Aircraft Airworthiness Certification Department of
Civil Aviation Administration of China
(CAAC-AAD)

Airworthiness Procedure

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How to Establish the Certification Basis for Changed Aeronautical Products

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Changed Aeronautical Products

1. Purpose

This airworthiness procedure (AP) provide the procedures for determining the certification basis for changes to type certificated products, implementing Chinese Civil Aviation Regulations Part 21 (CCAR-21) §§ 21.19 and 21.101. These procedures apply to design changes made through an amended Type Certificate (TC), a Supplemental Type Certificate (STC), an amended STC, a Modification Design Approval (MDA) or an amended MDA. These procedures also apply to type validation programs of foreign authority. Under this AP, Aircraft Certification Service must apply these procedures to determine the certification basis for changed products.

2. Authority

This AC is formulated on the basis of Civil Aviation Products and Parts (CCAR-21).

3. References

AP-21-AA-2011-03-R4, Type Certification Procedures

AP-21-14, Supplemental Type Certification Procedures

AP-21-15, Certification Procedures for Modification Design of Import Civil Aircraft

AP-21-01R2, Validation Procedures for Import Civil Aviation Products and Parts

AP-21-AA-2009-19, Validation Procedures for USA Aviation Products and TSO Articles

AC-21-AA-2014-36, Establishing the Certification Basis of Changed Aeronautical Products

4. Background

The general certification procedures for products (aircraft, aircraft engines, and

propellers) and parts are in CCAR-21. §§ 21.16 through 21.29, and 21.101 specify certain regulations and the applicable airworthiness standards for type certification of new and changed products. The term “changed product” – used throughout CCAR-21 and this AP – includes changes that are made through an amended TC, an STC, an amended STC, a MDA or an amended MDA

Previous CCAR-21 section 33 required that an applicant for a change to a TC comply with either the regulations cited in the TC or applicable regulations in effect on the date of application, plus any other amendments the Administrator found to be directly related.

Current CCAR-21 § 21.101, “Designation of applicable regulations”, applies to changes in the type design of aircraft, aircraft engines, and propellers, which do not require a new TC under 14 CFR § 21.19. This procedure enhances safety by applying the latest airworthiness standards, to the greatest extent practical, for certifying significant design changes.

For validation programs, the validating authority’s date of application is the date the applicant applied to the certificating authority for the design change. Applicants should consult individual Bilateral Aviation Safety Agreement Implementation Procedures for Airworthiness (BASA IPA) when developing the validation basis for an amended TC, STC, or amended STC program.

Under § 21.101(a), a change to a type certificated product must comply with the latest requirements, unless it complies with the exceptions in §§ 21.101(b). The certification basis does not depend on whether the TC holder or an applicant for a STC is originating the change.

§ 21.101(b) describes criteria for when an applicant can use earlier requirements. Applicants may use earlier requirements when the change is not significant. In cases where design changes involve features that have no adequate regulatory standard in the existing certification basis – but later appropriate regulations exist – the Administrator requires that applicants use appropriate later regulations for the proposed design change. For not significant design changes, the rule allows continued compliance with the existing certification basis, unless there is no adequate regulatory standard in the existing certification basis, without further approval by the Administrator.

§§ 21.101(b) 1.(1) and (2) describes the automatic criteria for determining if the change is significant. Under §§ 21.101(b) 2 and 3, applicants may use earlier requirements for significant changes to areas not affected by the change, or for cases where compliance to the latest requirements would not contribute

materially to the level of safety or would be impractical. Earlier amendments may not precede the corresponding regulation listed in the existing certification basis.

Under § 21.101(c), special conditions apply when the regulations do not provide adequate standards for the proposed change because of a novel or unusual design feature. § 21.101(c) applies to significant and not significant design changes.

§ 21.101(d) explains how long an application remains valid for a change to a TC, including STCs. An application for a change to a TC for a transport category aircraft is effective for five years, and an application for a change to any other category aircraft is effective for three years.

5. Roles and Responsibilities

The following information identifies the roles and responsibilities for both the applicant and Aircraft Certification Service during certification projects:

a. Applicants:

(1) Identify and evaluate the proposed change. In assessing the change, define the affected areas and include previous relevant design changes along with the related, appropriate regulations. The evaluation should be comprehensive enough to fully understand the scope of the change.

(2) Identify if the change is significant or not significant at the product level using the information in AC-21-AA-2014-36. The determination of significance must include a review of any previous relevant design changes.

(3) Apply the latest regulations for significant changes, unless a proposal is presented to apply earlier regulations. The applicant may propose to use one of the exceptions of § 21.101(b) 2 or 3, that is, not affected area, does not contribute materially to the level of safety, and/or impracticality.

(4) Propose a certification basis with appropriate amendment levels.

b. Aircraft Certification Service:

(1) Guides the applicant on how to apply the rule.

(2) Uses the delegation system to streamline implementation. Aircraft Certification Service must work closely with its applicants to establish an effective delegation system.

(3) Approves or disapproves the latest amendment exceptions as proposed by the applicant. When the applicant proposes exceptions, the CAAC engineer must review data submitted and make a finding. Many times the Administrator will have predetermined if the change is not significant. The table in Appendix A of AC-21-AA-2014-36 contains examples – predetermined by the Administrator – of substantial, significant, and not significant design changes.

(6) Uses the G-1 issue paper to record issues and resolution for changes to the certification basis. The G-1 issue paper would normally be used to document: significant changes where earlier regulations are applied per § 21.101(b) 2, 3 (unaffected area, contribution to the level of safety, and impracticality); not significant changes, due to an inadequate certification basis, requiring the use of later regulations; and the application of special conditions per § 21.101(c).

(5) Determines the certification basis. To establish the certification basis for validation programs, the procedures in the appropriate BASA IPA should be consult.

6. Determining the Applicability of § 21.101 for Changed Products

a. A "change to a type certificate" as stated in § 21.101 refers to changes in type design. Minor changes (as classified by §21.93 and approved §21.95) are by definition considered to be not significant. Therefore, they can be approved per the existing certification basis.

b. Substantial changes (§21.19) to a product that are so extensive that they require a complete investigation of compliance require a new TC. The Administrator weighs the magnitude of the proposed design change against the degree of investigation needed to establish compliance with the regulations. New type certificates require the use of the regulations in effect on the date of application for the change. The following table outlines the certification process for substantial and not substantial changes:

If the Administrator finds that the proposed design change …	**Then the applicant must …**	**And …**
Is substantial.	Submit an application for a new TC.	Establish the certification basis (§21.17), using the regulations in effect on the date of application for the change.

Is not substantial.	Comply with §21.101.	Develop the certification basis, per guidance in this order and AC-21-AA-2014-36.

c. Samples of a design change that require a new TC are no longer listed in §21.19. These design changes are now evaluated case by case.

d. §21.101 applies to all changes to type certificated products regardless of approval method: amended TC, STC, or amended STC, MDA or amended MDA.

e. The certification basis can vary depending on the magnitude and scope of the change. See the tables in Appendix A of AC-21-AA-2014-36 for classifications of typical substantial, significant, and not significant design changes. Where the classification is not obvious for the proposed change, follow Paragraph 7 and Figure 1 of AC-21-AA-2014-36 to determine the appropriate certification basis for the changed product.

f. A product level change is a change or combination of changes that makes the product distinct from the existing product (for example, range, payload, speed). Product level change is defined at the aircraft, aircraft engine, or propeller level and would result in an amended TC, STC, or amended STC, MDA or amended MDA. These changes typically, but not always, result in a model change that requires an amendment to the TC. However, a model change is not a prerequisite for a product level change. A system or component change can also rise to the product level.

The product level change concept is directly related to the determination of significance, that is, the criteria used to determine significance. To assess if a change is significant, the applicant must consider the change and its effect on the overall aircraft, aircraft engine, or propeller at the product level.

g. A significant change is a change to the type certificate to the extent that it changes one or more of the following: general configuration, principles of construction, or the assumptions used for certification, but not to the extent to be considered a substantial change. The significance of the change must be considered in the context of all previous relevant design changes and all related revisions to the applicable regulations. Not all changes or product level changes are significant. §21.101(b) 1 defines a significant change based on three automatic criteria:

(1) Significant changes to the general configuration are changes likely to

require a new model designation to distinguish the product from other product models, for example, performance or interchangeability of major components.

(2) Significant changes to the principles of construction are changes to the materials and/or construction methods that affect the overall product's operating characteristics or inherent strength. They would require extensive reinvestigation to show compliance. An example is a primary structure change from metal to composites.

(3) Significant changes to the assumptions used for certification are changes to the product level assumptions associated with the compliance demonstration, performance, or operating envelope. These changes are so different that they invalidate the original assumptions. Examples may include:

(a) Changing an aircraft from an unpressurized to pressurized fuselage;

(b) Changing operation of a transport fixed wing airplane from land-based to water-based; and

(c) Operation envelope expansions that are outside the existing design parameters and capabilities. Merely expanding the envelope for which the product was originally designed is generally not a significant change because the assumptions – that is, the methodology or approach – used for certification of the basic product remain valid. The applicant can use the methodology/approach for the changed product with predictable effects.

h. Typically a change to a single area, system, or component will not result in a product level change. However there may be distinct cases where the change to a single system or component may, in fact, result in a significant change. For example, most avionics system installations adapt easily and do not change the product's general configuration or principles of construction. However, where a system installation affects the aircraft's operation, performance, or capability, it may, in turn, invalidate the original assumptions used for certification, and therefore result in a significant change under §21.101(b) 1.

i. Previous relevant design changes can trigger one or more of the criteria in §§21.101(b) 1.(1) and (2). When assessing a significant design change, either singularly or collectively, consider the cumulative effect of previous relevant design changes. Applicants may have included these previous design changes through earlier changes in the TC. The collective result may be a product

considerably different from the latest updated certification basis for the product or model. Two examples of previous relevant aircraft design changes, which address those incremental increases, are weight or thrust. While individually not significant (for example, 2 percent, 4 percent, or 5 percent discrete increases), these changes can – through a series of changes – become a significant change as incremental changes are made to the product.

j. If a proposed design change, together with any previous relevant design changes, triggers any of the three criteria in §§21.101(b) 1.(1) and (2), the change is significant. Later regulatory amendments by themselves cannot drive the design change to be significant. See AC-21-AA-2014-36, Paragraphs 6 and 7 for additional guidance on assessing significance.

k. The applicant must assess the effects of a significant change on other systems, components, equipment, or appliances of the product because areas that have not been changed may be affected. However, the applicant need not resubstantiate those areas of the product where the change or the updated certification basis will not invalidate the original substantiation. If the significant change does not affect an area, then the applicant need not revisit the certification basis of that area.

l. Secondary changes are changes to the affected areas that are part of, and consequential to, the design change. They do not add new capabilities or capacity to the product, and are always required by the significant change to complete the installation. Examples of secondary changes include: extending hydraulic line for landing gear, adding circuit breakers for a comprehensive flight deck upgrade, extending ventilation ducting, lengthening control cables or wiring to accommodate a fuselage plug. Secondary changes are considered not significant and may continue to comply with the existing certification basis.

m. The Administrator evaluates a design change on an engine or propeller independently of the aircraft. However, applicants must assess engine or propeller design changes when installed at the aircraft level. They also should establish a separate classification for the product. A significant change at the engine or propeller level may not be significant at the aircraft level or vice versa, and may require dual certification (one for the engine or propeller, and the other for the aircraft).

n. The airworthiness requirements in effect on the date of application are in CCAR-21, 23, 25, 27, 29, 31, 33, and 35.

7. Certification Basis for Significant Changes

a. If the Administrator classifies the change as significant, the applicant must comply with the amendments in effect on the date of application for the change. The applicant may use the exceptions in§§ 21.101(b) 2 and 3 to show compliance with earlier amendments or with the existing certification basis. For areas not affected by the change, and areas affected by the change for which compliance with the latest requirements would not contribute materially to the level of safety or would be impractical, the applicant must provide acceptable justification to support the application of the earlier amendments. The final certification basis may combine the latest, earlier, and existing regulations, but not regulations that precede the existing certification basis. Paragraph 8 and Appendices B and C of the AC-21-AA-2014-36 describe exceptions to §§ 21.101(b) 2 and 3.

b. Pursuing a change for a specific product may not be economically viable for all applicants. Some applicants cannot afford changes that are deemed practical. Because compliance with the latest regulations may be affordable for a large manufacturer but not a smaller one, the change may appear practical for the larger manufacturer, but impractical for the smaller one. To avoid creating business inequities, both would be required to comply with the same amendment level of a particular regulation.

8. Certification Basis for Changes That Are Not Significant

When the change is determined to be not significant, the rule allows continued compliance with the existing certification basis except in the following cases:

a. If the change consists of a new or substantially complete redesign of a component or system and the existing certification basis does not provide adequate standards for the design change – that is, the change includes features that were not foreseen in the existing certification basis. The change must comply with later appropriate regulations. Examples are:

(1) Replacing a conventional aluminum constructed flap with an all-composite flap. This change would be considered not significant because it does not change the general configuration, principals of construction, or assumptions used for certification at the product level. If the existing certification basis does not contain appropriate regulations, the applicant would apply later regulations addressing the composite requirements. Starting with the

existing certification basis, the Administrator will progress through each later regulation to determine the amendment appropriate for the change.

NOTE: However, if the applicant changed the primary structure, for example, the wing, from aluminum to composites, this would be a change in the product level principles of construction, and the product level change would be significant. The appropriate latest regulations for composite materials would apply.

(2) Adding an advanced avionics system on an aircraft that did not have lightning protection. Compliance with the regulations for lightning protection would be appropriate for this not significant change.

b. Applicants may volunteer to comply with later amendments in the existing certification basis, but should consult the Administrator to ensure they also are complying with any other, directly related regulations. Applicants are not allowed to pick and choose without a full understanding of interrelated regulations.

9. Special Conditions (Novel or Unusual Design Features)

a. If the Administrator finds that the regulations in effect on the date of application for the change do not provide adequate standards because of novel or unusual design features, special conditions apply. Special conditions can apply to both significant and not significant changes.

b. The intent of applying special conditions remains the same as before, in that it addresses novel and unusual design features that were not considered by the existing certification basis and are not covered in later regulations. The appropriate level of safety for the special conditions should be commensurate with the agreed upon certification basis for the change.

10. Documenting Changes to a Product's Certification Basis

a. All changes that revise the product's certification basis must be documented on the TC, STC, MDA, VTC or VSTC. The certification basis for changes to TCs, STCs, MDAs, VTCs or VSTCs requires that the applicant documents the regulations, as well as the regulations' amendment levels.

b. Complete the TC, STC, MDA, VTC or VSTC before issuing the design approval. The certification basis must be readily available to applicants modifying type certificated products. The certification basis on amended TCs,

STCs, amended STCs, MDAs and amended MDAs must be available to other companies or individuals upon request from the ACO that issued or amended the document.

11. Supplementary Provision

11.1 CAAC-AAD shall be responsible for the interpretation of this AP.

11.2 This AP shall come into force as of January 26, 2014.