 135 operators conducting powered-lift operations on a scale no greater than that imposed on like operators conducting operations with airplanes or rotorcraft.
Part 135 *Operating Requirements Commuter and On-Demand Operations and Rules Governing Persons on Board such Aircraft*	§ 135.1 (a)(9) *Conducting operations in accordance with subpart L: Helicopter Air Ambulance Equipment, Operations, and Training Requirements* § 135.117(a)(9) *Briefing of passengers before flight:* § 135.145 *Aircraft proving and validation tests* § 135.150 *Public address and crewmember interphone systems* § 135.151 *Cockpit voice Recorders,* § 135.152 *Flight data recorders* § 135.154 *Terrain awareness warning systems* § 135.158 *Pitot heat indication systems* § 135.160 *Radio altimeters for rotorcraft operations* § 135.165 *Communication and navigation equipment* § 135.168 *Emergency equipment* § 135.169 *Additional airworthiness requirements* § 135.170 *Materials for compartment interiors* § 135.173 *Airborne thunderstorm equipment requirements* § 135.178 *Additional emergency equipment* § 135.180 *Traffic alert and collision avoidance system*	Imposes a regulatory burden on part 135 operators conducting powered-lift operations on a scale no greater than that imposed on like operators conducting operations with airplanes or rotorcraft.

Section	Proposed Amendments to Operating Rules and Other Miscellaneous Provisions	Economic Impact
	§ 135.209 *VFR: Fuel supply* § 135.223 *IFR: Alternate airport requirements* § 135.225 *IFR: Takeoff, approach, and landing minimums* § 135.227 *Icing conditions: Operating limitations* § 135.271 *Helicopter hospital emergency medical evacuation services (HEMES)*	
Part 135 *Operating Requirements Commuter and On-Demand Operations and Rules Governing Persons on Board such Aircraft*	§ 135.128 *Use of safety belts, child restraint systems* § 135.159(a)(1) *Gyroscopic rate of turn indicator* § 135.163(g) *Exception for helicopters is allowed* § 135.229 *Airport requirements* § 135.429(d) *Required inspection personnel*	Relieving - no additional regulatory costs
Part 111 *Pilot Records Database*	§ 111.1 *Applicability*	Imposes a regulatory burden on operators of large powered-lift on a scale no greater than that imposed on operators of airplanes or rotorcraft
Part 136 *Commercial Air Tours and National Parks Air Tour Management*	§ 136.1 *Suitable landing area for helicopters* § 136.9 *Life preservers for over water* § 136.11 *Helicopter floats for over water* § 136.13*Helicopter performance plan and operations* Appendix A§ 136.75 *Special Operating Rules for Air Tour Operators in the State of Hawaii – Equipment and Requirements*	Imposes a regulatory burden on part 136 operators conducting operations with powered-lift on a scale no greater than that imposed on like operators conducting operations with airplanes or rotorcraft

Appendix E: Monetized Costs Using 3 and 7 Percent Discount Rates

Table E1 below presents the monetized costs of the SFAR using discount rates of 3 percent and 7 percent. These were the discount rates used to monetize the costs in the

preliminary regulatory impact analysis presented with the NPRM for the rule, consistent with OMB guidance in effect at that time.[71]

Table E1: Monetized Costs of SFAR (Millions $)

Forecast Scenario	10-Year Present Value (2%)	Annualized (2%)	10-Year Present Value (3%)	Annualized (3%)	10-Year Present Value (7%)	Annualized (7%)
Base - Primary Estimate	$914.2	$101.8	$884.2	$103.7	$779.2	$110.9
Pessimistic	$865.5	$96.4	$830.8	$97.4	$710.1	$101.1
Optimistic	$966.1	$107.6	$941.2	$110.3	$854.6	$121.7

Appendix F: OMB A-4 Accounting Statement

In accordance with OMB Circular A-4 (at www.whitehouse.gov/omb/circulars/), an accounting statement showing the classification of impacts associated with the rule is provided below.

Table F1: OMB A-4 Accounting Statement

OMB A-4 Accounting Statement							
Category	**Primary Estimate**	**Low Estimate**	**High Estimate**	**Dollar Year**	**Discount Rate**	**Time Horizon**	Notes
BENEFITS							
Annualized monetized benefits	Not Estimated	Not Estimated	Not Estimated	N/A	N/A	N/A	
Annualized quantified, but non-monetized, benefits	N/A	N/A	N/A	N/A	N/A	N/A	
Unquantified benefits:	*Mitigates Risk and Narrows Safety Gap* - The SFAR establishes a regulatory structure that leverages airplane, helicopter, and rotorcraft rules to narrow a safety gap that would otherwise exist absent the rule.						The powered-lift industry is nascent, and the timeframe in which commercial

[71] OMB Circular A-4, *Regulatory Analysis* (2003), https://www.federalregister.gov/documents/2003/10/09/03-25606/circular-a-4-regulatory-analysis

	Data Collection - For the duration of the SFAR, the FAA will gather data and information to evaluate the temporary requirements to determine the most appropriate permanent rulemaking path for powered-lift. The FAA anticipates gathering data and information through: 1) formal information collections; 2) regulatory requirements; 3) regular, formal and informal interactions with the public, including conferences, data-sharing systems, and outreach initiatives; and 4) informal anecdotal information and observations.						operations will become viable is unknown. A certain degree of operational growth is dependent on industry readiness once the regulatory framework is in place.
	Alternate Pathway to Pilot Certification - The SFAR introduces an alternate pathway for pilots to obtain powered-lift ratings on the commercial pilot certificates.						
	Relief from the provision of dual-control a/c for training - The SFAR provides for three alternatives to accomplish training for aircraft that are not equipped with dual-controls, which are: 1) accomplishing training in a powered-lift equipped with a single functioning flight control accessible by both the student and instructor; 2) accomplishing 100% of training in a full flight simulator that is combined with in-aircraft solo aeronautical experience; and 3) FAA can issue deviation authority to facilitate flight training in powered-lift with a single functioning flight control based on future advancements in technology.						
Category	**Primary Estimate**	**Low Estimate**	**High Estimate**	**Dollar Year**	**Discount Rate**	**Time Horizon**	**Notes**
COSTS							
Annualized monetized costs: *2% PV*	$101.8	$96.4	$107.6	2022	2%	10 years	Costs are incurred as powered-lift enter the fleet. For the high estimate, it is determined powered-lift deliveries start during the year of the SFAR's publication. For the primary estimate and the low estimate, it is determined powered-lift enter the fleet in year 2 and 3, respectively.
Annualized monetized costs: *3% PV*	$103.7	$97.4	$110.3	2022	3%	10 years	
Annualized monetized costs: *7% PV*	$110.9	101.1	$121.70	2022	7%	10 years	
Annualized quantified, but non-monetized, costs	N/A	N/A	N/A	N/A	N/A	N/A	

Unquantified costs	*Equipage Requirements* - The SFAR imposes equipage requirements which would add costs for entities manufacturing and/or operating powered-lift. These costs could include, but are not necessarily limited to, the purchase and installation of equipment, the decrease of aircraft performance due to added weight of required equipment, and the cost to perform required maintenance and repairs of equipment. The equipage requirements being imposed generally affect powered-lift with 6 or more seats for which 2 pilots are required, or for powered-lift with 10 or more seats. At present, there is only one powered-lift undergoing type certification that meets these requirements.	The costs imposed by the finalized rule provide for the integration of powered-lift into the NAS expeditiously without compromising safety. Generally, the rule mirrors requirements that are applicable to operators of airplanes and rotorcraft.
	Advanced Qualification Program - The FAA determined that the same safety standard imposed in § 135.3(b) for commuter operations involving airplanes for which two pilots are required by type certification should apply to powered-lift requiring two pilots by type certification. The safety standard requires these kinds of operations to comply with subparts N and O to part 121, which are multiengine specific. At this time, the FAA is not revising part 121 to accommodate powered-lift as part 121 operations are not anticipated during the period of the SFAR. Thus, for these operations, the FAA will require certificate holders to comply with subpart Y to part 121. At present, there is only one powered-lift undergoing type certification that meets these requirements.	
TRANSFERS		
Annualized transfers	Not Applicable	
From whom to whom?		
MISCELLANEOUS		
Effects on State, local, or Tribal Govt	None	
Effects on small businesses	Generally, entities affected by the rule are small, and the FAA does not anticipate that they will be negatively impacted by this rule. The introduction of powered-lift operations into the NAS is an emerging market, and the number of entities that will be impacted by this rule is uncertain.	
Effects on wages	None	
Effects on growth	The rule puts a regulatory framework in place for the safe integration of powered-lift in the National Airspace System. A certain degree of operational growth is dependent on industry readiness.	