U.S. Department
of Transportation
Federal Aviation
Administration

Advisory Circular

Subject: Establishing the Certification Basis of Changed Aeronautical Products

Date: March 11, 2016
Initiated By: AIR-100

AC No: 21.101-1B

This advisory circular (AC) provides guidance for the application of the "Changed Product Rule (CPR)," pursuant to Title 14 of the Code of Federal Regulations (14 CFR) 21.101, *Designation of applicable regulations,* and 21.19, *Changes requiring a new type certificate*, for changes made to type certificated aeronautical products.

If you have suggestions for improving this AC, you may use the feedback form at the end of this AC.

Susan J. M. Cabler
Acting Manager, Design, Manufacturing & Airworthiness Division
Aircraft Certification Service

CONTENTS

Paragraph **Page**

Chapter 1. Introduction 1-1

1.1 Purpose. 1-1

1.2 Applicability. 1-1

1.3 Cancellation. 1-1

1.4 AC Content. 1-1

1.5 Terms Used in this AC. 1-3

Chapter 2. Overview of §§ 21.19 and 21.101 2-1

2.1 Section 21.19. 2-1

2.2 Section 21.101. 2-1

Chapter 3. Process for Establishing the Certification Basis for Changed Products. 3-1

3.1 Overview. 3-1

3.2 Step 1. Identify the Proposed Type Design Changes to an Aeronautical Product. 3-3

3.3 Step 2. Verify the Proposed Type Design Change is Not Substantial. 3-4

3.4 Step 3. Will you Use the Latest Standards? 3-4

3.5 Step 4. Arrange Changes into Related and Unrelated Groups. 3-5

3.6 Step 5. Is Each Related or Unrelated Group a Significant Change? 3-6

3.7 Proposing an Amendment Level for a Significant Change. 3-9

3.8 Proposing an Amendment Level for a Not Significant Change. 3-9

3.9 Step 6. Prepare your Proposed Certification Basis List. 3-9

3.10 Step 7. Do the Latest Requirements Contribute Materially to the Level of Safety and are They Practical? 3-11

3.11 Step 8. Ensure Proposed Certification Basis is Adequate. 3-17

Chapter 4. Excepted Products under § 21.101(c) 4-1

4.1 Excepted Products. 4-1

Chapter 5. Other Considerations. 5-1

5.1 Design-Related Operating Requirements. 5-1

5.2 FAA Policy. 5-1

5.3 A Baseline Product Consists of One Unique Type Design Configuration. 5-1

5.4 Predecessor Regulations. 5-2

CONTENTS (CONTINUED)

Paragraph **Page**

5.5 Special Conditions, § 21.101(d). 5-2
5.6 Effective Period for an Application to Change a Type Certificate, § 21.101(e). 5-2
5.7 Other Category Aircraft, § 21.101(f). 5-3
5.8 Clarification of § 21.101(g), Part 26 Requirements. 5-5
5.9 Documentation. 5-5
5.10 Incorporation of STCs into the Type Design. 5-6
5.11 Removing Design Changes. 5-6
5.12 The Certification Basis is Part of the Design Change. 5-7
5.13 Sequential Design Changes—Cumulative Effects. 5-7

Appendix A. Classification of Design Changes A-1

Appendix B. Application Charts for Changed Product Rule B-1

Appendix C. A Method to Determine the Changed and Affected Areas C-1

Appendix D. Other Guidance for Affected Areas D-1

Appendix E. Procedure for Evaluating Material Contribution to Safety or Impracticality of Applying Latest Requirements to a Changed Product E-1

Appendix F. The Use of Service Experience in the Exception Process F-1

Appendix G. Changed Product Rule Decision Record G-1

Appendix H. Examples of Documenting the Proposed Certification Basis List H-1

Appendix I. Related Documents I-1

Appendix J. Definitions and Terminology J-1

CONTENTS (CONTINUED)

FIGURES

Number **Page**

Figure 3-1. Developing a Proposed Certification Basis for a Changed Product Pursuant to § 21.101 3-2

Figure 3-2. Related and Unrelated Changes for Example of Increasing the Maximum Number of Passengers 3-6

Figure 3-3. Affected Areas versus Not Affected Areas 3-10

Figure 3-4. Design Change Affected Areas with Secondary Changes 3-14

Figure C-1. Method to Determine the Changed and Affected Areas C-1

Figure E-1. Safety Benefits versus Resources E-2

TABLES

Number **Page**

Table A-1. Examples of Substantial Changes for Small Airplanes (Part 23) A-1

Table A-2. Examples of Significant Changes for Small Airplanes (Part 23) A-3

Table A-3. Examples of Not Significant Changes for Small Airplanes (Part 23) A-14

Table A-4. Examples of Substantial Changes for Transport Airplanes (Part 25) A-25

Table A-5. Examples of Significant Changes for Transport Airplanes (Part 25) A-26

Table A-6. Examples of Not Significant Changes for Transport Airplanes (Part 25) A-38

Table A-7. Examples of Substantial Changes for Rotorcraft (Parts 27 and 29) A-49

Table A-8. Examples of Significant Changes for Rotorcraft (Parts 27 and 29) A-50

Table A-9. Examples of Not Significant Changes for Rotorcraft (Parts 27 and 29) A-56

Table A-10. Examples of Substantial Changes for Engines (Part 33) A-64

Table A-11. Examples of Significant Changes for Engines (Part 33) A-65

Table A-12. Examples of Not Significant Changes for Engines (Part 33) A-72

Table A-13. Example of a Substantial Change for Propellers (Part 35) A-80

Table A-14. Examples of Significant Changes for Propellers (Part 35) A-80

Table A-15. Examples of Not Significant Changes for Propellers (Part 35) A-84

Table B-1. Application Chart for § 21.101(a) and (b) and § 21.19 ..... B-1

Table B-2. Application Chart for § 21.101(c) Excepted Products B-2

CONTENTS (CONTINUED)

TABLES (CONTINUED)

Number **Page**

Table C-1. Example of Associating a Physical Change with the Applicable Airworthiness Requirements C-2

Table C-2. Example of a Functional Change, Affected Areas, and Associated Effects C-3

Table C-3. Example of Associating Affected Areas with the Applicable Airworthiness Requirements C-4

Table C-4. Example of a Combined List of Physical and Functional Changes with Applicable Airworthiness Requirements C-5

Table H-1. Tabular Form for Documenting a Proposed Certification Basis H-2

CHAPTER 1. INTRODUCTION

1.1 Purpose.

This AC provides guidance for establishing the certification basis for changed aeronautical products pursuant to Title 14 of the Code of Federal Regulations (14 CFR) 21.101, *Designation of the applicable regulations*. The guidance is intended to help applicants and delegated organizations determine if it will be necessary to apply for a new type certificate (TC) under § 21.19, *Changes requiring a new type certificate*. The guidance describes the process for establishing the certification basis for an amended TC, supplemental type certificate (STC), and amended STC, detailing the requirements (evaluations, classifications, and decisions) throughout the process.

1.2 Applicability.

1.2.1 This AC is for applicants and holders of delegated organizations applying for amended TCs, STCs, or amended STCs.

1.2.2 This AC applies to major type design changes under § 21.101 for aeronautical products certificated under 14 CFR parts 21, 23, 25, 27, 29, 31, 33, and 35. References to "design change" include the design change and areas affected by the design change pursuant to § 21.101.

1.2.3 Minor type design changes are automatically considered not significant under the "does not contribute materially to the level of safety" provision of § 21.101(b).

1.2.4 This AC also applies to aircraft certificated under §§ 21.17(b), 21.19, 21.24, 21.25, and 21.27.

1.2.5 The term aeronautical product, or product, means a type certificated aircraft, aircraft engine, or propeller.

1.2.6 This AC is not intended to be used to determine the applicable aircraft noise, fuel venting, and exhaust emission requirements for changed products.

1.2.7 This AC is not mandatory and is not a regulation. This AC describes an acceptable means, but not the only means, to comply with § 21.101. However, if you use the means described in this AC, you must follow it entirely.

1.3 Cancellation.

This AC cancels AC 21.101-1A, dated September 3, 2010.

1.4 AC Content.

This AC contains 5 chapters and 10 appendices.

1.4.1 This chapter clarifies the purpose of this AC, describes its content, specifies the intended audience affected by this AC, clarifies which changes are within the scope of this AC, and references the definitions and terminology used in this AC.

1.4.2 Chapter 2 provides a general overview of §§ 21.101 and 21.19, clarifies the main principles and safety objectives, and directs applicants to the applicable guidance contained in subsequent chapters of this AC.

1.4.3 Chapter 3 contains guidance for implementation of § 21.101(b) to establish the type certification basis for changed aeronautical products. It describes in detail the various steps for developing the certification basis, a process that applies to all major design changes to aeronautical products. Chapter 3 also addresses § 21.19 considerations for identifying conditions under which an applicant for a type design change is required to submit an application for a new TC and provides guidance at which stage of the process this assessment is performed.

1.4.4 Chapter 4 provides guidance about products excepted from the requirement of § 21.101.

1.4.5 Chapter 5 contains considerations for—

- Design-related operating requirements,
- Determining which policy to apply to a design change,
- Defining a baseline product,
- Predecessor regulations,
- Using special conditions under § 21.101(d),
- The effective period of application for a change to a TC under § 21.101(e),
- Other category aircraft under § 21.101(f),
- Clarification of § 21.101(g) regarding 14 CFR part 26 requirements,
- Documenting revisions to the TC basis,
- Incorporating STCs into the type design,
- Removing design changes,
- Determining a certification basis after removing an approved design change, and
- Sequential design changes.

1.4.6 Appendix A contains examples of typical type design changes for small airplanes, transport airplanes, rotorcraft, engines, and propellers. The Federal Aviation Administration (FAA) has categorized these examples into individual tables according to the classifications of design change—“substantial,” “significant,” and “not significant.”

1.4.7 Appendix B contains application charts for applying the § 21.101 process, including the excepted process.

1.4.8 Appendix C contains one method for determining the changed and affected areas of a product.

1.4.9 Appendix D contains additional guidance on affected areas not discussed in other parts of this AC.

1.4.10 Appendix E provides detailed guidance with examples for evaluating the "impracticality" exception in the rule.

1.4.11 Appendix F provides guidance with examples on the use of relevant service experience in the certification process as one way to show that a later amendment may not contribute materially to the level of safety, allowing the use of earlier requirements.

1.4.12 Appendix G provides an example CPR decision record.

1.4.13 Appendix H provides examples of documenting a proposed certification basis list.

1.4.14 Appendix I lists the FAA regulations and orders related to this AC.

1.4.15 Appendix J lists the definitions and terminology applicable for application of the rule.

1.5 Terms Used in this AC.

1.5.1 The following terms are used interchangeably and have the same meaning: requirements, regulations, standards, and airworthiness standards.

1.5.2 The terms certification basis, type certification basis, and amendment are used interchangeably to refer to the groups of requirements defined above.

CHAPTER 2. OVERVIEW OF §§ 21.19 AND 21.101

2.1 Section 21.19.

2.1.1 Section 21.19 requires an applicant to apply for a new TC for a changed product if the FAA finds that the change in design, power, thrust, or weight is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.

2.1.2 Changes that require a substantial re-evaluation of the product's compliance findings are referred to as "substantial changes." For guidance, see paragraph 3.3 in chapter 3 of this AC. Appendix A of this AC provides examples of type design changes that will require a new TC.

2.1.3 If the FAA determines through § 21.19 that your proposed design change does not require a new TC, see § 21.101 for the applicable requirements to develop the certification basis for your proposed design change. For guidance, see chapter 3 and the examples in appendix A of this AC.

2.2 Section 21.101.

2.2.1 Section 21.101(a).

Section 21.101(a) requires a change to a TC and the area affected by the change to comply with the latest requirements, unless the change meets the criteria for the exceptions identified in § 21.101(b) or (c). The intent of § 21.101 is to enhance safety by incorporating the latest requirements into the type certification basis for the changed product to the greatest extent practicable.

2.2.2 Section 21.101(b).

2.2.2.1 Section 21.101(b) pertains to when an applicant may show that a changed product complies with an earlier amendment of a regulation, provided that the earlier amendment is considered adequate and meets the criteria in § 21.101(b)(1), (2), or (3). When design changes involve features or characteristics that are novel and unusual as compared to the airworthiness standard at the proposed amendment, more recent airworthiness standards and/or special conditions will be applied for these features.

2.2.2.2 You can comply with the earlier requirements consistent with § 21.101(b), when—

2.2.2.2.1 A change is not significant (see § 21.101(b)(1));

2.2.2.2.2 An area, system, component, equipment, or appliance is not affected by the change (see § 21.101(b)(2));

2.2.2.2.3 Compliance with a later amendment for a significant change does not contribute materially to the level of safety (see § 21.101(b)(3)); or

2.2.2.2.4 Compliance with the latest amendment would be impractical (see § 21.101(b)(3)).

2.2.2.3 Earlier amendments may not precede the regulatory amendment level of the identified baseline product's type certification basis and any requirement found in 14 CFR 23.2, 25.2, 27.2, and 29.2 or the applicable provision of part 26 related to the change.

2.2.2.4 Section 21.101(b)(1)(i) and (ii) pertain to design changes that meet the automatic criteria where the change is significant.

2.2.3 Section 21.101(c).

Section 21.101(c) provides an exception from the requirements of § 21.101(a) for a change to certain aircraft with less than the specified maximum weight. If you apply for a type design change to an aircraft (other than rotorcraft) of 6,000 pounds or less maximum weight, or to a non-turbine powered rotorcraft of 3,000 pounds or less maximum weight, you can show that the changed product complies with the regulations incorporated by reference in the type certificate. You can also elect to comply or may be required to comply with the later regulations. See paragraph 4.1 of this AC for specific guidance on this provision.

2.2.4 Section 21.101(d).

Section 21.101(d) provides for the use of special conditions, under § 21.16, when the proposed certification basis and any later regulations do not provide adequate standards to the proposed change because of a novel or unusual design feature.

2.2.5 Section 21.101(e).

Section 21.101(e) prescribes the effective period that an application will remain valid for a change.

2.2.6 Section 21.101(f).

Section 21.101(f) pertains to aircraft certificated in certain categories and special classes (e.g., gliders, airships, other nonconventional aircraft, and balloons certificated under 14 CFR part 31), including the engines and propellers installed on them, under the requirements of §§ 21.17(b), 21.24, 21.25, and 21.27 airworthiness requirements.

2.2.7 Section 21.101(g).

Section 21.101(g) pertains to regulatory compliance of transport category airplanes with the applicable provisions of part 26 and/or corresponding later amendments to part 25. See paragraph 5.8 of this AC for additional details.

CHAPTER 3. PROCESS FOR ESTABLISHING THE CERTIFICATION BASIS FOR CHANGED PRODUCTS

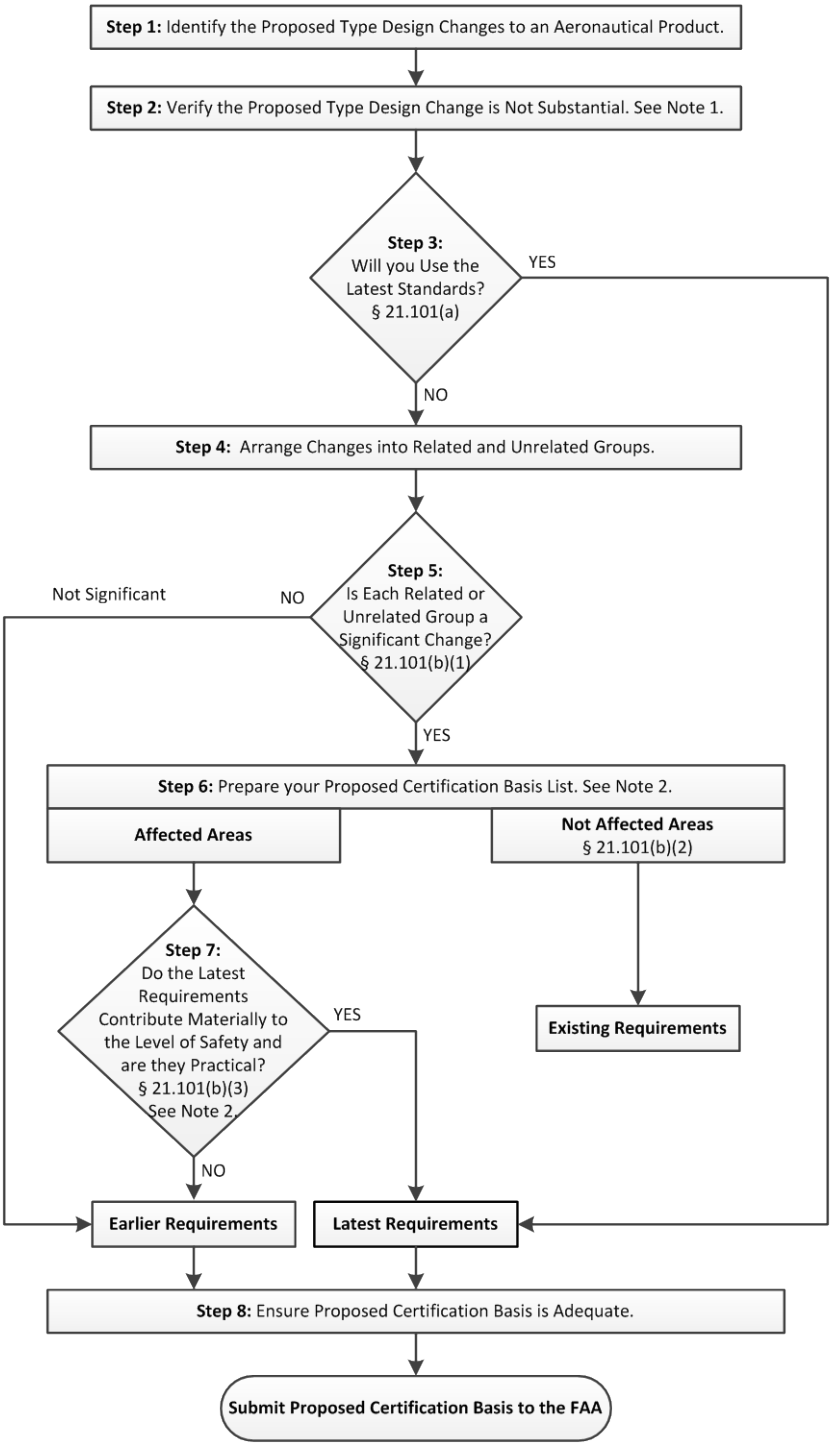
3.1 Overview.

3.1.1 The applicant and the FAA each have a responsibility under § 21.101(a) and (b). As an applicant for the certification of a type design change, you must show that the change and areas affected by the change comply with the latest applicable airworthiness requirements unless you propose exception(s) under § 21.101(b). If you are proposing exception(s), you should make a preliminary classification whether the change is "significant" or "not significant," and propose an appropriate certification basis. The FAA is responsible for determining whether your classification of the change, and proposal for the certification basis, are consistent with the applicable rules and their interpretation. The FAA determination does not depend on whether the TC holder or applicant for an STC is originating the change. The certification basis can vary depending on the magnitude and scope of the change. The steps below present a streamlined approach for making this determination.

3.1.2 The tables in appendix A of this AC are examples of classifications of typical type design changes. See paragraph 3.6.3 of this chapter for instructions on how to use those tables.

3.1.3 If your proposed change is not in the examples provided in appendix A, you may use the following steps in conjunction with the flowchart in figure 3-1 of this AC to develop the appropriate certification basis for the type design change. For clarification, the design change discussed in the flowchart also includes areas affected by the design change pursuant to § 21.101. See paragraph 3.9.1 of this AC for guidance about affected areas.

Figure 3-1. Developing a Proposed Certification Basis for a Changed Product Pursuant to § 21.101



Notes:
1. Changed products that are substantially changed do not follow this flowchart. Refer to § 21.19.
2. Process and propose each applicable requirement individually. If requirements are linked together, then they should be assessed together.

3.2 Step 1. Identify the Proposed Type Design Changes to an Aeronautical Product.

- Identify the type design you are changing (the baseline product).
- Identify the proposed change.
- Use high level descriptors.

3.2.1 Identify the Type Design You are Changing (the Baseline Product).

Prior to describing the proposed change(s), it is important to clearly identify the specific type design configuration you are changing.

Note: For additional guidance on the baseline product, see paragraph 5.3 of this AC.

3.2.2 Identify the Proposed Change.

3.2.2.1 The purpose of this process step is to identify and describe the change to the aeronautical product. Changes to a product can include physical design changes and functional changes (e.g., operating envelope or performance changes). You must identify all changes and areas affected by the change, including those where you plan to use previously approved data. The FAA considers all of these changes and areas affected by the change part of the entire proposed type design and are considered as a whole in the classification of whether the proposed design change is substantial, significant, or not significant. The change can be a single change or a collection of changes. In addition to the proposed changes, consider the cumulative effect of previous relevant design changes incorporated since the last time the certification basis was upgraded. An applicant for a type design change must consider all previous relevant design changes and the amendment level of the certification basis used for these changes.

3.2.2.2 When you identify the proposed changes, consider previous relevant design changes that create a cumulative effect, as these may influence the decisions regarding the type of design change later in the process. By "previous relevant design changes," the FAA means changes where effects accumulate, such as successive thrust increases, incremental weight increases, or sectional increases in fuselage length. You must account for any previous relevant design changes in the area affected by the proposed change that did not involve an upgrade of the certification basis in the proposed design change.

3.2.2.3 **Example:**

An applicant proposes a 5 percent weight increase, but a previous 4 percent and another 3 percent weight increase was incorporated into this aircraft without upgrading the existing certification basis. In the current proposal for a 5 percent weight increase, the cumulative effects of the two previous weight increases that did not involve an upgrade of the certification basis will now be accounted for as an approximate 12 percent increase in weight. Note that the cumulative effects the applicant accounts

for are only those incremental increases since the last time the airworthiness requirements in the type certification basis applicable to the area affected by the proposed change were upgraded.

3.2.3 Use High Level Descriptors.

To identify and describe the proposed changes to any aeronautical product, use a high level description of the design change that characterizes the intent of, or the reason for, the change. No complex technical details are necessary at this stage. For example, a proposal to increase maximum passenger-carrying capacity may require an addition of a fuselage plug, and as such, a "fuselage plug" becomes one possible high level description of this design change. Similarly, a thrust increase, a new or complete interior, an avionics system upgrade, or a passenger-to-cargo conversion are all high level descriptions that characterize typical changes to the aircraft, each driven by a specific goal, objective, or purpose.

3.2.4 Evolutionary changes that occur during the course of a certification program may require re-evaluation of the certification basis, and those changes that have influence at the product level may result in re-classification of the change.

3.3 Step 2. Verify the Proposed Type Design Change is Not Substantial.

3.3.1 Section 21.19 requires that you apply for a new TC for a changed product if the change in design, power, thrust, or weight is so extensive that a substantially complete investigation of compliance with the applicable regulations is required. A new TC could be required for either a single extensive change to a previously type certificated product or for a changed design derived through the cumulative effect of a series of design changes from a previously type certificated product.

3.3.2 A "substantially complete investigation" of compliance is required when most of the existing substantiation is not applicable to the changed product. In other words, you may consider the design change substantial if it is so extensive (making the product sufficiently different from its predecessor) that the design models, methodologies, and approaches used to demonstrate a previous compliance finding could not be used in a similarity argument. The FAA considers a change substantial when these approaches, models, or methodologies of how compliance was shown are not valid for the changed product.

3.3.3 If it is not initially clear that a new TC is required, appendix A of this AC provides some examples of substantial changes to aid in this classification. A substantial change requires application for a new TC. See §§ 21.17 and 21.19. If the change is not substantial, proceed to Step 3.

3.4 Step 3. Will you Use the Latest Standards?

You can use the latest requirements for your proposed type design change and the area affected by the change. If you use the latest requirements, you will have met the intent

of § 21.101 and no further classification (significant or not significant) and justification is needed. Even though an applicant elects to use the latest certification requirements, the applicant will still be able to apply § 21.101 for future similar changes, and use the exceptions under § 21.101(b). However, the decision to comply with the latest requirements sets a new regulatory basis for all future related changes in the same affected area for that amended TC.

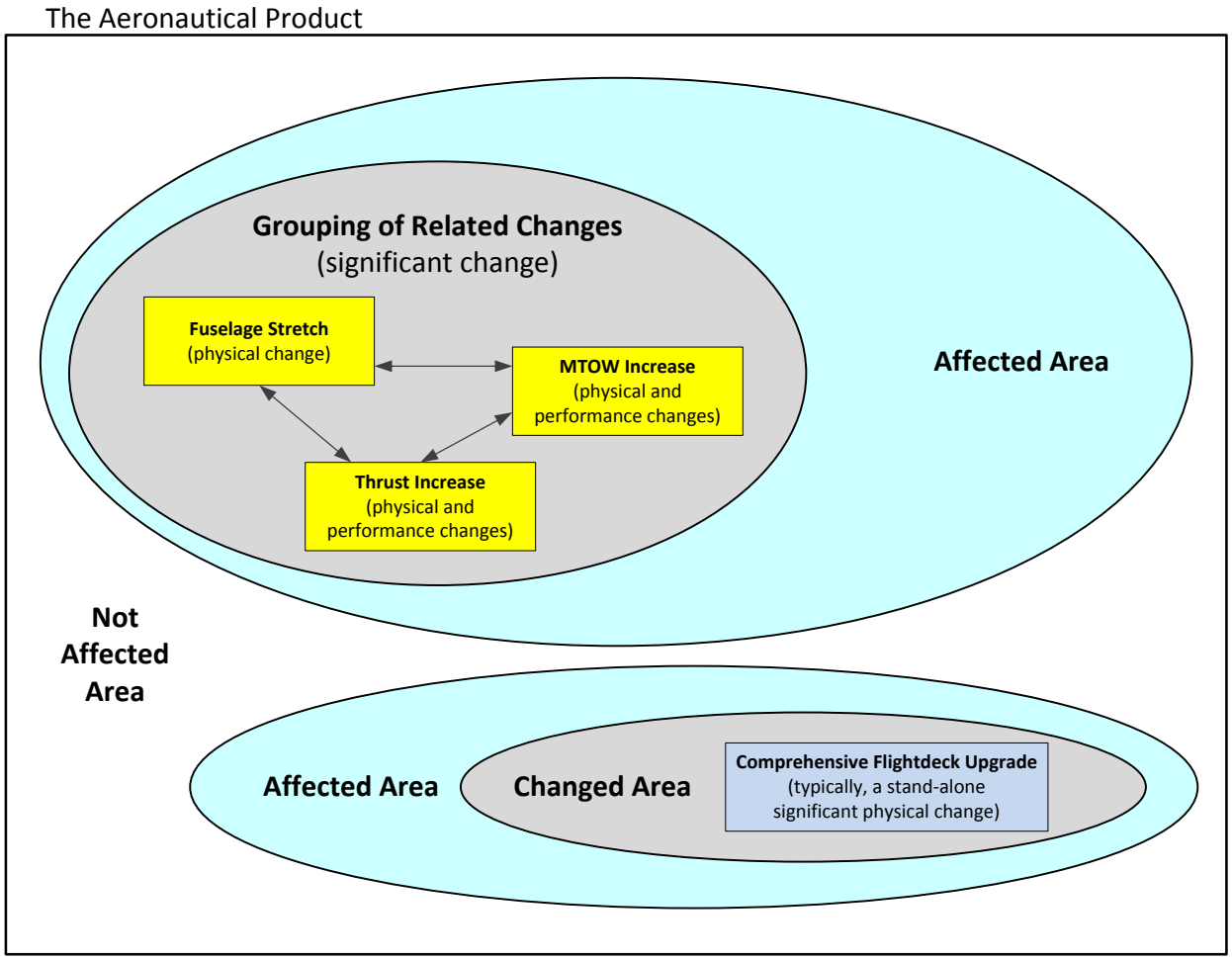
- If you are using the latest requirements, proceed to Step 6 (in paragraph 3.9 of this AC).
- If you are not using the latest requirements, proceed to Step 4 below.

3.5 Step 4. Arrange Changes into Related and Unrelated Groups.

3.5.1 You should now determine if any of the changes identified in Step 1 are related to each other. Related changes are those that cannot exist without another, are co-dependent, or a pre-requisite of another. For example, a need to carry more passengers could require the addition of a fuselage plug, which will result in a weight increase, and may necessitate a thrust increase. Thus, the fuselage plug, weight increase, and thrust increase are all related, high level changes needed to achieve the goal of carrying more passengers. A decision to upgrade the flightdeck to more modern avionics at the same time as these other design changes may be considered unrelated, as the avionics upgrade is not necessarily needed to carry more passengers (it has a separate purpose, likely just modernization). The proposed avionics upgrade would then be considered an unrelated (or a stand-alone) change. However, the simultaneous introduction of a new cabin interior is considered related since occupant safety considerations are impacted by a cabin length change. Even if a new cabin interior is not included in the product level change, the functional effect of the fuselage plug has implications on occupant safety (e.g., the dynamic environment in an emergency landing, emergency evacuation, etc.), and thus the cabin interior becomes an affected area. Figure 3-2 below illustrates the grouping of related and unrelated changes using the example of increasing the maximum number of passengers.

Note: If you plan changes in sequence over time, refer to the discussion on “sequential design changes” in paragraph 5.13 of this AC.

Figure 3-2. Related and Unrelated Changes for Example of Increasing the Maximum Number of Passengers



3.5.2 Once you organize the change(s) into groupings of those that are related and those that are unrelated (or stand-alone), proceed to Step 5 below.

3.6 Step 5. Is Each Related or Unrelated Group a Significant Change?

3.6.1 The applicant is responsible for proposing the classification of groups of related design changes or unrelated design changes as significant or not significant. Significant changes are product level changes that could result from an accumulation of changes, or occur through a single significant change that makes the changed product distinct from its baseline product. The grouping of related and unrelated changes is particularly relevant to the FAA's significant Yes/No decision (§ 21.101(b)(1)) described in Step 5 of figure 3-1. The FAA evaluates each group of related changes and each unrelated (stand-alone) change on its own merit for significance. Thus, there may be as many evaluations for significance as there are groupings of related and unrelated changes. Step 1 of figure 3-1 explains the accumulation of changes that you must consider.

Additionally, § 21.101(b)(1) defines a design change as significant when at least one of three automatic criteria applies:

3.6.1.1 **Changes where the General Configuration is Not Retained (Significant Change to General Configuration).**

A change to the general configuration at the product level is one that distinguishes the resulting product from other product models, for example, performance or interchangeability of major components. Typically, for these changes, an applicant will designate a new product model, although this is not required. For examples, see appendix A of this AC.

3.6.1.2 **Changes where the Principles of Construction are Not Retained (Significant Change to Principles of Construction).**

A change at the product level to the materials and/or construction methods that affects the overall product's operating characteristics or inherent strength and would require extensive reinvestigation to show compliance. For examples, see appendix A of this AC.

3.6.1.3 **Product Level Changes that Invalidate the Assumptions used for Certification of the Baseline Product.**

Examples include—

- Change of an aircraft from an unpressurized to pressurized fuselage,
- Change of operation of a fixed wing aircraft from land-based to water-based, and
- Operating envelope expansions that are outside the approved design parameters and capabilities.

For additional examples, see appendix A of this AC.

3.6.2 The above criteria are used to determine if each change grouping and each stand-alone change is significant. These three criteria are assessed at the product level. In applying the automatic criteria and the examples in appendix A of this AC, you should focus on the design change and how it impacts the existing product (including performance, operating envelope, etc.). A design change cannot be classified or re-classified as a significant change on the basis of the importance of a later amendment level.

3.6.3 Appendix A of this AC includes tables of typical changes (examples) for small airplanes, transport airplanes, rotorcraft, engines, and propellers that meet the criteria for a significant design change. The appendix also includes tables of typical design changes that the FAA classifies as not significant. The tables can be used in one of two ways—

3.6.3.1 To identify the classification of a proposed design change listed in the table, or

3.6.3.2 In conjunction with the three automatic criteria, to help classify a proposed design change not listed in the table by comparison to determinations made for changes with similar type and magnitude.

3.6.4 In many cases, a significant change may involve more than one of these criteria and will be obvious and distinct from other product improvements or production changes. There could be cases where a change to a single area, system, component, or appliance may not result in a product level change. There could also be other cases where the change to a single system or component might result in a significant change due to its effect on the product overall. Examples may include the addition of winglets or leading edge slats, or a change in primary flight controls to a fly-by-wire system.

3.6.5 If an unrelated (stand-alone) change or a grouping of related changes is classified as—

3.6.5.1 **Significant (§ 21.101(a)):**

You must comply with the latest airworthiness standards for certification of the design change and areas affected by change, unless you justify use of one of the exceptions provided in § 21.101(b)(2) or (3) to show compliance with earlier amendment(s). The final certification basis may consist of a combination of the requirements recorded in the certification basis ranging from the original aircraft certification basis to the most current regulatory amendments.

3.6.5.2 **Not Significant (§ 21.101(b)(1)):**

You may comply with the existing certification basis unless the standards in the proposed certification basis are deemed inadequate. In cases where the existing certification basis is inadequate or no regulatory standards exist, later requirements and/or special conditions will be required. See paragraph 3.11 of this AC for a detailed discussion.

3.6.6 A new model designation to a changed product is not necessarily indicative that the design change is significant under § 21.101. Conversely, retaining the existing model designation does not mean that the design change is not significant. Significance is determined by the magnitude of the type design change.

3.6.7 The FAA determines the final classification of whether a design change is significant or not significant. To assist you in your assessment, the FAA has predetermined the classification of several typical design changes that you can use for reference, and these examples are listed in appendix A of this AC.

3.6.8 At this point, the determination of significant or not significant for each of the groupings of related changes and each stand-alone change is completed. For significant changes, if you propose to comply with an earlier requirement, use the procedure outlined in paragraph 3.7 below. For changes identified as not significant, see paragraph 3.8 below.

3.7 Proposing an Amendment Level for a Significant Change.

3.7.1 If the classification of the group of related changes is significant, all areas, systems, components, parts, or appliances affected by the change must comply with the airworthiness standards at the amendment level in effect on the date of application for the change. You can justify use of one of the exceptions in § 21.101(b)(2) and (3) to comply with an earlier amendment but no earlier than the existing certification basis. You must comply with any retroactive requirement found in §§ 23.2, 25.2, 27.2, 29.2 applicable on the date of the application for the change. See paragraphs 3.9 and 3.10 of this AC.

3.7.2 For transport category airplanes only, § 21.101(g) requires that you comply with any applicable provision of part 26 (related to the change), which is applicable on the date of the application for the change, unless you elected or were required to comply with later corresponding part 25 requirements.

3.7.3 The final certification basis may combine latest, earlier (intermediate), and existing regulations, but cannot contain regulations preceding the existing certification basis.

3.8 Proposing an Amendment Level for a Not Significant Change.

3.8.1 When the FAA classifies the type design change as not significant, the rule allows compliance with earlier amendments but not prior to the existing certification basis. Within this limit, the applicant may propose an amendment level for each certification standard for the affected area. However, you should be aware that the FAA will review your proposal for the type certification basis to ensure that the certification basis is adequate for the proposed change under Step 8. (See paragraph 3.11 of this AC.) You must also comply with the retroactive requirements found in §§ 23.2, 25.2, 27.2, 29.2, applicable on the date of the application for the change.

3.8.2 For transport category airplanes only, § 21.101(g) also requires that you comply with any applicable provision of part 26 (related to the change), which is applicable on the date of the application for the change, unless you elected or were required to comply with later corresponding part 25 requirements. You may comply with a specific airworthiness requirement or a subset of airworthiness requirements at later amendments. In such a case, any other airworthiness requirements that are directly related should be included in the certification basis for the change.

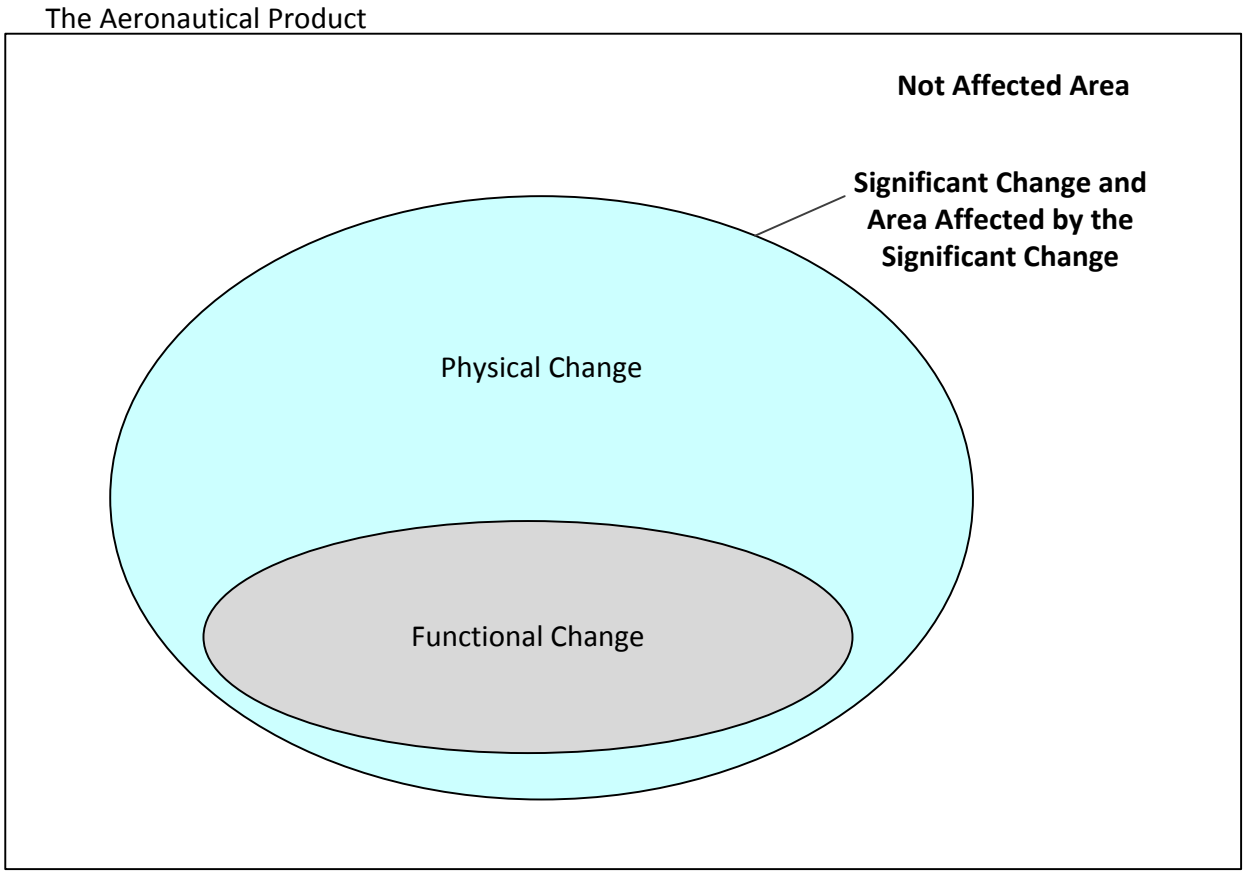
3.9 Step 6. Prepare your Proposed Certification Basis List.

As part of preparing your proposed certification basis list, you must identify any areas, systems, components, equipment, or appliances of the product that are affected by the design change and the corresponding regulatory standards associated with these areas. For each group, you must assess the physical and/or functional effects of the change on any areas, systems, components, equipment, or appliances of the product. The characteristics affected by the change are not only physical changes, but also functional

changes brought about by the physical changes. Examples of physical aspects are structures, systems, components, equipment, appliances, and software in combination with the affected hardware. Examples of functional characteristics are performance, handling qualities, aeroelastic characteristics, and emergency egress. The intent is to encompass all aspects where there is a need for re-evaluation, that is, where the substantiation presented for the product you are changing should be updated or rewritten. Appendix H of this AC contains two examples of how to document a proposed certification basis list.

3.9.1 An area affected by the change is any system, component, part, or appliance of the aeronautical product that you physically and/or functionally change. Figure 3-3 of this AC illustrates concepts of physical and functional changes of an affected area. Appendix C of this AC contains a method used to define the change and areas affected by the change. This appendix is meant to assist you when you propose a large, complex design change. For a type design change, it is important that you properly assess the effects of such change on any areas, systems, components, equipment, or appliances of the product because areas that have not been physically changed may still be considered part of the affected area. If a new compliance finding is required, regardless of its amendment level, it is an affected area.

Figure 3-3. Affected Areas versus Not Affected Areas



3.9.2 An area not affected by a change can remain at the existing certification basis, provided you present to the FAA acceptable justification that the area is not affected.

3.9.3 For sample questions to assist in determining affected areas, see paragraph D.1 of appendix D of this AC.

3.9.4 Consider the following aspects of a type design change:

3.9.4.1 **Physical Aspects.**

The physical aspects include direct changes to structures, systems, equipment, components, and appliances, and may include software/airborne electronic hardware changes and the resulting effect on systems functions.

3.9.4.2 **Performance/Functional Characteristics.**

The less obvious aspect of the word "areas" covers general characteristics of the type certificated product, such as performance features, handling qualities, emergency egress, structural integrity (including load carrying), aeroelastic characteristics, or crashworthiness. A product level change may affect these characteristics. For example, adding a fuselage plug could affect performance and handling qualities, and thus regulations associated with these aspects would be considered part of the affected area. Another example is the addition of a fuel tank and new fuel conditioning unit. This change affects the fuel transfer and fuel quantity indication system resulting in the airplane's unchanged fuel tanks being affected. Thus, the entire fuel system (changed and unchanged areas) may become part of the affected area due to the change in functional characteristics. Another example is changing turbine engine ratings and operating limitations affecting the engine rotors' life limits.

3.9.5 All areas affected by the proposed design change must comply with the latest requirements, unless you show that demonstrating compliance with the latest amendment of a requirement would not contribute materially to the level of safety or would be impractical. Step 7 below provides further explanation.

3.9.6 The applicant should document the change and area affected by the change using high level descriptors along with the applicable regulations and their associated amendment levels. The applicant proposes this change in certification basis that the FAA will consider for documentation in the type certificate data sheet (TCDS) or STC, if they are different from that recorded for the baseline product in the TCDS.

3.10 Step 7. Do the Latest Requirements Contribute Materially to the Level of Safety and are They Practical?

Pursuant to § 21.101(a), compliance with the latest airworthiness standards is required. However, exceptions may be allowed pursuant to § 21.101(b)(3). The applicant must provide justification to support the rationale for the application of earlier amendments

for areas affected by a significant change to document that compliance with later requirements in these areas would not contribute materially to the level of safety or would be impractical. Such justification should address all the aspects of the area, system, component, equipment, or appliance affected by the significant change. See paragraphs 3.10.1 and 3.10.1.4 of this AC.

3.10.1 Do the Latest Requirements Contribute Materially to the Level of Safety?

You could consider compliance with the latest requirements to "not contribute materially to the level of safety" if the existing type design and/or relevant experience demonstrates a level of safety comparable to that provided by the latest requirements. In cases where design features provide a level of safety greater than the existing certification basis, you may use acceptable data, such as service experience to establish the effectiveness of those design features at mitigating the specific hazards by a later amendment. You must provide sufficient justification to allow the FAA to make this determination. An acceptable means of compliance is described in appendix E of this AC. Justification is sufficient when it provides a summary of the evaluation that supports the determination using an agreed evaluation method such as that in appendix E of this AC. This exception could be applicable in the situations described in the paragraphs below.

Note: Compliance with later requirements is not required where the amendment is of an administrative nature and made only to correct inconsequential errors or omissions, consolidate text, or clarify an existing requirement.

3.10.1.1 **Improved Design Features.**

Design features that exceed the existing certification basis requirements, but do not meet the latest requirements, can be used as a basis for granting an exception under § 21.101(b)(3) since complying with the latest amendment of the requirements would not contribute materially to the level of safety of the product. If the FAA accepts these design features as justification for an exception, you must incorporate them in the amended type design configuration and record them, where necessary, in the certification basis. The description of the design feature would be provided in the TCDS or STC at a level that allows the design feature to be maintained, but does not contain proprietary information. For example, an applicant proposes to install winglets on a part 25 airplane, and part of the design involves adding a small number of new wing fuel tank fasteners. Assuming that the latest applicable amendment of § 25.981 is Amendment 25-102, which requires structural lightning protection, the applicant could propose an exception from these latest structural lightning protection requirements because the design change uses new wing fuel tank fasteners with cap seals installed. The cap seal is a design feature that exceeds the requirement of § 25.981 at a previous amendment level, but does not meet the latest Amendment 25-102. If the applicant can successfully substantiate that compliance with Amendment 25-102 would not materially increase the level of safety of the changed product, then this

design feature can be accepted as an exception to compliance with the latest amendment.

3.10.1.2 **Consistency of Design.**

This provision gives the opportunity to consider the consistency of design. For example, when a small fuselage plug is added, additional seats and overhead bins are likely to be installed, and the lower cargo hold extended. These components may be identical to the existing components. The level of safety may not materially increase by applying the latest requirements in the area of the fuselage plug. Compliance of the new areas with the existing certification basis may be acceptable.

3.10.1.3 **Service Experience.**

3.10.1.3.1 Relevant service experience, such as experience based on fleet performance or utilization over time (relevant flight hours or cycles), is one way of showing that the level of safety will not materially increase by applying the latest amendment, so the use of earlier requirements could be appropriate. Appendix F of this AC provides additional guidance on the use of service experience, along with examples.

3.10.1.3.2 When establishing the highest practicable level of safety for a changed product, the FAA has determined that it is appropriate to assess the service history of a product, as well as the later airworthiness standards. It makes little sense to mandate changes to well understood designs, whose service experience has been acceptable, merely to comply with new standards. The clear exception to this premise is if the new standards were issued to address a deficiency in the design in question, or if the service experience is not applicable to the new standards.

3.10.1.3.3 There may be cases for rotorcraft and small airplanes where relevant data may not be sufficient or not available at all because of the low utilization and insufficient amount and type of data available. In such cases, other service history information may provide sufficient data to justify the use of earlier requirements, such as warranty, repair, and parts usage data; accident, incident, and service difficulty reports; service bulletins; airworthiness directives; or other pertinent and sufficient data collected by the manufacturers, authorities, or other entities.

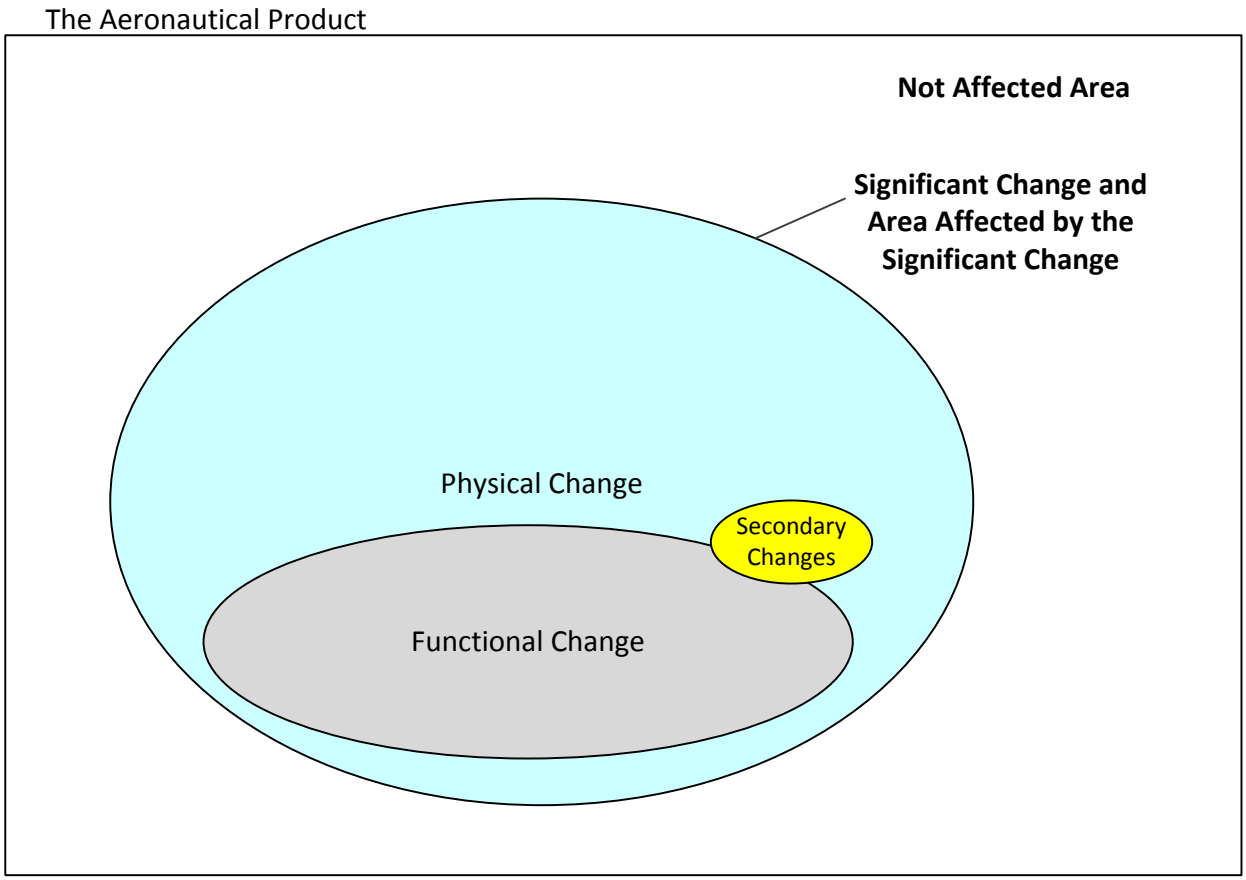
3.10.1.3.4 The FAA will determine if proposed service experience levels necessary to demonstrate the appropriate level of safety as they relate to the proposed design change is acceptable.

3.10.1.4 **Secondary Changes.**

3.10.1.4.1 The design change proposed by the applicant can consist of physical and/or functional changes to the product. See figure 3-4 below. There may

be aspects of the existing type design of the product that the applicant may not be proposing to change directly, but that are affected by the overall design change. For example, changing an airframe's structure, such as adding a cargo door in one location, may affect the frame or floor loading in another area. Further, upgrading engines with new performance capabilities could require additional showing of compliance for minimum control speeds and airplane performance requirements. For many years, the FAA has required applicants to consider these effects, this practice is unchanged under the procedures of § 21.101.

Figure 3-4. Design Change Affected Areas with Secondary Changes



3.10.1.4.2 For each design change, it is important that the effects of the change on other systems, components, equipment, or appliances of the product are properly identified and assessed. The intent is to encompass all aspects where there is a need for re-evaluation, that is, where the substantiation presented for the product being changed should be reviewed, updated, or rewritten.

3.10.1.4.3 In assessing the areas affected by the design change, it may be helpful to identify secondary changes. A secondary change is a change in physical and/or functional aspects that is part of but consequential to a significant physical design change, whose only purpose is to restore, and not add or increase, existing functionality or capacity. The term "consequential" is intended to refer to—

- A change that would not have been made by itself; it achieves no purpose on its own.
- A change that has no effect on the existing functionality or capacity of areas, systems, structures, components, parts, or appliances affected by the design change.
- A change that would not create the need for: (1) new limitations or affect existing limitations; (2) a new airplane flight manual (AFM) or instructions for continued airworthiness (ICA) or a change to the AFM or ICA; or (3) special conditions, equivalent safety findings, or exemptions.

3.10.1.4.4 A secondary change is not required to comply with the latest requirements because it is considered "not contributing materially to the level of safety" and, therefore, eligible for an exception under § 21.101. Determining whether a change meets the description for a secondary change, and thus eligible for an exception, should be straightforward. Hence, the substantiation or justification need only be minimal. If this determination is not straightforward, then your proposed change is not a secondary change.

3.10.1.4.5 In some cases, a secondary area of change that restores functionality may in fact contribute materially to the level of safety by meeting a later amendment. If this is the case, it is not considered a secondary change.

3.10.2 Are the Latest Requirements Practical?

The intent of § 21.101 is to enhance safety by applying the latest airworthiness standards to the greatest extent practicable. The concepts of contributing materially and practicality are linked. If compliance with the latest airworthiness standards does contribute materially to the level of safety, then the applicant may assess incremental costs to see if it is commensurate with the increase in safety. The additional resource requirements could include those arising from design changes required for compliance and the effort required to demonstrate compliance, but excludes resource expenditures for prior product changes. The cost of changing compliance documentation and/or drawings is not an acceptable reason for an exception.

3.10.2.1 Support your position that compliance is impractical with substantiating data and analyses. While evaluating your position and your substantiating data regarding impracticality, the FAA may consider other factors (e.g., the costs and safety benefits for a comparable new design).

3.10.2.2 A review of transport category projects showed that, in certain cases where the FAA allowed an earlier amendment of applicable requirements, the applicants made design changes that nearly complied with the latest amendments. In these cases, the applicants successfully demonstrated that full compliance would require a substantial increase in the outlay or expenditure of resources with a very small increase in the level of safety. These design features can be used as a basis for granting an exception under § 21.101(b)(3) on the basis of "impracticality."

3.10.2.3 Appendix E of this AC provides additional guidance and examples for evaluating the impracticality of applying the latest requirements to a changed product for which compliance with the latest requirements would contribute materially to the level of safety of the product.

3.10.2.3.1 The exception of impracticality is a qualitative and quantitative cost/safety benefit assessment for which it is difficult to specify clear criteria. Experience to date with applicants has shown that justification of impracticality is more feasible when both the applicant and FAA agree at an earlier discussion that the effort (in terms of cost, changes in manufacturing, etc.) required to comply would not be commensurate with a small incremental safety gain. This would be clear even without the need to perform any detailed cost/safety benefit analysis (although an applicant could always use cost analysis to support an appropriate amendment level). However, there should be enough detail in the applicant's rationale to justify the exception.

Note: An applicant should not base the impractical exception on the size of the applicant's company or their financial resources. The applicant must evaluate the costs to comply with a later amendment against the safety benefit of complying with the later amendment.

3.10.2.3.2 For example, a complex redesign of an area of the baseline aircraft may be required to comply with a new requirement, and that redesign may make the changed product uncommon with respect to design and manufacturing processes from the existing family of models. Relevant service experience of the existing fleet of the baseline aircraft family would be required to show that there has not been a history of problems associated with the hazard that the new amendment in question was meant to address. In this way, the incremental cost/impact to the applicant is onerous, and the incremental safety benefit realized by complying with the later amendment would be minimal. This would be justified with a demonstrated acceptable service experience in relation to the hazard that the new rule addresses.

3.11 Step 8. Ensure Proposed Certification Basis is Adequate.

The FAA considers a proposed certification basis for any design change (whether it is significant or not significant) to be adequate when—

- The airworthiness standards provide an appropriate level of safety for the intended change, and
- The change and the areas affected by the change do not result in unsafe design features or characteristics for the intended use.

3.11.1 For a change that contains new design features that are novel and unusual for which there are no later applicable airworthiness requirements at a later amendment level, the FAA will designate special conditions pursuant to § 21.16. The FAA will impose later airworthiness standards that contain adequate or appropriate safety standards for this feature, if they exist, in lieu of special conditions. An example is adding a flight critical system such as an electronic air data display on a part 25 airplane whose existing certification basis does not have lightning and high intensity radiated fields (HIRF) protection requirements. In this case, the FAA will require compliance with the regulations for lightning and HIRF protection, even though the FAA determined the change is not significant.

3.11.2 For new design features or characteristics that may pose a potential unsafe condition for which there are no later applicable airworthiness requirements, new requirements may be required to address § 21.21(b)(2).

3.11.3 In cases where inadequate or no airworthiness standards exist for the change in the existing type certification basis but adequate standards exist in a later amendment of the applicable airworthiness code, the later amendment will be made part of the type certification basis to ensure adequacy of its certification basis.

3.11.4 The FAA determines the final certification basis for a product design change. This may consist of a combination of those airworthiness standards ranging from the existing certification basis of the baseline product to the latest amendments and special conditions.

CHAPTER 4. EXCEPTED PRODUCTS UNDER § 21.101(c)

4.1 Excepted Products.

For excepted products as defined in paragraph 4.1.1 below, the starting point for regulatory analysis is the existing certification basis for the baseline product.

4.1.1 Section 21.101(c) provides an exception to § 21.101(a) compliance with the latest requirements for aircraft (other than rotorcraft) of 6,000 pounds or less maximum weight, or to a non-turbine rotorcraft of 3,000 pounds or less maximum weight. In these cases, the applicant may elect to comply with the existing certification basis. However, the applicant has the option of applying later appropriate regulations. Special classes of aircraft—including gliders, airships, and primary category—are addressed in § 21.101(f), and not in § 21.101(c).

4.1.2 If the FAA finds that the change is significant in an area, the FAA may require the applicant to comply with a later regulation and any regulation the FAA finds is directly related. Starting with the existing certification basis, the FAA will progress through each later regulation to determine the amendment appropriate for the change. However, if an applicant proposes, and the FAA finds, that complying with the later amendment or regulation would not contribute materially to the level of safety of the changed product or would be impractical, the FAA may allow the applicant to comply with an earlier amendment appropriate for the proposed design change. The amendment may not be earlier than the existing certification basis. For excepted products, changes that meet one of the following criteria, in the area of change, are automatically considered significant if—

4.1.2.1 The general configuration or the principles of construction are not retained.

4.1.2.2 The assumptions used for certification of the area to be changed do not remain valid.

4.1.2.3 The change contains new features (not foreseen in the existing certification basis and for which appropriate later regulations exist). In this case, the FAA will designate the applicable airworthiness requirements, starting with the existing certification basis and progressing to the most appropriate later amendment level for the change.

4.1.2.4 The change contains a novel or unusual design feature. In this case, the FAA will designate the applicable special conditions appropriate for the change, pursuant to § 21.101(d).

4.1.3 The exception for products under § 21.101(c) applies to the aircraft only. Design changes to engines and propellers installed on these excepted aircraft are assessed as separate type certificated products using § 21.101(a) and (b).

CHAPTER 5. OTHER CONSIDERATIONS

5.1 Design-Related Operating Requirements.

Some rules in other 14 CFR parts (e.g., parts 91, 121, 125, and 135) impose airworthiness standards that are not required for issuance of a TC or STC. If not already included in the certification basis, any such applicable airworthiness standards may be added to the type certification basis by mutual agreement between the applicant and the FAA. The benefit of adding these airworthiness standards to the type certification basis is to increase awareness of these standards, imposed by other 14 CFR parts, during design certification and future modifications to the airplane. The use of exceptions under § 21.101 is not intended to alleviate or preclude compliance with operating regulations.

5.2 FAA Policy.

Once the certification basis has been established, the exceptions of § 21.101 are not applicable in determining which policy (e.g., ACs and policy statements) applies to the design change. Guidance on the use of policy is found in FAA Order 8110.4C, *Type Certification*, and Order 8110.48A, *How to Establish the Certification Basis for Changed Aeronautical Products*. In general, you should use the latest FAA policy in effect at the date of application. However, there might be cases where policy may differ depending on the amendment level of the rule (i.e., the intent of the regulation may be different). It is acceptable to use another means of compliance, provided it is agreed upon by the FAA. This is typically documented via an issue paper.

5.3 A Baseline Product Consists of One Unique Type Design Configuration.

As mentioned in paragraph 3.2.1 of this AC, it is important to clearly identify the type design configuration to be changed. The baseline for a changed product consists of one unique type design configuration. This unique type design configuration is an approved product configuration that can be manufactured at one time or may consist of multiple approvals over time (e.g., airplane model with an approved STC incorporated). The applicant should identify the specific product configuration that will be modified. The FAA does not require an applicant to assign a new model name for a changed product. Therefore, there are vastly different changed products with the same airplane model name, and there are changed products with minimal differences that have different model names. Since the assignment of a model name is based solely on an applicant business decision, the identification of the baseline product, for the purposes of § 21.101, is one unique type design configuration, as mentioned above.

Note: The type design configuration, for this purpose, could be based on a currently approved configuration or based on a proposed future configuration that is expected to be approved at a later date but prior to the proposed changed product.

5.4 Predecessor Regulations.

The airworthiness requirements in effect on the date of application are in parts 21, 23, 25, 27, 29, 31, 33, and 35. Consequently, when electing to comply with later requirements, the predecessor regulations (i.e., Civil Air Regulations (CARs)) are not considered in effect on the date of application. Predecessor regulations are not recognized under § 21.101(a), but may be allowed under § 21.101(b), (c), and (f).When choosing the amendment level of a regulation, all related regulations associated with that amendment level would have to be included.

5.5 Special Conditions, § 21.101(d).

Section 21.101(d) allows for the application of special conditions, or for changes to existing special conditions, to address the changed designs where the proposed certification basis does not provide adequate standards for an area, system, component, equipment, or appliance related to the change. The objective is to achieve a level of safety consistent with that provided for other areas, systems, components, equipment, or appliances affected by the change by the other requirements of the proposed certification basis. The application of special conditions to a design change is not, in itself, a reason to classify it as either a substantial change or a significant change. When the change is significant with earlier requirements allowed through exceptions, or not significant, the level of safety intended by the special conditions must be consistent with the agreed certification basis.

5.6 Effective Period for an Application to Change a Type Certificate, § 21.101(e).

According to § 21.101(e), an application for, or a change to, a TC for transport category aircraft is effective for five years from the date of application, and an application for a change to any other type certificate is effective for three years. The FAA intended this to ensure that the certification basis for the changed product is as current as practicable.

5.6.1 If the FAA has not approved a design change, or if it is clear that the FAA will not approve the change, within the time limit, the applicant may do either of the following: (1) file for a new application, or (2) file for an extension to the original application.

5.6.2 When filing an extension, the applicant must choose a completion date, then apply the applicable effectivity from § 21.101(e) to determine an effective application date. The effective application date must not precede the original date of application for the proposed design change and must not be later than the filing date for an extension.

5.6.3 If you request an extension to the application date, and the product change is significant, a new certification basis is required. The new certification basis requires the additional latest regulations effective through the new application extension date. However, the applicant may use earlier regulations by documenting justification that the latest regulations for the change would not contribute materially to the level of safety or would be impractical.

5.6.4 If the product change is not significant, you may continue to use the existing certification basis for product certification. However, if you make additional design changes to the product, and the FAA finds the existing certification basis for the change inadequate, the new certification basis will require later appropriate standards.

5.7 Other Category Aircraft, § 21.101(f).

For aircraft type certificated under §§ 21.17(b), 21.24, 21.25, and 21.27, the certification basis for the changed product consists of the amendment levels of the applicable regulations that the FAA finds appropriate for the change in effect on the date of application for the change. When selecting a certification basis for a change, you can propose compliance to an earlier amendment using the provisions of § 21.101(b). The exceptions in § 21.101(c) do not apply to categories of products defined in § 21.101(f).

5.7.1 Special Classes Aircraft.

For special classes of aircraft (e.g., gliders, airships, etc.) including any installed engines and propellers certificated pursuant to § 21.17(b), the applicable requirements are portions of those other airworthiness requirements in parts 23, 25, 27, 29, 31, 33, and 35 that the FAA finds appropriate for the aircraft and applicable to the specific type design, or such airworthiness criteria that the FAA finds an equivalent level of safety to those parts.

5.7.2 Primary Category Aircraft.

For primary category aircraft certificated under § 21.24, the applicable airworthiness requirements are in parts 23, 27, 31, 33, and 35, or such other requirements the FAA finds appropriate. These requirements must be applicable to the specific design and intended use of the aircraft and provide a level of safety acceptable to the FAA.

5.7.3 Restricted Category Aircraft.

For aircraft certificated in the restricted category under § 21.25(a)(1), the application of the latest regulations typically would be considered not to contribute materially to the level of safety or be practical for its intended use. However, if the airworthiness regulations applicable to the aircraft at the time the TC was issued do not provide an adequate level of safety for the design change, the application of later regulations will be required.

5.7.3.1 Features of the changed product that are “novel” or “unusual” to the original certificated restricted category product may be assessed against a later requirement that addresses the feature. In this case, the applicable airworthiness requirements in effect at the time of the existing restricted category TC may be viewed as a starting point, with subsequent amendments being examined, if necessary, to arrive at a requirement that provides an appropriate level of safety.

5.7.3.2 For the installation of turbo-propeller engines instead of reciprocating engines (either in a restricted category aircraft that was originally

certificated based on satisfactory military service experience or in a restricted category aircraft for which the original certification basis did not contain regulations for turbine engine installations), later amendments will be used to provide an appropriate level of safety for its intended operation. In addition, any change to the aircraft must be shown to be "safe for its intended use" as required by § 21.25. See Order 8110.56A, *Restricted Category Type Certification*, for additional details.

5.7.3.3 If the design change includes a new special purpose, it may require a re-evaluation of the regulations for certification. See Order 8110.56A, Chapter 3.

5.7.4 Military Aircraft Designs.

Aircraft type certificated in the restricted category under § 21.25(a)(2) are accepted on the basis of the U.S. military use and other eligibility factors, instead of showing compliance with airworthiness standards in 14 CFR Chapter 1. (See Order 8110.56, Chapter 4, for additional details.) Many of these aircraft were not certificated to airworthiness standards; therefore, any modifications made to the military configuration must meet an equivalent civil certification basis derived from the airworthiness regulations contained in 14 CFR. This baseline certification basis is the airworthiness regulations (i.e., parts 23, 25, 27, 29, 33, or 35, or CARs, as appropriate) that were in effect on the date that the first military model was accepted for operational use by the U.S. Armed Forces. Section 21.101(f) requires the application of the latest amendments to significant changes to these products. However, since the latest amendments may not be appropriate for the aircraft's intended use, earlier regulations are acceptable. They cannot predate the equivalent certification basis. If these regulations do not include airworthiness standards applicable to the change, later regulations appropriate to the product category will be applied. In addition, any design change to the aircraft must be shown to be "safe for its intended use" as required by § 21.25. See Order 8110.56A for additional details.

5.7.5 Surplus Military Aircraft.

Aircraft type certificated under § 21.27 are entitled to a TC in the normal, utility, acrobatic, commuter, or transport category. These aircraft were designed and constructed in the United States, accepted for operational use, and declared surplus by the U.S. Armed Forces. These aircraft may be counterparts, and are considered equivalent, to the previously civil certificated aircraft. Product changes or modifications to these aircraft are certificated in the same manner as their civil counterparts.

5.7.6 Limited Category Aircraft.

Limited category aircraft are surplus military aircraft, mostly from World War II, that were type certificated under CAR part 9 for use other than air transport. These aircraft are not permitted to carry persons or property for hire, and were accepted based on their previous military qualifications. A change to aircraft not supported by the military service history must comply with appropriate airworthiness standards. The level of safety associated with earlier standards may be acceptable for limited category aircraft.

5.8 Clarification of § 21.101(g), Part 26 Requirements.

5.8.1 Part 26 establishes requirements for support of continued airworthiness of and safety for transport category airplanes. The applicant must show compliance with each applicable provision of part 26, unless the applicant has elected or was required to comply with a corresponding amendment to part 25 that was issued on or after the date of the applicable part 26 provision. Section 21.101(g) does not allow an applicant to use an exception under § 21.101(b) for relief from complying with the applicable provisions of part 26.

5.8.2 The language in § 21.101(g) also recognizes that future part 25 amendments will be issued after the requirements in part 26 are established. Consequently, an applicant may be required to comply with a later part 25 amendment. Section 21.101(g) does not contain exception provisions for reverting to earlier part 26 requirements. However, under § 21.101(b) instead of complying with a later part 25 requirement, an applicant may be allowed to comply with an earlier part 26 or earlier part 25 requirement if justification is provided.

5.9 Documentation.

5.9.1 Documenting the Proposal.

In order to efficiently determine and agree upon a certification basis with the FAA, the following information is useful to understand your position:

- The current certification basis of the product you are changing, including amendment level.
- The amendment level of all the applicable airworthiness requirements at the date of application.
- Your proposed certification basis, including amendment levels.
- Description of the affected area.
- If you propose a certification basis that includes amendment levels earlier than what was in effect at the date of application, include the exception as outlined in § 21.101(b) and your justification if needed.

Please see appendix H for examples of optional tools you can use to document your proposed certification basis.

5.9.2 Documenting the Significant/Not Significant Decision.

5.9.2.1 The FAA determines whether the design changes are significant or not significant, and this decision is documented on the Certification Project Notification according to FAA Order 8110.115, *Certification Project Initiation and Certification Project Notification*. However, the FAA provides an optional decision record for the applicant to make a predetermination to facilitate the FAA decision. This form is provided in

appendix G of this AC and follows the flowchart in figure 3-1 of this AC. If used, you should submit it along with the certification plan.

5.9.2.2 Design changes that are determined to be significant changes under § 21.101, the exceptions, and agreement of affected and unaffected areas is typically documented through the G-1 issue paper process. An example tool is provided in appendix H of this AC.

5.9.3 Documenting the Certification Basis.

5.9.3.1 The FAA will amend the certification basis for all design changes that result in a revision to the product's certification basis on the amended TCDS or STC. The FAA will document the resulting certification basis because it is part of the compliance record required by FAA Order 8110.4C. For further information on documenting the certification basis, see FAA Order 8110.48A.

5.9.3.2 The FAA will document the certification basis of each product model on all STCs, including Approved Model List STCs.

5.10 Incorporation of STCs into the Type Design.

The incorporation of STCs into the product type design may generate an additional major change when that change is needed to account for incompatibility between several STCs that were initially not intended to be applied concurrently.

5.10.1 If the incorporation of the STC(s) does not generate an additional major change, the incorporation is not evaluated pursuant to § 21.101. The existing certification basis should be updated to include the later amendments of the STC(s) being incorporated.

5.10.2 If the incorporation of the STC(s) generates an additional major change, the change must be evaluated pursuant to § 21.101, and the existing certification basis should be updated to include the amendments resulting from the application of § 21.101.

5.11 Removing Design Changes.

Approved design changes may be removed after incorporation in an aeronautical product. These design changes will most commonly occur via an STC or service bulletin kit.

5.11.1 You should identify a product change that you intend at its inception to be removable as such, and you should develop instructions for its removal during the initial certification. The FAA will document the certification basis for both the installed and removed configuration separately on the TCDS or STC.

5.11.2 If specific removal instructions and a certification basis corresponding to the removed condition are not established at the time of the initial product change certification, the removal of design changes or portions of those changes may constitute a significant

change to type design. A separate STC or amended TC may be required to remove modifications and the resulting certification basis established for the changed product.

5.12 The Certification Basis is Part of the Design Change.

A new design change may be installed in a product in production or via a service bulletin or STC. In terms of § 21.101, each of the approved design changes has its own basis of certification. If an applicant chooses to remove an approved installation (e.g., interior installation, avionics equipment) and install a new installation, a new certification basis may be required for the new installation, depending on whether the change associated with the new installation is considered significant compared to the baseline configuration that the applicant chooses. If the new installation is a not significant change, the unmodified product's certification basis may be used (not the previous installation certification basis), provided the certification basis is adequate. For example, a transport category airplane is certified as a "green" configuration. The airplane certification basis does not include § 25.562 if it was manufactured prior to October 28, 2009. An interior is installed under an STC, and the applicant elects to include § 25.562 (dynamic seats) in the certification basis to meet specific operational requirements. At a later date, the airplane is sold to a non-part 121 operator (i.e., does not have the same operating requirements). A new interior is installed; there will be no requirement for § 25.562 to be included in the new certification basis.

5.13 Sequential Design Changes—Cumulative Effects.

5.13.1 If you intend to accomplish a product change by incorporating several design changes in a sequential manner, you should identify to the FAA up front when the first application is made. In addition, the cumulative effects arising from the initial change, and from all of the follow-on changes should be included as part of the description of the change in the initial proposal. The classification of the intended product change will not be evaluated solely on the basis of the first application, but rather on the basis of all the required design changes needed to accomplish the intended product change. If the FAA determines that the current application is a part of a sequence of related changes, then the FAA will re-evaluate the determination of significance and the resulting certification basis as a group of related changes.

5.13.2 <u>Example: Cumulative Effects—Advancing the Certification Basis.</u>

The type certificate for airplane model X lists three models, namely X-300, X-200, and X-100. The X-300 is derived from the X-200, which is derived from the original X-100 model. An applicant proposes a design change to the X-300 airplane model. During the review of the X-300 certification basis and the regulations affected by the proposed change, it was identified that one regulation, § 25.571 (damage tolerance requirements), remained at the same amendment level as the X-100 original certification basis (exception granted on the X-200). Since the amendment level for this particular regulation was not changed for the two subsequent airplane models (X-200 and X-300), the applicant must now examine the cumulative effects of these two previous design

changes that are related to the proposed change and the damage tolerance requirements to determine whether the amendment level needs to advance.

APPENDIX A. CLASSIFICATION OF DESIGN CHANGES

The following tables of "substantial," "significant," and "not significant" changes are adopted by the FAA, Agência Nacional de Aviação Civil (ANAC), European Aviation Safety Agency (EASA), and Transport Canada Civil Aviation (TCCA) through international collaboration. The classification may change due to cumulative effects and/or combinations of individual changes.

A.1 Examples of Substantial, Significant, and Not Significant Changes for Small Airplanes (Part 23).

A.1.1 Table A-1 contains examples of changes that are "substantial" for small airplanes (part 23).

Table A-1. Examples of Substantial Changes for Small Airplanes (Part 23)

Example	Description of Change	Notes
1.	Change in wing location (tandem, forward, canard, high/low).	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
2.	Fixed wing to tilt wing.	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
3.	A change in the number of engines.	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
4.	Replacement of piston or turbo-prop engines with turbojet or turbofan engines.	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.

Table A-1. Examples of Substantial Changes for Small Airplanes (Part 23) (continued)

Example	Description of Change	Notes
5.	Change in engine configuration (tractor/pusher).	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
6.	Increase from subsonic to supersonic flight regime.	
7.	Change from an all-metal to all-composite airplane.	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
8.	Certificating a part 23 (or predecessor amendment airplane basis airplane such as CAR 3) into another regulatory category such as part 25.	

A.1.2 Table A-2 contains examples of changes that are “significant” for small airplanes (part 23).

Table A-2. Examples of Significant Changes for Small Airplanes (Part 23)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
1.	Conventional tail to T-tail or V-tail, or vice versa.	Yes	No	Yes	Change in general configuration. Requires extensive, structural flying qualities and performance reinvestigation. Requires new airplane flight manual (AFM) to address performance and flight characteristics.
2.	Changes in wing configuration such as change in dihedral, changes in wing span, flap or aileron span, addition of winglets, or increase of more than 10 percent of the original wing sweep at the quarter chord.	Yes	No	Yes	Change in general configuration. Likely requires extensive changes to wing structure. Requires new AFM to address performance and flight characteristics. **Note:** Small changes to the wingtip or winglet are not significant changes. See table for “not significant” changes.

Table A-2. Examples of Significant Changes for Small Airplanes (Part 23) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
3.	Changes to tail configuration such as the addition of tail strakes or angle of incidence of the tail.	Yes	No	Yes	Change in general configuration. Likely requires extensive changes to tail structure. Requires new AFM to address performance and flight characteristics. **Note:** Small changes to tail are not significant changes.
4.	Tricycle/tail wheel undercarriage change or addition of floats.	Yes	No	No	Change in general configuration. Likely, at airplane level, general configuration and certification assumptions remain valid.
5.	Passenger to freighter configuration conversion that involves the introduction of a cargo door or an increase in floor loading of more than 20 percent, or provision for carriage of passengers and freight together.	Yes	No	Yes	Change in general configuration affecting load paths, aeroelastic characteristics, aircraft related systems, etc. Change in design assumptions.

Table A-2. Examples of Significant Changes for Small Airplanes (Part 23) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
6.	Replace reciprocating engines with the same number of turbo-propeller engines.	Yes	No	No	Requires extensive changes to airframe structure, addition of aircraft systems, and new AFM to address performance and flight characteristics.
7.	Addition of a turbo-charger that changes the power envelope, operating range, or limitations.	No	No	Yes	Invalidates certification assumptions due to changes in operating envelope and limitations. Requires new AFM to address performance and flight characteristics.

Table A-2. Examples of Significant Changes for Small Airplanes (Part 23) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
8.	The replacement of an engine of higher rated power or increase thrust would be considered significant if it would invalidate the existing substantiation, or would change the primary structure, aerodynamics, or operating envelope sufficiently to invalidate the assumptions of certification.	No	Yes	Yes	Invalidates certification assumptions. Requires new AFM to address performance and flight characteristics. Likely changes to primary structure. Requires extensive construction reinvestigation.
9.	A change in the type of material, such as composites in place of metal, or one composite fiber material system with another (e.g., carbon for fiberglass), for primary structure would normally be assessed as a significant change.	No	Yes	Yes	Change in principles of construction and design from conventional practices. Likely change in design/certification assumptions.

Table A-2. Examples of Significant Changes for Small Airplanes (Part 23) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
10.	A change involving appreciable increase in design speeds V_D, V_B, V_{MO}, V_C, or V_A.	No	No	Yes	Certification assumptions invalidated. Requires new AFM to address performance and flight characteristics.
11.	Installation of a short takeoff and landing (STOL) kit.	No	No	Yes	Certification assumptions invalidated. Requires new AFM to address performance and flight characteristics.
12.	A change in the rated power or thrust could be a significant change if the applicant is taking credit for increased design speeds per example 10 of this table.	No	No	Yes	Certification assumptions invalidated. Requires new AFM to address performance and flight characteristics.

Table A-2. Examples of Significant Changes for Small Airplanes (Part 23) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
13.	Fuel state such as compressed gaseous fuels or fuel cells. This could completely alter the fuel storage and handling systems and possibly affect the airplane structure.	No	No	Yes	Changes in design/certification assumptions. Extensive alteration of fuel storage and handling systems.
14.	A change in the flight control concept for an aircraft, e.g., to fly by wire (FBW) and side-stick control, or a change from hydraulic to electronically actuated flight controls, would in isolation normally be regarded as a significant change.	No	No	Yes	Changes in design and certification assumptions. Requires extensive systems architecture and integration reinvestigation. Requires new AFM.

Table A-2. Examples of Significant Changes for Small Airplanes (Part 23) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
15.	Change to airplane's operating altitude, or cabin operating pressure greater than 10 percent in maximum cabin pressure differential.	No	No	Yes	This typically invalidates certification assumptions and the fundamental approach used in decompression, structural strength, and fatigue. May require extensive airframe changes affecting load paths, fatigue evaluation, aeroelastic characteristics, etc. Invalidates design assumptions.
16.	Addition of cabin pressurization system.	No	Yes	Yes	Extensive airframe changes affecting load paths, fatigue evaluation, aeroelastic characteristics, etc. Invalidates design assumptions.
17.	Changes in types and number of emergency exits or an increase in maximum certificated passenger capacity.	Yes	No	Yes	Emergency egress requirements exceed those previously substantiated. Invalidates assumptions of certification.

Table A-2. Examples of Significant Changes for Small Airplanes (Part 23) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
18.	A change in the required number of flightcrew that necessitates a complete flightdeck rearrangement, and/or an increase in pilot workload.	No	No	Yes	Extensive changes to avionics and aircraft systems. Invalidates certification assumptions. Requires new AFM.
19.	Expansion of an aircraft's operating envelope.*	No	No	Yes* *Some changes may be deemed "not significant" depending on the extent of the expansion.	An expansion of operating capability is a significant change (e.g., an increase in maximum altitude limitation, approval for flight in icing conditions, or an increase in airspeed limitations).
20.	Replacement of an aviation gasoline engine with an engine of approximately the same horsepower utilizing, e.g., diesel, hybrid, or electrical power.	No	No	Yes	A major change to the airplane. The general configuration and principles of construction will usually remain valid; however, the assumptions for certification are invalidated.

Table A-2. Examples of Significant Changes for Small Airplanes (Part 23) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
21.	Comprehensive flightdeck upgrade, such as conversion from entirely federated, independent electro-mechanical flight instruments to highly integrated and combined electronic display systems with extensive use of software and/or complex electronic hardware.	No	No	Yes	Affects avionics and electrical systems integration and architecture concepts and philosophies. This drives a reassessment of the human-machine interface, flightcrew workload, and re-evaluation of the original design flightdeck assumptions.
22.	Introduction of autoland.	No	No	Yes	Invalidates original design assumptions.
23.	Conversion from a safe life design to a damage-tolerance-based design.	No	No	Yes	Where the airframe-established safe life limits change to damage tolerance principles, then use of an inspection program in lieu of the safe life design limit invalidates the original assumptions used during certification.

Table A-2. Examples of Significant Changes for Small Airplanes (Part 23) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
24.	Extensive structural airframe modification, such as a large opening in the fuselage.	Yes	No	No	Requires extensive changes to fuselage structure, affects aircraft systems, and requires a new AFM to address performance and flight characteristics.
25.	Fuselage stretch or shortening in the cabin or pressure vessel.	Yes	No	Yes	Cabin interior changes are related changes since occupant safety considerations are impacted by a cabin length change. Even if a new cabin interior is not included in the product level change, the functional effect of the fuselage plug has implications on occupant safety (e.g., the dynamic environment in an emergency landing, emergency evacuation, etc.), and thus the cabin interior becomes an affected area.

Table A-2. Examples of Significant Changes for Small Airplanes (Part 23) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
26.	Conversion from normal category to commuter category airplane.	Yes	No	Yes	Requires compliance with all commuter regulatory standards. In many cases, this change could be considered a substantial change to the type design. Therefore, a proposed change of this nature would be subject to FAA determination under § 21.19.
27.	Installation of a full authority digital engine control (FADEC) on an airplane that did not previously have a FADEC installed.	No	No	Yes	

A.1.3 Table A-3 contains examples of changes that are “not significant” for small airplanes (part 23).

Table A-3. Examples of Not Significant Changes for Small Airplanes (Part 23)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
1.	Addition of wingtip modifications (not winglets).	No	No	No	A major change to the airplane. Likely, the original general configuration, principles of construction, and certification assumptions remain valid.
2.	Installation of skis or wheel skis.	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
3.	Forward looking infrared (FLIR) or surveillance camera installation.	No	No	No	Additional flight or structural evaluation may be necessary, but the change does not alter basic airplane certification.
4.	Litter, berth, and cargo tie down device installation.	No	No	No	Not an airplane-level change.

Table A-3. Examples of Not Significant Changes for Small Airplanes (Part 23) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
5.	Increased tire size, including tundra tires.	No	No	No	Not an airplane-level change.
6.	Replacement of one propeller type with another (irrespective of increase in number of blades).	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
7.	Addition of a turbo-charger that does not change the power envelope, operating range, or limitations (e.g., a turbo-normalized engine, where the additional power is used to enhance high altitude or hot day performance).	No	No	No	Not an airplane-level change.
8.	Substitution of one method of bonding for another (e.g., change in type of adhesive).	No	No	No	Not an airplane-level change.

Table A-3. Examples of Not Significant Changes for Small Airplanes (Part 23) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
9.	Substitution of one type of metal for another.	No	No	No	Not an airplane-level change.
10.	Any change in construction or fastening not involving primary structure.	No	No	No	Not an airplane-level change.
11.	A new fabric type for fabric-skinned aircraft.	No	No	No	Not an airplane-level change.
12.	Increase in flap speed or undercarriage limit speed.	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
13.	Structural strength increases.	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.

Table A-3. Examples of Not Significant Changes for Small Airplanes (Part 23) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
14.	Instrument flight rules (IFR) upgrades involving installation of components (where the original certification does not indicate that the airplane is not suitable as an IFR platform, e.g., special handling concerns).	No	No	No	Not an airplane-level change.
15.	Fuel tanks where fuel is changed from gasoline to diesel fuel and tank support loads are small enough that an extrapolation from the previous analysis would be valid. Chemical compatibility would have to be substantiated.	No	No	No	Not an airplane-level change.

Table A-3. Examples of Not Significant Changes for Small Airplanes (Part 23) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
16.	Limited changes in a pressurization system, e.g., number of outflow valves, type of controller, or size of pressurized compartment, but the system must be resubstantiated if the original test data are invalidated.	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
17.	Install a different exhaust system.	No	No	No	Not an airplane-level change.
18.	Changes in engine cooling or cowling.	No	No	No	Not an airplane-level change.
19.	Changing fuels of substantially the same type, such as AvGas to AutoGas, AvGas (80/87) to AvGas (100LL), ethanol to isopropyl alcohol, Jet B to Jet A.	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.

Table A-3. Examples of Not Significant Changes for Small Airplanes (Part 23) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
20.	Fuels that specify different levels of "conventional" fuel additives that do not change the primary fuel type. Different additive levels (controlled) of MTBE, ETBE, ethanol, amines, etc., in AvGas would not be considered a significant change.	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
21.	A change to the maximum takeoff weight of less than 5 percent, unless assumptions made in justification of the design are thereby invalidated.	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
22.	An additional aileron tab (e.g., on the other wing).	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.

Table A-3. Examples of Not Significant Changes for Small Airplanes (Part 23) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
23.	Larger diameter flight control cables with no change in routing, or other system design.	No	No	No	Not an airplane-level change.
24.	Autopilot installation (for IFR use, unless the original certification indicates that the airplane is not suitable as an IFR platform).	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
25.	Increased battery capacity or relocate battery.	No	No	No	Not an airplane-level change.
26.	Replace generator with alternator.	No	No	No	Not an airplane-level change.
27.	Additional lighting (e.g., navigation lights, strobes).	No	No	No	Not an airplane-level change.
28.	Higher capacity brake assemblies.	No	No	No	Not an airplane-level change.

Table A-3. Examples of Not Significant Changes for Small Airplanes (Part 23) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
29.	Increase in fuel tank capacity.	No	No	No	Not an airplane-level change.
30.	Addition of an oxygen system.	No	No	No	Not an airplane-level change.
31.	Relocation of a galley.	No	No	No	Not an airplane-level change.
32.	Passenger to freight (only) conversion with no change to basic fuselage structure.	No	No	No	Although a major change to the airplane, likely the original general configuration, principles of construction, and certification assumptions remain valid. Requires certification substantiation applicable to freighter requirements.
33.	New cabin interior with no fuselage length change.	No	No	No	
34.	Installation of new seat belt or shoulder harness.	No	No	No	Not an airplane-level change.

Table A-3. Examples of Not Significant Changes for Small Airplanes (Part 23) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
35.	A small increase in center of gravity (CG) range.	No	No	No	At airplane level, no change in general configuration, principles of construction, and certification assumptions.
36.	Auxiliary power unit (APU) installation that is not flight essential.	No	No	No	Although a major change to the airplane level, likely the original general configuration, principles of construction, and certification assumptions remain valid. Requires certification substantiation applicable to APU installation requirements.
37.	An alternative autopilot.	No	No	No	Not an airplane-level change.
38.	Addition of Class B terrain awareness and warning systems (TAWS).	No	No	No	Not an airplane-level change.

Table A-3. Examples of Not Significant Changes for Small Airplanes (Part 23) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
39.	Extending an established life limit.	No	No	No	This extension may be accomplished by various methods, such as ongoing fatigue testing, service life evaluation, component level replacement, and inspections based on damage tolerance principles.
40.	Flightdeck replacement of highly integrated and combined electronic display systems with other highly integrated and combined electronic display systems.	No	No	No	Not significant if the architecture concepts, design philosophies, human-machine interface, or flight crew workload assumptions are not impacted.
41.	Interior cabin reconfigurations are generally considered not significant. This includes installation of in-flight entertainment (IFE), new seats, and rearrangement of furniture.	No	No	No	

Table A-3. Examples of Not Significant Changes for Small Airplanes (Part 23) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
42.	Modification to ice protection systems.	No	No	No	Re-certification required, but certification basis should be evaluated for adequacy.

A.2 Examples of Substantial, Significant, and Not Significant Changes for Transport Airplanes (Part 25).

A.2.1 Table A-4 contains examples of changes that are "substantial" for transport airplanes (part 25).

Table A-4. Examples of Substantial Changes for Transport Airplanes (Part 25)

Example	Description of change	Notes
1.	Change in the number or location of engines, e.g., four to two wing-mounted engines or two wing-mounted to two body-mounted engines.	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
2.	Change from a high-wing to low-wing configuration.	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
3.	Change from an all-metal to all-composite airplane.	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
4.	Change of empennage configuration for larger airplanes (cruciform vs. 'T' or 'V' tail).	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
5.	Increase from subsonic to supersonic flight regime.	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.

A.2.2 Table A-5 contains examples of changes that are “significant” for transport airplanes (part 25).

Table A-5. Examples of Significant Changes for Transport Airplanes (Part 25)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
1.	Reduction in the number of flightcrew (in conjunction with flightdeck update).	No	No	Yes	Extensive changes to avionics and aircraft systems. Impact to crew workload and human factors, pilot type rating.
2.	Modify an airplane to add certification for flight in icing conditions by adding systems such as ice detection and ice protection.	Yes	No	Yes	New aircraft operating envelope. Requires major new systems installation and aircraft evaluation. Operating envelope changed.
3.	Conversion—passenger or combination freighter/passenger to all freighter, including cargo door, redesign floor structure and 9g net or rigid barrier.	Yes	No	Yes	Extensive airframe changes affecting load paths, aeroelastic characteristics, aircraft related systems for fire protection, etc. Design assumptions changed from passenger to freighter.

Table A-5. Examples of Significant Changes for Transport Airplanes (Part 25) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
4.	Conversion from a cargo to passenger configuration.	Yes	No	Yes	Completely new floor loading and design. Redistribution of internal loads, change in cabin safety requirements, system changes.
5.	Increase in cabin pressurization greater than 10 percent.	No	No	Yes	A change greater than 10 percent in operational cabin pressure differential is a significant change since it requires extensive airframe changes affecting load paths, fatigue evaluation, or aeroelastic characteristics, invalidating the certification assumptions.
6.	Addition of leading edge slats.	Yes	No	Yes	The addition of leading edge slats is significant since it requires extensive changes to wing structure, adds aircraft systems, and requires a new AFM to address performance and flight characteristics.

Table A-5. Examples of Significant Changes for Transport Airplanes (Part 25) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
7.	Fuselage stretch or shortening in the cabin or pressure vessel.	Yes	No	Yes	Cabin interior changes are related changes since occupant safety considerations are impacted by a cabin length change. Even if a new cabin interior is not included in the product level change, the functional effect of the fuselage plug has implications on occupant safety (e.g., the dynamic environment in an emergency landing, emergency evacuation, etc.), and thus the cabin interior becomes an affected area.
8.	Extensive structural airframe modification, such as installation of a large telescope with large opening in the fuselage.	Yes	No	No	These types of structural modifications are significant since they require extensive changes to fuselage structure, affect aircraft systems, and require a new AFM to address performance and flight characteristics.

Table A-5. Examples of Significant Changes for Transport Airplanes (Part 25) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
9.	Changing the number of axles or number of landing gear done in context with a product change that involves changing the airplane gross weight.	Yes	No	No	This type of landing gear change with an increase in gross weight is significant since it requires changes to aircraft structure, affects aircraft systems, and requires AFM changes, which invalidate the certification assumptions.
10.	Primary structure changes from metallic material to composite material.	No	Yes	No	Change in principles of construction and design from conventional practices.
11.	An increase in design weight of more than 10 percent.	No	No	Yes	Design weight increases of more than 10 percent result in significant design load increase that invalidates the assumptions used for certification, requiring re-substantiation of aircraft structure, aircraft performance, and flying qualities and associated systems.

Table A-5. Examples of Significant Changes for Transport Airplanes (Part 25) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
12.	Installation of winglets, modification of existing winglets, or other changes in wing tip design.	Yes	No	Yes	Significant if it requires extensive changes to wing structure or aircraft systems, or if it requires a new AFM to address performance and flight characteristics. It may also affect the wing fuel tanks, including fuel tank lightning protection, fuel tank ignition source prevention, and fuel tank flammability exposure.
13.	Changes in wing span, chord, or sweep.	Yes	No	Yes	Significant if it requires extensive changes to wing structure or aircraft systems, or if it requires a new AFM to address performance and flight characteristics. It may also affect the wing fuel tanks, including fuel tank lightning protection, fuel tank ignition source prevention, and fuel tank flammability exposure.

Table A-5. Examples of Significant Changes for Transport Airplanes (Part 25) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
14.	A change in the type or number of emergency exits or an increase in the maximum certificated number of passengers.	Yes	No	Yes	
15.	A comprehensive avionics upgrade that changes a federated avionics system to a highly integrated avionics system.	No	No	Yes	This change refers to the avionics system that feeds the output to displays and not the displays themselves.
16.	An avionics upgrade that changes the method of input from the flightcrew, which was not contemplated during the original certification.	No	No	Yes	A change that includes touchscreen technology typically does not invalidate the assumptions used for certification. A change that incorporates voice activated controls or other novel human-machine interface would likely invalidate the assumptions used for certification.

Table A-5. Examples of Significant Changes for Transport Airplanes (Part 25) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
17.	Change in primary flight controls to FBW system. (Some airplanes have some degree of FBW. Achieving full FBW may be a not significant change on some airplanes.)	No	No	Yes	When the degree of change is so extensive that it affects basic aircraft systems integration and architecture concepts and philosophies. This drives a complete reassessment of flightcrew workload, handling qualities, and performance evaluation, which are different from the original design assumptions.
18.	Replace reciprocating with turbo-propeller engines.	Yes	No	No	Requires extensive changes to airframe structure, addition of aircraft systems, and new AFM to address performance and flight characteristics.

Table A-5. Examples of Significant Changes for Transport Airplanes (Part 25) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
19.	Maximum continuous or takeoff thrust or power increase of more than 10 percent or, for turbofans, an increase of the nacelle diameter.	No	No	Yes	A thrust or power increase of more than 10 percent is significant because it does have a marked effect on aircraft performance and flying qualities, or requires re-substantiation of powerplant installation. An increase of the nacelle diameter as a result of an increase in the bypass ratio is significant because it results in airframe-level effects on aircraft performance and flying qualities. However, a small increase of the nacelle diameter would not have such an airframe-level effect and would not be considered a significant change.

Table A-5. Examples of Significant Changes for Transport Airplanes (Part 25) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
20.	Initial installation of an autoland system.	No	No	Yes	Baseline airplane not designed for autoland operation, potential crew workload, and systems compatibility issues.
21.	Installation of a new fuel tank, e.g., installation of an auxiliary fuel tank in a cargo bay or installation of an auxiliary fuel tank that converts a dry bay into a fuel tank (such as a horizontal stabilizer tank).	No	No	Yes	Requires changes to airframe, systems, and AFM. Results in performance changes. These changes typically affect fuel tank lightning protection, fuel tank ignition source prevention, and fuel tank flammability exposure.
22.	Main deck cargo door installation.	Yes	No	No	Redistribution of internal loads, change in aeroelastic characteristics, system changes.

Table A-5. Examples of Significant Changes for Transport Airplanes (Part 25) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
23.	Expansion of an aircraft's operating envelope.*	No	No	Yes* *Some changes may be deemed "not significant" depending on the extent of the expansion.	An expansion of operating capability is a significant change (e.g., an increase in maximum altitude limitation, approval for flight in icing conditions, or an increase in airspeed limitations).
24.	Changing the floor from passenger carrying to cargo carrying capability.	Yes	No	Yes	Completely new floor loading and design. Redistribution of internal loads, change in cabin safety requirements, system changes. If a cargo handling system is installed, it would be a related change.
25.	Initial installation of an APU essential for aircraft flight operation.	No	No	Yes	Changes emergency electrical power requirements, change in flight manual and operating characteristics.

Table A-5. Examples of Significant Changes for Transport Airplanes (Part 25) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
26.	Conversion from hydraulically actuated brakes to electrically actuated brakes.	No	No	Yes	Assumptions of certification for airplane performance are changed.
27.	Installation of engine thrust reversers.	Yes	No	Yes	
28.	Request for extended operations (ETOPS) type design approval for: (a) airplanes without an existing ETOPS type design approval, and (b) extension of an airplane's diversion time.	No	No	Yes	An expansion of diversion capability for ETOPS would normally be a significant change. However, expanding the diversion capability for which it was originally designed is generally not a significant change. In this case, the assumptions used for certification of the basic product remain valid, and the results can be applied to cover the changed product with predictable effects or can be demonstrated without significant physical changes to the product.

Table A-5. Examples of Significant Changes for Transport Airplanes (Part 25) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
29.	Installation of an engine with a FADEC on an airplane that did not previously have a FADEC engine installed.	No	No	Yes	A changed from a mechanical control engine to a FADEC engine may be so extensive that it affects basic aircraft systems integration and architecture concepts and philosophies. This drives a complete reassessment of flightcrew workload, handling qualities, and performance evaluation, which are different from the original design assumptions.

A.2.3 Table A-6 contains examples of changes that are “not significant” for transport airplanes (part 25).

Table A-6. Examples of Not Significant Changes for Transport Airplanes (Part 25)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
1.	Alternate engine installation or hush kit at same position.	No	No	No	It is not significant so long as there is less than a 10 percent increase in thrust or there is not a change in the principles of propulsion. A change in position to accommodate a different size engine could influence airplane performance and handling qualities and result in a significant change.
2.	A small change in fuselage length due to refairing the aft body or radome.	No	No	No	For cruise performance reasons, where such changes do not require extensive structural, systems, aerodynamic, or AFM changes.

Table A-6. Examples of Not Significant Changes for Transport Airplanes (Part 25) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
3.	Refairing of wing tip caps (for lights, fuel dump pipes) and addition of splitter plates to the trailing edge thickness of the cruise airfoil.	No	No	No	Does not require extensive structural, AFM, or systems changes.
4.	Additional power used to enhance high altitude or hot day performance.	No	No	No	Usually no change in basic operating envelope. Existing certification data can be extrapolated. Could be significant product change if the additional power is provided by installation of a rocket motor or additional, on demand engine due to changes in certification assumptions.

Table A-6. Examples of Not Significant Changes for Transport Airplanes (Part 25) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
5.	Installation of an autopilot system.	No	N/A	See notes	It may be possible that the modification is adaptive in nature, with no change to original certification assumptions. However, in certain cases the installation of an autopilot may include extensive changes and design features that change both the general configuration and the assumptions for certification (i.e., installation of the autopilot may introduce a number of additional mechanical and electronic failure modes and change the hazard classification of given aircraft-level failures).
6.	Change from assembled primary structure to monolithic or integrally machined structure.	No	No	No	Method of construction must be well understood.

Table A-6. Examples of Not Significant Changes for Transport Airplanes (Part 25) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
7.	Modification to ice protection systems.	No	No	No	Recertification required, but certification basis is adequate.
8.	Brakes: design or material change, e.g., steel to carbon.	No	No	No	Recertification required, but certification basis is adequate.
9.	Redesign floor structure.	No	No	No	By itself, not a significant product change. It is significant if part of a cargo conversion of a passenger airplane.

Table A-6. Examples of Not Significant Changes for Transport Airplanes (Part 25) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
10.	New cabin interior with no fuselage length change.	No	No	No	A new cabin interior includes new ceiling and sidewall panels, stowage, galleys, lavatories, and seats. Novel or unusual design features in the cabin interior may require special conditions. Many interior related requirements are incorporated in operational rules. Even though the design approval holder may not be required to comply with these requirements, the operator may be required to comply.
11.	A rearrangement of an interior (e.g., seats, galleys, lavatories, closets, etc.).	No	No	No	

Table A-6. Examples of Not Significant Changes for Transport Airplanes (Part 25) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
12.	Novel or unusual method of construction of a component.	No	No	No	The component change does not rise to the product level. Special conditions could be required if there are no existing regulations that adequately address these features.
13.	Initial installation of a non-essential APU.	No	No	No	A stand-alone initial APU installation on an airplane originally designed to use ground- or airport-supplied electricity and air conditioning. In this case, the APU would be an option to be independent of airport power.

Table A-6. Examples of Not Significant Changes for Transport Airplanes (Part 25) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
14.	Increasing the life limit as § 25.571 fatigue testing progresses for a recently type certificated airplane.	No	No	No	For example, a recently type certificated airplane may undergo fatigue testing as part of compliance with § 25.571. In this case, the TC holder may specify an initial life limit in the airworthiness limitations section (ALS) and gradually increase that life limit as fatigue testing progresses. Such change to the ALS is considered not significant.

Table A-6. Examples of Not Significant Changes for Transport Airplanes (Part 25) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
15.	Extending limit of validity (LOV) pursuant to § 26.23.	No	No	No	Extending an LOV pursuant to § 26.23 without any other change to the airplane is not a significant change. However, if extending the LOV requires a physical design change to the airplane, the design change is evaluated to determine the level of significance of the design change. Note that if design approval holders are developing modifications to support an extended LOV, they must also comply with the requirements of subpart E of part 26.

Table A-6. Examples of Not Significant Changes for Transport Airplanes (Part 25) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
16.	Airframe life extension.	No	No	No	This does not include changes that involve changes to design loads, such as pressurization or weight increases. Also, this does not include changing from safe life to damage tolerance.
17.	Changes in the type or number of emergency exits by de-rating doors or deactivating doors with corresponding reduction in passenger capacity.	No	No	No	The new emergency egress does not exceed that previously substantiated because the certificated number of passengers is reduced.

Table A-6. Examples of Not Significant Changes for Transport Airplanes (Part 25) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
18.	Request for ETOPS type design approval for a type design change of a product with an existing ETOPS type design approval.	No	No	No	A change to a product with an existing ETOPS type design approval without a change in diversion capability would normally not be significant. However, if the existing ETOPS type design approval was based on policy prior to the adoption of transport category ETOPS airworthiness standards, then there is not an adequate certification basis to evaluate the type design change for ETOPS. In this case, the change is still not significant, and the appropriate transport category ETOPS airworthiness standards would apply.

Table A-6. Examples of Not Significant Changes for Transport Airplanes (Part 25) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
19.	An avionics change from federated electro-mechanical displays to federated electronic displays.	No	No	No	Changing an electro-mechanical display to an electronic display is not considered significant.
20.	An avionics change replacing an integrated avionics system with another integrated avionics system.	No	No	No	The assumptions used to certify a highly integrated avionics system should be the same for another highly integrated avionics system.

A.3 Examples of Substantial, Significant, and Not Significant Changes for Rotorcraft (Parts 27 and 29).

A.3.1 Table A-7 contains examples of changes that are "substantial" for rotorcraft (parts 27 and 29).

Table A-7. Examples of Substantial Changes for Rotorcraft (Parts 27 and 29)

Example	Description of change	Notes
1.	Change from the number and or configuration of rotors (e.g., main & tail rotor system to two main rotors).	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
2.	Change from an all-metal rotorcraft to all-composite rotorcraft.	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.

A.3.2 Table A-8 contains examples of changes that are “significant” for rotorcraft (parts 27 and 29).

Table A-8. Examples of Significant Changes for Rotorcraft (Parts 27 and 29)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
1.	Comprehensive flightdeck upgrade, such as conversion from entirely federated, independent electro-mechanical flight instruments to highly integrated and combined electronic display systems with extensive use of software and/or complex electronic hardware.	No	No	Yes	Affects avionics and electrical systems integration and architecture concepts and philosophies. This drives a reassessment of the human-machine interface, flightcrew workload, and re-evaluation of the original design flightdeck assumptions
2.	Certification for flight into known icing conditions.	No	No	Yes	
3.	(Fixed) flying controls from mechanical to fly by wire.	No	No	Yes	This drives a complete reassessment of the rotorcraft controllability and flight control failure.

Table A-8. Examples of Significant Changes for Rotorcraft (Parts 27 and 29) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
4.	Addition of an engine; e.g., from single to twin or reduction of the number of engines; e.g., from twin to single.	Yes	Yes	Yes	
5.	A change of the rotor drive primary gearbox from a splash type lubrication system to a pressure lubricated system due to an increase in horsepower of an engine or changing from a piston engine to turbine engine.	No	Yes	Yes	
6.	A fuselage or tail boom modification that changes the primary structure, aerodynamics, and operating envelope sufficiently to invalidate the certification assumptions.	Yes	No	Yes	

Table A-8. Examples of Significant Changes for Rotorcraft (Parts 27 and 29) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
7.	Application of an approved primary structure to a different approved model (e.g., installation on a former model of the main rotor approved on a new model that results in increase performance).	No	Yes	Yes	
8.	Emergency medical service (EMS) configuration with primary structural changes sufficient to invalidate the certification assumptions.	No	No	Yes	Many EMS configurations will not be classified as significant. Modifications made for EMS are typically internal, and the general external configuration is normally not affected. These changes should not automatically be classified as significant. **Note:** Door addition or enlargement involving structural change would be significant.

Table A-8. Examples of Significant Changes for Rotorcraft (Parts 27 and 29) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
9.	Skid landing gear to wheel landing gear or wheel landing to skid.	Yes	No	Yes	
10.	Change of the number of rotor blades.	Yes	No	Yes	
11.	Change tail anti-torque device (e.g., tail rotor, ducted fan or other technology).	Yes	Yes	No	
12.	Passenger configured helicopter to a Firefighting equipment configured helicopter.	Yes	No	Yes	Depends on the firefighting configuration.
13.	Passenger configured helicopter to an agricultural configured helicopter.	Yes	No	Yes	Depends on the agricultural configuration.
14.	An initial Category A certification approval to an existing configuration.	No	No	Yes	

Table A-8. Examples of Significant Changes for Rotorcraft (Parts 27 and 29) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
15.	IFR upgrades involving installation of upgraded components for new IFR configuration.	No	No	Yes	Changes in architecture concepts, design philosophies, human-machine interface, or flightcrew workload.
16.	Human external cargo (HEC) certification approval.	No	No	Yes	Must comply with the latest HEC certification requirements in order to obtain operational approval. HEC include fatigue, quick release systems, HIRF, one engine inoperative (OEI) performance, and OEI procedures.
17.	Reducing the number of pilots for IFR from two to one.	No	No	Yes	
18.	An avionics upgrade that changes a federated avionics system to a highly integrated avionics system.	No	No	Yes	This change refers to the avionics system that feeds the output to displays and not the displays themselves.

Table A-8. Examples of Significant Changes for Rotorcraft (Parts 27 and 29) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
19.	An avionics upgrade that changes the method of input from the flightcrew, which was not contemplated during the original certification.	No	No	Yes	A change that includes touchscreen technology typically does not invalidate the assumptions used for certification. A change that incorporates voice activated controls or other novel human-machine interface would likely invalidate the assumptions used for certification.

A.3.3 Table A-9 contains examples of changes that are “not significant” changes for rotorcraft (parts 27 and 29).

Table A-9. Examples of Not Significant Changes for Rotorcraft (Parts 27 and 29)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
1.	Emergency floats.	No	No	No	Must comply with the specific applicable requirements for emergency floats. This installation, in itself, does not change the rotorcraft configuration, overall performance, or operational capability. Expanding an operating envelope (such as operating altitude and temperature) and mission profile (such as passenger carrying operations to external load operations, flight over water, or operations in snow conditions) are not by themselves so different that the original certification assumptions are no longer valid at the type certificated product level.

Table A-9. Examples of Not Significant Changes for Rotorcraft (Parts 27 and 29) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
2.	FLIR or surveillance camera installation.	No	No	No	Additional flight or structural evaluation may be necessary but the change does not alter the basic rotorcraft certification.
3.	Helicopter terrain awareness warning system (HTAWS) for operational credit.	No	No	No	Certificated under rotorcraft HTAWS AC guidance material and FAA TSO-C194. Does not alter the basic rotorcraft configuration.
4.	Health usage monitoring system (HUMS) for maintenance credit.	No	No	No	Certificated under rotorcraft HUMS AC guidance material. Does not alter the basic rotorcraft configuration.

Table A-9. Examples of Not Significant Changes for Rotorcraft (Parts 27 and 29) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
5.	Expanded limitations with minimal or no design changes, following further tests/justifications or different mix of limitations (CG limits, oil temperatures, altitude, minimum/ maximum weight, minimum/ maximum external temperatures, speed, engine ratings).	No	No	No	Changes to an operating envelope (such as operating altitude and temperature) and mission profile (such as passenger carrying operations to external load operations, flight over water, or operations in snow conditions) that are not so different that the original certification assumptions remain valid.
6.	Change from a single channel FADEC to a dual channel FADEC.				Change does not change the overall product configuration or the original certification assumptions.
7.	Installation of a new engine type, equivalent to the former one, leaving aircraft installation and limitations substantially unchanged.	No	No	No	Refer to AC 27-1 or AC 29-2 for guidance. Does not alter the basic rotorcraft configuration, provided there is no additional capacity embedded in the new design.

Table A-9. Examples of Not Significant Changes for Rotorcraft (Parts 27 and 29) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
8.	Windscreen installation.	No	No	No	Does not change the rotorcraft overall product configuration.
9.	Snow skis, “Bear Paws.”	No	No	No	Must comply with specific requirements associated with the change. Expanding an operating envelope (such as operating altitude and temperature) and mission profile (such as passenger carrying operations to external load operations, flight over water, or operations in snow conditions) are not by themselves so different that the original certification assumptions are no longer valid at the type certificated product level.

Table A-9. Examples of Not Significant Changes for Rotorcraft (Parts 27 and 29) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
10.	External cargo hoist.	No	No	No	Must comply with the specific applicable requirements for external loads. This installation, in itself, does not change the rotorcraft configuration, overall performance, or operational capability. Expanding an operating envelope (such as operating altitude and temperature) and mission profile (such as passenger carrying operations to external load operations excluding HEC, flight over water, or operations in snow conditions) are not by themselves so different that the original certification assumptions are no longer valid at the type certificated product level.

Table A-9. Examples of Not Significant Changes for Rotorcraft (Parts 27 and 29) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
11.	IFR upgrades involving installation of upgraded components to replace existing components.	No	No	No	Not a rotorcraft-level change.
12.	An avionics change from federated electro-mechanical displays to federated electronic displays.	No	No	No	Changing an electro-mechanical display to an electronic display on a single avionics display is not considered significant.
13.	An avionics change replacing an integrated avionics system with another integrated avionics system.	No	No	No	The assumptions used to certify a highly integrated avionics system should be the same for another highly integrated avionics system.
14.	Flightdeck replacement of highly integrated and combined electronic display systems with other highly integrated and combined electronic display systems.	No	No	No	Not significant if the architecture concepts, design philosophies, human-machine interface, flightcrew workload design flightdeck assumptions are not impacted.

Table A-9. Examples of Not Significant Changes for Rotorcraft (Parts 27 and 29) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
15.	IFR upgrades involving installation of upgraded components for new IFR configuration.	No	No	No	No changes in architecture concepts, design philosophies, human-machine interface, or flightcrew workload.
16.	Flightdeck replacement or upgrade of avionics systems in non-appendix “B” (IFR) or non-CAT “A” rotorcraft that can enhance safety or pilot awareness.	No	No	No	
17.	Modifications to non-crashworthy fuel systems intended to improve its crashworthiness.	No	No	No	

Table A-9. Examples of Not Significant Changes for Rotorcraft (Parts 27 and 29) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
18.	Changing the hydraulic system from one similar type of fluid to another, e.g., a fluid change from a highly flammable mineral oil based fluid (MIL-H-5606) to a less flammable synthetic hydrocarbon based fluid (MIL-PRF-87257)	No	No	No	
19.	A TSO C-127 dynamic seat installed in a helicopter with an existing certification basis prior to addition of § 29.562, *Emergency landing dynamic conditions*.	No	No	No	

A.4 Examples of Substantial, Significant, and Not Significant Changes for Engines (Parts 33)

A.4.1 Table A-10 contains examples of changes that are "substantial" for engines (part 33).

Table A-10. Examples of Substantial Changes for Engines (Part 33)

Example	Description of Change	Notes
Turbine Engines		
1.	Traditional turbofan to geared-fan engine.	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
2.	Low bypass ratio engine to high bypass ratio engine with an increased inlet area.	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
3.	Turbojet to turbofan.	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
4.	Turbo-shaft to turbo-propeller.	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
5.	Conventional ducted fan to unducted fan.	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
6.	Turbine engine for subsonic operation to afterburning engine for supersonic operation.	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.

A.4.2 Table A-11 contains examples of changes that are “significant” for engines (part 33).

Table A-11. Examples of Significant Changes for Engines (Part 33)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
Turbine Engines					
1.	Increase/decrease in the number of compressor/turbine stages with resultant change in approved operational limitations.	Yes	No	Yes	Change is associated with other changes that would affect the rating of the engine and the engine dynamic behavior, such as backbone bending, torque spike effects on rotors and casing, surge and stall characteristics, etc.

Table A-11. Examples of Significant Changes for Engines (Part 33) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
Turbine Engines					
2.	New design fan blade and fan hub, or a bladed fan disk to a blisk, or a fan diameter change, that could not be retrofitted.	Yes	No	Yes	Change is associated with other changes to the engine thrust/power, ratings, and operating limitations; engine dynamic behavior in terms of backbone bending, torque spike effects on casing, foreign object ingestion behavior (birds, hail, rain, ice slab); blade-out test and containment; induction system icing capabilities; and burst model protection for the aircraft. If there is a diameter change, installation will be also affected.
3.	Hydro-mechanical control to FADEC/EEC (electronic engine control) without hydro-mechanical backup.	Yes	No	No	Change in engine control configuration. Not interchangeable. Likely fundamental change to engine operation.

Table A-11. Examples of Significant Changes for Engines (Part 33) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
Turbine Engines					
4.	A change in the containment case from hard-wall to composite construction or vice versa that could not be retrofitted without additional major changes to the engine or restricting the initial limitations or restrictions in the initial installation manual.	No	Yes	Yes	Change in methods of construction that have affected inherent strength, backbone bending, blade to case clearance retention, containment wave effect on installation, effect on burst model, torque spike effects.

Table A-11. Examples of Significant Changes for Engines (Part 33) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
Turbine Engines					
5.	A change to the gas generator (core, turbine/compressor/ combustor) in conjunction with changes in approved operating limitations.	No	No	Yes	Change is associated with other changes that would affect engine thrust/power and operating limitations, and have affected the dynamic behavior of the engine, foreign object ingestion behavior (birds, hail storm, rain, ice shed), induction system icing capabilities. Assumptions used for certification may no longer be valid.
6.	A change from traditional metal to composite materials on an assembly or structure that provides a load path for the engine affecting the engine dynamic behavior and/or the engine inherent strength.	No	Yes	Yes	Change in principles of construction and design.

Table A-11. Examples of Significant Changes for Engines (Part 33) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
Piston Engines					
7.	Convert from mechanical to electronic control system.	Yes	Yes	No	Change in engine configuration: installation interface of engine changed. Changes to principles of construction: digital controllers and sensors require new construction techniques and environmental testing.
8.	Add turbocharger that increases performance and changes in overall product.	Yes	No	Yes	Change in general configuration: installation interface of engine changed (exhaust system). Certification assumptions invalidated: change in operating envelope and performance.

Table A-11. Examples of Significant Changes for Engines (Part 33) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
Piston Engines					
9.	Convert from air-cooled cylinders to liquid cooled cylinders.	Yes	No	Yes	Change to general configuration: installation interface of engine changed (cooling lines from radiator, change to cooling baffles). Certification assumptions invalidated: change in operating envelope and engine temperature requirements.
10.	A change from traditional metal to composite materials on an assembly or structure that provides a load path for the engine affecting the engine dynamic behavior and/or the engine inherent strength.	No	Yes	Yes	Change in principles of construction and design.

Table A-11. Examples of Significant Changes for Engines (Part 33) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
Piston Engines					
11.	Convert from spark-ignition to compression-ignition.	Yes	No	Yes	Change in general configuration: installation interface of engine changed (no mixture lever). Certification assumptions invalidated: change in operating envelope and performance.

A.4.3 Table A-12 contains examples of changes that are “not significant” for engines (part 33).

Table A-12. Examples of Not Significant Changes for Engines (Part 33)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
Turbine Engines					
1.	Change in the material from one type of metal to another type of metal of a compressor drum.	No	No	No	No change in performance. Assumptions are still valid.
2.	Increase/decrease in the number of compressor/turbine stages without resultant change in operational performance envelope.	No	No	No	No change in performance. Assumptions are still valid.

Table A-12. Examples of Not Significant Changes for Engines (Part 33) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
Turbine Engines					
3.	Hardware design changes to the FADEC/EEC, the introduction of which do not change the function of the system.	No	No	No	No change in configuration. Retrofitable. Assumptions used for certification are still valid. Possible changes in principles of construction are insignificant.
4.	Software changes.	No	No	No	
5.	Rub-strip design changes.	No	No	No	Component level change.
6.	A new combustor that does not change the approved limitations or dynamic behavior.* (*Exclude life limits.)	No	No	No	Component level change.
7.	Bearing changes.	No	No	No	Component level change.

Table A-12. Examples of Not Significant Changes for Engines (Part 33) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
Turbine Engines					
8.	New blade designs with similar material that can be retrofitted.	No	No	No	Component level change.
9.	Fan blade redesign that can be retrofitted.	No	No	No	Component level change.
10.	Oil tank redesign.	No	No	No	Component level change.
11.	Change from one hydro-mechanical control to another hydro-mechanical control.	No	No	No	Component level change.
12.	Change to limits on life limited components supported by data that became available after certification.	No	No	No	Extending or reducing the life limits. For example, extending life limits based on credits from service experience or new fatigue data.
13.	Changes to limits on exhaust gas temperature.	No	No	No	

Table A-12. Examples of Not Significant Changes for Engines (Part 33) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
Turbine Engines					
14.	Changes to Airworthiness Limitations section with no configuration changes.	No	No	No	
15.	Bump ratings within the product's physical capabilities that may be enhanced with gas path changes such as blade re-staggering, cooling hole patterns, blade coating changes, etc.	No	No	No	

Table A-12. Examples of Not Significant Changes for Engines (Part 33) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
Piston Engines					
16.	New or redesigned cylinder head, valves, or pistons.	No	No	No	
17.	Changes in crankshaft.	No	No	No	Component level change.
18.	Changes in crankcase.	No	No	No	Component level change.
19.	Changes in carburetor.	No	No	No	Component level change.
20.	Changes in mechanical fuel injection system.	No	No	No	
21.	Changes in mechanical fuel injection pump.	No	No	No	Component level change.

Table A-12. Examples of Not Significant Changes for Engines (Part 33) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
Piston Engines					
22.	Engine model change to accommodate new airplane installation. No change in principles of operation of major subsystems; no significant expansion in power or operating envelopes or in limitations.	No	No	No	
23.	A simple mechanical change, or a change that does not affect the basic principles of operation. For example, change from dual magneto to two single magnetos on a model.	No	No	No	

Table A-12. Examples of Not Significant Changes for Engines (Part 33) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
Piston Engines					
24.	Subsystem change produces no changes in base engine input parameters, and previous analysis can be reliably extended. For example, a change in turbocharger where induction system inlet conditions remain unchanged, or if changed, the effects can be reliably extrapolated.	No	No	No	
25.	Change in material of secondary structure or not highly loaded component. For example, a change from metal to composite material in a non-highly loaded component, such as an oil pan that is not used as a mount pad.	No	No	No	Component level change.

Table A-12. Examples of Not Significant Changes for Engines (Part 33) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
Piston Engines					
26.	Change in material that retains the physical properties and mechanics of load transfer. For example, a change in trace elements in a metal casting for ease of pouring or to update to a newer or more readily available alloy with similar mechanical properties.	No	No	No	Component level change.

A.5 Examples of Substantial, Significant, and Not Significant Changes for Propellers (Parts 35).

A.5.1 Table A-13 contains an example of a change that is "substantial" for propellers (part 35).

Table A-13. Example of a Substantial Change for Propellers (Part 35)

Example	Description of change	Notes
1.	Change in the number of blades.	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.

A.5.2 Table A-14 contains examples of changes that are "significant" for propellers (part 35).

Table A-14. Examples of Significant Changes for Propellers (Part 35)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
1.	Principle of pitch change such as a change from single acting to dual acting.	Yes	Yes	Yes	Requires extensive modification of the pitch change system with the introduction of back-up systems. The inherent control system requires re-evaluation.

Table A-14. Examples of Significant Changes for Propellers (Part 35) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
2.	Introduction of a different principle of blade retention such as a single row to a dual row bearing.	Yes	Yes	No	Requires extensive modification of the propeller hub and blade structure. The inherent strength requires re-evaluation.
3.	A hub configuration change such as a split hub to a one-piece hub.	Yes	Yes	No	Requires extensive modification of the propeller hub structure. The inherent strength requires re-evaluation.
4.	Changing the method of mounting the propeller to the engine such as a spline to a flange mount.	Yes	Yes	No	Requires extensive modification of the propeller hub structure. The inherent strength requires re-evaluation.

Table A-14. Examples of Significant Changes for Propellers (Part 35) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
5.	Change in hub material from steel to aluminum.	Yes	Yes	No	Requires extensive modification of the propeller hub structure and change to method of blade retention. The inherent strength requires re-evaluation.
6.	Change in blade material from metal to composite.	Yes	Yes	Yes	Requires extensive modification of the propeller blade structure and change to method of blade retention. Composite construction methods required. The inherent strength requires re-evaluation.

Table A-14. Examples of Significant Changes for Propellers (Part 35) (continued)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
7.	Change from hydro-mechanical to electronic control.	Yes	Yes	Yes	Electronic manufacturing and design methods required. Assumptions used for certification are no longer valid or not addressed in the original certification, i.e., HIRF and lightning protection, fault tolerance, software certification, and other aspects.

A.5.3 Table A-15 contains examples of changes that are “not significant” for propellers (part 35).

Table A-15. Examples of Not Significant Changes for Propellers (Part 35)

Example	Description of change	Is there a change to the general configuration? § 21.101(b)(1)(i)	Is there a change to the principles of construction? § 21.101(b)(1)(i)	Have the assumptions used for certification been invalidated? § 21.101(b)(1)(ii)	Notes
1.	Change in the material of a blade bearing.	No	No	No	Component level change.
2.	Change to a component in the control system.	No	No	No	Component level change.
3.	Change to a propeller de-icer boot.	No	No	No	Component level change.
4.	Changes to the operational design envelope such as increase in power.	No	No	No	Propeller’s operating characteristics and inherent strength require re-evaluation.
5.	Change to the intended usage such as normal to acrobatic category.	No	No	No	Propeller’s operating characteristics and inherent strength require re-evaluation.

APPENDIX B. APPLICATION CHARTS FOR CHANGED PRODUCT RULE

Table B-1. Application Chart for § 21.101(a) and (b) and § 21.19

<table>
<tr><td>Substantial
(§ 21.19)</td><td colspan="4">Significant
(§ 21.101(a) and (b))</td><td colspan="2">Not Significant
(§ 21.101)(b)(1))</td></tr>
<tr><td rowspan="3">Substantially changed product
Compliance to all latest regulatory standards required for product certification.
Previously approved type design and compliance data may be allowed if valid for the changed product.</td><td colspan="3">Affected area
(Changed and/or affected areas)
New showing of compliance is required</td><td rowspan="3">Unaffected area
No new showing of compliance is required.
Unaffected area continues to comply with the existing certification basis.</td><td rowspan="3">Affected area
(Changed and/or affected areas)
New showing of compliance is required.
The applicant may propose a certification basis using an earlier amendment but not earlier than in the existing TC basis.</td><td rowspan="3">Unaffected area
No new showing of compliance is required.
Unaffected area continues to comply with the existing certification basis.</td></tr>
<tr><td colspan="2">Compliance with the latest amendment materially contributes to safety</td><td>No material contribution to safety</td></tr>
<tr><td>Practical</td><td>Impractical
The applicant may propose a certification basis using earlier regulatory requirement(s), but not earlier than the existing TC basis.</td><td>The applicant may propose a certification basis using earlier regulatory requirement(s), but not earlier than the existing TC basis.</td></tr>
<tr><td colspan="7">Certification Basis Proposed by Applicant</td></tr>
<tr><td colspan="2">New certification basis using latest regulatory standards.</td><td colspan="2">Latest regulatory standards, with earlier amendments with supporting rationale.</td><td>Existing certification basis.</td><td>Existing certification basis including elect to comply.</td><td>Existing certification basis.</td></tr>
<tr><td colspan="7">FAA Resultant Type Certification Basis</td></tr>
<tr><td colspan="2">New certification basis using the latest regulatory standards, and special conditions if required.</td><td colspan="2">New certification basis using the latest regulatory standards with earlier approved amendments, and special conditions if required.</td><td>Existing certification basis.</td><td>Existing certification basis (if adequate); if not, first appropriate later amendment(s) and/or special condition including elect to comply.</td><td>Existing certification basis.</td></tr>
</table>

Table B-2. Application Chart for § 21.101(c) Excepted Products

<table>
<tr><td colspan="4">Affected Area
(Changed areas and/or unchanged but affected)

New showing of compliance is required.</td><td>Unaffected Area
No new showing of compliance is required.
Unaffected area continues to be compliant with the existing TC basis.</td></tr>
<tr><td colspan="5">Type Certification Basis Proposed by Applicant</td></tr>
<tr><td colspan="4">The existing TC basis, including “elects to comply.”</td><td>The existing TC basis.</td></tr>
<tr><td colspan="3">Found by the FAA to be “significant in an area.”</td><td>Not significant in an area.</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Compliance with a later amendment materially contributes to safety.</td><td rowspan="2">No material contribution to safety.</td><td rowspan="2"></td></tr>
<tr><td>Practical</td><td>Impractical</td></tr>
<tr><td colspan="5">FAA Resultant Type Certification Basis</td></tr>
<tr><td>The latest amendment designated by the FAA including special conditions and including elect to comply.</td><td colspan="3">The existing TC basis. If inadequate, the first appropriate later amendment. If not appropriate, add special conditions, including elect to comply.</td><td>The existing TC basis.</td></tr>
</table>

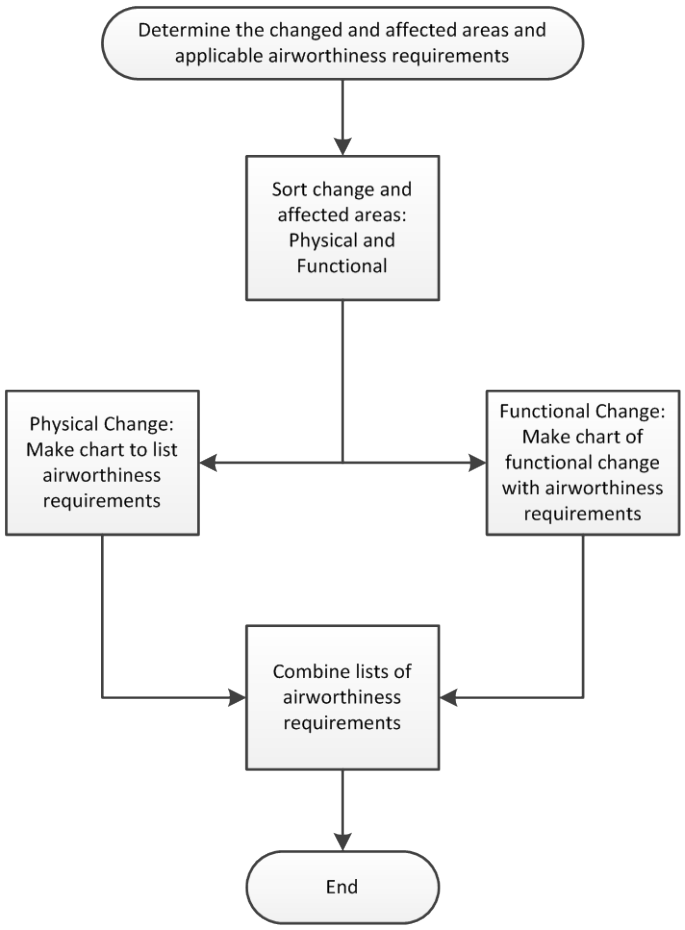
APPENDIX C. A METHOD TO DETERMINE THE CHANGED AND AFFECTED AREAS

C.1 Overview.

C.1.1 When you make a change to a product, some areas you change physically, while others you change functionally. The FAA refers to this combination as changed and affected areas. For example, if you extend the wing of a fixed wing aircraft, you would physically change the wing tip and likely other wing structure. Some areas of the airframe may have sufficient strength for the increase in load and would change functionally, i.e., carry greater load, but it would not change physically. These areas have associated airworthiness requirements, which become part of the certification basis for the change.

C.1.2 Figure C-1 below provides an overview of one method you can use to determine the changed and affected areas and the applicable airworthiness requirements.

Figure C-1. Method to Determine the Changed and Affected Areas



C.2 Physical Changes.

C.2.1 Steps.

- Step 1. Make a list of the physical changes.
- Step 2. List the corresponding airworthiness requirements applicable to the physical changes.
- Step 3. List the amendment level recorded on the existing certification basis of the baseline product and the amendments on the date of application.

C.2.2 Example.

The change is adding a winglet to a fixed wing aircraft and a change to the leading edge slats for a performance increase. As part of the change, you modify an electrically driven slat actuator by changing the mounting structure of the actuator used to connect the actuator to the slat. The actuator structure is changed. The electrical system in the actuator is not affected. You would list airworthiness requirements applicable to the actuator. You would not list the airworthiness requirements applicable to the electrical system of the actuator. See table C-1 below for an example of how to chart a physical change and the associated airworthiness requirements.

Table C-1. Example of Associating a Physical Change with the Applicable Airworthiness Requirements

Physical Change	Applicable Regulations*	Amendment of Existing Certification Basis	Amendment on Application Date
Structural change to slat actuator	§ 25.xxx	25-aaa	25-ddd
	§ 25.yyy	25-bbb	25-eee
	§ 25.zzz	25-ccc	25-fff

* These would be airworthiness requirements related to structural aspects only.

C.3 Functional Changes.

C.3.1 Steps.

- Step 1. Describe each change.
- Step 2. Describe the effects of the change (e.g., structural, performance, electrical, etc.).
- Step 3. List the areas, system, component, and appliance that are affected by that effect.

- Step 4. List the airworthiness requirements associated with the effect for each area, system, component, or appliance.
- Step 5. List the amendment level recorded on the existing certification basis of the baseline product and the amendments on the date of application.

C.3.2 Example.

The change is adding a winglet to a fixed wing aircraft and a change to the leading edge slats for a performance increase. The wing root bending moment has increased. The loads in the wing box are increased but the wing box has sufficient structural margins to carry the higher loads. Thus, the wing box is not physically changed but its function has changed because it carries greater loads. See table C-2 below for an example of how to chart a functional change, its effects, and the affected areas (steps 1 through 3 above). See table C-3 below for an example of how to chart an area affected by a functional change and the associated airworthiness requirements (steps 4 and 5 above).

Table C-2. Example of a Functional Change, Affected Areas, and Associated Effects

Description of Change	Effects	Affected Areas
Installation of winglet	Increased loads in wing structure	Wing spars
		Wing skins
	Effect 2*	Area 1
		Area 2
	Effect 3*	Area 3

* There may be other effects as well.

Table C-3. Example of Associating Affected Areas with the Applicable Airworthiness Requirements

Impacted Area	Applicable Regulations*	Amendment of Existing Certification Basis	Amendment on Application Date
Wing spar	§ 25.xxx	25-aaa	25-ddd
	§ 25.yyy	25-bbb	25-eee
	§ 25.zzz	25-ccc	25-fff

* These would be structural airworthiness requirements only. There could be other requirements applicable to the wing box. But since the effect is structural, then only the structural requirements are applicable.

C.4 Combine the Lists.

C.4.1 The FAA typically presents the certification basis for a product by regulation and not by area. The next step is to combine these two lists. However, since you are only changing a portion of the product, you will need to identify the changed and affected area of the new certification basis. The unchanged area is not required to comply with the airworthiness requirements in effect at the date of application. (See § 21.101(b)(2).)

C.4.2 When the change is quite extensive, you will save time by listing all the airworthiness requirements applicable to the category of product you are certifying. You can use table C-4 below in the next step where you will identify other exceptions you would like the FAA to consider.

C.4.3 Example.

If we use the examples above for the combined list for the actuator structural changes and the wing box functional change, then you would list the certification basis as shown in table C-4 below.

Table C-4. Example of a Combined List of Physical and Functional Changes with Applicable Airworthiness Requirements

14 CFR Section	Amendment Levels		Change and Affected Area
	Amendment of Existing Certification Basis	Amendment on Application Date	
§ 25.xxx*	25-aaa	25-ddd	• Wing spar • Leading edge actuator • Wing loads
§ 25.yyy*	25-bbb	25-eee	
§ 25.zzz*	25-ccc	25-fff	

* These represent structural requirements.

APPENDIX D. OTHER GUIDANCE FOR AFFECTED AREAS

D.1 Sample Questions in Determining Affected Areas.

Below are sample questions to assist in determining whether an area is affected by the change. If the answer to any of these questions is yes, then the area is considered affected.

1. Is the area changed from the identified baseline product?
2. Is the area impacted by a significant product level change?
3. Is there a functional effect on the unchanged area by a change to the system or system function that it is a part of?
4. Does the unchanged area need to comply with a system or product level requirement that is part of the change?
5. Are the product level characteristics affected by the change?
6. Is the existing compliance for the area invalidated?

D.2 Sub-Areas within an Affected Area.

Within areas affected by a change, there may be "sub-areas" of the area that are not affected. For those sub-areas, the amendment levels at the existing certification basis remain valid, along with the previous compliance findings. For example, if a passenger seat fitting is changed as part of a significant change, then the structure of the seat is affected. Thus, the amendment level for §§ 25.561 and 25.562, along with other applicable structural requirements, would be at the amendment level on the date of application (unless an exception is granted). However, the seat fabric is not affected, so the amendment level for § 25.853 (flammability) may remain at the existing certification basis, and a new compliance finding would not be required.

APPENDIX E. PROCEDURE FOR EVALUATING MATERIAL CONTRIBUTION TO SAFETY OR IMPRACTICALITY OF APPLYING LATEST REQUIREMENTS TO A CHANGED PRODUCT

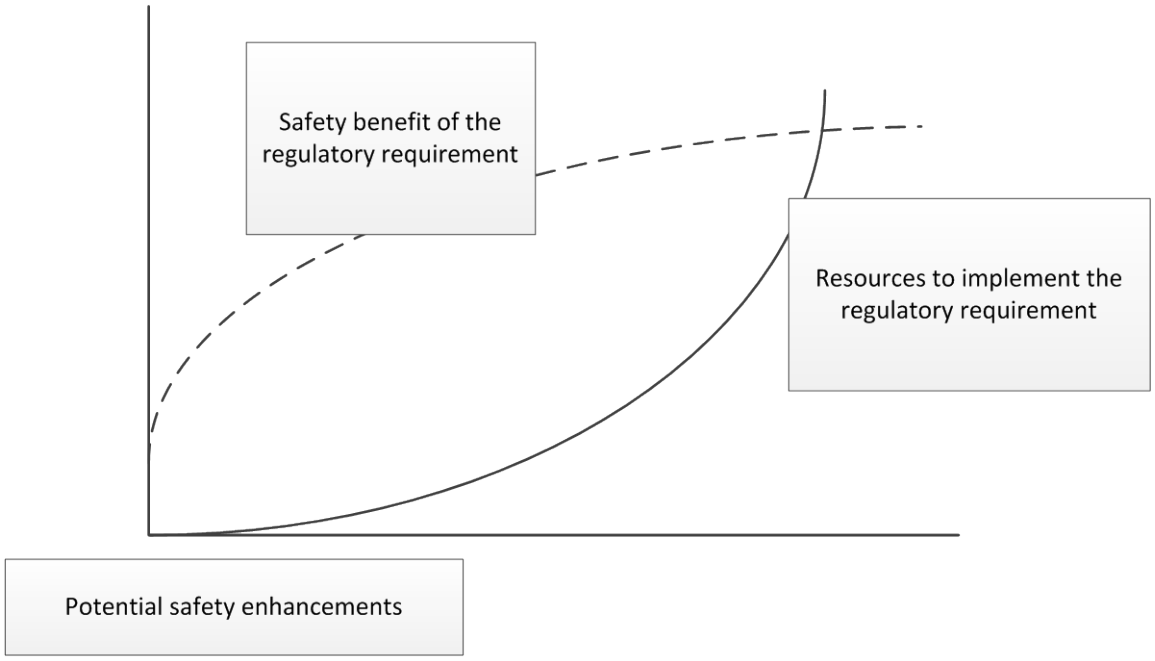
E.1 Introduction.

E.1.1 The basic principle of enhancing the level of safety of changed aeronautical products is to apply the latest regulations for significant design changes to the greatest extent practical. In certain cases, the cost of complying fully with a later regulation may not be commensurate with the small safety benefit achieved. These factors form the basis where compliance with the latest standard may be considered impractical, thereby allowing compliance with an earlier regulation. This appendix gives one method of determining if compliance with a later regulation is impractical; however, it does not preclude the use of other methods for improving the safety of aeronautical products.

E.1.2 The FAA recognizes that other procedures can be used and have historically been accepted on a case-by-case basis. The acceptance of results through the use of these procedures may vary from State to State. Consequently, they may not be accepted through all bilateral certification processes. Regardless of which method is used, the process must show that a proposed certification basis is able to achieve a positive safety benefit for the overall product.

E.1.3 In regard to impractical, any method used must encourage incorporating safety enhancements that will have the most dramatic impact on the level of safety of the aircraft while considering effective use of resources. This important point is illustrated graphically in figure E-1 below. This figure notionally shows the interrelation between the total resources required for incorporating each potential safety enhancement with the corresponding net increase in safety benefit.

Figure E-1. Safety Benefits versus Resources



E.1.4 Typically, you will find that, for impractical, there are proposals that can achieve a positive safety benefit that are resource effective. Conversely, there are proposals that may achieve a small safety benefit at the expense of a large amount of resources to implement. Clearly, there will be a point where a large percentage of the potential safety benefit can be achieved with a reasonable expenditure of resources. The focus of the methods used should be to determine the most appropriate regulatory standards relative to the respective incremental cost to reach this point.

E.1.5 This appendix provides procedural guidance for determining the material contribution to the level of safety, or the practicality of applying a requirement at a particular amendment level to a changed product. The procedure is generic in nature and describes the steps and necessary inputs that you can use on any project to develop a position.

E.1.6 The procedure is intended to be used, along with good engineering judgment, to evaluate the relative merits of a changed product complying with the latest regulations. It provides a means, but not the only means, for you to present your position regarding an exception under § 21.101(b)(3).

E.1.7 The certification basis for a change to a product will not be at an amendment level earlier than the existing certification basis or any requirement found in §§ 23.2, 25.2, 27.2, and 29.2, or part 26, that is related to the change.

E.2 **Procedure for Evaluating Material Contribution or Impracticality of Applying Latest Requirements to a Changed Product.**

The following are steps to determine the material contribution or impracticality of applying a requirement at a particular amendment level.

E.2.1 Step 1: Identify the Regulatory Change being Evaluated.

In this step, document—

E.2.1.1 The specific requirement (e.g., § 25.365),

E.2.1.2 The amendment level of the existing certification basis for the requirement, and

E.2.1.3 The latest amendment level of the requirement.

E.2.2 Step 2: Identify the Specific Hazard that the Requirement Addresses.

E.2.2.1 Each requirement and subsequent amendments address a hazard or hazards. In this step, the specific hazard(s) is identified. This identification will allow for a comparison of the effectiveness of amendment levels of the regulation at addressing the hazard.

E.2.2.2 In many cases, the hazard and the cause of the hazard will be obvious. When the hazard and its related cause are not immediately obvious, it may be necessary to review the preamble of the regulation. It may also be helpful to discuss the hazard with the responsible FAA office.

E.2.3 Step 3: Review the Consequences of the Hazard(s).

E.2.3.1 Once the hazard is identified, it is possible to identify the types of consequences that may occur due to the hazard. More than one consequence can be attributed for the same hazard. Typical examples of consequences would include, but are not limited to—

- Incidents where only injuries occurred,
- Accidents where a total hull loss occurred,
- Accidents where less than 10 percent of the passengers died,
- Accidents where 10 percent or more passengers died, and
- Engine- and propeller-specific hazards.

E.2.3.2 The preamble to the regulation may provide useful information regarding the consequences of the hazard that the requirement addresses.

E.2.4 Step 4: Identify the Historical and Predicted Frequency of Each Consequence.

E.2.4.1 Another source for determining impracticality is the historical record of the consequences of the hazard that led to a requirement or an amendment to a requirement. From these data, a frequency of occurrence for the hazard can be determined. It is important to recognize that the frequency of occurrence may be higher or lower in the future. Therefore, it also is necessary to predict the frequency of future occurrences.

E.2.4.2 More than one consequence can be attributed for the same hazard. Therefore, when applicable, the combination of consequences and frequencies of those consequences should be considered together.

E.2.4.3 The preamble of the regulation may provide useful information regarding the frequency of occurrence.

E.2.5 Step 5: Determine How Effective Full Compliance with the Latest Amendment of the Requirement would be at Addressing the Hazard.

E.2.5.1 When each amendment is issued, it is usually expected that compliance with the requirement would be completely effective at addressing the associated hazard for the designs and technology envisioned at the time. It is expected the hazard would be eliminated, avoided, or mitigated. However, experience has shown that this may not always be the case. It is also possible that earlier amendment levels may have addressed the hazard but were not completely effective. A product may also contain a design feature(s) that provides a level of safety that approaches the latest regulations, yet is not fully compliant with the latest regulations. Therefore, in comparing the benefits of compliance with the existing certification basis to the latest amendment level, it is useful to estimate the effectiveness of both amendment levels in dealing with the hazard.

E.2.5.2 It is recognized that the determination of levels of effectiveness is normally of a subjective nature. Therefore, prudence should be exercised when making these determinations. In all cases, it is necessary to document the assumptions and data that support the determination.

E.2.5.3 The following five levels of effectiveness are provided as a guideline:

1. Fully effective in all cases. Compliance with the requirement eliminates the hazard or provides a means to avoid the hazard completely.
2. Considerable potential for eliminating or avoiding the hazard. Compliance with the requirement eliminates the hazard or provides a means to completely avoid the hazard for all probable or likely cases, but it does not cover all situations or scenarios.

3. Adequately mitigates the hazard. Compliance with the requirement eliminates the hazard or provides a means to avoid the hazard completely in many cases. However, the hazard is not eliminated or avoided in all probable or likely cases. Usually this action only addresses a significant part of a larger or broader hazard.
4. Hazard only partly addressed. In some cases, compliance with the requirement partly eliminates the hazard or does not completely avoid the hazard. The hazard is not eliminated or avoided in all probable or likely cases. Usually this action only addresses part of a hazard.
5. Hazard only partly addressed but action has negative side effect. Compliance with the requirement does not eliminate or avoid the hazard or may have negative safety side effects. The action is of questionable benefit.

E.2.5.4 If it is determined that compliance with the latest regulations does not contribute materially to the product's level of safety, skip Step 6 of this appendix and go directly to Step 7 to document the conclusion. If it is determined that complying with the latest amendment of the regulation contributes materially to the product's level of safety, continue to Step 6 of this appendix.

E.2.6 Step 6: Determine the Incremental Resource Costs and Cost Avoidance.

E.2.6.1 There is always cost associated with complying with a requirement. This cost may range from minimal administrative efforts to the resource expenditures that support full-scale testing or the redesign of a large portion of an aircraft. However, there are also potential cost savings from compliance with a requirement. For example, compliance with a requirement may avoid aircraft damage or accidents and the associated costs to the manufacturer for investigating accidents. Compliance with the latest amendment of a requirement may also help a foreign authority certificate a product.

E.2.6.2 When determining the impracticality of applying a requirement at the latest amendment level, only the incremental costs and safety benefits from complying with the existing certification basis should be considered.

E.2.6.3 When evaluating the incremental cost, it may be beneficial for you to compare the increase in cost of complying with the latest requirements to the cost of incorporating the same design feature in a new airplane. In many cases, an estimate for the cost of incorporation in a new airplane is provided in the regulatory evaluation by the FAA, which was presented when the corresponding regulation was first issued. Incremental costs of retrofit/incorporation on existing designs may be higher than that for production. Examples of costs may include, but are not limited to, the following:

Costs

The accuracies of fleet size projections, utilization, etc., may be different than that experienced for derived product designs and must be validated.

- Labor: Work carried out in the design, fabrication, inspection, operation, or maintenance of a product for the purpose of incorporating or demonstrating compliance with a proposed action. Non-recurring labor requirements, including training, for the applicant supporting development and production of the product, should be considered.
- Capital: Construction of new, modified, or temporary facilities for design, production, tooling, training, or maintenance.
- Material: Cost associated with product materials, product components, inventory, kits, and spares.
- Operating Costs: Costs associated with fuel, oil, fees, training, and expendables.
- Revenue/Utility Loss: Costs resulting from earning/usage capability reductions from departure delays, product downtime, and performance loss due to seats, cargo, range, or airport restrictions.
- The cost of changing compliance documentation and/or drawings in itself is not an acceptable reason for an exception.

Cost Avoidance.

- Avoiding cost of accidents, including investigation of accidents, lawsuits, public relations activities, insurance, and lost revenue.
- Foreign Certification: Conducting a single effort that would demonstrate compliance to the requirements of most certifying Authorities, thus minimizing certification costs.

E.2.7 Step 7: Document the Conclusion.

With the information from previous steps documented and reviewed, the applicant's position and rationale regarding whether complying with the latest regulations contributes materially to the product's level of safety or its practicality can be documented. The FAA records the determination of whether the conditions for the proposed exception were met. That determination is based on the information and analysis provided by the applicant in the preceding steps. If the determination to grant the exception is based on the product's design features, those features are documented at a high level in the TCDS. Documentation in the TCDS is required so that the features are maintained during subsequent changes to the product, therefore, maintaining the product's agreed level of safety. If the results of this analysis are inconclusive, then further discussions with the FAA are warranted.

E.3 Examples of How to Certify Changed Aircraft.

The following examples illustrate the typical process an applicant follows. The process will be the same for all product types.

E.3.1 Example 1: § 25.963, Fuel Tank Access Covers.

This example is part of a significant change to a transport airplane that increases passenger payload and gross weight by extending the fuselage 20 feet. To accommodate the higher design weights and increased braking requirements and to reduce runway loading, the applicant will change the landing gear from a two-wheel to four-wheel configuration; this changes the debris scatter on the wing from the landing gear. The FAA will require that the new model airplane comply with the latest applicable regulations based on the date of application.

The wing will be strengthened locally at the side of the body and at the attachment of engines and landing gear, but the applicant would not like to alter wing access panels and the fuel tank access covers. Although the applicant recognizes that the scatter pattern and impact loading on the wing from debris thrown from the landing gear will change, the applicant proposes that it would be impractical to redesign the fuel tank access covers.

Note: Sections 121.316 and 21.21(b)(2) may be additional reasons the FAA would require compliance with § 25.963(e), regardless of the significant determination.

E.3.1.1 Step 1: Identify the Regulatory Change being Evaluated.

The existing certification basis of the airplane that is being changed is part 25 prior to Amendment 25-69. Amendment 25-69 added the requirement that fuel tank access covers on transport category airplanes be designed to minimize penetration by likely foreign objects, and that they be fire resistant.

E.3.1.2 Step 2: Identify the Specific Hazard that the Regulation Addresses.

Fuel tank access covers have failed in service due to impact with high-energy objects such as failed tire tread material and engine debris following engine failures. In one accident, debris from the runway impacted a fuel tank access cover, causing its failure and subsequent fire, which resulted in fatalities and loss of the airplane. Amendment 25-69 will ensure that all access covers on all fuel tanks are designed or located to minimize penetration by likely foreign objects, and that they are fire resistant.

E.3.1.3 Step 3: Review the History of the Consequences of the Hazard(s).

There have been occurrences with injuries and with more than 10 percent deaths.

E.3.1.4 **Step 4: Identify the Historical and Predicted Frequency of Each Consequence.**

In 200 million departures of large jets—

- One occurrence with more than 10 percent deaths, and
- One occurrence with injuries.

There is no reason to believe that the future rate of accidents will be significantly different than the historical record.

E.3.1.5 **Step 5: Determine How Effective Full Compliance with the Latest Amendment of the Regulation would be at Addressing the Hazard.**

Considerable potential for eliminating or avoiding the hazard. Compliance with Amendment 25-69 eliminates the hazard or provides a means to avoid the hazard completely for all probable or likely cases. However, it does not cover all situations or scenarios.

E.3.1.6 **Step 6: Determine Resource Costs and Cost Avoidance.**

Costs.

- For a newly developed airplane, there would be minor increases in labor resulting from design and fabrication.
- There would be a negligible increase in costs related to materials, operating costs, and revenue utility loss.

Cost Avoidance.

- There were two accidents in 200 million departures. The applicant believes that it will manufacture more than 2,000 of these airplanes. These airplanes would average five flights a day. Therefore, statistically there will be accidents in the future if the hazard is not alleviated. Compliance will provide cost benefits related to avoiding lawsuits, accident investigations, and public relation costs.
- There are cost savings associated with meeting a single certification basis for FAA and foreign regulations.

E.3.1.7 **Step 7: Document the Conclusion.**

It is concluded that compliance with the latest regulation increases the level of safety at a minimal cost to the applicant. Based on the arguments and information presented by the applicant through the issue paper process, the FAA determined that meeting the latest amendment would be practical. Additionally, operators are required to comply with § 25.963(e) under § 121.316. The FAA has also found that fuel tank access covers that are not impact resistant and fire resistant located where a strike is likely is an unsafe feature or characteristic, which precludes issuance of a type certificate under § 21.21(b)(2).

E.3.2 Example 2: § 25.365, Pressurized Compartment Loads.

This example is a passenger-to-freighter conversion STC. This change affects the floor loads on the airplane as well as the decompression venting.

E.3.2.1 **Step 1: Identify the Regulatory Change being Evaluated.**

The existing certification basis of the airplane that is being changed includes § 25.365 at Amendment 25-00. The initial release of § 25.365 required that the interior structure of passenger compartments be designed to withstand the effects of a sudden release of pressure through an opening resulting from the failure or penetration of an external door, window, or windshield panel, or from structural fatigue or penetration of the fuselage, unless shown to be extremely remote.

Amendment 25-54 revised § 25.365 to require that the interior structure be designed for an opening resulting from penetration by a portion of an engine, an opening in any compartment of a size defined by § 25.365(e)(2), or the maximum opening caused by a failure not shown to be extremely improbable. The most significant change is the "formula hole size" requirement introduced into § 25.365(e)(2) at Amendment 25-54.

Amendment 25-71/72 (Amendments 25-71 and 25-72 are identical) extended the regulation to all pressurized compartments, not just passenger compartments, and to the pressurization of unpressurized areas. Pressurization of unpressurized areas had previously been identified as an unsafe feature under § 21.21(b)(2).

Amendment 25-87 redefined the pressure differential load factor that applies above an altitude of 45,000 feet. Compliance with Amendment 25-87 is not affected since the airplane does not operate above an altitude of 45,000 feet. The applicant proposes to meet the "pressurization into unpressurized areas" requirement introduced in Amendment 25-71/72. The applicant does not propose to comply with the formula hole size requirement introduced in § 25.365(e)(2) at Amendment 25-54.

E.3.2.2 **Step 2: Identify the Specific Hazard that the Regulation Addresses.**

The hazard is a catastrophic structure and/or system failure produced by a sudden release of pressure through an opening in any compartment in flight. This opening could be caused by an uncontained engine failure, an opening of a prescribed size due to the inadvertent opening of an external door in flight, or an opening caused by a failure not shown to be extremely improbable. The opening could be produced by an event that has yet to be identified.

E.3.2.3 **Step 3: Review the History of the Consequences of the Hazard(s).**

There have been occurrences with injuries, with less than 10 percent deaths and with more than 10 percent deaths.

E.3.2.4 **Step 4: Identify the Historical and Predicted Frequency of Each Consequence.**

In 200 million departures of large jets—

- Two occurrences with more than 10 percent deaths,
- One occurrence with less than 10 percent deaths, and
- One occurrence with injuries.

There is no reason to believe that the future rate of accidents will be significantly different than the historical record.

E.3.2.5 **Step 5: Determine How Effective Full Compliance with the Latest Amendment of the Regulation would be at Addressing the Hazard.**

Compliance with the latest amendment eliminates the hazard or provides a means to avoid the hazard completely.

Design changes made to the proposed airplane bring it closer to full compliance with § 25.365 at Amendment 25-54. The original airplane was shown to meet the requirements for a hole size of 1.1 square feet. Amendment 25-54 would require a hole size of 5.74 square feet, and the current reinforcements for the converted airplane can sustain a hole size of 3.65 square feet in the forward area and 2.65 square feet at the aft area. This is 3.1 and 2.4 times, respectively, better than the original design condition of Amendment 25-0 and is a significant improvement over the worldwide passenger fleet in service.

E.3.2.6 **Step 6: Determine Resource Costs and Cost Avoidance.**

Costs.

There would be savings in both labor and capital costs if compliance were shown to Amendment 25-0 instead of Amendment 25-54. Major modifications to the floor beams would be necessary to meet the formula hole size requirement in Amendment 25-54.

Cost Avoidance.

There were four accidents in 200 million departures. The applicant believes that it will manufacture more than 2,000 of these airplanes. These airplanes would average two flights a day. Therefore, statistically there will be accidents in the future if the hazard is not alleviated. Compliance will provide cost benefits related to avoiding lawsuits, accident investigations, and public relation costs.

There are cost savings associated with meeting a single certification basis for FAA and foreign regulations.

E.3.2.7 **Step 7: Document the Conclusion Regarding Practicality.**

The design complies with § 25.365 at Amendments 25-0, 25-71/72, and 25-87, and it is nearly in full compliance with Amendment 25-54. The

design would adequately address the hazard at an acceptable cost. Therefore, based on arguments of impracticality discussed in an issue paper, the FAA accepts the applicant's proposal to comply with § 25.365 at Amendment 25-0.

E.3.3 Example 3: § 25.981, Fuel Tank Ignition Prevention.

This example is part of a significant change to a transport airplane that increases passenger payload and gross weight by extending the fuselage 20 feet. To accommodate the longer fuselage, the applicant will modify systems wiring installations; this includes changing fuel tank system wiring. The new model airplane will be required to comply with the latest applicable regulations based on the date of application.

E.3.3.1 **Step 1: Identify the Regulatory Change Being Evaluated.**

The existing certification basis of the airplane that is being changed is part 25 prior to Amendment 25-102 but includes Amendment 25-40.

Note: If the original certification basis does not include Amendment 25-40, the certification basis should be considered not adequate for fuel tank ignition prevention.

The 2001 Fuel Tank Safety (FTS) rule adopted Amendment 25-102 to add explicit requirements in § 25.981(a)(3) for demonstrating that the design precludes fuel tank ignition sources that was required but had in several cases not been properly applied in demonstrating compliance to §§ 25.901 and 25.1309. Amendment 25-102, § 25.981(b), added a requirement to develop fuel tank system airworthiness limitations to maintain the ignition prevention features of the design. Section H25.4, Amendment 25-102, requires including those fuel tank system airworthiness limitations in the Airworthiness Limitations section of the Instructions for Continued Airworthiness (ICA).

Since the FAA policy for performing the failure analysis to demonstrate compliance with §§ 25.901 and 25.1309 at Amendment 25-40 and 25-46 was adopted in the explicit fuel tank ignition prevention failure analysis requirements of § 25.981(a)(3), the incremental requirement for demonstrating compliance to the ignition prevention requirements of Amendment 25-102 is to develop and implement the fuel tank system airworthiness limitations instead of developing Certification Maintenance Requirements in accordance with § 25.901(b)(2) at Amendments 25-40 through 25-46 and AC 25-19A.

E.3.3.2 **Step 2: Identify the Specific Hazard that the Regulation Addresses.**

The FAA issued the 2001 FTS rule to preclude fuel tank ignition sources because of a history of fuel tank explosions. The catastrophic TWA Flight 800 in-flight fuel tank explosion on July 17, 1996, caused the death of all 230 people onboard.

E.3.3.3 **Step 3: Review the History of the Consequences of the Hazard(s).**

There have been occurrences with injuries, with more than 10 percent deaths, less than 10 percent deaths, and no deaths.

E.3.3.4 **Step 4: Identify the Historical and Predicted Frequency of Each Consequence.**

The 1998 Aviation Rulemaking Advisory Committee Fuel Tank Harmonization Working Group report documents the historical frequency of fuel tank explosions as 16, which caused a total of 539 fatalities.

There have been two additional fuel tank explosions since that report was issued:

- March 3, 2001—Thai Airways International Flight 114 experienced a fuel tank explosion on the ground that caused 1 fatality and 3 serious injuries. The explosion and subsequent fire destroyed the airplane.
- May 4, 2006—A Malaysia Airlines Boeing 727 experienced a wing tank low pressure explosion during ground operations. There was no fire and no injuries. The wing structure suffered significant damage.

There is no reason to believe that the future rate of accidents will be significantly different than the historical record if fuel tank system airworthiness limitations are not included in the ICA as is permitted in earlier amendment levels.

E.3.3.5 **Step 5: Determine How Effective Full Compliance with the Latest Amendment of the Regulation would be at Addressing the Hazard.**

Considerable potential for eliminating or avoiding the hazard.

In the 2008 Fuel Tank Flammability Reduction (FTFR) rule, the FAA estimated compliance with the ignition prevention requirements of Amendment 25-102 together with the fuel tank ignition prevention airworthiness directives issued as a result of the Special Federal Aviation Regulation number 88 reviews resulted in the range of effectiveness in preventing fuel tank explosions between 25 to 75 percent with a median value of 50 percent (73 FR 42449).

E.3.3.6 **Step 6: Determine Resource Costs and Cost Avoidance.**

<u>Costs.</u>

- For newly developed designs, there would be minor increases in costs resulting from identification and implementation of fuel tank system airworthiness limitations.
- There would be no increase in costs related to materials, operating costs, and revenue utility loss.

Cost Avoidance.

There were 18 accidents in 200 million departures. The applicant believes that it will manufacture more than 2,000 of these airplanes or derivatives of these airplanes. These airplanes would average five flights a day. Therefore, statistically there will be accidents in the future if the hazard is not alleviated. Compliance will provide cost benefits related to avoiding fatalities and injuries.

E.3.3.7 **Step 7: Document the Conclusion.**

It is concluded that compliance with the latest regulation increases the level of safety at a minimal cost to the applicant. Based on the arguments and information presented by the applicant through the issue paper process, the FAA determined that meeting the latest amendment would be practical.

The following is additional background on the specific hazard the regulation addresses:

As stated in the 2001 FTS rule under "Changes to part 25," § 25.981(a)(3) was adopted because the previous regulations (§§ 25.901 and 25.1309) were not always properly applied.

Section 25.901(b)(2), Amendments 25-40 through 46, requires in part preventative maintenance as necessary to ensure that components of the powerplant installation, which includes the fuel tank system, will safely perform their intended function between inspections and overhauls defined in the maintenance instructions. When demonstrating compliance to the requirements of § 25.901(b) for maintenance of fuel tank ignition prevention features, the policy has been that the applicant identify critical features as critical maintenance requirements using the guidance in AC 25-19A.

APPENDIX F. THE USE OF SERVICE EXPERIENCE IN THE EXCEPTION PROCESS

F.1 Introduction.

Service experience may support the application of an earlier regulatory standard pursuant to § 21.101(b)(3) if, in conjunction with the applicable service experience and other compliance measures, the earlier standard provides a level of safety comparable to that provided by the latest requirements. The applicant must provide sufficient substantiation to allow the FAA to make this determination. A statistical approach may be used, subject to the availability and relevance of data, but sound engineering judgment must be used. For service history to be acceptable, the data must be both sufficient and pertinent. The essentials of the process involve—

- A clear understanding of the requirement change and the purpose for the change,
- A determination based on detailed knowledge of the proposed design feature,
- The availability of pertinent and sufficient service experience data, and
- A comprehensive review of that service experience data.

F.2 Guidelines.

The issue paper process (either as a stand-alone issue paper or included in the G-1 issue paper) would be used, and the applicant should provide documentation to support the following:

F.2.1 The identification of the differences between the requirement in the existing basis and the requirement as amended, and the effect of the change in the requirement.

F.2.2 A description as to what aspect(s) of the latest requirements the proposed changed product would not meet.

F.2.3 Evidence showing that the proposed certification basis for the changed product, together with applicable service experience, relative to the hazard, provides a level of safety that approaches the latest regulations, yet is not fully compliant with the latest regulations.

F.2.4 A description of the design feature and its intended function.

F.2.5 Data for the product pertinent to the requirement.

F.2.5.1 Service experience from such data sources such as—

- Accident reports,
- Incident reports,
- Service bulletins,
- Airworthiness directives,
- Repairs,

- Modifications,
- Flight hours/cycles for fleet leader and total fleet,
- World airline accident summary data,
- Service difficulty reports,
- National Transportation Safety Board reports, and
- Warranty, repair, and parts usage data.

F.2.5.2 Show that the data presented represent all relevant service experience for the product, including the results of any operator surveys, and is comprehensive enough to be representative.

F.2.5.3 Show that the service experience is relevant to the hazard.

F.2.5.4 Identification and evaluation of each of the main areas of concern with regard to—

- Recurring and/or common failure modes,
- Cause,
- Probability by qualitative reasoning, and
- Measures already taken and their effects.

F.2.5.5 Relevant data pertaining to aircraft of similar design and construction may be included.

F.2.5.6 Evaluation of failure modes and consequences through analytical processes. The analytical processes should be supported by—

- A review of previous test results,
- Additional detailed testing as required, or
- A review of aircraft functional hazard assessments (FHA) and any applicable system safety assessments (SSA) as required.

F.2.6 A conclusion that draws together the data and the rationale.

F.2.7 These guidelines are not intended to be limiting, either in setting the required minimum elements or in precluding alternative forms of submission. Each case may be different, based on the particulars of the system being examined and the requirement to be addressed.

F.3 Example: § 25.1141(f) for Transport Category Airplanes.

F.3.1 The following example, for transport category airplanes (§ 25.1141(f), APU Fuel Valve Position Indication System), illustrates the typical process an applicant follows. The process will be the same for all product types.

F.3.2 This example comes from a derived model transport airplane where significant changes were made to the main airframe components, engines and systems, and APU. The baseline airplane has an extensive service history. The example shows how the use of service experience supports a finding that compliance with the latest regulation would not contribute materially to the level of safety and that application of the existing certification basis (or earlier amendment) would be appropriate. The example is for significant derived models of transport airplanes with extensive service history. It illustrates the process, following the guidelines in this appendix, but does not include the level of detail normally required.

F.3.2.1 Determine the differences between the regulation in the existing certification basis and the regulation as amended, and the effect of the change in the regulation. The existing certification basis of the airplane that is being changed is the initial release of part 25. Amendment 25-40 added requirement § 25.1141(f), which mandates that power-assisted valves must have a means to indicate to the flightcrew when the valve is in the fully open or closed position, or is moving between these positions. The addressed hazard would be risk of APU fire due to fuel accumulation caused by excessive unsuccessful APU start attempts.

F.3.2.2 What aspect of the proposed changed product would not meet the latest regulations? The proposed APU fuel valve position indication system does not provide the flightcrew with fuel valve position or transition indication and, therefore, does not comply with the requirements of § 25.1141(f).

F.3.2.3 The applicant provides evidence that the proposed certification basis for the changed product, together with applicable service experience of the existing design, provide a level of safety that approaches yet is not fully compliant with the latest regulations. The APU fuel shut-off valve and actuator are unchanged from those used on the current family of airplanes, and have been found to comply with the earlier Amendment 25-11 of § 25.1141. The existing fleet has achieved approximately (#) flights during which service experience of the existing design has been found to be acceptable. If one assumes a complete APU cycle, i.e., start-up and shutdown for each flight, the number of APU fuel shut-off valve operations would be over 10^8 cycles, which demonstrates that the valve successfully meets its intended function and complies with the intent of the regulation.

F.3.2.4 The applicant provides a description of the design feature and its intended function. The fuel shut-off valve, actuator design, and operation is

essentially unchanged with the system design ensuring that the valve is monitored for proper cycling from closed to open at start. If the valve is not in the appropriate position (i.e., closed), then the APU start is terminated, an indication is displayed on the flightdeck, and any further APU starts are prevented. Design improvements using the capability of the APU electronic control unit (ECU) have been incorporated in this proposed product change. These design changes ensure that the fuel valve indication system will indicate failure of proper valve operation to the flightcrew, these features increase the level of functionality and safety, but the system does not indicate valve position as required by § 25.1141(f).

F.3.2.5 The FAA and applicant record this in an issue paper. The FAA can use the G-1 or a technical issue paper for this purpose. An issue paper was coordinated, included data, or referenced reports documenting relevant service experience compiled from incident reports, fleet flight hour/cycle data, and maintenance records. The issue paper also discussed existing and proposed design details, failure modes, and analyses showing to what extent the proposed airplane complies with the latest amendment of § 25.1141. Information is presented to support the applicant's argument that compliance with the latest amendment would not materially increase the level of safety. Comparative data pertaining to aircraft of similar design and construction are also presented.

F.3.2.6 The conclusion, drawing together the data and rationale, is documented in the G-1 issue paper. The additional features incorporated in the APU fuel shut-off valve will provide a significant increase in safety to an existing design with satisfactory service experience. The applicant proposes that compliance with the latest amendment would not materially increase the level of safety and that compliance with § 25.1141 at Amendment 25-11 would provide an acceptable level of safety for the proposed product change.

APPENDIX G. CHANGED PRODUCT RULE DECISION RECORD

CHANGED PRODUCT RULE (CPR) DECISION RECORD		
TC/STC No.: Click here to enter text.	**Project Number:** Click here to enter text.	
Step 1: Identify the proposed type design changes to the aeronautical product. (See paragraph 3.2 of AC 21.101-1B)	The proposed type design changes are identified here or in the following document(s): Click here to enter text.	
Note: The Issue Paper process is used to track/document the decisions at Step 2 and Steps 5 through 8 as required.		
Step 2: Is the proposed type design change substantial? (See paragraph 3.3 of AC 21.101-1B)	☐ Yes	**New Type Certificate:** Proceed to § 21.19. Section 21.101 does not apply. A G-1 issue paper will be used to establish and document the certification basis.
	☐ No	**Proceed to Step 3.**
Step 3: Will you use the latest standards? (See paragraph 3.4 of AC 21.101-1B)	☐ Yes	**Latest Requirements:** Propose a certification basis using the standards in effect at the date of application. **Proceed to Step 8.**
	☐ No	**Proceed to Step 4.**
Step 4: Arrange changes into related and unrelated groups. (See paragraph 3.5 of AC 21.101-1B)	**Note:** For multiple groupings, continuation of this process should be split into separate decision records. Groupings may be rationalized and recorded in separate documents: Click here to enter text.	
Step 5: Is each related or unrelated group a significant change? (See paragraph 3.6 of AC 21.101-1B)	☐ Yes	**Proceed to Step 6.**
	☐ No	**Earlier Requirements:** Propose a certification basis using the standards in effect before the date of application but not earlier than the existing certification basis. Certification basis to be defined and documented as indicated (below). **Proceed to Step 8.**
Step 6: Prepare your Certification Basis List. (See paragraph 3.9 of AC 21.101-1B) **Affected Areas:**	The **Affected Area(s)** are detailed here or in the following Certification Basis List document number(s): Click here to enter text. Process and propose each applicable requirement individually. **Proceed to Step 7.**	
Not Affected Areas:	**Existing Requirements:** You may continue using the existing certification basis.	
Step 7: Do the latest requirements contribute materially to the level of safety and are they practical? (See paragraph 3.10 of AC 21.101-1B)	☐ Yes	**Latest Requirements:** Propose a certification basis using the standards in effect on the date of application.
	☐ No	**Earlier Requirements:** You may propose a certification basis using the standards in effect before the date of application but not earlier than the existing certification basis. Certification basis defined or documented as indicated below.
☐ Continuation Sheet(s) Attached	**Note:** Several standards may apply to each affected area, and the assessment may differ from standard to standard. Indicate "**Yes**" if compliance with any latest standard(s) is required. Indicate "**No**" only if earlier standards are proposed.	
Note:	You may submit a proposal for the decision in Step 7; however, the FAA will make the final certification basis determination.	
Step 8: Ensure the proposed certification basis is adequate. (See paragraph 3.11 of AC 21.101-1B)	If you deem that the certification basis is adequate, submit proposed certification basis to the FAA. If not, consult the FAA. A G-1 issue paper may be needed to document the certification basis.	
Certification Basis:	The certification basis is detailed here or in the following document(s): Click here to enter text.	
Based on the information provided above, I am proposing the certification basis with the following classification for the type design change. (check one) ☐ Significant, pursuant to § 21.101. ☐ Not significant, pursuant to § 21.101. Click here to enter text. / Printed Name/Title Signature Click here to enter text. / Date		

APPENDIX H. EXAMPLES OF DOCUMENTING THE PROPOSED CERTIFICATION BASIS LIST

H.1 **Example 1.**

H.1.1 This optional tool may be used to establish the applicable airworthiness regulations that will be the certification basis. For a significant change, the applicant must show compliance for the change and the area affected by the change to the airworthiness requirements that were in effect at the date of application. However, in some cases earlier requirements can be used, as allowed in § 21.101.

H.1.2 In order to efficiently determine and agree upon a certification basis with the FAA, the following information is useful to understand your position:

H.1.2.1 The scope of the change. This includes a high level description of the physical and functional changes and performance/functional characteristics, which are changed as a result of the physical or functional change, and the regulations for which showing compliance is required as a result of the change.

H.1.2.2 The amendment level of all the applicable airworthiness requirements at the date of application.

H.1.2.3 Your proposed certification basis, including amendment levels.

H.1.2.4 If you propose a certification basis that includes amendment levels earlier than what was in effect at the date of application, include the exception as outlined in § 21.101 and your justification if needed.

H.1.3 <u>Exceptions.</u>

H.1.3.1 Unrelated changes that are not significant (§ 21.101(b)(1)).

H.1.3.2 Not affected by the change (§ 21.101(b)(2)).

H.1.3.3 Compliance to the regulation would not contribute materially to the level of safety (§ 21.101(b)(3)).

H.1.3.4 Compliance to the regulation would be impractical (§ 21.101(b)(3)).

H.1.4 One easy way to document the proposed certification basis is using a tabular form as shown in table H-1 below.

Table H-1. Tabular Form for Documenting a Proposed Certification Basis

14 CFR Section	Amendment Levels			Applicant Justification for Lower Amendment Level and Comments	Affected Area
	Existing TCDS Amendment	Amendment at Date of Application	Proposed Amendment Level		
Subpart A – General					
Subpart B – Flight					

H.1.5 Best Practices.

H.1.5.1 Account for all regulations, even if they are not applicable.

H.1.5.2 Mark regulations that are not applicable as N/A.

H.1.5.3 If more than one amendment level is used depending on the area of the aircraft, list all areas and amendment levels at each area with proper justification.

H.1.5.4 If the justification is long, provide the justification below the table and only place the regulatory reference and note in the comment field.

H.1.5.5 Include airworthiness regulations required by other 14 CFR parts (e.g., parts 91, 121, 125, 135) of affected areas.

H.2 **Example 2.**

Pages H-3 through H-9 of this appendix contain another example for documenting a proposed certification basis.

Title of Design Change

Product Name or Change to Type Certificate [XXXX]

Proposed Certification Basis Pursuant to 14 CFR 21.101

1. INTRODUCTION.

1.1 REFERENCE DOCUMENTS.

Reference	Title
[1] Section 21.101	Designation of applicable regulations
[2] AC 21.101-1B	Establishing the Certification Basis of Changed Aeronautical Products
[3] XXXX	Application letter
[4] Type Certificate YYYY	Product type certification basis
[5] Document ZZZZ	Certification plan
[6]	

<The above referenced documents are examples. Each applicant should reference documents appropriate to their products and procedures.>

1.2 ACRONYMS.

Acronym	Meaning
AC	Advisory Circular
AFM	Airplane Flight Manual
ELOS	Equivalent Level of Safety
IP	Issue Paper
MOC	Means of Compliance
SC	Special Condition
TC	Type Certificate

<This section constitutes a representative list of acronyms. Each applicant should provide an acronym list appropriate for their product and document.>

1.3 PURPOSE OF THE DOCUMENT.

The purpose of this document is to propose the certification basis applicable to [Product Design Change] in accordance with 14 CFR 21.101.

<Note that this optional document is intended to be used for changes to type certificated products for which the change or a portion of the change is significant at the product level pursuant to § 21.101. Not significant changes being accomplished concurrently with significant changes(s) would also be identified in this document.>

1.4 PURPOSE OF THE CHANGE.

High-level description of the project (e.g., Airplane Model 123 is being modified from a passenger configuration to an all-cargo configuration).

2. DESIGN DEFINITION.

2.1 BASELINE PRODUCT.

The type design to be changed, which is also known as the "baseline product," is the Model Series___ (this should be a specific product configuration, such as a specific serial number or line number).

The reference product certification basis is TCDS No. [XXXX], issued on [DATE].

2.2 DESIGN CHANGE AND BASELINE PRODUCT COMPARISON SUMMARY.

<Example table where the product is an airplane. This is a representative set of data that may be provided by the applicant.>

Specification	Model Series X	Model Series Y
Max Taxi Weight – MTW (lbs)	A1	A2
Max Takeoff Weight – MTOW (lbs)	B1	B2
Max Landing Weight – MLW (lbs)	C1	C2
Max Zero Fuel Weight – MZFW (lbs)	D1	D2
Max Length (ft, in)	E1	E2
Max Height (ft, in)	F1	F2
Wing Span (ft, in)	G1	G2
Horizontal Tail Span (ft, in)	H1	H2
Fuel Capacity (gal)	I1	I2
Total Cargo Volume (ft^3)	J1	J2
Max Passenger Limit – one class seating (occupants)	K1	K2
Engine Types	L1 & M1	L2
Maximum Engine Thrust	T1	T2

2.3 DESCRIPTION OF DESIGN CHANGE, GROUPING AND CLASSIFICATION.

2.3.1 SIGNIFICANT CHANGE(S).

<Describe here the stand-alone change(s) and/or change grouping(s) that are part of the proposed changed product and are proposed as significant. Include with each stand-alone change or change grouping the relevant accumulated change(s) and the applicable physical and/or functional effects. Note, the description should be detailed enough to identify why the change or change grouping is proposed as significant.>

The following group of changes is proposed as significant based on [AC 21.101-1, Appendix A, "[Description of Change in Appendix A]] or [the general configuration is not retained, principles of construction are not retained, or assumptions for certification of the product to be changed do not remain valid].

Changes Related to [Title of Significant Change X]:

[Title of High-Level Change C1]

The areas of physical change are:

- [design change xx]
- [design change yy]
- [design change zz]

The areas unchanged but affected by the change are:

- [affected area aaa]
- [affected area bbb]
- [affected area ccc]

[Title of High-Level Change C2]…..

2.3.2 UNRELATED NOT-SIGNIFICANT CHANGES.

<Describe here the stand-alone changes or change groupings that are part of the modification but are unrelated to any of the significant changes described in paragraph 2.3.1.>

[Title of High-Level Change D1]. [Description].

<The description must be just detailed enough to serve its purpose, which is to identify why each of those changes is not-significant and unrelated.>

[Title of High-Level Change D2]. [Description]…..

3. IDENTIFICATION OF APPLICABLE REQUIREMENTS.

3.1 PROPOSED CERTIFICATION BASIS.

Based on the effective application date, [date], under the provisions of § 21.101, the applicable type certification standards for the [Title of Design Change] are proposed as

follows. The proposed certification basis includes exceptions to earlier amendments, exemptions, special conditions, and equivalent level of safety findings.

3.1.1 Requirements Effective at the Date of Application.

Applicable requirements in effect on the date of the application are:

<List the applicable parts and amendment levels here.>

Example for FAA transport airplane:

- 14 CFR 25 through Amendment 25-138.
- 14 CFR 26 through Amendment 26-6.
- 14 CFR 34 through Amendment 34-5A.
- 14 CFR 36 through Amendment 36-29.

3.1.2 Section 21.101 Exception Rationale.

The completed rationale for each does not contribute materially to the level of safety (DCMLS) or impractical exception is provided in this section.

Exception 1:

Exception 2: ….

3.1.3 Optional Requirements

Applicable requirements in effect on the date of the application are:

<List the applicable parts and amendment levels here.>

Example for FAA transport airplane:

- 14 CFR 25.1419, *Ice protection*, Amendment 25-129.
- 14 CFR 25.1535, *ETOPS approval*, Amendment 25-120.

3.1.4 Requirements in Other 14 CFR Parts

Applicable requirements in effect on the date of the application are:

<List the applicable parts and amendment levels here.>

Example for FAA transport airplane:

- 14 CFR 121.215, *Cabin interiors*, Amendment 121-84.
- 14 CFR 121.316, *Fuel tanks*, Amendment 121-293.

3.1.5 Proposed Special Conditions.

Special Condition (or TBD)	Title	Effective Date (or TBD)

3.1.6 Equivalent Level of Safety.

ELOS Memo No. (or TBD)	Title	Applicable Regulation

3.1.7 Exemptions.

Exemption No. (or TBD)	Title	Applicable Regulation	Date Issued (or TBD)

Proposed Certification Basis

The certification basis is a complete extract from the applicable 14 CFR part **[A]** and reference the type design certification basis **[B]**. Column **[C]** identifies the specific requirement amendment level on the date of application. The changed product's certification basis is proposed in last column **[D]**.

Example for a part 25 airplane:

[A] **Requirement**	**Title (or subparagraph)**	**[B]** **Existing Type Design Amendment Level**	**[C]** **Amendment Level on Application Date**	**[D]** **Proposed Amendment for Changed Product**	**Applicable Area**	**Notes**
25.25	*Weight Limits*					
		25-23	25-63	25-63	Product	
25.33	*Propeller speed and pitch limits*					
		N/A	25-72	N/A	—	Not applicable to Change Product (Jet Aircraft)
25.1309(a)	*Equipment, systems, and installations*					
		25-41	25-123	25-123	Changed and Affected Areas	
		25-41	25-123	25-41	Exception—Not Affected	See example 1 in section 3.1.2
25.1703	*Function and installation: EWIS*					
		N/A	25-123	N/A	Exception—Product	See example 2 in section 3.2.1

APPENDIX I. RELATED DOCUMENTS

I.1 Related 14 CFR Regulations.

- Section 21.16, *Special conditions*.
- Section 21.17, *Designation of applicable regulations*.
- Section 21.19, *Changes requiring a new type certificate*.
- 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*.
- Section 21.93, *Classification of changes in type design*.
- Section 21.101, *Designation of applicable regulations*.
- Section 21.115, *Applicable requirements*.

I.2 FAA Orders.

- Order 8110.4C, *Type Certification*.
- Order 8110.48A, *How to Establish the Certification Basis for Changed Aeronautical Products*.
- Order 8110.56A, *Restricted Category Type Certification*.
- Order 8110.115, *Certification Project Initiation and Certification Project Notification*.

I.3 How to Get Publications.

I.3.1 Order copies of 14 CFR parts from the Superintendent of Documents, Government Printing Office, P.O. 979050, St. Louis, MO 63197. For general information telephone (202) 512-1800 or fax (202) 512-2250. You can order copies online at www.access.gpo.gov. Select “Access” then “Online Bookstore.” Select “Aviation,” then “Code of Federal Regulations.”

I.3.2 Order copies of FAA orders and ACs from the U.S. Department of Transportation, Subsequent Distribution Office, M-30, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD, 20785. You can also get copies from the FAA website.

APPENDIX J. DEFINITIONS AND TERMINOLOGY

J.1 Aeronautical Product.

The terms "aeronautical product" or "product" used in this guidance material includes type certificated aircraft, engines, and propellers

J.2 Assumptions Used for Certification.

The assumptions used for certification are the evaluations and decisions that led to the approval of the baseline product's characteristics. Examples of the product's baseline characteristics include, but are not limited to—

- Design methodologies, methods of compliance, and standards used to achieve compliance to the regulations making up the certification basis;
- Structural, mechanical, electrical, propulsion, aerodynamic, performance, operational, and maintenance characteristics;
- Operational and flight envelopes defining the product performance and capabilities at specified weights, speeds, altitudes, load factors, and centers of gravity;
- Crashworthiness;
- Role or mission;
- Airworthiness and operational limitations; or
- Pilot training, if necessary.

J.3 Baseline Product.

It is an aeronautical product with a specific, defined approved configuration and certification basis that the applicant proposes to change.

J.4 Certification Basis.

The applicable airworthiness requirements as established in §§ 21.17 and 21.101, as appropriate, special conditions, equivalent level of safety findings, requirements under § 21.21(b)(2), and exemptions applicable to the product to be certificated.

J.5 Design Change.

A change in the type design of an aeronautical product. In the context of this document, the terms "change," "modification," "design change," and "type design change" are synonymous.

J.6 **Earlier Requirements.**

The requirements in effect prior to the date of application for the change, but not prior to the existing certification basis.

J.7 **Existing Certification Basis.**

The requirements incorporated by reference in the type certificate of the baseline product to be changed.

J.8 **Latest Requirements.**

The requirements in effect on the date of application for the change.

J.9 **Previous Relevant Design Changes.**

Previous design changes, the cumulative effect of which could result in a product significantly or substantially different from the original product or model, when considered from the last time the latest regulations were applied.

J.10 **Product Level Change.**

A change or combination of changes that makes the product distinct from other models of the product (e.g., range, payload, speed, design philosophy). Product level change is defined at the aircraft, aircraft engine, or propeller level of change.

J.11 **Secondary Change.**

A change that is part of a significant physical change that does not contribute materially to the level of safety. Guidance is contained in paragraph 3.10.1.4 of this AC.

J.12 **Significant Change.**

A change to the type certificate to the extent that it changes one or more of the following, but not to the extent to be considered a substantial change: general configuration, principles of construction, or the assumptions used for certification. The significance of the change is considered in the context of all previous relevant design changes and all related revisions to the applicable regulations. Not all product level changes are significant.

J.13 **Significant Change in Area.**

For aircraft excepted under § 21.101(c) only: A change in an area is significant if the general configuration or the principles of construction in that area are not retained, or the assumptions used for certification of that area do not remain valid.

J.14 **Substantial Change.**

A change that is so extensive that a substantially complete investigation of compliance with the applicable regulations is required, and consequently a new type certificate is required pursuant to § 21.19.

Advisory Circular Feedback

If you find an error in this AC, have recommendations for improving it, or have suggestions for new items/subjects to be added, you may let us know by (1) emailing this form to 9-AWA-AVS-AIR500-Coord@faa.gov or (2) faxing it to the attention of the Aircraft Certification Service Directives Management Officer at (202) 267-3983.

Subject: AC 21.101-1B _____ Date: _____

Please check all appropriate line items:

☐ An error (procedural or typographical) has been noted in paragraph _____ on page _____ .

☐ Recommend paragraph _____ on page _____ be changed as follows:

☐ In a future change to this AC, please cover the following subject:
(Briefly describe what you want added.)

☐ Other comments:

☐ I would like to discuss the above. Please contact me.

Submitted by: _____ Date: _____