DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 21, 38, 121, and 125

[Docket No.: FAA–2022–0241 Amdt. No. 121–391, 125–75, 38–1, 21–107]

RIN 2120–AL54

Airplane Fuel Efficiency Certification

AGENCY: Federal Aviation Administration (FAA), Department of Transportation (DOT).

ACTION: Final rule.

SUMMARY: This action adopts fuel efficiency requirements for certification of certain airplanes. These certification requirements implement the emissions standards adopted by the Environmental Protection Agency (EPA) to allow manufacturers to certificate their airplanes for fuel efficiency in the United States. This action also fulfills the FAA's Clean Air Act obligations to enforce implementation of EPA's aircraft emissions standards for greenhouse gas emissions.

DATES: Effective April 16, 2024.

The incorporation by reference of a certain publication listed in this rule is approved by the Director of the Federal Register as of April 16, 2024.

ADDRESSES: For information on where to obtain copies of rulemaking documents and other information related to this final rule, see ''How to Obtain Additional Information'' in the **SUPPLEMENTARY INFORMATION** section of this document.

FOR FURTHER INFORMATION CONTACT: For technical questions concerning this action, contact Ralph Iovinelli, Office of Policy, International Affairs, & Environment, Emissions Division (AEE–300), Federal Aviation Administration, 800 Independence Avenue SW, Washington, DC 20591; telephone 202–267–3566; email *ralph.iovinelli@faa.gov.*

SUPPLEMENTARY INFORMATION:

I. Executive Summary

A. Purpose of the Regulatory Action

As a signatory State to the Chicago Convention, the United States must establish minimum standards consistent with those prescribed by the International Civil Aviation Organization (ICAO) on a wide range of aviation-related matters, including aircraft emissions, or file a difference. The United States' adoption of the 2017 ICAO carbon dioxide (CO_2) emission standards for certain airplanes aligns United States law with the ICAO standards.

Moreover, the Clean Air Act Amendments of 1970 (Clean Air Act) direct the U.S. Environmental Protection Agency (EPA) to adopt standards applicable to the emission of any air pollutant from any class of aircraft engines. The Clean Air Act also directs the Secretary of Transportation (and by delegation, the Administrator of the FAA) to implement the standards adopted by the EPA.[1] On January 11, 2021, the EPA published a final rule adopting new domestic airplane greenhouse gas (GHG) emissions standards in 40 Code of Federal Regulations (CFR) part 1030.[2] As required by the Clean Air Act[3], the FAA is implementing those EPA standards through this final rule by adopting new certification regulations in 14 CFR part 38 for fuel efficiency for certain covered airplanes. The applicability of these regulations and the regulatory emissions limits are the same as those adopted by ICAO in its airplane CO_2 emission standards.

This rulemaking establishes fuel efficiency certification requirements for certain subsonic jet airplanes with a maximum takeoff mass greater than 5,700 kilograms and for certain propeller-driven airplanes with a maximum takeoff mass greater than 8,618 kilograms. Under this final rule, an airplane is subject to these certification requirements: (1) at new (original) type certification; (2) upon manufacture of any covered airplane after January 1, 2028; or (3) when a modification to a covered airplane meets change criteria specified in the regulations. This rulemaking excepts from applicability airplanes used for firefighting, amphibious airplanes, airplanes lower than specific masses, reciprocating engine airplanes, non-pressurized airplanes, and certain specialized operations airplanes.

For covered airplanes, a certification applicant must demonstrate that the airplane meets these new part 38 requirements. The new part 38 requirements established by this rulemaking prescribe fuel efficiency limits, which are the emission standards adopted by the EPA. This rulemaking expresses fuel efficiency limits as maximum permitted fuel efficiency metric (FEM) values that are determined by the maximum takeoff mass of the airplane. Thus, the applicant must determine an FEM value to demonstrate compliance against the applicable fuel efficiency limit. The two certifiable components of the FEM are the specific air range (SAR) and the reference geometric factor (RGF). The SAR represents the distance an airplane can travel per unit of fuel consumed and is determined by direct flight test measurement or use of a validated performance model. The RGF is a representation of airplane fuselage size based on the floor area of pressurized space in an airplane. The technical detail needed to determine the FEM value of an airplane is included in Appendix A to part 38. An applicant must receive FAA approval for all information the applicant uses to calculate the FEM value of an airplane. To comply with part 38, the FEM value must not exceed the airplane's applicable fuel efficiency limit.

In addition, to fully implement the EPA standards through the FAA's certification process, this rulemaking makes corresponding changes to the FAA certification procedures in part 21 to include compliance with part 38 as a certification requirement. Moreover, this rulemaking requires that the FEM value of the airplane, along with other part 38 compliance information, be placed in an FAA-approved section of the flight manual of the airplane.

The FAA's adoption of these certification requirements implements the emissions standards adopted by the EPA, allows manufacturers to certificate their airplane for fuel efficiency in the United States, and fulfills the statutory obligations of the FAA under the Clean Air Act. The FAA's promulgation of this Airplane Fuel Efficiency regulation is the final step for the United States in implementing the 2017 ICAO carbon dioxide (CO_2) emission standards for certain airplanes promulgated in Annex 16 Volume III under the Chicago Convention.

B. Changes Made in This Final Rule

The FAA has adopted part 38 and sections of parts 21, 121, and 125 largely as they were proposed in a notice of proposed rulemaking (NPRM) that was published on June 15, 2022.[4]

[1] ''The Secretary of Transportation, after consultation with the Administrator, shall prescribe regulations to insure compliance with all standards prescribed under section 7571 of this title by the Administrator. The regulations of the Secretary of Transportation shall include provisions making such standards applicable in the issuance, amendment, modification, suspension, or revocation of any certificate authorized by part A of subtitle VII of title 49 or the Department of Transportation Act.'' 42 U.S.C. 7572

[2] **Federal Register** Vol. 86, No. 6, Final Rule, 40 CFR parts 87 and 1030 ''*Control of Air Pollution from Airplanes and Airplane Engines: GHG Emission Standards and Test Procedures,*'' Environmental Protection Agency, pp. 2136–2174.

[3] 42 U.S.C. 7571

[4] **Federal Register** Vol. 87, No. 115, Notice of Proposed Rulemaking, 14 CFR parts 21, 38, 121, and 125 ''*Airplane Fuel Efficiency Certification,*'' Federal Aviation Administration, pp. 36076–36091.

The FAA considered the public comments it received on its proposal and the adopted rule reflects consideration of those comments. The FAA received over 60 comments on the NPRM, ranging from suggested typographical and grammatical edits to substantive comments on proposed regulatory text and language in the NPRM preamble. As a result of these comments, the FAA made changes throughout the regulatory text. For instance, the FAA revised the language in the applicability and change criteria sections (§§ 38.1 and 38.19) to clarify the applicability of part 38 to newly built airplanes and modifications to airplanes. These revisions clarify this final rule is not applicable to modifications of in-service airplanes that have not previously shown compliance to part 38 prior to the modification, except for manufacturers who are required to comply with part 38 for in-production airplanes that have not received their first certificate of airworthiness as provided in the applicability section of this rule. The FAA also made edits to several technical requirements in Appendix A (*e.g.,* center of gravity, airplane weight, fuel samples, flight test procedures, and calculations and corrections of test data). Revisions to sections within parts 21 and 121 include: the inadvertent omission of the reference to these new fuel efficiency certification requirements in the certification provisions (§ 21.21), consistency edits (§ 21.93), and correction of an error (§ 121.141).

II. Authority for This Rulemaking

The FAA's authority to issue rules on aviation safety is found in Title 49 of the United States Code (49 U.S.C.). Subtitle I, Section 106 describes the authority of the FAA Administrator.

The Clean Air Act, 42 U.S.C. 7572, authorizes the Secretary of Transportation to implement aviation emission standards adopted by the EPA to insure compliance with the same. Furthermore, 49 CFR 1.83(c) delegates to the FAA Administrator the authority to carry out the functions of this section of the Clean Air Act.

This rulemaking adopts regulations to insure compliance with the standards adopted by the EPA under the Clean Air Act in 40 CFR part 1030 to control the emissions of certain GHG emissions from airplanes. This rulemaking is issued under the authority described in 42 U.S.C. 7572 and 49 CFR 1.83(c).

III. Background

A. General Background

As a signatory State to the Chicago Convention, the United States must establish minimum standards consistent with those prescribed by ICAO or file a difference with ICAO if the United States' standards differ from them in any particular respect. The Committee on Aviation Environmental Protection (CAEP) is a technical committee of the ICAO Council that assists in formulating ICAO policy and adopting Standards and Recommended Practices related to aircraft noise and emissions. The FAA represents the United States on CAEP, attending annual Steering Group meetings and CAEP triennial meetings, and contributing technical expertise to CAEP's many working groups. The EPA serves as an advisor to the United States member of CAEP at the annual and triennial meetings and contributes technical expertise to the FAA and CAEP's working groups on aviation emissions, pollution control technology, and environmental policy. Within CAEP, the FAA assists and advises the EPA on aviation-specific environmental issues, airplane and engine technologies, and airworthiness certification matters.

In 2009, the ICAO Council and its Group on International Aviation and Climate Change (GIACC) developed a ''Programme of Action'' to limit or reduce the impact of aviation on the climate. The program's ''basket of measures'' included the reduction of the carbon footprint of international civil aviation, beginning with the development of a technology-based certification standard for CO_2 emissions from subsonic airplanes.

The CO_2 standard-setting process included input from governments, airplane and engine manufacturers, non-governmental environmental organizations, research institutions, and academics worldwide. The standard-setting process occurred in two 3-year phases. The first phase focused on the development of the CO_2 certification requirement (*i.e.,* a CO_2 metric, test procedures, and measurement methodology). The second phase focused on the development of the CO_2 standard itself (*i.e.,* establishing regulatory limits, applicability, and assessments of cost effectiveness). The principles and key criteria that guided the process included the concepts that:

—No certification requirements should be imposed that compromise airplane safety;
—Airplane CO_2 emissions should be reduced through the integration of fuel efficient technologies in airplane type designs;
—Airplanes that incorporate differing generations of CO_2 reduction technologies should be treated fairly and equitably;
—Any adopted standard should be independent of airplane size, purpose or utilization;
—The metric used should be robust and minimize unintended airplane and system design consequences;
—Any adopted standard should use industry standard practices of measurement and correction; and
—The implementation of any adopted standard should reflect a manageable and appropriate level of resources to be expended by national airworthiness authorities and manufacturers.

In February 2016, CAEP agreed on a new CO_2 emission standard for certain airplanes. ICAO adopted this new standard, set out in Annex 16, Volume III, in March 2017.[5]

In the United States, the Clean Air Act directs the EPA to adopt standards applicable to the emission of any air pollutant from any class of aircraft engines, which in the EPA Administrator's judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare. The Clean Air Act also directs the Secretary of Transportation (and by delegation, the Administrator of the FAA) to implement the standards adopted by the EPA. The FAA implements these EPA standards by prescribing regulations in title 14 CFR that require the certification of aircraft and aircraft engines to the EPA standards.

On January 11, 2021, the EPA published a final rule[6] adopting new domestic airplane GHG emission standards in 40 CFR part 1030. In accordance with the Clean Air Act, the FAA is adopting new certification regulations for certain airplanes to insure compliance with the EPA standards. The FAA also supports the adoption of these standards because they are aligned with the principles and key criteria that guided the ICAO process. The applicability of these

[5] Annex 16 to the Convention on International Civil Aviation, Environmental Protection, Volume III, ''*Aeroplane CO_2 Emissions,*'' First Edition, July 2017. *https://store.icao.int/collections/annex-16-environmental-protection/products/annex-16-environmental-protection-volume-iii-aeroplane-co2-emissions.*

[6] **Federal Register** Vol. 86, No. 6, Final Rule, 40 CFR parts 87 and 1030 ''*Control of Air Pollution from Airplanes and Airplane Engines: GHG Emission Standards and Test Procedures,*'' Environmental Protection Agency, pp. 2136–2174.

regulations and the regulatory emissions limits in the United States are the same as those adopted by ICAO as its airplane CO_2 emission standard in Annex 16, Volume III.

The FAA, EPA, and ICAO each use different terminology to reference the same standards. In Annex 16 Volume III, ICAO references its standard as CO_2 emissions because the amount of CO_2 emitted is directly proportional to the amount of fuel burned by an airplane at cruise speed and altitude. ''Airplane CO_2 emissions'' is a commonly used term that fits well within ICAO's international goals to reduce the carbon footprint of aviation. More specifically, Part II of Annex 16 Volume III is titled ''Certification Standard for Aeroplane CO_2 Emissions Based on the Consumption of Fuel.''

Domestically, the EPA issued an endangerment finding for GHG emissions from airplane engines,[7] which, in turn, required the EPA to issue GHG standards for airplane engines. The EPA rule establishes standards for GHGs in recognition of airplane engine emissions of CO_2 and another GHG, nitrous oxide (N_2O).[8] The EPA did not set limits on N_2O emissions, noting that they are small and are proportionally reduced as fuel consumption is reduced. Accordingly, the EPA adopted the fuel efficiency metric established by ICAO, which effectively limits both CO_2 and N_2O GHGs emitted by airplane engines.

The FAA describes these same limits and procedures as measures of fuel efficiency, since this final rule prescribes a measurement of airplane performance determined by the SAR parameter to determine fuel efficiency. This measurement is akin to the fuel-burn-based ICAO standard. The FAA intends that the fuel efficiency standards be the same as the standards that the EPA adopted in 40 CFR part 1030.

In summary, it is the FAA's intent that the three standards—FAA's fuel efficiency regulations in 14 CFR part 38, the EPA's GHG emission standards in 40 CFR part 1030, and ICAO's CO_2 emissions standards—be considered equivalent for purposes of implementation.

The FAA is making final guidance material for part 38 available at the same time as this final rule and has placed the final Advisory Circular 38 (AC38) in the docket.

B. Summary of the NPRM

On June 15, 2022, the FAA published the NPRM titled ''Airplane Fuel Efficiency Certification.'' At the same time, the FAA also posted for comment in the NPRM docket draft guidance material for the proposal in the form of a draft AC38.

In its NPRM, the FAA proposed the adoption of the EPA's GHG standards as fuel efficiency standards for airplanes in a new 14 CFR part 38. The FAA-proposed standards would impose requirements when an applicant seeks type certification. In general, the proposal applied to certain subsonic jet airplanes and certain propeller-driven airplanes above a specified mass. The FAA's proposal also provided for use of the existing part 11 exemption process.

Importantly, the NPRM provided the requirements for determining the fuel efficiency value for subsonic airplanes at certification. The proposal then established fuel efficiency limits as adopted by the EPA. For an airplane, the fuel efficiency limit would be based on a fuel efficiency value calculated using two primary parameters: the SAR and the RGF. The FAA proposal included an Appendix A, which contained the technical detail needed to determine the FEM value. For an airplane to comply with part 38, under the NPRM, the FEM value could not exceed the applicable fuel efficiency limit.

In addition, to fully implement the EPA standards through the FAA's certification process, for applicable airplanes the proposal included amendments to part 21 to include compliance with part 38, and to the operating regulations to ensure that flight manuals contained fuel efficiency certification information. The FAA solicited public comments on the NPRM and draft AC38 for a period of 61 days. The comment period on the NPRM closed on August 15, 2022.

C. General Overview of Comments

The FAA received 62 comments on the NPRM and the draft AC38. One of these comments was received and considered after the comment period closed.

Most comments were from individuals. In addition, the agency received comments from several airplane and engine manufacturers and industry groups: Aerospace Industries Association (AIA), Airbus, Airlines for America (A4A), Airlines Pilots Association (ALPA), Avions de Transport Regional (ATR), Boeing, Embraer S.A. (Embraer), FedEx Corporation (FedEx), General Electric Aviation (GE), General Aviation Manufacturers Association (GAMA), Gulfstream Aerospace Corporation (Gulfstream), Modification and Replacement Parts Association (MARPA), National Business Aviation Association (NBAA), and the Port of Seattle.

The FAA received nine comments generally supporting the rule as proposed. These commenters included ALPA, ATR, Port of Seattle, and some individuals. Fourteen commenters, including Boeing, AIA, A4A, Airbus, FedEx, GE, MARPA, Gulfstream, NBAA, GAMA, Embraer, and some individuals supported the rule generally but offered requests for clarifications, changes, or additional provisions. The FAA received comments from 39 individuals who opposed the proposed rule.

The commenters raised overarching issues on the NPRM related to the FAA's authority to issue the rule, the applicability of the rule, and potential costs of the rule. Commenters also requested clarifications and raised several technical issues. A discussion of comments requesting specific clarifications, changes, or revisions to the NPRM and the FAA's responses to these requests is in Section IV, ''Discussion of Comments and the Final Rule.''

IV. Discussion of Comments and the Final Rule

The following summarizes the comments received to the NPRM and the FAA's responses to these comments.

A. FAA's Part 38 Authority

Comments: Several individuals commented that the proposed rule exceeded the FAA's authority or was otherwise unnecessary for a wide variety of reasons. Conversely, other commenters indicated the proposed rule is needed to allow manufacturers to certificate their airplanes for fuel efficiency in the United States and would fulfill the FAA's Clean Air Act statutory obligations.

Response: The FAA disagrees with those commenters who indicated that the FAA exceeded its authority or that the rule was unnecessary. The proposed rule falls well within the FAA's statutory mandate and is required by Section 7572 of the Clean Air Act. The Clean Air Act vests authority to regulate airplane emissions with both the EPA and the FAA. Section 7571 of the Clean

[7] **Federal Register** Vol. 81, No. 7, Final Rule, 40 CFR parts 87 and 1068 ''*Finding that Greenhouse Gas Emissions From Aircraft Cause or Contribute to Air Pollution That May be Reasonably Be Anticipated To Endanger Public Health and Welfare.*'' Environmental Protection Agency pp. 54422–54475.

[8] Both CO_2 and N_2O are constituents of EPA's defined term ''greenhouse gases,'' which means an air pollutant that is the aggregate group of six greenhouse gases: CO_2, N_2O, methane, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. See 40 CFR 1030.105.

Air Act directs the EPA to adopt standards applicable to the emission of any air pollutant from any class of aircraft engines, which in the EPA Administrator's judgment causes, or contributes to, air pollution that may reasonably be anticipated to endanger public health or welfare. Further, the EPA must consult with the FAA on these aircraft engine emissions standards. The EPA adopts these standards in title 40 of the CFR.

After the EPA adopts the standards, section 7572 of the Clean Air Act directs the Secretary of Transportation (and by delegation, the Administrator of the FAA) [9] to implement the standards adopted by the EPA. The FAA implements these standards by adopting regulations in title 14 of the CFR that allow the certification of aircraft and aircraft engines to the EPA standards. In addition, the proposed rule is consistent with the FAA's own statutes (49 U.S.C. 106) that authorize the Administrator to issue regulations.

On January 11, 2021,[10] the EPA published a final rule adopting GHG emissions standards applicable to certain aircraft engines and airplanes in 40 CFR part 1030. In accordance with the mandate under Section 7572, the FAA adopts this rule through new certification regulations in part 38 for certain airplanes to insure compliance with the EPA standards in 40 CFR part 1030.

B. FAA's Role in Establishing Fuel Efficiency Standards

Comments: Several commenters opined that the proposal was unrealistic or that the FAA was ''simply bowing to'' the EPA. Others said that the FAA should focus on other matters, such as safety.

Response: As described in the ''General Background,'' the FAA and the EPA both participated heavily in the ICAO working group and CAEP that established ICAO's Aeroplane CO_2 standard. Other entities also provided significant input into the process, including the affected global aviation industry and many other representatives. The standard that ICAO ultimately established was based on a process that considered views from all participants. This process resulted in the adoption of technology-following certification requirements that also prevent backsliding to less fuel-efficient airplanes. For the same reasons articulated in the principles and key criteria that guided the ICAO standard development process, the FAA supported and continues to support the adoption of the ICAO and EPA standards.

Finally, as described in ''FAA's Part 38 Authority,'' the FAA is statutorily obligated to adopt the EPA standard.

Comments: Other commenters suggested that the goals of the proposed regulation may already be met by the existing body of regulations or that industry was already incentivized to achieve fuel efficiency through market forces or otherwise. Some suggested that the industry had already achieved low emissions.

Response: The CO_2 standard-setting process at ICAO included input from many stakeholders, including airplane and engine manufacturers. In addition, the FAA received comments from several airplane and engine manufacturers, including Boeing, Gulfstream, Airbus, GE, Embraer, and ATR, as well as industry groups that represent the broader aviation manufacturers and airlines such as GAMA, AIA, A4A, and NBAA. In their comments on the proposed rule, these entities recognized the domestic and international need of expeditiously adopting these standards in order to establish a global fuel efficiency certification scheme for airplanes. The aviation industry has shown strong support for the standard, which is the first aviation standard aimed at improving airplane fuel efficiency and reducing CO_2 emissions.

C. Consideration of Other Alternatives

Comment: A number of comments went beyond the scope of the proposed rule to suggest that the FAA should instead consider alternative means of achieving decreased CO2 emissions, such as adding a tax on fuel sales; increasing airplane registration fees; changing flight procedures; creating incentives to encourage operators to purchase newer, more fuel-efficient airplanes; restricting business jets; developing alternative fuels; or increasing the availability of alternative fuels. Other commenters indicated that the rule was not going far enough to improve fuel efficiency.

Response: The FAA reiterates that part 38 is consistent with the FAA's authority under its own statutes and the Clean Air Act. In particular, the purpose of this rule is to implement EPA's GHG standards through the FAA certification process. Comments received requesting that FAA take an alternative approach to address fuel efficiency are not within the scope of the proposed rule.[11]

Comment: Other commenters were concerned that the proposed rule would result in manufacturers' transitioning to alternative fuels, such as biofuels, or wanted clarity on the applicability of the proposed rule to hybrid airplanes or airplanes using alternative fuels.

Response: This rule is a technology-based standard, aiming at measuring the performance of the airplane in terms of fuel efficiency, predicated on the ability of manufacturers to improve engine propulsion efficiency, aerodynamics, and airplane weight—all elements of the SAR parameter in the FEM. Neither the SAR nor the RGF parameters are affected by the type of fuel used in the airplane. Therefore, the FEM value does not change based on the fuel used in the airplane.

As a general matter, the rule could apply to any airplanes meeting the applicability criteria of § 38.1, including hybrids or those using alternative fuels as long as those fuel(s) meet the applicable specifications in Appendix A. The FAA wants to clarify that the use of alternative fuels does not exempt covered airplanes from compliance with this rule.

D. General Applicability (§ 38.1(a) and (b))

In the NPRM, the FAA proposed that part 38 would apply to certain subsonic jet airplanes and propeller-driven airplanes at three applicability points. These three points are airplanes (1) receiving original type certification on or after January 11, 2021; (2) manufactured after January 1, 2028, regardless of the date of type certification; and (3) type-certificated before the applicable compliance date but where a modification is made that would affect the fuel efficiency of the airplane after January 1, 2023.

1. Discussion of Final Rule

The FAA adopts the applicability requirements for part 38 in § 38.1(a) and

[9] Boeing commented that the proposed rule should update the DOT regulations in 49 CFR 1.83(c) that delegate this authority to the FAA Administrator to reflect the new 40 CFR part 1030. Paragraph 1.83(c) delegates to FAA the authority to implement the standards adopted by the EPA under 42 U.S.C. 7572. The FAA does not have the authority to amend 49 CFR 1.83(c) but will raise the issue to DOT.

[10] **Federal Register** Vol. 86, No. 6, Final Rule, 40 CFR parts 87 and 1030 ''*Control of Air Pollution from Airplanes and Airplane Engines: GHG Emission Standards and Test Procedures,*'' Environmental Protection Agency, pp. 2136–2174.

[11] In *California* v. *EPA,* a number of states and environmental organizations challenged EPA's adoption of the standards in 40 CFR part 1030. The District of Columbia Circuit Court of Appeals held that the rule was within EPA's authority under 42 U.S.C. 7571 and that the agency reasonably explained its decision to harmonize its regulation with the ICAO standards. The Court also held that as the EPA had made the policy choice to align with ICAO standards, the EPA did not have a need to examine alternatives departing from the ICAO standards. 72 F.4th 308 (D.C. Cir. 2023).

(b). These paragraphs remain largely as proposed and have the same applicability as the EPA regulations. These paragraphs continue to provide for the applicability of these standards to certain subsonic jet airplanes and propeller-driven airplanes at three applicability points. After consideration of public comments, the FAA is revising the regulation to clarify the applicability of part 38 to the currently flying in-service airplanes as well as to proposed modifications to covered [12] airplanes that have received their type certificate. The regulation was also revised to make some other non-substantive changes to the text. These changes are discussed in this section.

As developed by ICAO, the standards adopted by the EPA include three occasions on which an airplane becomes subject to the 40 CFR 1030 standards. These same applicability points are included in § 38.1(a) and (b): (1) at new (original) type certification; (2) the manufacture of any covered airplane after January 1, 2028; or (3) a modification to a covered airplane that meets the change criteria of § 38.19. These change criteria pertaining to airplane modifications are described in further detail in § 38.19. The applicability points include:

• *New (Original) Type Certification Applicability:* Paragraphs 38.1(a)(1)–(3) describe airplanes whose applications for original type certification were submitted after January 11, 2021. Although the ICAO standard on which these regulations are based was effective on January 1, 2020, for certifications of new type designs, the effective date of the EPA regulation was January 11, 2021, for certifications of new type designs. Except for the effective date, the EPA and the FAA regulations have the same applicability as the ICAO standard. The difference in effective dates between the ICAO and EPA standards has no practical effect in the United States. In the twelve months between the effective date of the ICAO standard and the effective date of the EPA standards, the FAA received no applications for new type certification that would meet the applicability criteria of this rule. Although EPA's GHG emissions standards are now applicable in the United States through 40 CFR part 1030, the FAA did not receive an application for new type certification before the adoption of either EPA's rule or the FAA's rule. Once an airplane is type-certificated for fuel efficiency in accordance with this rule, all airplanes produced under that type certificate must comply with the fuel efficiency standards.

• *Manufacture of covered airplanes after January 1, 2028:* Paragraphs 38.1(a)(6)–(7) describe the second instance of applicability for covered airplanes manufactured after January 1, 2028. These paragraphs address covered airplanes that are newly built after January 1, 2028, regardless of the date of type certification. Airplanes manufactured after this date would not be eligible for a first certificate of airworthiness unless compliance with part 38 has been shown.

• *A modification to a covered airplane that meets the change criteria of § 38.19:* Paragraphs 38.1(a)(4)–(5) address modifications to covered airplanes whose type designs were not certified under this rule, where an application by the type certificate holder for a type design change is submitted on or after January 1, 2023, and the first certificate of airworthiness is issued with the modified type design that exceeds the change criteria in § 38.19(c). In determining applicability under these paragraphs, a certification applicant must consider § 38.1(b), which addresses modifications made to covered airplanes and directs the reader to the change criteria in § 38.19. See section IV.N for a discussion on the change criteria in § 38.19.

As noted, the FAA made a few non-substantive changes to the applicability provisions. The FAA added levels of designation to paragraph (a)(1) at the suggestion of the **Federal Register** to help clarify the two independent applicability provisions in § 38.1(a)(1). The FAA also fixed a minor typographical error in § 38.1(a)(6)(ii) and changed the order of the agencies identified in § 38.1(a)(4) to reflect that the FAA is issuing this rule.

2. Public Comments and FAA Response

Comments: Multiple commenters, such as A4A, AIA, Boeing, Airbus, FedEx, NBAA, and some individuals, requested clarification that the rule would not apply to in-service airplanes, consistent with the related EPA regulation and the applicable ICAO standard. These comments, summarized in the following sentences, included specific statements and questions related to the applicability of the rule to current in-service airplanes and modifications to such airplanes. Boeing requested clarity that individual in-service airplanes, whose type designs have not been previously certificated to part 38, and to which modifications are made by the owners/operators or other third parties, do not need to demonstrate compliance with part 38. Similarly, some of the commenters, including A4A, Airbus, and Boeing, requested that the FAA clarify the part 38 applicability provisions regarding modified type designs and modified versions of airplanes to more clearly state that part 38 applies only when a type-certificate holder changes the type design of an airplane mid-production by applying for FAA approval of a modified type design. To clarify these concepts, the AIA, A4A, Airbus, and Boeing specifically requested that the FAA modify § 38.1(a)(4)(iii) and (a)(5)(iii) to add ''by the holder of the type certificate'' to explain that a third party would not be required to show compliance to part 38 when requesting a supplemental type certificate that aims to modify one or more individual in-service airplanes.

In addition, Airbus requested that the FAA clarify the regulatory text in § 38.1(b) by changing ''prior version'' to ''prior non-modified version'' to emphasize that the prior version of the airplane is the one that does not include the modification.

Response: The FAA intends this rule to have the same applicability as the related EPA regulation and the ICAO standard. As such, this final rule is not applicable to current in-service airplanes. Where a type certificate holder submits an application for a change in type design after January 1, 2023, and the change meets the requirements of § 38.19(c), part 38 will apply to a newly built airplane incorporating this change in order to receive its first certificate of airworthiness. After January 1, 2028, part 38 will apply to all newly built airplanes receiving their first certificate of airworthiness.

The FAA recognizes that determining the applicability of this rule to a specific airplane requires consideration of multiple sections in part 38. Although § 38.1 addresses applicability in general, when an applicant requests a change in type design, it must also consider § 38.19's change criteria to determine the applicability of part 38. Sections 38.1(a)(1) through (3) address newly built airplanes whose applications for original type certification were submitted after the specified dates. Sections 38.1(a)(4) and (5) provide applicability requirements for a modified version of an airplane whose type design was not certificated under part 38. Further, § 38.1(a)(4) and (5)

[12] For the purpose of FAA's final rule, ''covered airplanes'' are defined the same as EPA's definition in their final rule: ''*Civil subsonic jet airplanes (those powered by turbojet or turbofan engines and with a MTOM greater than 5,700 kilograms), as well as larger civil subsonic propeller driven airplanes (those powered by turboprop engines and with a MTOM greater than 8,618 kilograms*).'' 86 FR 2136 (Jan. 11, 2021).

relate to a newly built airplane, receiving its first certificate of airworthiness, based on a type design change submitted by the type certificate holder on or after January 1, 2023, that exceeds the change criteria in § 38.19(c). On or after January 1, 2028, all newly built covered airplanes that meet the requirements of § 38.1(a)(6) and (7) must comply with part 38 to receive their first certificate of airworthiness.

Section 38.1(b) makes the important connection to the § 38.19 change criteria. In § 38.1(b), part 38 applies to an airplane where an applicant requests a change in type design that meets the change criteria of § 38.19. Airplanes that have demonstrated compliance to this rule (*i.e.,* those that do not fall in § 38.1(a)(4) and (5)) and subsequently undergo modifications will need to re-demonstrate compliance according to the change criteria shown in § 38.19(a) and (b).

With the applicability context described in the previous paragraphs, the FAA agrees to revise the proposed §§ 38.1 and 38.19 to clarify part 38 applicability to individual in-service airplanes and modifications to airplanes. The FAA recognizes that § 38.1(a)(4)(iii) and (5)(iii) in the NPRM may have been interpreted, as commenters suggested, to require compliance with part 38 for any modifications to an airplane, even a currently in-service airplane. The FAA does not intend this applicability. This final rule slightly updates these paragraphs to clarify that this specific set of applicability requirements are for applications for a change in type design made by the type certificate holder. Specifically, in response to comments requesting clarity on modifications to airplanes under these specific applicability requirements, this rule revises § 38.1(a)(4)(iii) and (5)(iii) to state that compliance is required when ''an application by the type certificate holder for a type design change is submitted on or after January 1, 2023.'' In combination with the rest of the requirements under § 38.1(a)(4) and (5), the part 38 now reads clearly that it does not apply to a type design change application for a currently in-service airplane that has not previously shown compliance to part 38. Only a newly built airplane with a change in type design by the type certificate holder, applied for on or after January 1, 2023, and exceeding change criteria in § 38.19(c), would be required to comply with part 38. Therefore, the final rule clarifies that part 38 does not apply to currently in-service airplanes, including modifications, and instead focuses on newly built airplanes that incorporate modifications.

Further, in proposed § 38.1(a)(4)(iv) and (a)(5)(iv), the words ''for an airplane built'' were redundant with the introductory text of § 38.1(a)(4) and (5), which already stated, ''A subsonic jet airplane—'' and ''A propeller-driven airplane—'', respectively. To correct this redundancy, this final rule removes ''for an airplane built'' from § 38.1(a)(4)(iv) and (a)(5)(iv). Also, this change is consistent with other changes FAA made to § 38.1(a)(4) and (5) to clarify to the applicability. This change does not alter the meaning of the paragraph.

For consistency with and to fully respond to the comments on § 38.1(a), the FAA updates the proposed § 38.1(b) to reflect that part 38 applies to modifications that are based on an application for a change in type design and meet the change criteria of § 38.19. As part of these updates, the FAA moves the § 38.19 reference earlier in the paragraph to incorporate the change criteria more clearly in § 38.1(b). Also, the FAA revises § 38.1(b) to explicitly state that the applicability is tied to an application for a change in the type design. This better aligns with the text of § 38.1(a)(4) and (5).

In response to Airbus' request that to change ''prior version'' to ''prior non-modified version,'' the FAA recognizes that ''prior version'' of an airplane may not have been described with sufficient detail. Based on these considerations, this rule also revises § 38.1(b) for consistency with § 38.1(a) to more accurately describe the state of an airplane before or after modifications, rather than using ''prior version,'' and to highlight the connection to the change criteria in § 38.19.

Finally, because § 38.19(b) and (c) also use ''prior version,'' this rule makes similar consistency changes to these paragraphs.

In summary, these edits to §§ 38.1(a) and (b) and 38.19(b) and (c) clarify that part 38 does not apply to current in-service airplanes.

Comments: Airbus, A4A, and Boeing also recommended that table 1 in the NPRM be clarified to avoid the implication that part 38 be applied to in-service airplanes.

Response: In lieu of providing an updated table 1 from the NPRM to provide a quick reference for applicability with examples, the FAA has provided a much more detailed discussion here to clarify applicability of part 38 to in-service airplanes in this section.

Comments: Similar to comments requesting clarity on prior version of an airplane, Boeing, AIA, and A4A requested a definition of ''subsequent version,'' a term that appears in § 38.19, to clarify that modifications to individual in-service airplanes do not require application of the fuel efficiency standards.

Response: This rule's changes to § 38.1 address the fact that current in-service airplanes, or modification to such airplanes, do not require compliance with this rule. Therefore, the FAA does not see a need to add a definition for the term ''subsequent version.''

Comments: Boeing requested that the FAA add a definition of ''modified type design,'' which is used in § 38.1(a)(4)(iv) and (5)(iv), because it was concerned that the lack of a definition could create potential ambiguity when the text is read together with the well-established aircraft certification regulations in part 21 that address 'changes in type design.'

Response: The FAA notes that the term ''modified type design'' in the context of § 38.1(a)(4)(iv) and (5)(iv), where it appears, refers to the final modified configuration of an airplane receiving its first certificate of airworthiness.

The FAA is using the word modified for consistency with EPA's regulations. For the purposes of part 38, the FAA uses the words ''changed'' and ''modified'' interchangeably.

Comment: Airbus recommended that the four (4) applicability requirements listed under § 38.1(a)(4) and (a)(5) should be joined by adding the conjunction ''and'' after each individual requirement to clarify that applicability to this rule consists of all four requirements in total.

Response: The FAA reviewed the grammatical structure of § 38.1(a)(4) and (a)(5). As proposed, the four applicability requirements listed under each of these sections are separated by a semicolon in a list from (i) to (iv) with the conjunction ''and'' between the final two provisions (iii) and (iv), signifying that the ''and'' applies to all requirements in this list. This format follows the Office of the Federal Register (OFR) formatting practices, and, therefore, the repetition of ''and'' between each requirement is not required. The FAA believes this is the correct structure and will not incorporate Airbus's recommendation to add an ''and'' after each requirement.

Comment: Airbus further commented on several items such as changing the following text from the proposed rule: ''. . . an application . . .'' to ''. . . the application . . .'' in paragraph (a)(4)(iii); ''. . . type design is submitted . . .'' to ''. . . type design was submitted . . .'' in paragraph (a)(4)(iii);

and ''. . . for an airplane built . . .'' to ''. . . for that airplane built . . .'' in paragraph (a)(4)(iv).

Response: The FAA does not agree with these suggestions. The FAA wrote this rule to apply to a wide range of civil airplanes and changing words to ''that airplane'' or ''the application'' adds a level of specificity that is not needed for this rule. The suggested change to ''for that airplane built with'' is not necessary because the FAA removed this phrase from §§ 38.1(a)(4)(iv) and (a)(5)(iv) in response to previously addressed comments. Regarding the change from ''is'' to ''was,'' the FAA notes that the verb tense of this rule is written in present tense.

Comment: Airbus commented on § 38.1(a)(6) and (a)(7) that the words ''An individual . . .'' should be added to the beginning of these applicability paragraphs to reinforce that these requirements apply to individual airplanes. Airbus states this would be similar to the applicability language in ICAO Annex 16 Vol III, Part II, Chapter 2, § 2.1.1(f)&(g).

Response: The applicability language in § 38.1(a)(6) and (a)(7) has the same meaning as the ICAO Annex 16 Vol III language even if the terminology is slightly different. The applicability language in § 38.1(a)(6) and (a)(7) is written in singular form starting with: ''*A* subsonic jet airplane . . .'' and ''*A* propeller-driven airplane . . .'' that has ''Its first certificate of airworthiness issued on or after January 1, 2028.'' The word ''a'' already places the subject in singular form that clearly represents an individual airplane, which is consistent with the ICAO Annex 16 Vol III. For these reasons, it is not necessary to reinforce that these paragraphs apply to ''individual'' airplanes.

Comment: The GAMA commented that the applicability requirements for propellor-driven airplanes with maximum takeoff mass (MTOM) greater than 8,618 kilograms (kg), as used in the proposed rule, could include airplanes with maximum takeoff weight (MTOW) greater than 18,999.45 lbs when 8,618 kilograms are converted to pounds. The GAMA noted that the mathematical conversion of an MTOM of 8,618 kg equates to 18,999.45 lbs, which is less then what is used for the MTOW limits of parts 21 and 23 for normal category airplanes. Therefore, the GAMA argues the proposed part 38 fuel efficiency standards would apply to FAA type certificated part 23 airplanes at the maximum allowable MTOW of 19,000 lbs. The GAMA suggested two alternative approaches to address this potential unit conversion issue in § 38.1 MTOM references: (1) use 8,619 kg in all instances for MTOM threshold for propeller-driven airplanes instead of 8,618 kg; or (2) list both the applicable MTOM (mass) of 8,618 kg and MTOW (weight) 19,000 lbs.

Response: The FAA acknowledges that conversion from 8,618 kg to lbs equates to a weight that is approximately 0.5 lbs less than the 19,000 lbs threshold of other FAA regulations. However, when applying the conversion in reverse, going from 19,000 lbs to kg, the result is 0.25 kg greater than 8,618 kg. This difference of less than 1 lb or 1 kg is extremely small; it is unlikely that an airplane would fall within this conversion difference. Importantly, differences less than 1 lb or 1 kg would not be reflected in either a TCDS or an airplane flight manual. Additionally, the use of kilograms as the applicability threshold is consistent with the EPA standards. For these reasons, the FAA finalizes the threshold as proposed in § 38.1(a)(3)(i).

Comments: The MARPA requested that the FAA clarify that part 38 does not apply to parts manufactured by holders of a Parts Manufacturer Approval (PMA). In particular, the MARPA asked that the FAA include text in the preamble to the final rule stating that the rule applies only to the design and approval of type certificated products. In addition, the MARPA wanted this text to also state that the proposed rule does not apply to Parts Manufacturer Approval (PMA) manufacturers of modification and replacement parts under part 21 subpart K.

Response: The FAA disagrees with adding the suggested text to the preamble. The applicability section does not apply to parts manufactured by holders of a PMA. Because these parts have the same fit, form, and function of the parts they replace they are not considered a change in type design.

Comment: One individual thought that this rule would benefit those who use private airplanes for travel, implicitly indicating that those types of planes would not need to comply with part 38.

Response: The FAA disagrees as the applicability of this rule includes all airplanes that meet the applicability requirements regardless of who is using the airplane or whether they are privately owned. The type of airplanes described by the commenter are not necessarily exempted from the rule.

E. Exceptions to Applicability (§ 38.1)

In the NPRM, the FAA proposed several exclusions to the applicability of part 38. Part 38 would not apply to airplanes with lesser MTOMs than those specified in § 38.1(a). Part 38 also would exclude airplanes that are designed for specialized operations (including the presence of unique design features to carry out those operations). The NPRM also would exclude amphibious airplanes, airplanes that have no pressurized areas, airplanes designed for firefighting, and airplanes powered by reciprocating aircraft engines.

1. Discussion of the Final Rule

In § 38.1(c), the FAA is adopting the same exclusions to part 38 that were adopted by the EPA and ICAO. The section is remaining as proposed, except for one minor non-substantive change in § 38.1(c)(4) where the FAA switched the EPA and FAA references so that the FAA is identified first as the agency is issuing this rule.

As finalized, part 38 does not apply to airplanes with lower MTOMs than those specified in § 38.1(a) and § 38.1(c)(1) and (2)). The rule also excludes airplanes that are initially designed, or modified and used, for specialized operations (including the presence of unique design features to carry out those operations) from part 38, subject to a determination that a design for specialized operation is detrimental to fuel efficiency. The FAA and the EPA would make this determination at the time an airplane is presented for certification. Examples of such airplanes could include specialized cargo features, specialized missions, or crop dusting (§ 38.1(c)(4)). The rule excludes from part 38 the following: amphibious airplanes (as defined in § 38.3); airplanes that have no pressurized areas (described as having zero reference geometric factor (RGF)); airplanes designed for, or modified and used for, firefighting; and airplanes powered by reciprocating aircraft engines (§ 38.1(c)(3), (5), (6), and (7)).

2. Public Comments and FAA Response

Comments: Commenters, including Boeing and AIA (echoed by GE [13]), requested that the FAA clarify and revise the regulatory text to explicitly state that the rule only applies to civil airplanes and not military airplanes. The AIA specifically requested clarification that part 38 did not apply to state airplanes, such as those used by military, customs, and police services,

[13] GE specifically incorporated by reference Boeing's substantive, non-technical comments on the NPRM, including comments on the applicability to military aircraft and other requested changes for alignment with EPA and ICAO standards. GE also specifically incorporated by reference AIA's substantive comments on the proposed rule, including comments on the inapplicability of the rule to state aircraft and modifications to an in-service aircraft.

or other types of airplanes, such as rotorcraft or piston-engine airplanes. Boeing requested that the FAA clarify the language in § 38.1(a) so that the regulation explicitly stated that part 38 only applied to civil airplanes as defined in 14 CFR 1.1.

Boeing further requested a change in § 38.1(a) from original type certification to original civil certification. Boeing believed this change and other consistency changes would remove any ambiguity and clarify that only airplanes seeking civil certification are subject to the rule. GE supported Boeing and AIA comments on this issue.

Response: The FAA disagrees with the request to explicitly revise the regulatory text to state that the rule only applies to civil airplanes and not military airplanes. This rule addresses the certification of fuel efficiency for subsonic, civil airplanes.[14] As defined in 14 CFR 1.1, civil aircraft are aircraft other than public aircraft. Public aircraft is an operational status under the statute, not a certification status, since any airplane operated by a valid government entity could be a public aircraft depending on its use. 49 U.S.C. 40102(a)(41), 40125. Because the FAA cannot predict whether a type certificated airplane may be used for a public aircraft operation, and the status of that airplane may change from civil to public and back on a flight-by-flight basis, the FAA finds that this distinction is not appropriate for purposes of this rule.

Further, the FAA disagrees with Boeing's suggested change to original civil certification. The FAA does not reference its airworthiness certificates as ''civil certificates.'' The FAA uses terminology such as ''original type certificates,'' consistent with part 21.

Thus, the FAA declines to modify § 38.1 as suggested by commenters.

Comments: Commenters also suggested the FAA clarify that part 38 does not apply to airplanes that are initially certificated as civil airplanes during the production process but immediately used for military operations. Both AIA and Boeing explicitly requested that the FAA add these types of airplanes to the list of airplanes not covered by the rule in § 38.1(c). Boeing also requested corresponding changes to the draft Advisory Circular. These commenters indicated that these changes are consistent with the ICAO standards. In particular, they referenced the ICAO Environmental Technical Manual (ETM) [15] and its inclusion of these types of airplanes in a list of examples of specialized operational requirements. Because the FAA had included language in the NPRM to propose the same exclusions adopted by ICAO, Boeing stated the FAA should include language excluding these types of airplanes from coverage under part 38. Boeing stated the exception would be consistent with the examples for these airplanes in the ICAO guidelines (the ETM). Boeing also indicated that this exception would be consistent with past EPA and Department of Defense (DOD) practice, citing to the EPA's 2012 Final Rule adopting new aircraft engine emissions standards for nitrogen oxides.

Response: Commenters indicated that to be consistent with the ICAO standards, the FAA needs to exclude from part 38 a civil-certificated airplane immediately converted to military use. The FAA disagrees with the underlying premise that part 38 does not apply to civil certificated airplanes immediately converted to military use. The FAA regulations are consistent with ICAO Annex 16 Volume III standards, which contain no such exemption. The ICAO language suggesting the exception of military airplanes from CO_2 applicability is in ICAO guidance (*i.e.,* the ETM guidance document to Annex 16 Volume III), not in the ICAO standards (*i.e.,* Annex 16 Volume III).[16] The FAA is not obligated to include in its standards any exception suggested in ICAO guidance that is not in the ICAO standard.

The FAA has no authority over military airplanes involved in public aircraft operations, and its regulations do not apply to airplanes produced for the armed services. The FAA certification regulations apply only to airplanes that seek civil certification in the United States. When an airplane is produced, the FAA issues an airworthiness certificate for that airplane if it conforms to the type design and complies with all applicable civil regulations. FAA regulations do not consider intended use or conversion involved in airplane certification—either the airplane complies with all regulatory requirements and is eligible for a civil airworthiness certificate, or it does not.

A manufacturer may produce airplanes and parts for the military without involving the FAA. If an applicant requests civil certification from the FAA, the applicant must satisfy all applicable regulations for that airplane regardless of the potential for that airplane's use for military operations.

In the United States, the FAA has no statutory authority over military airplanes involved in public aircraft operations. Part 38 does not apply to these airplanes; accordingly, these airplanes cannot be exempted or excluded from something that does not apply in the first place. For these reasons, the FAA does not see the need to modify § 38.1(c) in this respect.

F. Definitions (§ 38.3)

In the NPRM, the FAA proposed several definitions for part 38. These definitions would be specific to fuel efficiency certification. The proposed definitions included: amphibious airplane; ICAO Annex 16, Volume III; maximum takeoff mass (MTOM); performance model; reference geometric factor (RGF); specific air range (SAR); subsonic; and type certificated maximum passenger seating capacity.

1. Discussion of the Final Rule

The rule includes a definitions section as § 38.3. The section is adopted, as proposed, except this rule makes modifications to the definition of maximum takeoff mass (MTOM) based on comments received.

2. Public Comments and FAA Response

Comments: Some commenters suggest the FAA include additional definitions, such as ''subsequent version'' and ''modified type design.''

Response: See responses to these comments that are discussed in section IV.D.

Comments: The FAA received several comments on the definition of Maximum takeoff mass (MTOM) in § 38.3. Specifically, Airbus commented that the definition of MTOM should be modified by replacing ''maximum allowable'' with ''highest of all certified'' takeoff masses. Airbus stated that the proposed definition could be misinterpreted and suggested clarifying that the MTOM represents the highest of all of the certified takeoff masses in the Type Certificate Data Sheet (TCDS). Airbus also suggested replacing ''approved certification basis'' with ''Type Certificate Data Sheet'' since the approved certification basis of a type design generally represents the set of applicable requirements to the type

[14] 87 FR at 36082.

[15] Volume III—Procedures for the CO_2 Emissions Certification of Airplanes, § 2.1.3.

[16] The FAA inadvertently included guidance from ICAO's Environmental Technical Manual in the draft AC38 that was included in the docket for review with the NPRM. The exception has never been included in the part 38 rule text, and for the reasons discussed it has been removed from the final AC38.

design and it would be more exact to refer to the TCDS.

Response: The FAA does not agree that ''highest of all certified'' should replace ''maximum allowable'' in the definition of MTOM. The MTOM is intended to mean the maximum takeoff mass an airplane type design is certified to and recorded in the TCDS. As mentioned by an individual commenter, the FAA agrees that the TCDS may contain several maximum takeoff masses for different variants of the same airplane type design, and the MTOM is the highest of these maximum takeoff masses. The comments reflected confusion around which maximum mass was meant—maximum structural, maximum takeoff for an airplane, or the maximum mass of several variants of similar design. The FAA does recognize that the definition as proposed was not clear on this point and is changing ''maximum allowable takeoff mass'' to ''maximum certified takeoff mass,'' which clarifies reference to certified MTOM values in the TCDS. The FAA also notes that the use of ''maximum certified takeoff weight'' (similar to maximum certified takeoff mass) is used in other parts of title 14 CFR, including parts 21, 25, and 36.

Regarding the reference in the proposal to the ''approved certification basis'' and the requests to replace this phrase in the MTOM definition with ''TCDS,'' the FAA agrees that the TCDS is the appropriate document to reference in determining the maximum takeoff weight for FAA-certified variants of the base model. However, the FAA decided to remove ''approved certification basis'' from the regulatory text, and not replace it with ''TCDS,'' because the change to ''maximum certified takeoff mass,'' earlier in the definition addresses these concerns. Applicants may propose the use of the highest weight of an airplane type design to represent lower-weight variants. This allowance provides flexibility to applicants who may not be interested in certifying an individual FEM value for each lower weight variant. Such proposals will be considered on a case-by-case basis for FAA approval as provided in § 38.23.

Comment: Boeing commented that the FAA should revise its description of the MTOM definition to clarify that MTOM is not an international standard term for airplane weight expressed in kilograms. Boeing indicated that its expression in kilograms is not integral to its meaning. Boeing requested that the FAA revise its description to state that the MTOM is the highest of all takeoff masses for the type design configuration.

Similarly, an individual commented that although MTOM needs to be expressed in kilograms for use in showing compliance with the proposed requirements, MTOM is not an international standard term for airplane weight expressed in kilograms. In addition, the commenter noted that MTOM is the highest maximum takeoff mass specified for the airplane type design as stated in the airplane TCDS, and that the TCDS may contain several maximum takeoff masses (identified as maximum takeoff weights in the TCDS) for different weight variants for the same airplane type design. The commenter concluded by stating that the MTOM is the highest of these maximum takeoff masses.

Response: The FAA acknowledges that in the NPRM preamble the FAA described MTOM as the international standard term of airplane weight expressed in kilograms. The FAA recognizes that this statement is incorrect as MTOM is not an international standard term for airplane weight.

The FAA made minor revisions for clarification and moved the reference to kilograms to be more closely associated with the relevant terms.

As a result, the FAA has modified the definition of MTOM in this final rule to be:

The maximum certified takeoff mass, expressed in kilograms, for an airplane type design

Comment: A commenter asked that the definition of MTOM include the phrase ''for the purposes of complying with the requirements of this part.''

Response: The FAA notes that § 38.3 already begins with the phrase, ''For the purpose of showing compliance with this part, the following terms have the specified meanings:.'' Based on that, the FAA has not changed the definition as suggested by the commenter.

Comment: Airbus provided a comment on the definition of ''Performance model'' stating that in the phrase ''using corrected flight test data that can be used to determine the specific air range values,'' the word ''corrected'' should be removed since test data in test conditions could also be used to validate a performance model.

Response: The FAA disagrees with this change as it would cause a substantive difference between the FAA and the EPA and ICAO standards, both of which include the term ''corrected flight test data'' in the definition (See, *e.g.,* 40 CFR 1030.105). A substantive difference would change the meaning, intent, or level of a particular requirement.

G. Compatibility With Airworthiness Requirements (§ 38.4)

As proposed, this section addressed compatibility between environmental and airworthiness standards. The NPRM intended to prohibit the sequencing of certification tests for an airplane that has not met the applicability airworthiness requirements. This requirement would ensure that no airworthiness requirements are compromised during the fuel efficiency certification. In addition, the FAA proposed to require that all the procedures used to conduct the flights to demonstrate fuel efficiency compliance be conducted in compliance with all airworthiness regulations that apply to the airplane.

1. Discussion of the Final Rule

The FAA received one comment on § 38.4 regarding the sequencing of certification tests. The FAA did not make any changes to the section based on the comment and is adopting the section as proposed.

2. Public Comments and FAA Response

Comment: Gulfstream asked if an applicant, when developing an aero-propulsion model, could substantiate the score by conducting some of the testing (on a conforming test article) before 100% of airworthiness certification is complete.

Response: The FAA recognizes that Gulfstream's comment was in response to a sentence in the NPRM preamble noting that § 38.4 is intended to prohibit the sequencing of certification tests for an airplane that has not met the applicable airworthiness requirements. In response to Gulfstream's question, the FAA clarifies that testing could be done on a type design conforming test article before 100% of the airworthiness certification is complete. The airplane configuration conformed for fuel efficiency testing purposes must represent the configuration sufficiently such that the FEM is representative of the final type design. The FAA must approve configuration(s) not completely conforming to the type design prior to testing. The FAA did not revise the regulatory text based on this comment.

H. Exemptions (§ 38.5)

In the NPRM, the FAA proposed a process for exemptions. The NPRM proposed that a petitioner submit petitions for exemption from any requirement in part 38 in accordance with 14 CFR part 11. The proposal also noted that the FAA would consult with the EPA on any request for exemption from the regulations of part 38. This proposed process is the same process

the FAA follows when it considers petitions for exemption from the engine emissions standards promulgated by the EPA under 40 CFR part 87 and by the FAA in 14 CFR part 34.

1. Discussion of the Final Rule

The FAA is adopting § 38.5 as proposed. In accordance with 42 U.S.C. 7572, 49 CFR 1.83(a)(6) and (c), and 49 U.S.C. 44701(f), the FAA may issue exemptions from its regulations when such exemption would be in the public interest. As adopted, § 38.5 continues to provide for submittal of petitions for exemption from any requirement in part 38 in accordance with 14 CFR part 11. The FAA is adopting § 38.5 as proposed.

2. Public Comments and FAA Response

Comments: Some commenters, including AIA, A4A, Boeing, NBAA, and Airbus, expressed overall support for the FAA's approach to addressing exemption requests from part 38. In particular, Boeing supported the use of the public interest standard under 49 U.S.C. 44701 in considering exemptions. Several commenters requested clarity on the FAA process for exemptions in § 38.5.

Response: The FAA will follow its standard process for petitions for exemption that are outlined in 14 CFR part 11. Section 11.15 of these regulations defines a petition for exemption and §§ 11.61 through 11.103 contain the FAA's regulatory process for exemptions. Part of what must be included in a petition for exemption is an explanation of why the proposed action will be in the public interest (14 CFR 11.71). Section 38.5 adds a requirement to this process as it provides that the FAA consult with the EPA on each exemption petition before taking action. This process is the same as that followed when the FAA considers petitions for exemption from the engine emissions standards promulgated by the EPA under 40 CFR part 87 and by the FAA in 14 CFR part 34.

Comment: Airbus requested that the FAA provide information on the number of exemptions that could be granted and whether the FAA would follow the ICAO recommendations in granting exemptions.

Response: How the FAA will process future exemptions under part 11 and the possible number of exemptions the FAA could issue is outside the scope of this rulemaking. Although ICAO provides some guidance on exemptions that member countries could consider, the FAA processes each request for exemption on a case-by-case basis.

I. Incorporation by Reference (§ 38.7)

In the NPRM, the FAA noted that it was reserving § 38.7 for materials to be incorporated by reference into part 38. As part of the final rule development, FAA assessed the references to external documents throughout the proposed rule and is incorporating by reference ICAO Doc 7488/3, *Manual of the ICAO Standard Atmosphere (extended to 80 kilometres (262 500 feet)),* 1993 (Manual) in § 38.7. The Manual was identified in the part 38 Appendix and the FAA did not receive any comments on the Manual. Specifically, this Manual is referenced in sections A38.2.1.3.1, A38.5.2.2.1.9, and A38.5.2.2.1.10 of Appendix A to part 38. In these sections, the applicant must use this Manual to establish certain reference specifications when determining SAR.

The OFR has regulations concerning incorporation by reference (1 CFR part 51). These regulations require that, for a final rule, agencies must discuss in the preamble the way in which the materials that the agency incorporated by reference are reasonably available to interested persons, and how interested parties can obtain the materials. In addition, in accordance with 1 CFR 51.5(b), the agency must summarize the material in the preamble of the final rule.

In accordance with the OFR's requirements, the Manual provides the standard values of atmospheric parameters, the values of constants and coefficients, and the underlying equations used in the calculation of the atmospheric parameters. The Manual is intended for use in calculations in the design of airplanes, in presenting test results of airplanes and their components under identical conditions, and in facilitating standardization in the development and calibration of instruments.

Interested persons can purchase this Manual from the ICAO Store at 999 Robert-Bourassa Boulevard Montréal (Quebec) Canada H3C 5H7, (*www.store.icao.int*).

J. Relationship to Other Regulations (§ 38.9)

Section 38.9 in the proposed rule described the authority of the EPA and the FAA under the Clean Air Act to set and implement standards for aircraft engine emissions. In proposed § 38.9, if the EPA changed any requirement in 40 CFR part 1030 that corresponded with a regulation in part 38, applicants could request a waiver for provisions as they appear in part 38 to comply with the changes; proposed § 38.9 also described the circumstances under which a waiver may be granted.

This proposed section also provided that, unless otherwise specified in this part, all terminology and abbreviations in part 38, that are defined in 40 CFR part 1030, have the same meaning as specified in part 1030.

The FAA did not receive comments on this section. However, the FAA did make some corrections to the text, including fixing a typographical error and an incorrect reference to the DOT delegations of authority to the FAA. Other than these corrections, the FAA is adopting this section as proposed.

K. Fuel Efficiency Metric (§ 38.11)

The NPRM proposed that the fuel efficiency of an airplane be determined by the amount of fuel it uses to travel a certain distance under prescribed conditions. This measure was proposed as the fuel efficiency metric (FEM). As proposed, for each airplane subject to part 38 (including an airplane subject to the change criteria of § 38.19), § 38.11 would require the calculation of an FEM value using an equation identical to the one adopted by the EPA in 40 CFR 1030.20.

1. Discussion of the Final Rule

The FAA is adopting § 38.11 as proposed. This section describes the FEM of an airplane. The FEM value is calculated using an equation identical to the one adopted by the EPA. The two primary components of the FEM are the SAR (provided in § 38.13) and the RGF (provided in § 38.15). As described in § 38.11, the FEM is ultimately calculated by dividing the average SAR values by RGF in a universal equation to denote the fuel efficiency of any airplane in a manner that is transport capability neutral.

2. Public Comments and FAA Response

Comment: Gulfstream commented that the NPRM preamble description for § 38.11 was confusing and highly simplified when it stated that dividing SAR by RGF results in a universal equation to denote the fuel efficiency of any airplane regardless of size.

Response: The FAA notes that the preamble is not meant to reflect every detail of the rule, but rather summarizes its contents and elaborates as necessary. The statement was referring to the fuel efficiency metric equation, provided in § 38.11, which is $(1/SAR)_{average}$ divided by $RGF^{0.24}$. In describing it as a universal equation, the FAA was referring to the fact that these parameters also comprise the metric in ICAO's international Aeroplane CO_2 Emissions standard.

Comment: An individual commented that the FEM seems to be defined upside down because the higher the fuel efficiency value gets, the worse the airplane is, efficiency-wise.

Response: The term ''Fuel Efficiency Metric'' (FEM), as used in this rule, is not a measure of airplane fuel efficiency, as commonly understood. This rule uses a newly defined term, FEM, that represents a correlation to the level of GHG emissions produced by the airplane.

The ICAO designed the FEM system (the FEM metric plotted against MTOM) similarly to other ICAO environmental standards, where the FEM of an airplane must be below a limit line to pass the standard. In order to achieve this result, the parameter SAR was inversed (*i.e.,* 1/SAR).

L. Specific Air Range (§ 38.13)

Section 38.13 of the NPRM proposed the requirements for determining SAR, one of the two primary components of the FEM.

1. Discussion of the Final Rule

As adopted, Section 38.13 describes the SAR. The SAR is an aeronautical parameter used in the aviation industry to represent the distance an airplane can travel per unit of fuel consumed. In part 38 it is used to represent the instantaneous fuel efficiency of an airplane at any point during stable cruise flight. The FAA made one minor revision to § 38.13(a)(2)(ii) by replacing ''made'' with ''submitted'' to be consistent with the FAA's intent. The FAA made a second minor revision to add the word ''or'' after § 38.13(a)(1) to indicate the requirements more clearly. Otherwise, the FAA is adopting this section as proposed.

2. Public Comments and FAA Response

Comment: Boeing suggested that § 38.13(b), as proposed, could be overbroad and subject to misinterpretation as it could limit SAR calculations until the performance model is approved by the FAA. Boeing requested that the FAA change ''are made'' to ''are submitted.''

Response: The FAA agrees that this requirement could be read to mean applicants may not make SAR calculations, whether for compliance or not, until the performance model is approved by the FAA. That was not the intent of this requirement. In the final regulatory text, the word ''made'' is changed to ''submitted.''

Comment: Boeing commented that the SAR should be multiplied by the airplane's instantaneous weight in order to be used as a measurement of fuel efficiency. Boeing suggested clarifying that in part 38, the term ''efficiency'' is used to represent the instantaneous fuel efficiency of an airplane at any point during stable cruise flight. Other individual commenters agreed with Boeing's assertion that SAR alone does not measure the fuel efficiency of an airplane.

Response: The FAA recognizes that the parameter SAR does not ''measure'' the instantaneous fuel efficiency. As stated above, SAR is the distance an airplane can travel per unit of fuel consumed to represent instantaneous fuel efficiency. Inherently, the determination of instantaneous SAR already includes the instantaneous weight of the airplane (*i.e.,* structural efficiency in context of this rule), as well as the airplane aerodynamic and propulsive efficiencies of the airplane. The FAA agrees that, in this part, SAR is used to represent the instantaneous fuel efficiency of an airplane at any point during stable cruise flight.

Comment: Gulfstream requested clarification of the FAA's expectations for substantiation of the performance model and allowances for weight increases.

Response: Although models may be built with first principles analysis or wind tunnel data, the model used to show compliance must be validated by flight test data and approved by the FAA. The FAA must also approve any allowances regarding models. See section 38.13. The AC38 contains additional related guidance.

Comment: An individual commenter questioned the need for the statement to exclude auxiliary power units (APU) from the 1/SAR calculation in § 38.13(c), stating that they would not normally need to be included. The commenter noted that if there was ever a design where they did need to be included for some reason, this requirement would preclude that. Another commenter said that APU usage for traditional airplanes should be included because the goal is to reduce the consumption of hydrocarbons rather than potentially shifting the location where hydrocarbons are burned from a place where they are included to one where they are not.

Response: Section 38.13 specifically excludes APUs from the SAR calculation. The EPA's standard in 40 CFR 1030.23 also contains this exclusion and this is a key component of the standards. To comply with 42 U.S.C. 7572 and maintain consistency with EPA's standards in 40 CFR part 1030, the FAA is adopting this paragraph as proposed.

M. Reference Geometric Factor (§ 38.15)

Section 38.15 of the NPRM proposed the requirements for determining RGF, one of the two primary components of the FEM.

1. Discussion of the Final Rule

As adopted, § 38.15 describes the RGF. The RGF is a representation of airplane fuselage size based on the floor area of pressurized space in an airplane and is flexible enough to account for single or multi-deck airplanes. This rule adopts changes from ''cockpit'' to ''flight deck'' to provide gender-neutral language without changing the meaning or intent. Other than this change, the FAA is adopting this section as proposed.

2. Public Comments and FAA Response

Comments: Some commenters, including A4A and Boeing, requested clarifications on FAA's descriptions of the RGF. Specifically, they requested that the preamble state that the RGF is a representation of airplane fuselage size based on the floor area of pressurized space in an airplane and is flexible enough to account for single or multi-deck airplanes. They further stated that dividing SAR by RGF results in a universal equation to denote the fuel efficiency of any airplane in a manner that is transport capability neutral (which is the FEM). Boeing stated that this change was needed because RGF was not developed to account for productivity and load carrying capability, noting that RGF was included to achieve the aim of having a transport-capability-neutral metric.

Response: The FAA agrees with A4A and Boeing's characterization of RGF, specifically its purpose to create a transport capability neutral FEM, and the FAA believes the regulatory text is consistent with this description. As a result, FAA has determined that no changes to § 38.15 are necessary based on this comment.

Comment: An individual commenter questioned the appropriateness of RGF. The commenter proposed an example to show that a poorly designed airplane could have a similar FEM value as a better-designed airplane. The commenter also questioned the value of the RGF concept when passengers or payload transported over a given distance, per unit of energy input could be considered instead.

Response: The FAA disagrees. A specific goal of the standards are to avoid unintentionally incentivizing airplane manufacturers to design airplanes for specific operational objectives, such as payload-carrying

capability or mission range. The RGF is not intended to account for an airplane's transport capabilities (*e.g.,* its productivity or payload-carrying capability). Instead, the use of RGF in this regulation creates a transport capability neutral fuel efficiency metric. The FAA asserts that RGF is appropriate.

The FEM system is designed to account for aerodynamic, structural (*i.e.,* airplane weight), and propulsive efficiencies using its SAR parameter, and utilizes RGF to normalize those efficiencies across a broad range of MTOMs. If two airplanes have the same efficiencies in these three categories as well as in RGF, as described in the commenter's example, then the FEM will be the same—regardless of whether the interior layout or sub-weight components of MTOM result in a poor design with respect to a particular operational purpose.

N. Fuel Efficiency Regulatory Limits (§ 38.17)

As proposed, § 38.17 incorporated, as fuel efficiency limits, the emission standards adopted by the EPA in 40 CFR 1030.30. Airplanes subject to part 38 would be required to demonstrate that the FEM value does not exceed the fuel efficiency limits in § 38.17. Using the applicable provision in § 38.1, the NPRM proposed calculating the fuel efficiency limit using the airplane's MTOM and the equations listed in the last column of the table in § 38.17(b).

The FAA did not receive comments on this section and is adopting it as proposed.

O. Change Criteria (§ 38.19)

As proposed, this section would apply the fuel efficiency requirement at the time certain modifications were made. The NPRM would adopt the EPA airplane change criteria of 40 CFR 1030.35. The change criteria proposed in § 38.19 described the modifications affecting compliance. The requirements differ depending on whether or not the airplane had previously demonstrated compliance with part 38.

1. Discussion of the Final Rule

Section 38.19 provides the change criteria for modified airplanes. Section 38.19 adopts the EPA airplane change criteria of 40 CFR 1030.35.

As discussed in section IV.D. of this preamble, the third occasion when part 38 applies is at the time certain modifications are made to the airplane. Airplanes routinely have modifications incorporated into their designs. A modification may require demonstration of compliance to part 38, regardless of whether the airplane was required to previously demonstrate compliance with part 38.

The change criteria in § 38.19 describe the modifications which require compliance with part 38. The requirements differ depending on whether an airplane demonstrated compliance with part 38 before a modification is made, or whether an airplane was type certificated before January 1, 2023, and had not previously demonstrated compliance to this rule. The change criteria in § 38.19(a) indicates that a compliance demonstration to this new rule is required if a modification to an airplane, that has been shown to comply with § 38.17, will increase the MTOM of the airplane as written in § 38.19(a)(1) or increases the FEM value above the thresholds provided in § 38.19(a)(2)(i) through (iii). Where an airplane has been shown to comply with § 38.17, for a modification that does not increase either the MTOM or the FEM value, then under section § 38.19(b) the airplane may retain the same FEM value as prior to modification. The last piece of the change criteria in § 38.19(c) provides that an airplane, which meets the applicability provisions of § 38.1(a)(4) or (5) on or after January 1, 2023, and before January 1, 2028, must demonstrate compliance if the incorporated modifications exceed 1.5% when comparing its FEM before and after the modifications.

The FAA received several comments on this section. Some of these comments were directly related to § 38.1 because of the relationship between the regulatory text of §§ 38.1 and 38.19. As such, the FAA responded to some of the § 38.19 comments in the related applicability responses (see IV.D. General Applicability). As a result of FAA responses to those comments in the general applicability discussion, FAA made changes to § 38.19(b) and (c). As a result of other comments, the FAA made minor clarification changes to § 38.19(a)(2)(i) and (ii) and (b). Other than these changes, the FAA adopts the section as proposed.

The FAA recognized that the change criteria as proposed in the NPRM may have been difficult to understand because it described the change criteria thresholds as ''values'' that could be confused with fuel efficiency metric ''values'' described in § 38.11. The FAA made minor edits to the text in § 38.19(a) to remove the potential for confusion by properly describing the change criteria as a threshold whereby changes in fuel efficiency metric values are compared to the thresholds in percentages.

2. Public Comments and FAA Response

Comment: Several commenters, including Embraer, Boeing, AIA, and Airbus, commented on § 38.19(b) that the text ''this paragraph (b)'' should say ''paragraph (a) of this section.''

Response: The FAA agrees that this was a typographical error and has corrected the text.

Comment: Airbus recommended that the non-cumulative (non-tracking) nature of changes that meet the change criteria, a core part of the change criteria developed by ICAO, should be mentioned in either part 38 or AC38.

Response: The FAA disagrees. The FAA recognizes that the ICAO standard and the EPA rule do not require cumulative tracking of airplane modifications to a type design. In kind, the FAA also does not have such a requirement. Since there is no requirement to track cumulative modifications, the FAA does not see a need to include any explanation of modification tracking in either part 38 or the AC38.

Comment: Boeing asked to clarify § 38.19(a)(2)(i) and (ii) by specifying the MTOM starting point associated with the percentage starting point in these two change criteria.

Response: The FAA agrees these edits may help to clarify the requirement. The FAA has added the phrases ''for an airplane with a MTOM of 5,700 kg'' to clarify the 1.35 percent in § 38.19(a)(2)(i) and ''for an airplane with an MTOM of 60,000 kg'' to clarify the 0.75 percent in § 39.19(a)(2)(ii).

Comment: Gulfstream requested that the FAA provide clarification for documentation expectations in § 38.19(c). Gulfstream noted that it is not clear how it is determined and what the FAA expectation will be to document that a modification does not increase the FEM by more than 1.5%.

Response: For context, § 38.19(c) requires an airplane that meets the criteria of § 38.1(a)(4) and (5) on or after January 1, 2023, and before January 1, 2028, to demonstrate compliance with § 38.17 if it incorporates any modification that increases the FEM value of the airplane by more than 1.5% prior to modification.

Regarding the portion of Gulfstream's comment on documentation expectations, the FAA will determine whether part 38 applies to a covered airplane according to the criteria in § 38.19(c) and the supporting documentation provided by the applicant. This determination is part of the type design change certification process in § 21.93(d) and FAA will decide documentation expectations on a

case-by-case basis depending on the complexity of the type design change.

Comment: Gulfstream asked how a change in the FEM value is determined.

Response: The requirements in part 38 and its appendix provide the detailed information required to determine a fuel efficiency metric value for a type design, such as corrections, tolerances, and confidence intervals. The AC38 provides additional detailed guidance and worked examples on how applicants can evaluate the FEM value for an airplane.

Comment: An individual commented that the magnitude of change in the FEM value caused by the addition of a satellite antenna could be lower than in the example provided in that discussion.

Response: The FAA acknowledges that FEM value changes due to modifications to airplanes could vary significantly. As provided in § 38.19, the FEM values can increase or decrease when there are modifications to an airplane that impact aerodynamics.

The NPRM discussion for § 38.19 intended to focus on how the change criteria thresholds work, rather than the specific examples themselves. This comment does not require changes to the regulatory text.

P. FAA Approval Before Compliance Testing (§ 38.21)

As proposed, § 38.21 would require FAA approval of all procedures, weights, configurations, and other information needed to calculate the FEM value of an airplane. As described in the NPRM, the FAA would not apply this section to data an applicant submits for validation following fuel efficiency certification by another authority.

1. Discussion of the Final Rule

As adopted, § 38.21 requires FAA approval of all information needed to calculate the FEM value of an airplane. The FAA approvals are necessary and establish the airplane configuration and fuel efficiency certification procedures. These procedures remain unchanged before fuel efficiency compliance tests are conducted. This section does not apply to data submitted for validation following fuel efficiency certification by another authority. The FAA received several comments on proposed § 38.21. The FAA adopts § 38.21 as proposed.

2. Public Comments and FAA Response

Comment: The GAMA requested that the FAA add the phrase ''documented in compliance demonstration plans'' before ''approved by the FAA'' to § 38.21.

Response: The FAA finds the proposed change to be too prescriptive. Section 38.21 requires FAA approval of certain items prior to compliance testing, including procedures, weights, configurations, and other information. These items are used to establish the fuel efficiency level. Compliance demonstration plans may be one way of providing this information to the FAA. However, the FAA intends to preserve the ability for applicants to use other mechanisms to provide the required information to the FAA. The GAMA's proposed change would remove this flexibility.

Q. Manual Information and Limitations (§ 38.23)

As proposed, § 38.23 would require placement of the FEM value of the airplane, along with other part 38 compliance information, in an FAA-approved section of the flight manual of the airplane. Inclusion of this information in the approved airplane flight manual would provide owners, operators, and flight crew with information regarding the airplane's compliance with part 38. The FAA proposed that if a weight lower than the MTOM was used for fuel efficiency certification, then that lower weight becomes an operating limitation for that airplane and would be included in the operating limitations section of the flight manual. As provided in the NPRM, operators could not exceed the weight at which compliance with part 38 was demonstrated, even if that weight was lower than the MTOM for the airplane under other airworthiness requirements.

1. Discussion of the Final Rule

The FAA made one change to this section in response to comments to specify that the manual include the fuel efficiency level as established in part 38. Other than the change to § 38.23(a)(1), the FAA adopts the regulation as proposed.

2. Public Comments and FAA Response

Comment: Boeing suggested clarifying the language in § 38.23(a)(1) to refer to compliance, as required by the part, rather than during certification. Boeing indicated that the proposed text could give rise to potential ambiguity with respect to an in-production airplane that complies with the fuel efficiency requirement in part 38, and compliance to part 38 need not be shown during type certification. Further, Boeing remarked that there is no reason that the compliance demonstration itself needs to be done during type certification and the FAA's regulatory language should be sufficiently flexible to accommodate such an approach.

Response: The FAA concurs with the change proposed by Boeing and has replaced ''during type certification'' with ''as required by this part'' in § 38.23(a). The use of ''as required by this part'' more specifically refers to the part 38 requirements rather than the type certification process.

Comment: Airbus suggested removing the requirement to publish certified fuel efficiency data in the flight manual by deleting §§ 38.23 and 21.5(b)(3). Airbus indicates that the adoption of these provisions would create de-harmonization between certification authorities. Airbus instead suggests relying on the ICAO CO_2 databank maintained by the FAA as well as through the EASA CO_2 databank. Using the same justification, Airbus also requested that the FAA remove the proposed flight manual requirements from §§ 121.141(b) and 125.75.

Airbus was also concerned that if the certification applicant chooses to certify several MTOMs against the new part 38, several flight manual supplements would have to be created and maintained for the same airplane model.

Response: The FAA disagrees with removing the flight manual publication requirement. Although most information may be available through the ICAO CO_2 database [17] or another certification authority-maintained database, these databases are either outside the FAA's control or potentially incomplete, because manufacturers are not required to submit information to the database. For these reasons, the databanks may not provide a complete set of information and may not contain information for a particular airplane. The inclusion of fuel efficiency levels and MTOM in the flight manual associated with a serial number specific airplane allows anyone, including an authority, to determine the compliance state of an airplane.

For these reasons, the FAA is retaining these requirements.

Comment: Gulfstream asked if the industry could expect to see airports imposing fees or restrictions based on fuel efficiency, similar to noise, that would motivate an applicant to certify an airplane at a lower MTOM. Gulfstream recommended clarifying the potential for any benefit with artificially limiting the MTOM to a lower value than the design specification.

[17] The FAA hosts but does not control the contents of the ICAO Airplane CO_2 Certification Database located at: *www.faa.gov/headquartersoffices/apl/aee/icao-airplane-co2-certification-database.*

Response: The FAA cannot speculate as to whether third parties, such as airports, would impose fees or restrictions on airplanes based on these fuel efficiency values.

R. Appendix A to Part 38

As proposed, Appendix A provided the technical detail needed to determine the FEM value of an airplane required to demonstrate compliance with part 38. It also detailed the process and procedures an applicant needed to use when measuring an airplane for fuel efficiency. The proposal also described the data the applicant would submit to the FAA.

1. Discussion of the Final Rule

As adopted, Appendix A to part 38 provides the technical, certification-specific details an applicant needs to determine the FEM value of an airplane and demonstrate compliance with part 38. The primary sources of the information contained in the appendix are Sections 2.5 and 2.6 of ICAO Annex 16, Volume III, as well as appendices 1 and 2 to that volume. These sources of information were not included in the EPA rule directly but were incorporated by reference. In coordination with the EPA, the FAA decided it was important to include such certification-related details in part 38 given the FAA's responsibility to enforce the EPA rule within the FAA airplane certification framework. As a result, in this rule, the FAA does not incorporate this Annex information by reference but includes all the requirements from Annex 16 Volume III using current United States certification terminology, format, and references.

Appendix A to part 38 details the processes and procedures to be used when measuring an airplane for fuel efficiency. To comply with part 38, a certification applicant would need to determine the core parameters of the FEM, specifically the SAR and RGF. The specifications for the flight tests to gather airplane performance data are provided in Appendix A, including the formulas to be used to determine the SAR and RGF from data gathered during testing. The appendix also describes certification data that would be submitted to the FAA in the certification test report that is a part of fuel efficiency certification.

The FAA received comments on several sections of Appendix A to part 38. As a result of these comments, as well as consistency edits that result from the FAA's responses to these comments, the FAA has made changes to proposed paragraphs A38.1.2.3.1, A38.1.2.3.4, A38.2.1.1.3, A38.2.1.1.6, A38.2.1.3.1, A38.2.1.3.2, A38.4.2.1.2, A38.4.2.1.3, A38.4.2.1.4.1, A38.4.2.1.4.2, A38.4.2.1.5.1, A38.4.2.1.5.2, A38.4.2.2, A38.4.2.2.1, A38.4.2.2.1.2, A38.4.2.2.1.4, A38.4.2.3.2.1, A38.4.2.3.2.2, A38.4.2.3.2.3, A.38.5.2.2.1.1, A38.6, A38.6.1.2, A38.6.3.7, A38.6.3.9, and A38.6.4. In general, the comments pertained to clarifications on airplane weighing and mass requirements, fuel sampling requirements, fuel kinematic viscosity requirements, airplane trim requirements, the use of standard United States aerospace terminology, engine deterioration, corrections to reference specifications, the reporting of data, the fixing titles of reference citations, and some minor typographical errors.

Paragraph A38.2.1.3.1 identifies a reference specification for standard day atmosphere. As discussed in relation to § 38.7, the FAA has determined that this specification needs to be incorporated by reference and has indicated that in A38.2.1.3.1 as well as the other paragraphs that include this same reference specification (*i.e.,* paragraphs A38.5.2.2.1.9 and A38.5.2.2.1.10). Also, in paragraph A38.2.1.3.1, the FAA noticed that it inadvertently failed to include an ''and'' at the end of this paragraph, which is now included for consistency with the ICAO standard. The FAA corrected the section accordingly. In paragraphs 38.3.2, 38.3.3, and 38.3.4, this rule adopts changes from ''cockpit'' to ''flight deck'' to provide gender-neutral language without changing the meaning or intent.

Other than these changes, the FAA adopts the Appendix as proposed.

2. Public Comments and FAA Response

The comments and responses below are categorized based on the relevant appendix section.

a. Appendix A to Part 38, A38.1 Introduction

Comment: For proposed paragraphs A38.1.2.3.1 and A38.1.2.3.4, Airbus noted potential errors including a missing ''and'' between listed requirements of a performance model, and incorrect numbering of appendix sections where A38.1.2.3.4 should have been A38.1.2.3.3.

Response: The FAA disagrees with the request to add an ''and'' at the end of A38.1.2.3.1. The FAA notes the proposal contained an ''and'' in the next to last item in the list and this is sufficient to make each of the items under A.38.1.2.3 a requirement. Thus, the FAA did not make this proposed change. However, with respect to the incorrect numbering in proposed A38.1.2.3.4, the FAA agrees that this is a typographical error and has corrected it.

b. Appendix A to Part 38, A38.2 Reference Specifications for SAR Flight Tests

Comment: For paragraph A38.2.1.1.3, Boeing suggested using standard industry terminology of ''unaccelerated'' instead of ''unaccelerating.''

Response: The FAA agrees that ''unaccelerated'' is a more common aerospace industry terminology when describing steady-level flight, thus the FAA made the suggested changes. The FAA also made these same changes to paragraphs A38.4.2.2.1.2 and A38.5.2.2.1.

Comment: For paragraph A38.2.1.1.5, Gulfstream requested confirmation that, when it uses a performance model, all the provided information in the section will be embedded in the model and additional corrections will not be required in the model results.

Response: The FAA confirms that reference specifications are required for flight test data, which can be used to validate a performance model. Depending on how the performance model is built and on what data it is based, corrections may be necessary for SAR values calculated from the model.

c. Appendix A to Part 38, A38.4 Certification Test Specifications

Comment: For paragraph A38.4.2.1.2, Boeing requested to clarify the airplane weight and balance requirement by removing the words ''prior to the test flight.'' Boeing indicated it may be possible that the weight before flight may not be the best engineering value; because test data may, after post-flight weighing, suggest a more optimal means for establishing accurate weight.

Response: The FAA agrees that this airplane weight requirement can be clarified, however disagrees with the proposed changes as they would cause a substantive difference (discussed in IV.F.) with the ICAO international standard that includes the words ''prior to the test flight.'' The FAA has revised the text to align with the ICAO international standard by changing the requirement to read: ''The test airplane must be weighed. Any change in mass after the weighing and prior to the test flight must be accounted for.'' During its review of this paragraph, the FAA recognized that the ''and balance'' text that was contained in the proposed A38.4.2.1.2 is not required given the various center of gravity requirements throughout Appendix A. After reviewing all center of gravity requirements in Appendix A, the FAA

made a clarifying change in A38.2.1.1.6 by changing ''a'' to ''the'' in the proposed text (*i.e.,* representative of *a* mid-CG point relevant to design cruise performance). The FAA's clarifying change ensures there is no ambiguity as there is only one mid-CG point at each of the three reference airplane masses.

Comment: For paragraphs A38.4.2.1.3, A38.4.2.1.4.1, A38.4.2.1.5.1, and A38.4.2.1.5.2, Boeing suggested correcting these reference citations by: (1) removing the word ''specification'' when referring to the external American Society for Testing and Materials (ASTM) documents, and (2) correcting the titles of the documents as needed.

Response: The FAA agrees to these minor editorial changes and accepts them. The FAA also noticed, and corrected, that the word ''titled'' instead of ''entitled'' should have been used when quoting the titles of these documents.

Comment: For paragraph A38.4.2.1.4.2, Airbus suggested that it did not understand the text ''and may not have variations'' at the end of the fuel sample requirement, because fuel samples are analyzed for each test flight and a single lower heating value is determined.

Response: The FAA agrees with this reasoning and has revised the text to better align with the ICAO international standard regarding flexibility on variations and errors. The language now reads:

The fuel sample may be representative of the fuel used for each flight test and should not have errors or variations due to fuel being uplifted from multiple sources, fuel tank selection, or fuel layering in a tank.

Comment: For paragraph A38.4.2.1.5.2, Airbus requested an additional ASTM document be added for determining fuel kinematic viscosity.

Response: The FAA disagrees because it would result in a substantive difference (discussed in IV.F.) with the ICAO international standard. In addition, the FAA notes that the words ''or as approved by the FAA'' at the end of that paragraph allow applicants to seek approval of other methods for determining fuel kinematic viscosity, which is consistent with the ICAO standard.

Comment: An individual commented on paragraph A38.4.2.2 regarding the use of the term ''configuration.'' They indicated that this section relates to criteria, procedures, or requirements and that it does not relate to configurations, which is a term used for defining an airplane configuration such as a flap position, gear position, or some aspect of the type design.

Response: Upon review, the FAA acknowledges the word ''configuration(s)'' does not accurately reflect the requirement. The requirement relates more to procedures on how the pilot should fly the airplane during flight testing. As such, the FAA has replaced the word ''configuration(s)'' with the word ''procedure(s)'' in A38.4.2.2 and A38.4.2.2.1.

Comment: For paragraph A38.4.2.2.1.4, Boeing requested a change to the text ''there are no changes in trim.'' Boeing requested that the text be revised to allow some changes by stating that changes are to be avoided or minimized as practicable. Boeing explained that it may not be possible to eliminate all changes during flight because there may be unavoidable circumstances during flight; however, such changes may be accounted for through data analysis and interpretation.

Response: The FAA agrees that in-flight conditions may not make it possible to eliminate changes to some trim and engine settings, and that changes may be accounted for through post-flight data analysis. The FAA also notes that providing flexibility better aligns with the same recommendation in the ICAO international standard. Accordingly, the FAA revised the text to read as follows:

Changes in trim or engine power/thrust settings, engine stability and handling bleeds, or electrical and mechanical power extraction (including bleed flow) are avoided or minimized as practicable.

Comment: For paragraph A38.4.2.3.2, Airbus explained that the requirement regarding airplane mass determination should provide for alternative methods, specifically by changing the word ''must'' to ''may.''

Response: The FAA agrees that this requirement should allow additional methods to determine the mass of the airplane because the ICAO Annex 16 Vol III also lists the two methods as recommended options for determining mass, not as required methods. Therefore, the FAA kept the word ''must,'' but added a third option to A38.4.2.3.2.3: other methods as approved by the FAA. This third option will allow alternative methods in addition to the two options listed.

d. Appendix A to Part 38, A38.5 Measurement of Specific Air Range

Comment: For paragraph A38.5.2.2.1.7, Airbus suggested the sentence starting with the text ''(s)ince engine deterioration is rapid when . . .'' may not be grammatically correct.

Response: The FAA notes that this is a partial sentence that is a lead-in to the two sub-paragraphs that follow it. In that context, the FAA does not see a need to make changes to this text.

Comment: For paragraph A38.5.2.2.1.7.2, Boeing suggested replacing the proposed text, ''. . . and no correction is permitted'' with, ''. . . and a correction to the reference deterioration level may be approved by the FAA.'' Boeing asserted that technology and processes have advanced to the point where it is reasonable to employ engine deterioration corrections in certain circumstances. Boeing noted that it has successfully employed deterioration corrections on occasion and believes that the FAA provide flexibility for deterioration corrections if the FAA approves of the correction.

Response: The FAA disagrees with providing the suggested flexibility for this requirement because this change would cause a substantive difference (discussed in IV.F.) with the ICAO international standard that precludes correction in these instances.

Comment: For paragraph A38.5.3, Gulfstream commented that it is unclear how an applicant will manage confidence intervals when a performance model is used.

Response: The AC38 provides guidance on determining and using confidence intervals.

e. Appendix A to Part 38, A38.6 Submission of Certification Data to the FAA

Comment: For paragraph A38.6, Airbus recommended edits to the proposed text to allow other analysis reports to convey the required information, not just the certification test report.

Report: The FAA agrees that there are various types of reports during certification that could contain the required information. The FAA made the change from ''certification test report'' to ''certification reports.''

Comment: For paragraphs A38.6.1.2, A38.6.3.7, and A38.6.3.9, Airbus and Boeing noted typographical and reference errors, including a reference to § 38.23(a)(3) that does not exist in A38.6.1.2, a correction to a semicolon in A38.6.3.7, and incorrect references within A38.6.3.9.

Response: The FAA agrees and fixed the noted typographical and reference errors.

Comment: For paragraph A38.6.4, Airbus requested that the FAA remove the text ''defined in § 38.13(b).'' Airbus indicated that this language suggested that the test measurements are

systematically done at the reference masses of the standard but that this was not the case when a performance model was used.

Response: The FAA agrees that the reference to § 38.13(b) should be removed for the reasons Airbus stated and has removed the reference. In addition, the FAA's review resulted in the need to clarify this requirement in paragraph A38.6.4 by clearly stating that SAR values, corrections from measured data to reference specifications, and finally the SAR values calculated from corrected data must be provided for the test measurement points. As such, the requirement has been updated to the following language:

The measured SAR test data, all corrections of the measured data to the reference specifications, and the SAR values calculated from the corrected data must be provided.

S. Other Revisions to 14 CFR

The proposed rule set forth several amendments to part 21 to include compliance with part 38 as a requirement for type, supplemental type, or airworthiness certification using the applicability described in § 38.1. If adopted, the amendment proposed to part 21 would include adding references to part 38 in §§ 21.5, 21.17, 21.29, 21.31, 21.93, 21.101, 21.115, 21.183, and 21.187. The NPRM also proposed to adopt the move and redesignation of § 21.187(c) to § 21.187(a)(3). The proposal also included amendments to the operating regulations (§§ 121.141 and 125.75) for airplanes subject to part 38. The revisions were included to add the certification information for fuel efficiency to the airplane flight manuals.

1. Discussion of the Final Rule

With some changes, this rule adopts the proposed changes to part 21 and §§ 121.141 and 125.75.

In particular, in this final rule, the FAA also makes a change to § 21.93(d) by adding that a voluntary change that may increase the MTOM of that airplane is a ''fuel efficiency change.'' The proposal only identified an increase in the FEM value as a ''fuel efficiency change.'' This change was made to ensure consistency with the change criteria in § 38.19.

Further, as a result of comments, the FAA made changes to §§ 21.21, 21.93, and 121.141. These changes ensure that the fuel efficiency requirements are appropriately included in part 21 and corrected an inadvertent change in § 121.141. Other than these identified changes, the FAA adopts the amendments to part 21 and §§ 121.141 and 125.75 as proposed.

Finally, this rule adopts changes to § 21.187 to provide gender-neutral language (from ''He'' to ''The applicant'') without changing the meaning or intent of the rule.

The comments and responses are organized by the specific regulatory section.

2. Public Comments and FAA Response

a. Section 21.5: Airplane or Rotorcraft Flight Manual

Comment: One individual commenter recommended adding ''Rotorcraft Flight Manual'' to the change proposed in § 21.5(b)(3).

Response: The FAA does not concur with adding ''Rotorcraft Flight Manual'' to the changes in § 21.5(b)(3) to accommodate the addition of part 38 requirements as this rule only applies to fixed wing airplanes.

Comment: One commenter stated § 21.5 only pertains to airplanes and rotorcraft not type certificated with an Airplane or Rotorcraft Flight Manual and asked whether there were any such airplanes in existence that would be subject to part 38.

Response: Section 21.5 applies to all airplanes that do not have flight time prior to March 1, 1979. Airplanes produced or certified on or after that date are required to have an approved flight manual.

Comment: One individual proposed the airplane flight manual requirement should be placed in §§ 25.1581 and 23.2620. They stated that it was also unclear how the requirement in § 21.5 meshes with § 38.23. They thought the requirements of § 38.23 should either be placed in or reference the sections of parts 23 and 25 pertaining to Airplane Flight Manuals and airplane limitations.

Response: The FAA disagrees with the requested amendments to parts 23 and 25. Flight manual requirements are covered in the revised § 21.5. This final rule also amends the applicability requirements in other sections of part 21 such that § 21.5 applies to part 23 and 25 airplanes. Accordingly, the flight manuals for these airplanes must include the flight manual requirements of part 38.

b. Section 21.21: Issue of Type Certificate: Normal, Utility, Acrobatic, Commuter, and Transport Category Aircraft; Manned Free Balloons; Special Classes of Aircraft; Aircraft Engines; Propellers

Comment: Boeing recommended that the FAA revise § 21.21(b) and (b)(1) by adding ''and fuel efficiency'' to be consistent with proposed § 38.1(a)(1), (2) and (3) (for new-type airplanes seeking original type certification). Boeing noted that adding ''fuel venting and exhaust emissions'' to § 21.21 would also be consistent with the FAA's revision of § 21.29.

Response: Section 21.21 identifies all the necessary requirements for receiving a type certificate. In order to fully effectuate part 38 into the type certification requirements, it is important to include this rule in paragraph (b) of this section. Further, the FAA agrees that consistency is necessary between §§ 21.21 and 21.29. Section 21.21 was revised to list fuel efficiency in addition to the other environmental requirements that an applicant must comply with in order to get a type certificate. The FAA has modified § 21.21 to include fuel efficiency.

The FAA inadvertently revised § 21.29 with a punctuation error in the proposed rule to state, ''fuel venting and exhaust emissions, and fuel efficiency.'' The FAA has corrected this in the final rule to state ''fuel venting, exhaust emission, and fuel efficiency'' to be consistent with § 21.21.

c. Section 21.93: Classification of Changes in Type Design

Comments: Gulfstream requested clarity on the use of the word ''voluntary'' regarding type design changes in § 21.93(d). Gulfstream recollected that the ICAO language did not include the word ''voluntary'' and asked if it was the FAA's intent to protect applicants from having to reverify part 38 compliance after a mandated design change.

Response: The FAA's intent was to prevent applicants from having to reverify part 38 compliance after a mandated design change. The FAA uses the word ''voluntary'' to describe the action initiated by an applicant to obtain an approval. On the other hand, non-voluntary or mandated changes, typically required by an authority, are needed to maintain the airworthiness of in-service airplanes as soon as possible for safety concerns. The ICAO Standards and Recommended Practices do not have a similar exception for authority-mandated changes to an airplane. It is the responsibility of the authority adopting the Annexes to provide their own procedures for handling mandated changes required for continued operational safety.

Comments: Embraer noted that 14 CFR 21.93(d) defines the term 'fuel efficiency change' that is not used within 14 CFR part 38. This leaves the applicability definition of 14 CFR part 38 within § 38.19. On the other hand,

Embraer stated that ICAO/RBAC [18] uses the definition of ''derived version'' to determine applicability. Although the definitions are similar, Embraer states this could generate interpretation problems when classifying a modification and, consequently, to define the involvement of the authorities.

Response: The FAA is not defining a new term ''fuel efficiency change'' as Embraer indicates. This language refers to changes in the certified ''fuel efficiency metric value'' as provided in part 38. The applicability of § 38.1 includes a direct reference to § 38.19 (see in § 38.1(b)) and, therefore, includes modifications as part of applicability considerations. Similarly, ICAO includes modifications via a definition of ''derived versions'' that is contained outside the applicability provisions.

d. Other Part 21 Sections

Comments: Boeing suggested adding additional text to §§ 21.101(a), 21.115(a)(3), 21.183(j), and 21.187(a)(4) that direct a reader to specific applicability sections of part 38. Boeing was concerned that, as drafted, these sections could mistakenly be read to mean that an obligation to demonstrate compliance with part 38 applies automatically upon any application for approval of a modification in type design for any airplane, including an in-service airplane, regardless of whether the requirements of §§ 38.1 and 38.19 are met.

Response: The FAA disagrees. Section 21.93(d) refers to part 38 for purposes of maintaining compliance with part 38. Part 38 is the appropriate regulatory location to determine which sections of part 38 apply in a particular circumstance.

Further, the FAA has revised the applicability requirements in part 38 to clarify its applicability to modifications in type design for any airplane, including an in-service airplane. See FAA's responses to comments in section IV.D. For these reasons, the FAA is not adopting the suggested changes.

e. Section 121.141 (Airplane Flight Manual) and 125.75 (Airplane Flight Manual)

Comment: One individual commenter noted that changing the word ''may'' to ''must'' is a significant change in § 121.141(b), making it mandatory to revise the performance section of the Airplane Flight Manual when operators create their own manual. The commenter also noted that this change was not consistent with the proposal to change § 125.75(b), which does not change a similar ''must'' in the existing text to ''may.'' The commenter also recommended that if FAA meant to change the language to ''must'' in § 121.141(b), the FAA should make a corresponding change in § 125.75(b) and explain the change in the preamble.

Response: The FAA concurs that the text added to § 121.141(b) should have said ''may revise'' not ''must revise.'' This was an inadvertent change from existing text. Accordingly, the final rule text is corrected to ''may revise'' and the FAA does not need to make the suggested change to § 125.75(b).

T. Costs

A number of individuals commented generally regarding their concerns about the monetary costs of the rule.

The FAA conducted an analysis of the costs and benefits of the proposed rule. As described in the preliminary regulatory impact analysis (RIA) that accompanied the proposal, in the absence of the FAA's rule aircraft manufacturers would have to certify to the fuel efficiency standards through foreign authorities. As a result, the rule reduces the cost of this certification by enabling certification through the FAA. Therefore, the FAA does not expect this rule will impose an undue burden on industry, an increase in the cost of air travel, or other negative economic impacts commenters attribute to the rule. Regarding the need for government intervention, airplane fuel efficiency has increased as the standard is technology-following, but the rule prevents backsliding to less fuel-efficient airplanes. The FAA also noted that the rule may generate minimal benefits since the ICAO designed the standard in such a way that most airplanes would already meet the standard.

Boeing asserted that footnote 8 in the preliminary RIA contradicted the EPA's unambiguous intent with respect to the inapplicability of its GHG standards to modifications of individual in-service airplanes. The footnote stated that owners or operators that modify an airplane that was not certificated to the proposed fuel efficiency standard may also need to comply with the rule when the modifications are made. The National Business Aviation Association (NBAA) also asserted that in the preliminary RIA, the FAA failed to analyze the financial impact this rule may have on the current fleet. Specifically, it stated that operators seeking to modify their airplanes through a Supplemental Type Certificate (STC) may have to complete additional modifications or data analysis to meet the FEM, resulting in additional costs. The NBAA encouraged the FAA to consider this submission prior to applying this rule to modified airplanes.

The FAA asserts that there will be no economic impact on the current fleet stemming from this rule. The FAA agrees that owners or operators that modify an airplane that was not certificated to the fuel efficiency standards will not need to comply with the rule when those modifications are made. The rule does not apply to the in-service fleet that was not certified to the fuel efficiency standard, including any future modifications. As such, there will be no impact on the current fleet for operators seeking to modify their airplane through an STC. The FAA deleted the referenced footnote 8 in the final RIA.

V. Regulatory Notices and Analyses

Federal agencies consider impacts of regulatory actions under a variety of executive orders and other requirements. First, Executive Order 12866 and Executive Order 13563 direct that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify the costs. Second, the Regulatory Flexibility Act of 1980 (Pub. L. 96–354) requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (Pub. L. 96–39) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. Fourth, the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate that may result in the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector, of $100 million or more (adjusted annually for inflation) in any one year. The current threshold after adjustment for inflation is $177 million using the most current (2022) Implicit Price Deflator for the Gross Domestic Product. The FAA has provided a detailed Regulatory Impact Analysis (RIA) in the docket for this rulemaking. This portion of the preamble summarizes the FAA's analysis of the economic impacts of this rule.

In conducting these analyses, the FAA has determined that this rule: will result in benefits that justify costs; is not a ''significant regulatory action'' as defined in section 3(f) of Executive Order 12866, as amended by Executive Order 14094; will not have a significant

[18] This is an acronym in Portuguese for Brazilian Regulations for Civil Aviation.

economic impact on a substantial number of small entities; will not create unnecessary obstacles to the foreign commerce of the United States; and will not impose an unfunded mandate on State, local, or Tribal governments, or on the private sector.

A. Summary of the Regulatory Impact Analysis

The FAA identified three United States manufacturers that would be affected by the rule. Manufacturers will incur certification costs even in the absence of the rule since they would pursue certification with foreign authorities. Certification tasks will vary greatly depending on the stage of the airplane development process (*e.g.,* new type certificate, supplemental type certificate, etc.). Additionally, the first fuel efficiency certification project undertaken by any one manufacturer may require more resources because of the new processes and the need for new data generation. The FAA used information provided by the affected airplane manufacturers to construct a timeline of when these costs would be incurred over a 10-year period, and the cost savings from domestic certification enabled by the rule.

Because the EPA standards apply to airplanes certificated in the United States even in the absence of the rule, there are no incremental benefits associated with the FAA's action; however, the rule will result in cost savings by enabling United States manufacturers to certificate to the standards domestically. Annualized costs savings may be approximately $0.4 million using discount rates of 3 percent and 7 percent (a present value over 10 years of $3.5 million to $2.9 million, using discount rates of 3 percent and 7 percent, respectively).

Please see the RIA available in the docket for more details.

B. Regulatory Flexibility Act

The Regulatory Flexibility Act (RFA) of 1980, (5 U.S.C. 601–612), as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (Pub. L. 104–121) and the Small Business Jobs Act of 2010 (Pub. L. 111–240), requires Federal agencies to consider the effects of the regulatory action on small business and other small entities and to minimize any significant economic impact. The term ''small entities'' comprises small businesses and not-for-profit organizations that are independently owned and operated and are not dominant in their fields, and governmental jurisdictions with populations of less than 50,000.

As described in the RIA, the FAA identified three United States manufacturers that would be affected by the proposed rule. Based on the Small Business Administration (SBA) size standard for aircraft manufacturing (Table 1), all three manufacturers are large businesses. If an agency determines that a rulemaking will not result in a significant economic impact on a substantial number of small entities, the head of the agency may so certify under section 605(b) of the RFA. Therefore, as provided in section 605(b) and based on the foregoing, the head of FAA certifies that this rulemaking will not result in a significant economic impact on a substantial number of small entities.

TABLE 1—SMALL BUSINESS SIZE STANDARDS: AIR TRANSPORTATION

NAICS code	Description	Size standard
336411	Aircraft manufacturing.	1,500 employees.

Source: SBA (2022).[19]
NAICS = North American Industrial Classification System.

C. International Trade Impact Assessment

The Trade Agreements Act of 1979 (Pub. L. 96–39), as amended by the Uruguay Round Agreements Act (Pub. L. 103–465), prohibits Federal agencies from establishing standards or engaging in related activities that create unnecessary obstacles to the foreign commerce of the United States. Pursuant to these Acts, the establishment of standards is not considered an unnecessary obstacle to the foreign commerce of the United States, so long as the standard has a legitimate domestic objective, such as the protection of safety and does not operate in a manner that excludes imports that meet this objective. The statute also requires consideration of international standards and, where appropriate, that they be the basis for United States standards.

The FAA has assessed the potential effects of this rule and finds that it does not create an unnecessary obstacle to foreign commerce. The United States has adopted the same airplane emission standards as ICAO and many of its member States. This rule is the next step in insuring compliance with the internationally recognized standard.

[19] Small Business Administration (SBA). 2022. Table of Size Standards. Effective July 14, 2022. *www.sba.gov/document/support--table-size-standards.*

D. Unfunded Mandates Assessment

The Unfunded Mandates Reform Act of 1995 (2 U.S.C. 1531–1538) governs the issuance of Federal regulations that require unfunded mandates. An unfunded mandate is a regulation that requires a State, local, or Tribal government or the private sector to incur direct costs without the Federal government having first provided the funds to pay those costs. The FAA determined that this final rule will not result in the expenditure of $177 million or more by State, local, or Tribal governments, in the aggregate, or the private sector, in any one year.

This rule does not contain such a mandate; therefore, the requirements of title II of the Act do not apply.

E. Paperwork Reduction Act

The Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)) requires that the FAA consider the impact of paperwork and other information collection burdens imposed on the public. According to the 1995 amendments to the Paperwork Reduction Act (5 CFR 1320.8(b)(2)(vi)), an agency may not collect or sponsor the collection of information, nor may it impose an information collection requirement unless it displays a currently valid Office of Management and Budget (OMB) control number.

This action contains the following new information collection requirement. As required by the Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)), the FAA has submitted these information collection amendments to OMB for its review. The OMB control number for this action is 2120–0815.

Summary

The regulations, adding a new part 38 to 14 CFR that requires certification for fuel efficiency, includes a collection of data from certification applicants. Certain data collected by the respondent during its certification flight tests are to be included in a certification test report that is submitted to the FAA. Those data are described in Appendix A to part 38. The information in the test report is used by the agency to determine whether the subject airplane complies with the fuel efficiency requirements promulgated by the EPA and the FAA. Without such information, the FAA would not have the complete record of an airplane's fuel efficiency performance and would be unable to issue a type or airworthiness certificate.

Use

Respondent's data will be used to determine compliance with the fuel efficiency standards established by the

EPA under the requirements of the Clean Air Act. The FAA is required by the Clean Air Act to implement those standards, which is done at the time of airplane certification.

Respondent's test data will not be maintained by the FAA following a certification determination. The certification test report is not available to the public. The regulation also requires that certain values be listed in the flight manual of the airplane, which is given to the purchaser of an airplane.

Respondents (including number of): The FAA anticipates three respondents to the collection of information.

Frequency: The FAA anticipates that respondents will provide responses annually (averaged).

Annual Burden Estimate: Table 1 provides the FAA's estimates of annual reporting (submittal of certification data) and recordkeeping (manual information) burden.

TABLE 1—SUMMARY OF ANNUAL BURDEN

Category	Reporting	Recordkeeping
# of respondents	3	3
# of responses per respondent	2	2
Time per response (hours)	2	8
Total # of responses	6	6
Total burden (hours)	12	48

F. International Compatibility

In keeping with United States' obligations under the Convention on International Civil Aviation, it is FAA policy to conform to International Civil Aviation Organization (ICAO) Standards and Recommended Practices to the maximum extent practicable. The FAA has reviewed the corresponding ICAO Standards and Recommended Practices and has identified no substantive differences with these regulations.

G. Environmental Analysis

FAA Order 1050.1F identifies FAA actions that are categorically excluded from preparation of an environmental assessment or environmental impact statement under the National Environmental Policy Act (NEPA) in the absence of extraordinary circumstances. The FAA has determined this rulemaking action qualifies for the categorical exclusion identified in paragraph 5–6.6f for regulations and involves no extraordinary circumstances.

VI. Executive Order Determinations

A. Executive Order 13132, Federalism

The FAA has analyzed this final rule under the principles and criteria of Executive Order (E.O.) 13132, Federalism. The FAA has determined that this action will not have a substantial direct effect on the States, or the relationship between the Federal Government and the States, or on the distribution of power and responsibilities among the various levels of government, and, therefore, will not have federalism implications.

B. Executive Order 13175, Consultation and Coordination With Indian Tribal Governments

Consistent with Executive Order 13175, Consultation and Coordination with Indian Tribal Governments,[20] and FAA Order 1210.20, American Indian and Alaska Native Tribal Consultation Policy and Procedures,[21] the FAA ensures that Federally Recognized Tribes (Tribes) are given the opportunity to provide meaningful and timely input regarding proposed Federal actions that have the potential to have substantial direct effects on one or more Indian Tribes, on the relationship between the Federal government and Indian Tribes, or on the distribution of power and responsibilities between the Federal government and Indian Tribes; or to affect uniquely or significantly their respective Tribes. At this point, the FAA has not identified any unique or significant effects, environmental or otherwise, on Tribes resulting from this final rule.

C. Executive Order 13211, Regulations That Significantly Affect Energy Supply, Distribution, or Use

The FAA analyzed this final rule under E.O. 13211, Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use (May 18, 2001). The FAA has determined that it is not a ''significant energy action'' under the executive order and not likely to have a significant adverse effect on the supply, distribution, or use of energy.

[20] 65 FR 67249 (Nov. 6, 2000).

[21] FAA Order No. 1210.20 (Jan. 28, 2004), available at *www.faa.gov/documentLibrary/media/1210.pdf.*

D. Executive Order 13609, Promoting International Regulatory Cooperation

Executive Order 13609, Promoting International Regulatory Cooperation, promotes international regulatory cooperation to meet shared challenges involving health, safety, labor, security, environmental, and other issues and reduce, eliminate, or prevent unnecessary differences in regulatory requirements. The FAA has analyzed this action under the policy and agency responsibilities of Executive Order 13609. The FAA has determined that this action will eliminate differences between United States aviation standards and those of other civil aviation authorities by adopting the airplane certification regulations needed to comply with the standards adopted by ICAO and the EPA.

VII. Additional Information

A. Electronic Access and Filing

A copy of the NPRM, all comments received, this final rule, and all background material may be viewed online at *www.regulations.gov* using the docket number listed above. A copy of this final rule will be placed in the docket. Electronic retrieval help and guidelines are available on the website. It is available 24 hours each day, 365 days each year. An electronic copy of this document may also be downloaded from the Office of the Federal Register's website at *www.federalregister.gov* and the Government Publishing Office's website at *www.govinfo.gov.* A copy may also be found at the FAA's Regulations and Policies website at *www.faa.gov/regulations_policies.*

Copies may also be obtained by sending a request to the Federal Aviation Administration, Office of Rulemaking, ARM–1, 800 Independence Avenue SW, Washington, DC 20591, or by calling (202) 267–9677. Commenters must identify the docket or notice number of this rulemaking.

All documents the FAA considered in developing this final rule, including economic analyses and technical reports, may be accessed in the electronic docket for this rulemaking.

B. Small Business Regulatory Enforcement Fairness Act

The Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996 requires the FAA to comply with small entity requests for information or advice about compliance with statutes and regulations within its jurisdiction. A small entity with questions regarding this document may contact its local FAA official, or the person listed under the **FOR FURTHER INFORMATION CONTACT**

heading at the beginning of the preamble. To find out more about SBREFA on the internet, visit *www.faa.gov/regulations_policies/rulemaking/sbre_act/.*

List of Subjects

14 CFR Part 21

Aircraft, Aviation safety, Exports, Imports, Reporting and recordkeeping requirements.

14 CFR Part 38

Air Pollution Control, Aircraft, Incorporation by reference.

14 CFR Part 121

Air carriers, Aircraft, Airmen, Alcohol abuse, Aviation safety, Charter flights, Drug abuse, Drug testing, Reporting and recordkeeping requirements, Safety, Transportation.

14 CFR Part 125

Aircraft, Airmen, Aviation safety, Reporting and recordkeeping requirements.

The Amendment

In consideration of the foregoing, the Federal Aviation Administration amends chapter I of title 14, Code of Federal Regulations as follows:

PART 21—CERTIFICATION PROCEDURES FOR PRODUCTS AND ARTICLES

■ 1. The authority citation for part 21 continues to read as follows:

Authority: 42 U.S.C. 7572; 49 U.S.C. 106(f), 106(g), 40105, 40113, 44701–44702, 44704, 44707, 44709, 44711, 44713, 44715, 45303.

■ 2. Amend § 21.5 by adding paragraph (b)(3) to read as follows:

§ 21.5 Airplane or Rotorcraft Flight Manual.

* * * * *

(b) * * *

(3) Documentation of compliance with part 38 of this chapter, in an FAA-approved section of any approved airplane flight manual. Such material must include the fuel efficiency metric value as calculated under § 38.11 of this chapter, and the specific paragraph of § 38.17 of this chapter with which compliance has been shown for that airplane.

■ 3. Amend § 21.17 by revising paragraph (a) introductory text to read as follows:

§ 21.17 Designation of applicable regulations.

(a) Except as provided in §§ 25.2, 27.2, and 29.2 of this subchapter, and in parts 26, 34, 36, and 38 of this subchapter, an applicant for a type certificate must show that the aircraft, aircraft engine, or propeller concerned meets—

* * * * *

■ 4. Amend § 21.21 by revising paragraphs (b) introductory text and (b)(1) to read as follows:

§ 21.21 Issue of type certificate: normal, utility, acrobatic, commuter, and transport category aircraft; manned free balloons; special classes of aircraft; aircraft engines; propellers.

* * * * *

(b) The applicant submits the type design, test reports, and computations necessary to show that the product to be certificated meets the applicable airworthiness, aircraft noise, fuel venting, exhaust emission, and fuel efficiency requirements of this subchapter and any special conditions prescribed by the FAA, and the FAA finds—

(1) Upon examination of the type design, and after completing all tests and inspections, that the type design and the product meet the applicable noise, fuel venting, emissions, and fuel efficiency requirements of this subchapter, and further finds that they meet the applicable airworthiness requirements of this subchapter or that any airworthiness provisions not complied with are compensated for by factors that provide an equivalent level of safety; and

* * * * *

■ 5. Amend § 21.29 by revising paragraphs (a)(1)(i) and (b) to read as follows:

§ 21.29 Issue of type certificate: import products.

(a) * * *

(1) * * *

(i) The applicable aircraft noise, fuel venting, exhaust emissions, and fuel efficiency requirements of this subchapter as designated in § 21.17, or the applicable aircraft noise, fuel venting, exhaust emissions, and fuel efficiency requirements of the State of Design, and any other requirements the FAA may prescribe to provide noise, fuel venting, exhaust emission, and fuel efficiency levels no greater than those provided by the applicable aircraft noise, fuel venting, exhaust emissions, and fuel efficiency requirements of this subchapter as designated in § 21.17; and

* * * * *

(b) A product type certificated under this section is determined to be compliant with the fuel venting and exhaust emission standards of part 34 of this subchapter, the noise standards of part 36 of this subchapter, and the fuel efficiency requirements of part 38 of this subchapter. Compliance with parts 34, 36, and 38 of this subchapter is certified under paragraph (a)(1)(i) of this section, and the applicable airworthiness standards of this subchapter, or an equivalent level of safety, with which compliance is certified under paragraph (a)(1)(ii) of this section.

■ 6. Amend § 21.31 by revising paragraph (e) to read as follows:

§ 21.31 Type design.

* * * * *

(e) Any other data necessary to allow, by comparison, the determination of the airworthiness, noise characteristics, fuel efficiency, fuel venting, and exhaust emissions (where applicable) of later products of the same type.

■ 7. Amend § 21.93 by adding paragraph (d) to read as follows:

§ 21.93 Classification of changes in type design.

* * * * *

(d) For the purpose of maintaining compliance with part 38 of this chapter, any voluntary change in the type design of an airplane that may increase the fuel efficiency metric value or the MTOM of that airplane is a ''fuel efficiency change'', in addition to being a minor or major change as classified in paragraph (a) of this section.

■ 8. Amend § 21.101 by revising paragraph (a) to read as follows:

§ 21.101 Designation of applicable regulations.

(a) An applicant for a change to a type certificate must show that the change and areas affected by the change comply with the airworthiness requirements applicable to the category of the product in effect on the date of the application for the change and with parts 34, 36, and 38 of this chapter. Exceptions are detailed in paragraphs (b) and (c) of this section.

* * * * *

■ 9. Amend § 21.115 by revising paragraph (a) to read as follows:

§ 21.115 Applicable requirements.

(a) Each applicant for a supplemental type certificate must show that the altered product meets applicable requirements specified in § 21.101 and—

(1) In the case of an acoustical change described in § 21.93(b), show compliance with the applicable noise requirements of part 36 of this chapter;

(2) In the case of an emissions change described in § 21.93(c), show compliance with the applicable fuel venting and exhaust emissions

requirements of part 34 of this chapter; and

(3) In the case of a fuel efficiency change described in § 21.93(d), show compliance with the applicable fuel efficiency requirements of part 38 of this chapter.

* * * * *

■ 10. Amend § 21.183 by adding reserved paragraph (i) and adding paragraph (j) to read as follows:

§ 21.183 Issue of standard airworthiness certificates for normal, utility, acrobatic, commuter, and transport category aircraft; manned free balloons; and special classes of aircraft.

* * * * *

(i) [Reserved]

(j) *Fuel efficiency requirements.* No original standard airworthiness certificate may be issued under this section unless the applicant has demonstrated that the type design complies with the applicable fuel efficiency requirements of part 38 of this chapter.

■ 11. Amend § 21.187 by revising paragraph (a) to read as follows:

§ 21.187 Issue of multiple airworthiness certification.

(a) An applicant for an airworthiness certificate in the restricted category, and in one or more other categories except primary category, is entitled to the certificate, if—

(1) The applicant shows compliance with the requirements for each category, when the aircraft is in the configuration for that category;

(2) The applicant shows that the aircraft can be converted from one category to another by removing or adding equipment by simple mechanical means;

(3) The aircraft complies with the applicable requirements of part 34 of this subchapter; and

(4) The airplane complies with the applicable requirements of part 38 of this subchapter.

* * * * *

■ 12. Add part 38 to read as follows:

PART 38—AIRPLANE FUEL EFFICIENCY CERTIFICATION

Subpart A—General

Subpart B—Determining Fuel Efficiency for Subsonic Airplanes

Appendix A to Part 38—Determination of Airplane Fuel Efficiency Metric Value

Authority: 42 U.S.C. 4321 *et seq.,* 7572; 49 U.S.C. 106(g), 40113, 44701–44702, 44704; 49 CFR 1.83(c)

Subpart A—General

§ 38.1 Applicability.

(a) Except as provided in paragraph (c) of this section, an airplane that is subject to the requirements of 40 CFR part 1030 may not exceed the fuel efficiency limits of this part when original type certification under this title is sought. This part applies to the following airplanes:

(1) A subsonic jet airplane that has—

(i) Either—

(A) A type-certificated maximum passenger seating capacity of 20 seats or more;

(B) A maximum takeoff mass (MTOM) greater than 5,700 kg; and

(C) An application for original type certification that is submitted on or after January 11, 2021;

(ii) Or—

(A) A type-certificated maximum passenger seating capacity of 19 seats or fewer;

(B) A MTOM greater than 60,000 kg; and

(C) An application for original type certification that is submitted on or after January 11, 2021.

(2) A subsonic jet airplane that has—

(i) A type-certificated maximum passenger seating capacity of 19 seats or fewer;

(ii) A MTOM greater than 5,700 kg, but not greater than 60,000 kg; and

(iii) An application for original type certification that is submitted on or after January 1, 2023.

(3) A propeller-driven airplane that has—

(i) A MTOM greater than 8,618 kg; and

(ii) An application for original type certification that is submitted on or after January 11, 2021.

(4) A subsonic jet airplane—

(i) That is a modified version of an airplane whose type design was not certificated under this part;

(ii) That has a MTOM greater than 5,700 kg;

(iii) For which an application by the type certificate holder for a type design change is submitted on or after January 1, 2023; and

(iv) For which the first certificate of airworthiness is issued with the modified type design.

(5) A propeller-driven airplane—

(i) That is a modified version of an airplane whose type design was not certificated under this part;

(ii) That has a MTOM greater than 8,618 kg;

(iii) For which an application by the type certificate holder for a type design change is submitted on or after January 1, 2023; and

(iv) For which the first certificate of airworthiness is issued with the modified type design.

(6) A subsonic jet airplane that has—

(i) A MTOM greater than 5,700 kg; and

(ii) Its first certificate of airworthiness issued on or after January 1, 2028.

(7) A propeller-driven airplane that has—

(i) A MTOM greater than 8,618 kg; and

(ii) Its first certificate of airworthiness issued on or after January 1, 2028.

(b) The requirements of this part apply to an airplane for which an application for a change in type design is submitted that includes a modification that meets the change criteria of § 38.19. A modified airplane may not exceed the applicable fuel efficiency limit of this part when certification under this chapter is sought. A modified airplane is subject to the same fuel efficiency limit of § 38.17 as the airplane was certificated to prior to modification.

(c) The requirements of this part do not apply to:

(1) Subsonic jet airplanes having a MTOM at or below 5,700 kg.

(2) Propeller-driven airplanes having a MTOM at or below 8,618 kg.

(3) Amphibious airplanes.

(4) Airplanes initially designed, or modified and used, for specialized operations. These airplane designs may include characteristics or configurations necessary to conduct specialized operations that the FAA and the United States Environmental Protection Agency (EPA) have determined may cause a significant increase in the fuel efficiency metric value.

(5) Airplanes designed with a reference geometric factor of zero.

(6) Airplanes designed for, or modified and used for, firefighting.

(7) Airplanes powered by reciprocating engines.

§ 38.3 Definitions.

For the purpose of showing compliance with this part, the following terms have the specified meanings:

Amphibious airplane means an airplane that is capable of takeoff and

landing on both land and water. Such an airplane uses its hull or floats attached to the landing gear for takeoff and landing on water, and either extendable or fixed landing gear for takeoff and landing on land.

ICAO Annex 16, Volume III means Volume III of Annex 16 to the Convention on International Civil Aviation.

Maximum takeoff mass (MTOM) is the maximum certified takeoff mass, expressed in kilograms, for an airplane type design.

Performance model is an analytical tool (or a method) validated using corrected flight test data that can be used to determine the specific air range values for calculating the fuel efficiency metric value.

Reference geometric factor (RGF) is a non-dimensional number derived from a two-dimensional projection of the fuselage.

Specific air range (SAR) is the distance an airplane travels per unit of fuel consumed. Specific air range is expressed in kilometers per kilogram of fuel.

Subsonic means an airplane that has not been certificated under this title to exceed Mach 1 in normal operation.

Type certificated maximum passenger seating capacity means the maximum number of passenger seats that may be installed on an airplane as listed on its type certificate data sheet, regardless of the actual number of seats installed on an individual airplane.

§ 38.4 Compatibility with airworthiness requirements.

Unless otherwise approved by the FAA, an airplane used to demonstrate compliance with this part must meet all of the airworthiness requirements of this chapter required to establish the type certification basis of the airplane, for any condition under which compliance with this part is being demonstrated. Any procedure used to demonstrate compliance, and any flight crew information developed for demonstrating compliance with this part, must be consistent with the airworthiness requirements of this chapter that constitute the type certification basis of the airplane.

§ 38.5 Exemptions.

A petition for exemption from any requirement of this part must be submitted to the Administrator in accordance with and meet the requirements of part 11 of this chapter. The FAA will consult with the EPA on each exemption petition before taking action.

§ 38.7 Incorporation by reference.

The ICAO Doc 7488/3, *Manual of the ICAO Standard Atmosphere (extended to 80 kilometres (262 500 feet))* (1993), referenced in sections A38.2.1.3.1, A38.5.2.2.1.9, and A38.5.2.2.1.10 of appendix A to this part, is incorporated by reference into this part with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51. All approved material is available for inspection at the FAA and at the National Archives and Records Administration (NARA). Contact FAA at: Office of Rulemaking (ARM–1), 800 Independence Avenue SW, Washington, DC 20590 (telephone 202–267–9677). For information on the availability of this material at NARA, visit *www.archives.gov/federal-register/cfr/ibr-locations.html* or email *fr.inspection@nara.gov.* The ICAO Doc 7488/3 is available for purchase from the ICAO Store at 999 Robert-Bourassa Boulevard Montréal (Quebec) Canada H3C 5H7, (*https://store.icao.int/*).

§ 38.9 Relationship to other regulations.

In accordance with certain provisions of the Clean Air Act Amendments of 1970 (CAA) (42 U.S.C. 7571 *et seq.*), the United States Environmental Protection Agency (EPA) is authorized to set standards for aircraft engine emissions in the United States, while the FAA is authorized to ensure compliance with those standards under a delegation from the Secretary of Transportation (49 CFR 1.83). The fuel efficiency limits in § 38.17 are intended to be the same as that promulgated by the EPA in 40 CFR part 1030. Accordingly, if the EPA changes any regulation in 40 CFR part 1030 that corresponds with a regulation in this part, a certification applicant may request a waiver of those provisions as they appear in this part in order to comply with part 1030. In addition, unless otherwise specified in this part, all terminology and abbreviations in this part that are defined in 40 CFR part 1030 have the meaning specified in part 1030.

Subpart B—Determining Fuel Efficiency for Subsonic Airplanes

§ 38.11 Fuel efficiency metric.

For each airplane subject to this part, or to determine whether a modification makes an airplane subject to this part under the change criteria of § 38.19, a fuel efficiency metric value must be calculated, using the following equation, rounded to three decimal places:

$$Fuel\ Efficiency\ \text{metric value} = \frac{\left(\frac{1}{SAR}\right)_{avg}}{RGF^{0.24}}$$

Where:

The SAR is determined in accordance with § 38.13, and the RGF is determined in accordance with § 38.15. The fuel efficiency metric value is expressed in units of kilograms of fuel consumed per kilometer.

§ 38.13 Specific air range.

(a) For each airplane subject to this part, the SAR of an airplane must be determined by either:

(1) Direct flight test measurements; or

(2) Using a performance model that is:

(i) Validated by actual SAR flight test data; and

(ii) Approved by the FAA before any SAR calculations are submitted.

(b) For the airplane model, establish a 1/SAR value at each of the following reference airplane masses:

(1) High gross mass: 92 percent MTOM.

(2) Low gross mass: (0.45 * MTOM) + (0.63 * (MTOM^0.924)).

(3) Mid gross mass: simple arithmetic average of high gross mass and low gross mass.

(c) To obtain $(1/SAR)_{avg}$ as required to determine the fuel efficiency metric value described in § 38.11, calculate the average of the three 1/SAR values described in paragraph (b) of this section. Do not include auxiliary power units in any 1/SAR calculation.

(d) All determinations made under this section must be made in accordance with the procedures applicable to SAR as described in appendix A to this part.

§ 38.15 Reference geometric factor.

For each airplane subject to this part, determine the airplane's non-dimensional RGF for the fuselage size of each airplane model, calculated as follows:

(a) For an airplane with a single deck, determine the area of a surface

(expressed in m^2) bounded by the maximum width of the fuselage outer mold line projected to a flat plane parallel with the main deck floor and the forward and aft pressure bulkheads except for the crew flight deck zone.

(b) For an airplane with more than one deck, determine the sum of the areas (expressed in m^2) as follows:

(1) The maximum width of the fuselage outer mold line, projected to a flat plane parallel with the main deck floor by the forward and aft pressure bulkheads except for any crew flight deck zone.

(2) The maximum width of the fuselage outer mold line at or above each other deck floor, projected to a flat plane parallel with the additional deck floor by the forward and aft pressure bulkheads except for any crew flight deck zone.

(c) Determine the non-dimensional RGF by dividing the area defined in paragraph (a) or (b) of this section by 1 m^2.

(d) All measurements and calculations used to determine the RGF of an airplane must be made in accordance with the procedures for determining RGF in section A38.3 of appendix A to this part.

§ 38.17 Fuel efficiency limits.

(a) The fuel efficiency limits in this section are expressed as maximum permitted fuel efficiency metric values, as calculated under § 38.11.

(b) The fuel efficiency metric value of an airplane subject to this part may not exceed the following, rounded to three decimal places:

For airplanes described in...	With a MTOM...	The maximum permitted fuel efficiency metric value is...
(1) Section 38.1(a)(1) and (2)	5,700 < MTOM ≤ 60,000 kg	$10^{(-2.73780 + (0.681310 * \log_{10}(MTOM)) + (-0.0277861 * (\log_{10}(MTOM))^2))}$
(2) Section 38.1(a)(3)	8,618 < MTOM ≤ 60,000 kg	$10^{(-2.73780 + (0.681310 * \log_{10}(MTOM)) + (-0.0277861 * (\log_{10}(MTOM))^2))}$
(3) Section 38.1(a)(1) and (3)	60,000 < MTOM ≤ 70,395 kg	0.764
(4) Section 38.1(a)(1) and (3)	MTOM > 70,395 kg	$10^{(-1.412742 + (-0.020517 * \log_{10}(MTOM)) + (0.0593831 * (\log_{10}(MTOM))^2))}$
(5) Section 38.1(a)(4) and (6)	5,700 < MTOM ≤ 60,000 kg	$10^{(-2.57535 + (0.609766 * \log_{10}(MTOM)) + (-0.0191302 * (\log_{10}(MTOM))^2))}$
(6) Section 38.1(a)(5) and (7)	8,618 < MTOM ≤ 60,000 kg	$10^{(-2.57535 + (0.609766 * \log_{10}(MTOM)) + (-0.0191302 * (\log_{10}(MTOM))^2))}$
(7) Section 38.1(a)(4) through (7)	60,000 < MTOM ≤ 70,107 kg	0.797
(8) Section 38.1(a)(4) through (7)	MTOM > 70,107 kg	$10^{(-1.39353 + (-0.020517 * \log_{10}(MTOM)) + (0.0593831 * (\log_{10}(MTOM))^2))}$

§ 38.19 Change criteria.

(a) For an airplane that has been shown to comply with § 38.17, any subsequent version of that airplane must demonstrate compliance with § 38.17 if the subsequent version incorporates a modification that either increases:

(1) The maximum takeoff mass; or

(2) The fuel efficiency metric value by a percentage that is more than the following calculated thresholds.

(i) For airplanes with a MTOM greater than or equal to 5,700 kg, the threshold decreases linearly from 1.35 percent for an airplane with a MTOM of 5,700 kg to 0.75 percent for an airplane with a MTOM of 60,000 kg.

(ii) For airplanes with a MTOM greater than or equal to 60,000 kg, the threshold decreases linearly from 0.75 percent for an airplane with a MTOM of 60,000 kg to 0.70 percent for airplanes with a MTOM of 600,000 kg.

(iii) For airplanes with a MTOM greater than or equal to 600,000 kg, the threshold is 0.70 percent.

(b) For an airplane that has been shown to comply with § 38.17, and for any subsequent version of that airplane that incorporates modifications that do not increase the MTOM or the fuel efficiency metric value in excess of the levels shown in paragraph (a) of this section, the fuel efficiency metric value of the modified airplane may be reported to be the same as the value prior to modification.

(c) For an airplane that meets the criteria of § 38.1(a)(4) or (5), on or after January 1, 2023, and before January 1, 2028, the airplane must demonstrate compliance with § 38.17 if it incorporates any modification that increases the fuel efficiency metric value of the airplane prior to modification by more than 1.5 percent.

§ 38.21 Approval before compliance testing.

All procedures, weights, configurations, and other information or data that are used to establish a fuel efficiency level required by this part or in any appendix to this part (including any equivalent procedures) must be approved by the FAA prior to use in certification tests intended to demonstrate compliance with this part.

§ 38.23 Manual information and limitations.

(a) *Information in manuals.* The following information must be included in any FAA-approved section of a FAA-approved Airplane Flight Manual or combination of approved manual material:

(1) Fuel efficiency level established as required by this part; and

(2) Maximum takeoff mass at which fuel efficiency level was established.

(b) *Limitation.* If the fuel efficiency of an airplane is established at a weight (mass) that is less than the maximum certificated takeoff weight (mass) used to establish the airworthiness of the airplane under this chapter, the lower weight (mass) becomes an operating limitation of the airplane and that limitation must be included in the limitations section of any FAA-approved manual.

Appendix A to Part 38—Determination of Airplane Fuel Efficiency Metric Value

A38.1 Introduction

A38.1.1 This appendix describes the processes and procedures for determining the fuel efficiency metric value for an airplane subject to this part.

A38.1.2 Methods for Determining Specific Air Range (SAR)

A38.1.2.1 SAR may be determined by either—

A38.1.2.1.1 Direct flight test measurement at the SAR test points, including any corrections of test data to reference specifications; or

A38.1.2.1.2 Use of a performance model.

A38.1.2.2 For any determination made under section A38.1.2.1.1 of this appendix, the SAR flight test data must have been acquired in accordance with the procedures defined in this appendix and approved by the FAA.

A38.1.2.3 For any determination made under section A38.1.2.1.2 of this appendix, the performance model must:

A38.1.2.3.1 Be verified that the model produces the values that are the same as FAA-approved SAR flight test data;

A38.1.2.3.2 Include a detailed description of any test and analysis method and any algorithm used so as to allow evaluation by the FAA; and

A38.1.2.3.3 Be approved by the FAA before use.

A38.2 Reference Specifications for SAR Flight Tests

A38.2.1 The following reference specifications must be established when determining SAR values for an airplane. No reference specification may exceed any airworthiness limit approved for the airplane under this chapter. See section A38.5 of this appendix for further information.

A38.2.1.1 Reference specifications at the airplane level:

A38.2.1.1.1 Airplane at the reference masses listed in § 38.13(b);

A38.2.1.1.2 A combination of altitude and airspeed selected by the applicant;

A38.2.1.1.3 Airplane in steady, unaccelerated, straight and level flight;

A38.2.1.1.4 Airplane in longitudinal and lateral trim;

A38.2.1.1.5 Airplane gravitational acceleration when travelling in the direction of true North in still air at the reference altitude and a geodetic latitude of 45.5 degrees, based on g_0 (g_0 is 9.80665 m/s^2, which is the standard acceleration due to gravity at sea level and a geodetic latitude of 45.5 degrees);

A38.2.1.1.6 A reference airplane center of gravity (CG) position selected by the applicant to be representative of the mid-CG point relevant to design cruise performance at each of the three reference airplane masses; and

A38.2.1.1.7 A wing structural loading condition defined by the applicant that is representative of operations conducted in accordance with the airplane's maximum payload capability.

A38.2.1.2 Reference specifications at the engine level:

A38.2.1.2.1 Electrical and mechanical power extraction and bleed flow relevant to design cruise performance, as selected by the applicant;

Note 1 to A38.2.1.2.1—Power extraction and bleed flow attributable to the use of optional equipment such as passenger entertainment systems need not be included.

A38.2.1.2.2 Engine stability bleeds operating according to the manufacturer's normal schedule for the engine; and

A38.2.1.2.3 Engines with at least 15 cycles or 50 engine flight hours.

A38.2.1.3 Other reference specifications:

A38.2.1.3.1 ICAO standard day atmosphere (Doc 7488/3, 3rd edition 1993, titled ''Manual of the ICAO Standard Atmosphere (extended to 80 kilometres (262 500 feet))'') (incorporated by reference, see § 38.7); and

A38.2.1.3.2 Fuel lower heating value equal to 43.217 MJ/kg (18,−580 BTU/lb).

A38.2.2 If any test conditions are not the same as the reference specifications of this appendix, the test conditions must be corrected to the reference specifications as described in section A38.5 of this appendix.

A38.3 Determination of Reference Geometric Factor (RGF)

A38.3.1 This section provides additional information for determining the RGF, as required by § 38.15.

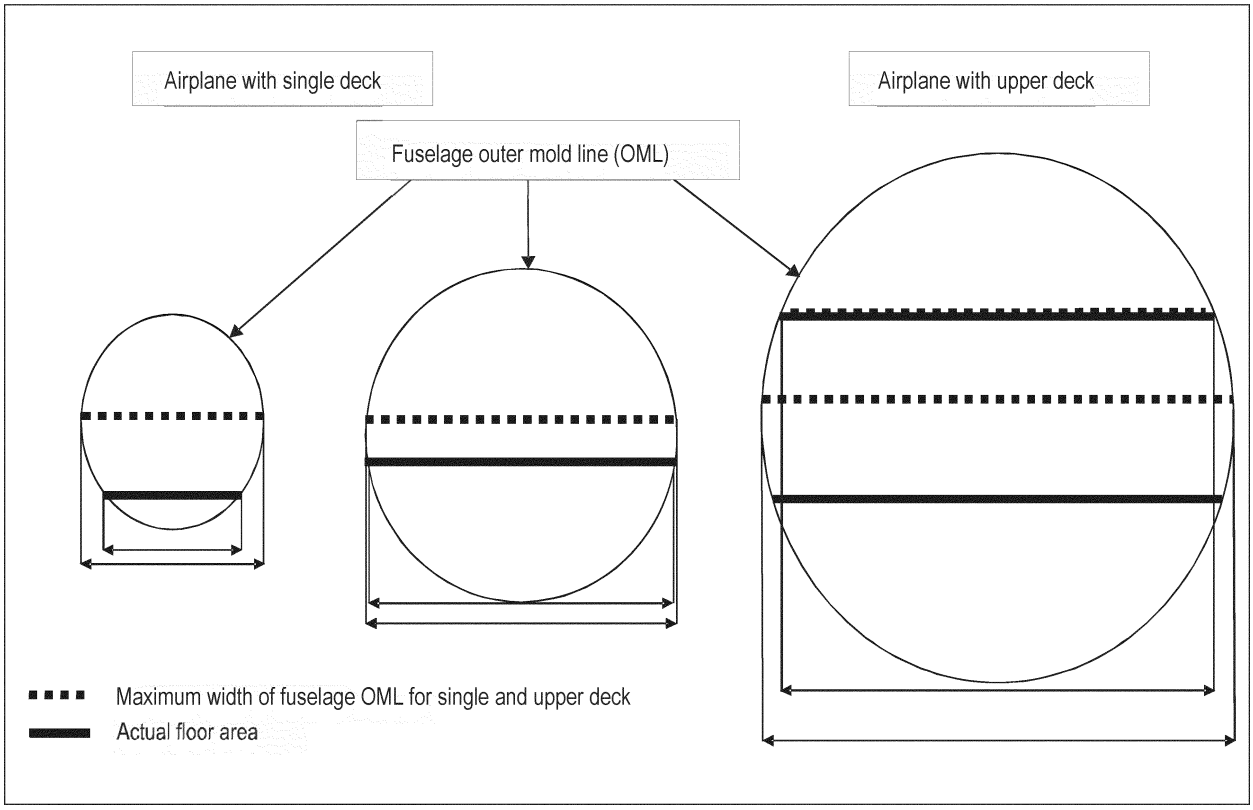
A38.3.2 The area that defines RGF includes all pressurized space on a single or multiple decks including aisles, assist spaces, passageways, stairwells and areas that can accommodate cargo or auxiliary fuel containers. It does not include permanent integrated fuel tanks within the cabin, or any unpressurized fairings, crew rest or work areas, or cargo areas that are not on the main or upper deck (*e.g.,* 'loft' or under floor areas). RGF does not include the flight deck crew zone.

A38.3.3 The aft boundary to be used for calculating RGF is the aft pressure bulkhead. The forward boundary is the forward pressure bulkhead, not including the flight deck crew zone.

A38.3.4 Areas that are accessible to both crew and passengers are not considered part of the flight deck crew zone. For an airplane that has a flight deck door, the aft boundary of the flight deck crew zone is the plane of the flight deck door. For an airplane that has no flight deck door or has optional interior configurations that include different locations of the flight deck door, the aft boundary is determined by the configuration that provides the smallest available flight deck crew zone. For airplanes certificated for single-pilot operation, the flight deck crew zone is measured as half the width of the flight deck.

A38.3.5 Figures A38–1 and A38–2 of this appendix provide a notional view of the RGF boundary conditions.

Figure A38-1 to Appendix A to Part 38—Cross-sectional view



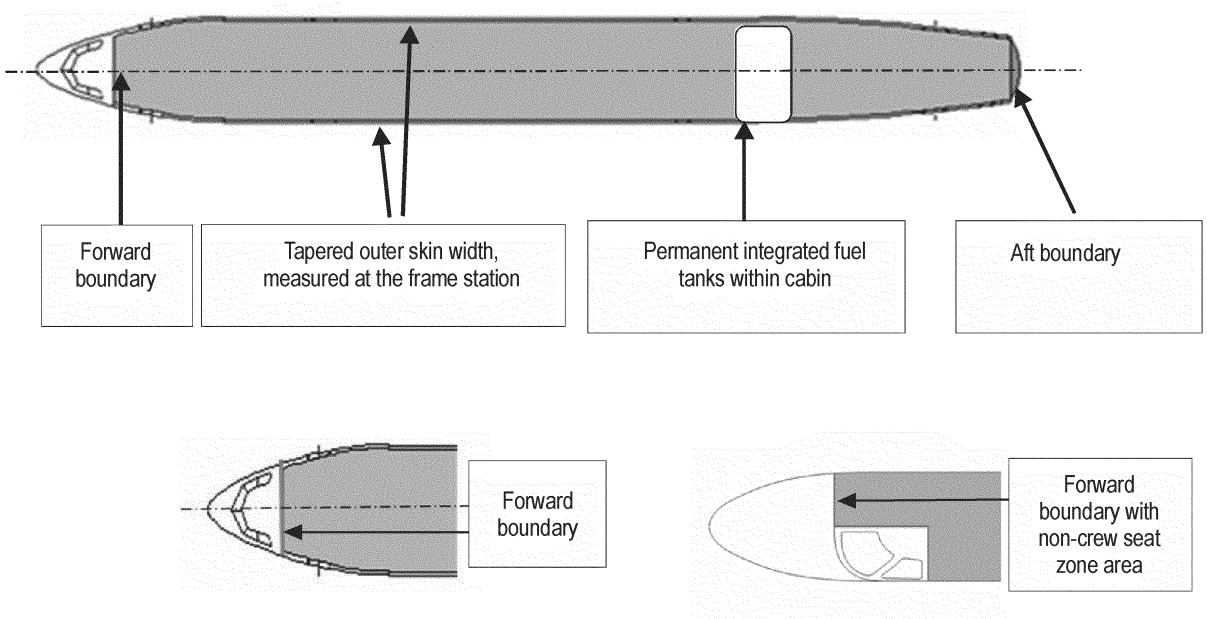


Figure A38-2 to Appendix A to Part 38. Longitudinal view

A38.4 Certification Test Specifications

A38.4.1 Certification Test Specifications. This section prescribes the specifications under which an applicant must conduct SAR certification tests.

A38.4.2 Flight Test Procedures

A38.4.2.1 Before a Test Flight. The test flight procedures must include the following elements and must be approved by the FAA before any test flight is conducted:

A38.4.2.1.1 *Airplane conformity.* The test airplane must conform to the critical configuration of the type design for which certification is sought.

A38.4.2.1.2 *Airplane weight.* The test airplane must be weighed. Any change in mass after the weighing and prior to the test flight must be accounted for.

A38.4.2.1.3 *Fuel.* The fuel used for each flight test must meet the specification defined in either ASTM D1655–15 (titled ''Standard Specification for Aviation Turbine Fuels''), UK MoD Defense Standard 91–91, Issue 7, Amendment 3 (titled ''Turbine Fuel, Kerosene Type, Jet A–1, NATO Code F–35; Join Services Designation; AVTUR''), or as approved by FAA.

A38.4.2.1.4 *Fuel lower heating value.* The lower heating value of the fuel used on a test flight must be determined from a sample of fuel used for the test flight. The lower heating value of the fuel sample must be used to correct measured data to reference specifications. The determination of lower heating value and the correction to reference specifications are subject to approval by the FAA.

A38.4.2.1.4.1 The fuel lower heating value may be determined in accordance with ASTM D4809–13 ''Standard Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter (Precision Method)'', or as approved by the FAA.

A38.4.2.1.4.2 The fuel sample may be representative of the fuel used for each flight test and should not have errors or variations due to fuel being uplifted from multiple sources, fuel tank selection, or fuel layering in a tank.

A38.4.2.1.5 *Fuel specific gravity and viscosity.* When volumetric fuel flow meters are used, the specific gravity and viscosity of the fuel used on a test flight must be determined from a sample of fuel used for the test flight.

A38.4.2.1.5.1 The fuel specific gravity may be determined in accordance with ASTM D4052–11 ''Standard Test Method for Density, Relative Density, and API Gravity of Liquids'', or as approved by FAA.

A38.4.2.1.5.2 The fuel kinematic viscosity may be determined in accordance with ASTM D445–15 (titled ''Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)''), or as approved by FAA.

A38.4.2.2 Flight Test Procedures and Test Condition Stability. An applicant must conduct each flight test in accordance with the flight test procedures and the stability conditions as follows:

A38.4.2.2.1 Flight Test Procedure. The following procedures must be maintained during each flight used to gather data for determining SAR values:

A38.4.2.2.1.1 To the extent that is practicable, the airplane is flown at constant pressure altitude and constant heading along isobars;

A38.4.2.2.1.2 The engine thrust/power setting is stable for unaccelerated level flight;

A38.4.2.2.1.3 The airplane is flown as close as practicable to the reference specifications to minimize the magnitude of any correction;

A38.4.2.2.1.4 Changes in trim or engine power/thrust settings, engine stability and handling bleeds, or electrical and mechanical power extraction (including bleed flow) are avoided or minimized as practicable; and

A38.4.2.2.1.5 There is no unnecessary movement of on-board personnel.

A38.4.2.2.2 Test Condition Stability. To obtain a valid SAR measurement, the following conditions must be maintained during each test flight, including the indicated tolerances for at least 1 minute while SAR data is acquired:

A38.4.2.2.2.1 Mach number within ±0.005;

A38.4.2.2.2.2 Ambient temperature within ±1 °C;

A38.4.2.2.2.3 Heading within ±3 degrees;

A38.4.2.2.2.4 Track within ±3 degrees;

A38.4.2.2.2.5 Drift angle less than 3 degrees;

A38.4.2.2.2.6 Ground speed within ±3.7 km/h (±2 kt);

A38.4.2.2.2.7 Difference in ground speed at the beginning of the SAR measurement from the ground speed at the end of the SAR measurement within ±2.8 km/h/min (±1.5 kt/min); and

A38.4.2.2.2.8 Pressure altitude within ±23 m (±75 ft).

A38.4.2.2.3 Alternatives to the stable test condition criteria of section A38.4.2.2.2 of this appendix may be used provided that stability is sufficiently demonstrated to the FAA.

A38.4.2.2.4 Data obtained at test points that do not meet the stability criteria of section A38.4.2.2.2 may be acceptable as an equivalent procedure, subject to FAA approval.

A38.4.2.2.5 SAR measurements at the test points must be separated by either:

A38.4.2.2.5.1 Two minutes; or

A38.4.2.2.5.2 An exceedance of one or more of the stability criteria limits described in A38.4.2.2.2.

A38.4.2.3 Verification of Airplane Mass at Test Conditions

A38.4.2.3.1 The procedure for determining the mass of the airplane at each test condition must be approved by the FAA.

A38.4.2.3.2 The mass of the airplane during a flight test is determined by subtracting the fuel used from the mass of the airplane at the start of the test flight. The accuracy of the determination of the fuel used must be verified by:

A38.4.2.3.2.1 Weighing the test airplane on calibrated scales before and after the SAR test flight;

A38.4.2.3.2.2 Weighing the test airplane before and after another test flight that included a cruise segment, provided that flight occurs within one week or 50 flight hours (at the option of the applicant) of the SAR test flight and using the same, unaltered fuel flow meters; or

A38.4.2.3.2.3 Other methods as approved by the FAA.

A38.5 Measurement of Specific Air Range

A38.5.1 Measurement System

A38.5.1.1 The following parameters must be recorded at a minimum sampling rate of 1 Hertz (cycle per second):

A38.5.1.1.1 Airspeed;

A38.5.1.1.2 Ground speed;

A38.5.1.1.3 True airspeed;

A38.5.1.1.4 Fuel flow;

A38.5.1.1.5 Engine power setting;

A38.5.1.1.6 Pressure altitude;

A38.5.1.1.7 Temperature;

A38.5.1.1.8 Heading;

A38.5.1.1.9 Track; and

A38.5.1.1.10 Fuel used (for the determination of gross mass and CG position).

A38.5.1.2 The following parameters must be recorded:

A38.5.1.2.1 Latitude;

A38.5.1.2.2 Engine bleed positions and power off-takes; and

A38.5.1.2.3 Power extraction (electrical and mechanical load).

A38.5.1.3 The value of each parameter used for the determination of SAR (except for ground speed) is the simple arithmetic average of the measured values for that parameter obtained throughout the stable test condition described in section A38.4.2.2.2 of this appendix.

A38.5.1.4 For ground speed, the value is the rate of change of ground speed during the SAR test measurement. The rate of change of ground speed during the SAR measurement must be used to evaluate and correct any acceleration or deceleration that might occur during the SAR measurement.

A38.5.1.5 Each measurement device must have sufficient resolution to determine that the stability of a parameter defined in section A38.4.2.2.2 of this appendix is maintained during SAR measurement.

A38.5.1.6 The SAR measurement system consists of the combined instruments and devices, and any associated procedures, used to acquire the following parameters necessary to determine SAR:

A38.5.1.6.1 Fuel flow;

A38.5.1.6.2 Mach number;

A38.5.1.6.3 Altitude;

A38.5.1.6.4 Airplane mass;

A38.5.1.6.5 Ground speed;

A38.5.1.6.6 Outside air temperature;

A38.5.1.6.7 Fuel lower heating value; and

A38.5.1.6.8 CG.

A38.5.1.7 The SAR value is affected by the accuracy of each element that comprises the SAR measurement system. The cumulative error associated with the SAR measurement system is defined as the root sum of squares (RSS) of the individual accuracies.

A38.5.1.8 If the absolute value of the cumulative error of the overall SAR measurement system is greater than 1.5 percent, a penalty equal to the amount that the RSS value exceeds 1.5 percent must be applied to the SAR value that has been corrected to reference specifications (see section A38.5.2 of this appendix). If the absolute value of the cumulative error of the overall SAR measurement system is less than or equal to 1.5 percent, no penalty will be applied.

A38.5.2 Calculation of Specific Air Range from Measured Data

A38.5.2.1 Calculating SAR. SAR must be calculated using the following equation:

$$SAR = TAS/W_f$$

Where:

TAS is the true airspeed and W_f is total airplane fuel flow.

A38.5.2.2 Correcting Measured SAR Values to Reference Specifications

A38.5.2.2.1 The measured SAR values must be corrected to the reference specifications listed in A38.2 of this appendix. Unless otherwise approved by the FAA, corrections to reference specifications must be applied for each of the following measured parameters:

A38.5.2.2.1.1 *Acceleration/deceleration (energy).* Drag determination is based on an assumption of steady, unaccelerated flight. Acceleration or deceleration occurring during a test condition affects the assessed drag level. The reference specification is in section A38.2.1.1.3 of this appendix.

A38.5.2.2.1.2 *Aeroelastics.* Wing aeroelasticity may cause a variation in drag as a function of airplane wing mass distribution. Airplane wing mass distribution will be affected by the fuel load distribution in the wings and the presence of any external stores. The reference specification is in section A38.2.1.1.7 of this appendix.

A38.5.2.2.1.3 *Altitude.* The altitude at which the airplane is flown affects the fuel flow. The reference specification is in section A38.2.1.1.2 of this appendix.

A38.5.2.2.1.4 *Apparent gravity.* Acceleration, caused by the local effect of gravity, and inertia, affect the test weight of the airplane. The apparent gravity at the test conditions varies with latitude, altitude, ground speed, and direction of motion relative to the Earth's axis. The reference gravitational acceleration is the gravitational acceleration for the airplane travelling in the direction of true North in still air at the reference altitude, a geodetic latitude of 45.5 degrees, and based on g_0 (see section A38.2.1.1.5 of this appendix).

A38.5.2.2.1.5 *CG position.* The position of the airplane CG affects the drag due to longitudinal trim. The reference specification is in section A38.2.1.1.6 of this appendix.

A38.5.2.2.1.6 *Electrical and mechanical power extraction and bleed flow.* Electrical and mechanical power extraction, and bleed flow affect the fuel

flow. The reference specifications are in sections A38.2.1.2.1 and A38.2.1.2.2 of this appendix.

A38.5.2.2.1.7 *Engine deterioration level.* The requirement in section A38.2.1.2.3 of this appendix addresses the minimum deterioration of an engine that is used to determine SAR. Since engine deterioration is rapid when an engine is new, when used for SAR determination:

A38.5.2.2.1.7.1 Subject to FAA approval, an engine having less deterioration than the reference deterioration level in section A38.2.1.2.3 of this appendix must correct the fuel flow to the reference deterioration using an approved method.

A38.5.2.2.1.7.2 An engine with greater deterioration than the reference deterioration level in section A38.2.1.2.3 of this appendix may be used, and no correction is permitted.

A38.5.2.2.1.8 *Fuel lower heating value.* The fuel lower heating value defines the energy content of the fuel. The lower heating value directly affects the fuel flow at a given test condition. The reference specification is in section A38.2.1.3.2 of this appendix.

A38.5.2.2.1.9 *Reynolds number.* The Reynolds number affects airplane drag. For a given test condition the Reynolds number is a function of the density and viscosity of air at the test altitude and temperature. The reference Reynolds number is derived from the density and viscosity of air from the ICAO standard atmosphere at the reference altitude (see sections A38.2.1.1.2 and A38.2.1.3.1 of this appendix, incorporated by reference see § 38.7).

A38.5.2.2.1.10 *Temperature.* The ambient temperature affects the fuel flow. The reference temperature is the standard day temperature from the ICAO standard atmosphere at the reference altitude (see section A38.2.1.3.1 of this appendix, incorporated by reference see § 38.7).

Note 2 to A38.5.2.2.1.10—Post-flight data analysis includes the correction of measured data for data acquisition hardware response characteristics (*e.g.,* system latency, lag, offset, buffering, etc.).

A38.5.2.2.2 Correction methods are subject to the approval of the FAA.

A38.5.2.3 Using Specific Air Range to Determine the Fuel Efficiency Metric Value

A38.5.2.3.1 Calculate the SAR values for each of the three reference masses as described in § 38.13, including any corrections to reference specifications, as required under this part. The final SAR value for each reference mass is the simple arithmetic average of all valid test points at the appropriate gross mass, or derived from a validated performance model. No data acquired from a valid test point may be omitted unless approved by the FAA.

A38.5.2.3.2 When an FAA-approved performance model is used, extrapolations to aircraft masses other than those tested may be approved when such extrapolations are consistent with accepted airworthiness practices. Since a performance model must be based on data covering an adequate range of lift coefficient, Mach number, and thrust specific fuel consumption, no extrapolation of those parameters is permitted.

A38.5.3 Validity of Results

A38.5.3.1 A 90 percent confidence interval must be calculated for each of the SAR values at the three reference masses.

A38.5.3.2 If the 90 percent confidence interval of the SAR value at any of the three reference airplane masses—

A38.5.3.2.1 Is less than or equal to ±1.5 percent, the SAR value may be used.

A38.5.3.2.2 Exceeds ±1.5 percent, a penalty equal to the amount that the 90 percent confidence interval exceeds ±1.5 percent must be applied to the SAR value, as approved by the FAA.

A38.5.3.3 If clustered data is acquired separately for each of the three gross mass reference points, the minimum sample size acceptable for each of the three gross mass SAR values is six.

A38.5.3.4 If SAR data is collected over a range of masses, the minimum sample size is 12 and the 90 percent confidence interval is calculated for the mean regression line through the data.

A38.6 Submission of Certification Data to the FAA

The following information must be provided to the FAA in the certification reports for each airplane type and model for which fuel efficiency certification under this part is sought.

A38.6.1 General Information

A38.6.1.1 Designation of the airplane type and model:

A38.6.1.2 Configuration of the airplane, including CG range, number and type designation of engines and, if fitted, propellers, and any modifications or non-standard equipment expected to affect the fuel efficiency characteristics;

A38.6.1.3 MTOM used for certification under this part;

A38.6.1.4 All dimensions needed for calculation of RGF; and

A38.6.1.5 Serial number of each airplane used to establish fuel efficiency certification in accordance with this part.

A38.6.2 Reference Specifications. The reference specifications used to determine any SAR value as described in section A38.2 of this appendix.

A38.6.3 Test Data. The following measured test data, including any corrections for instrumentation characteristics, must be provided for each of the test measurement points used to calculate the SAR values for each of the reference masses defined in § 38.13(b):

A38.6.3.1 Airspeed, ground speed and true airspeed;

A38.6.3.2 Fuel flow;

A38.6.3.3 Pressure altitude;

A38.6.3.4 Static air temperature;

A38.6.3.5 Airplane gross mass and CG for each test point;

A38.6.3.6 Levels of electrical and mechanical power extraction and bleed flow;

A38.6.3.7 Engine performance;

A38.6.3.7.1 For jet airplanes, engine power setting; or

A38.6.3.7.2 For propeller-driven airplanes, shaft horsepower or engine torque, and propeller rotational speed;

A38.6.3.8 Fuel lower heating value;

A38.6.3.9 When volumetric fuel flow meters are used, fuel specific gravity and kinematic viscosity (see section A38.4.2.1.5. of this appendix);

A38.6.3.10 The cumulative error (RSS) of the overall measurement system (see section A38.5.1.7 of this appendix);

A38.6.3.11 Heading, track and latitude;

A38.6.3.12 Stability criteria (see section A38.4.2.2.2 of this appendix); and

A38.6.3.13 Description of the instruments and devices used to acquire the data needed for the determination of SAR, and the individual accuracies of the equipment relevant to their effect on SAR (see sections A38.5.1.6 and A38.5.1.7 of this appendix).

A38.6.4 Calculations and Corrections of SAR Test Data to Reference Specifications. The measured SAR test data, all corrections of the measured data to the reference specifications, and the SAR values calculated from the corrected data must be provided for each of the test measurement points.

A38.6.5 Calculated Values. The following values must be provided for each airplane used to establish fuel efficiency certification in accordance with this part:

A38.6.5.1 SAR (km/kg) for each reference airplane mass and the associated 90 percent confidence interval;

A38.6.5.2 Average of the 1/SAR values;

A38.6.5.3 RGF; and

A38.6.5.4 Fuel efficiency metric value.

PART 121—OPERATING REQUIREMENTS: DOMESTIC, FLAG, AND SUPPLEMENTAL OPERATIONS

■ 13. The authority citation for part 121 continues to read as follows:

Authority: 49 U.S.C. 106(f), 106(g), 40103, 40113, 40119, 41706, 42301 preceding note added by Pub. L. 112–95, sec. 412, 126 Stat. 89, 44101, 44701–44702, 44705, 44709–44711, 44713, 44716–44717, 44722, 44729, 44732; 46105; Pub. L. 111–216, 124 Stat. 2348 (49 U.S.C. 44701 note); Pub. L. 112–95 126 Stat 62 (49 U.S.C. 44732 note).

■ 14. Amend § 121.141 by revising paragraph (b) introductory text to read as follows:

§ 121.141 Airplane flight manual.

* * * * *

(b) In each airplane required to have an airplane flight manual in paragraph (a) of this section, the certificate holder shall carry either the manual required by § 121.133, if it contains the information required for the applicable flight manual and this information is clearly identified as flight manual requirements, or an approved Airplane Manual. If the certificate holder elects to carry the manual required by § 121.133, the certificate holder may revise the operating procedures sections and modify the presentation of performance data, except for the information required by § 38.23 of this chapter identifying compliance with the fuel efficiency requirements of part 38 of this chapter, from the applicable flight manual if the revised operating procedures and modified performance data presentation are—

* * * * *

PART 125—CERTIFICATION AND OPERATIONS: AIRPLANES HAVING A SEATING CAPACITY OF 20 OR MORE PASSENGERS OR A MAXIMUM PAYLOAD CAPACITY OF 6,000 POUNDS OR MORE; AND RULES GOVERNING PERSONS ON BOARD SUCH AIRCRAFT

■ 15. The authority citation for part 125 continues to read as follows:

Authority: 49 U.S.C. 106(f), 106(g), 40113, 44701–44702, 44705, 44710–44711, 44713, 44716–44717, 44722.

■ 16. Amend § 125.75 by revising paragraph (b) to read as follows:

§ 125.75 Airplane flight manual.

* * * * *

(b) Each certificate holder shall carry the approved Airplane Flight Manual or the approved equivalent aboard each airplane it operates. A certificate holder may elect to carry a combination of the manuals required by this section and § 125.71. If it so elects, the certificate holder may revise the operating procedures sections and modify the presentation of performance from the applicable Airplane Flight Manual if the revised operating procedures and modified performance data presentation are approved by the Administrator. Any approved equivalent must include the information required by § 38.23 of this chapter identifying compliance with the fuel efficiency requirements of part 38 of this chapter.

Issued under authority provided in 42 U.S.C. 4321 *et seq.,* 7572, 49 U.S.C. 106(f), 40133, 44701–44701, 44703, and 44704 in Washington, DC.

Michael Gordon Whitaker,

Administrator.

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