COMMENT RESPONSE DOCUMENT (CRD) TO NOTICE OF PROPOSED AMENDMENT (NPA) 2010-02

for amending the Executive Director Decision No 2003/01/RM of 17 October 2003 on Acceptable Means of Compliance and Guidance Material for the airworthiness and environmental certification of aircraft and related products, parts and appliances, as well as for the certification of design and production organisations ('AMC and GM to Part 21')

'Improvement of GM to 21A.101'

(Establishment of the type-certification basis of Changed Aeronautical Products)

Explanatory Note

I. General

1. The purpose of the Notice of Proposed Amendment (NPA) 2010-02, dated 16 March 2010, was to propose an amendment to Decision 2003/01/RM of the Executive Director of the European Aviation Safety Agency of 17 October 2003[1] on Acceptable Means of Compliance and Guidance Material for the airworthiness and environmental certification of aircraft and related products, parts and appliances, as well as for the certification of design and production organisations ('AMC and GM to Part-21').

II. Consultation

2. The draft Executive Director Decision amending Decision 2003/01/RM was published on the website (http://www.easa.europa.eu) on 17 March 2010.

3. By the closing date of 17 June 2010, the European Aviation Safety Agency ("the Agency") had received 118 comments from 17 National Aviation Authorities, professional organisations and private companies.

III. Publication of the CRD

3. All comments received have been acknowledged and incorporated into this Comment Response Document (CRD) with the responses of the Agency.

4. In responding to comments, a standard terminology has been applied to attest the Agency's acceptance of the comment. This terminology is as follows:

   - **Accepted** – The comment is agreed by the Agency and any proposed amendment is wholly transferred to the revised text.
   - **Partially Accepted** – Either the comment is only agreed in part by the Agency, or the comment is agreed by the Agency but any proposed amendment is partially transferred to the revised text.
   - **Noted** – The comment is acknowledged by the Agency but no change to the existing text is considered necessary.
   - **Not Accepted** - The comment or proposed amendment is not shared by the Agency.

   The resulting text highlights the changes as compared to the NPA text and also some changes compared to the current rule. For details see the introductory to the resulting text (Appendix I).

5. The Executive Director Decision on Decision 2003/01/RM will be issued at least two months after the publication of this CRD to allow for any possible reactions of stakeholders regarding possible misunderstandings of the comments received and answers provided.

6. Such reactions should be received by the Agency not later than 21 March 2011 and should be submitted using the Comment-Response Tool at http://hub.easa.europa.eu/crt.

[1] Decision as last amended by Decision 2010/001/R of 23 March 2010.

IV. Summary of the review of comments

7. A good feedback was received on the NPA 2010-02. In general, the comments either support or at least did not oppose the substance of the proposal. As the CRD table of comments shows (see section V.), quite a number of valid comments was accepted, which helped to improve the text. Certain comments were found out of the scope of these rulemaking tasks which intends to amend just the Guidance Material for the 21A.101 and 21A.19 rules and it cannot amend the rule itself. Those comments have been deferred to a future rulemaking expected both for 21A.101 and 21A.19 rules. Certainly, some comments had to be rejected since not found valid. It is hoped, however, that the revised Guidance Material will help in better understanding of the 21A.101 and 21A.19 rules and their implementation.

8. The "Resulting text" for GM 21A.101 (see Appendix I) highlights the changes introduced after disposition of comments using the Word tracking of changes: new (in red), ~~deleted~~ (in blue). In addition, Appendices A (tables with examples) and B (guidance on impracticality exception) (formerly designated as Appendices 1 and 3), track also changes against the existing GM text. Namely, in Appendix A tracking of changes against the current text provides useful information to readers but outside of those appendices it was found counterproductive since the text, in particular the main body of GM, has been basically rewritten, using different wording and format, which made the final result very confusing.

9. As far as disposition of comments itself is concerned, except the EASA text specific comments disposed by the Agency alone, all other comments of substance on the common text were disposed jointly by the FAA, TCCA and the Agency within the CPR International Implementation Team (CPR-IIT). Therefore, the Agency's proposal is pretty much harmonised with the FAA AC (note that the FAA has already published their AC 21.101-1A dated 9/3/2010, the TCCA is preparing a draft). However, in a few cases the Agency arrived to slightly different conclusions so that the final text may contain small differences. The intent of the following paragraphs is to point at some of the proposed differences of attention.

10. There are differences given by the different FAA and EASA legal frameworks and different content and wording of the applicable FAA and EASA rules. These are the reasons for obvious need for terminology differences. These issues were already discussed in the NPA.

11. There are some non-substantial formal differences between both texts. For example, the FAA had to follow their internal practices and put the "Definitions and Terminology" section at the end of the AC document while the Agency placed it to the introductory part (Chapter 1) to guide readers to read these definitions and terminology before the main guidance starts. Another formal difference is that the FAA, in accordance with their internal practiced, uses "we" (for the FAA) and "you" (for the applicant), which is not the style used in the AMC & GM to Part-21.

12. There is a slight factual difference in definition of significant change (see Chapter 1, section 4) due to acceptance by the Agency of substance of the comment No. 30 (see section V). The EASA definition indicates that a significant change is indeed a product level change as it is also stated in paragraph 6.a of Chapter 3.

13. The difference of attention and further review is in the flowchart (Figure 1). The readers are invited to see the decision box for step 7 and use of the Boolean operator "and" in the EASA text, compare to "or" in the FAA text. Comments are welcomed on this subject.

14. The FAA changed the wording of the Note 2 in paragraph 2.a of Chapter 3. The Agency has taken these changes on board.

15. The Agency wording in 6.g. in Chapter 3 slightly differs from that of the FAA to be in line with the (harmonised) definition of the secondary change.

16. The paragraph 6.e. of Chapter 3 (Adequacy of Certification Basis) as in the FAA text was skipped to avoid duplication of the information provided in newly added section 11 of Chapter 3 that focuses on this subject.

17. In section 4 of Chapter 4 the Agency text slightly differs from the FAA to firmly stick to the requirements of the 21A.101(e) rule.

18. Due to a comment received (No 36) the Agency decided to introduce a new guidance on special purpose aircraft. However, this guidance differs from the FAA text because of the differences between the FAA and EASA 21.101 rules (21A.101 does not contain paragraph f. which allows the FAA to take special approach for “other category aircraft”). The Agency does not have such a possibility.

19. To help applicants and users of this GM to orientate among many kinds of different changes (expressed by means of multiple adjectives), the Agency decided to introduce in a new Appendix D figures and tables which are intended to provide the information in a condense way and facilitate understanding of the CPR concept and relation among various kinds of changes.

+V. CRD table of comments, responses and resulting text

(General Comments)	-

comment	*49* comment by: *UK CAA* Please be advised that the UK CAA have no comments on NPA 2010-02.
response	*Noted*

comment	*56* comment by: *Swedish Transport Agency, Civil Aviation Department (Transportstyrelsen, Luftfartsavdelningen)* The Swedish Transport Agency, Civil Aviation Department is supporting the content of NPA 2010-02
response	*Noted*

comment	*78* comment by: *General Aviation Manufacturers Association (GAMA)* Attachment #1 GAMA has included the attached comments in the CRT.
response	*Noted*

comment	*79* comment by: *General Aviation Manufacturers Association (GAMA)* **General Comments:** As this guidance material has been developed in close concert with the EASA's draft AC 21-101A, GAMA submitted very similar comments to the EASA during their public comment period. GAMA recommends the EASA include some type of indication of change revision when large guidance documents such as this are revised. With the large number of proposed regulations, policy and guidance that are put out for comment to a relatively small industry, such change tracking can save much needed time and resources. In the world of electronic documents this should not require significant resources of the EASA to address.
response	*Noted* Initially, the EASA standard way of tracking changes against the current text (deleted text shown with a strike through, new text with gray shading) was applied but the final result was not satisfactory. The text of this revised GM was substantially rearranged so that a consistent application of standard highlighting of changes could be even counterproductive for its readability.

comment	*105* comment by: *Luftfahrt-Bundesamt*

	The LBA has no comments on NPA 2010-02.
response	*Noted*

comment	*106* comment by: *Cessna Aircraft Company* Attachment #2 See attachment for Cessna Engineering's comments. Cessna Engineering does not have any comments on this issue at this time.
response	*Noted*

TITLE PAGE p. 1

comment	*57* comment by: *Boeing* GENERAL COMMENT: Boeing appreciates the opportunity EASA has afforded to provide comments on this draft NPA. The comments that we are submitting to it are essentially identical to the comments that we recently submitted to the FAA's proposed Advisory Circular on the same subject. (The only differences are those needed to reflect the various references in the FAA's Part 21.) We applaud EASA for considering close harmonization of this document with the related guidance issued by the FAA. Having one set of consistent guidelines in both the US and Europe will ensure increased compliance and greater efficiency for applicants.
response	*Noted*

A. Explanatory Note - I. General p. 3

comment	*55* comment by: *Swiss International Airlines / Bruno Pfister* SWISS International Air Lines Ltd is at present not holding a DOA; the airline takes note of the NPA without further comments.
response	*Noted*

A. Explanatory Note - IV. Content of the draft decision - Main changes against the current GM 21A.101 p. 6-8

comment	*1* comment by: *Francis Fagegaltier Services* Item 24, subject : 21A.19. The need for a future rulemaking action addressing

21A.19 is supported : after entry into force of the current 21A.101, 21A.19 can simply be deleted.

Indeed, the logic implemented in JAR-21, before the "CPR", was very clear : the initial certification basis was kept for design changes unless an improvement in this basis was rendered necessary for safety issues of general nature. This improvement was possible by means of special conditions under the authority of 21A.16B (a)(3) (of course to be read as "JAR 21" references). Any safety issue was then adequately addressed without the complex process described in the GM associated to "CPR".

When the change was "too important", then a new certificate was imposed by 21A.19 as a means to apply the latest certification specifications as part of the certification basis.

Nowadays, 21A.101 (a) plays the role of 21A.19 by imposing the latest texts. The decision whether to have a new certificate or to add a new model on an existing certificate is a minor administrative detail (*). 21A.19 can be deleted as being superseded by 21A.101 (a).

Note that 21A.19, being related to changes to a product, is misplaced in Part 21, subpart A : it should be in subpart D.

(*) both comply with the definition of a "certificate" found in the the so called Basic Regulation.

response *Noted*

The comment will be considered when a future rulemaking action on 21A.19 is launched.

comment *5* comment by: *Francis Fagegaltier Services*

Item 17. It is noted that CPR-IIT concluded that changes to 21.101 are not necessary (it is assumed that this is valid for 21A.101 as well). How is justified the fact that some aircraft may be exempted from the CPR process under 21A.101 (c) but not the engines or propellers installed in these aircraft ? (See also chapter 4, paragraph 2.f of the proposed GM).

We can have an aircraft designed in the 90s keeping the old certification basis for a change introduced in 2010, when its engine, designed in the 50s, would be obliged to use the 2010 certification specifications. Where is the logic ?

response *Noted*

Application of 21.101(c) does not always result in application of the original certification basis as the top-down CPR process does not always result in the latest certification specifications.

Also, engines and propellers are typically not type certificated as a part of a particular aircraft type but on their own right and can be potentially installed both on excepted and non-excepted aircraft.

B. DRAFT DECISION - PROPOSALS p. 12

comment	*48* comment by: *Pilatus* General: Pilatus Aircraft Ltd supports the proposed changes and improvements of the GM to 21A.101.
response	*Noted*

B. DRAFT DECISION - GM 21A.101 Establishing the type-certification basis of Changed Aeronautical Products - Chapter 1. Introduction p. 13-14

comment	*2* comment by: *Francis Fagegaltier Services* paragraph 1.c. Only aircraft, aircraft engines and propellers are noted in this paragraph. Because 21A.101 is also applicable to APUs, the reader should be made aware up front of this applicability. Suggestion: to add the word APUs to read "aircraft, aircraft engines, APUs and propellers".
response	*Accepted* See paragraphs 2 and 3 in the resulting text (see also response to comment No. 4).

comment	*3* comment by: *Francis Fagegaltier Services* Note after paragraph 1.f. This note duplicates the text of paragraph 3.f. Suggestion : to delete the note.
response	*Accepted* The note has been deleted (see paragraph 1. c. in the resulting text).

comment	*4* comment by: *Francis Fagegaltier Services* Paragraph 2. Because of the applicability to APUs, should reference to 21A.604 (b) be added ? Of course, 21A.604 refers to subpart D in general, including 21A.97, but perhaps it would be better to add a reference to an "APU" paragraph.
response	*Accepted* A reference was added to APUs and related paragraph 21A.604(b) (see the resulting text).

comment	*75* comment by: *Rolls-Royce plc [DGJ]* With regard to: **f.** This GM is not intended to be used to determine the applicable environmental protection requirements (aircraft noise, fuel venting and exhaust emission requirements) for changed products. It is recognised that similar text exists in the current GM.

	However, since this GM is not meant to apply to environmental protection requirements, it would be helpful if reference were made to those texts which <u>are</u> applicable to environmental protection requirements.
response	*Not accepted* 21A.101(a) rule itself contains a cross-reference to paragraph 21A.18 which specifies where the applicable environmental protection requirements can be found. No additional guidance is considered necessary.

comment	*80* comment by: *General Aviation Manufacturers Association (GAMA)* **Chapter 1, Section 1, (page 13) –** GAMA believes changes to this section have simplified the text but we do not see any substantiate changes in this section. If substantive changes were intended, GAMA requests the EASA further clarify them so they stand out more.
response	*Noted* In view of this and some other comments, Chapter 1 has been rewritten to introduce readers into the purpose and content of the revised GM. Information on the intent and content of 21A.101 and 21A.19 rules has been consolidated in Chapter 2 to avoid duplications.

B. DRAFT DECISION - GM 21A.101 Establishing the type-certification basis of Changed Aeronautical Products - Chapter 2. Overview of 21A.19 and 21A.101 p. 15-16

comment	*76* comment by: *Rolls-Royce plc [DGJ]* With regard to: **c.** Note that earlier amendments may not precede either the corresponding airworthiness code incorporated in the type-certificate. In deleting the text “or any requirement found in 14 CFR §§ 23.2, 25.2, 27.2, 29.2 or part 26 that is related to the change” from the draft FAA AC, the word “either” also needs to be deleted.
response	*Accepted* See the resulting text of 2.c. in Chapter 2.

comment	*81* comment by: *General Aviation Manufacturers Association (GAMA)* **Chapter 2, Section 2d (page 15) -** Section 2d refers to the need for later amendments or special conditions if the design change involves features that have no associated regulatory standard in the existing certification basis. This is a well established scenario and is expected by applicants. However, it is important for the EASA to state that the application of later amendments in these cases does not make the design change significant. Statements added here can be taken from, or may need to be repeated in, Chapter 3, Section 6h(2)&(3).
response	*Partially accepted*

The flowchart (Fig.1) has been amended to indicate that the decision on a need to apply later amendments and/or SC is to be made in the last step of the process (step 8). The classification 'significant/not significant' had already been made before (in step 5) and any decision in step 8 will not reverse it. As to the special conditions, a clear statement about no relation between use of special conditions and the 'significant'/'not-significant' classification is provided in Chapter 4, paragraph 3.

comment *107* comment by: *Airbus SAS*

Comment on GM 21A.101, Chapter 2, Section 2.c.
Airbus proposes to delete the word "either" to read Section 2.c. as following:
"Note that earlier amendments may not precede the corresponding airworthiness code incorporated in the type-certificate".
Rationale for this proposal: "either" used in this context is redundant.

response *Accepted*

See 2.c. in the resulting text.

B. DRAFT DECISION - GM 21A.101 Establishing the type-certification basis of Changed Aeronautical Products - Chapter 3. The Process for Establishing the Type-certification Basis for Changed Products 21A.101(b)(1) p. 17-29

comment *6* comment by: *Francis Fagegaltier Services*

In paragraph 1.a, third sentence. Because there is no definition of "acceptable" and because there is no criteria for accepting or rejecting proposals, it is suggested to change the word "acceptable" into "consistent with the applicables rules and their interpretation".

response *Accepted*

See 1.a. of Chapter 3 in the resulting text.

comment *7* comment by: *Francis Fagegaltier Services*

Paragraph 3, step 2, subparagraph b. The first sentence refers to "changed product" but the second sentence introduces confusion by referring only to "particular category of aircraft". If use of 21A.19 is limited to aircraft, this should be clearly stated.

response *Accepted*

The text has been amended to remove this wording inconsistency. Certainly 21A.19 is applicable to type certificated products, not just aircraft.

comment *8* comment by: *Francis Fagegaltier Services*

Paragraph 5, step 5, subparagraph a (3). This new document is making a big step backwards when compared to the existing one.

Like the current document, this new guidance does not define the "assumptions used for certification" : to miss the opportunity for clarification offered by this new GM is a pity.

But, more significantly, this proposal has deleted the extremely important note found in § 7 (3)(b) of existing GM : these "21A.101 assumptions" are not the same as the "CS-E30 assumptions".

It is strongly suggested to revert to the old text and to reintroduce the deleted note. Reminder : CS-E30 has no equivalent in FAR 33.

Again, it is suggested using the opportunity of this re-writing to define the "assumptions used for certification".

response *Partially accepted*

The deleted note has been returned back.

Further clarification (above the current GM text) of the term "assumptions used for certification" is not felt necessary as the general meaning of the term is considered commonly understood in the certification community. Detailed explanations of this term and other related terms are part of the CPR training.

Appendix A provides examples of application of this criterion in individual cases.

comment *24* comment by: *Francis Fagegaltier Services*

Impractical.

The "impracticality" exemption clause would only be used when the other clauses cannot be used, in particular, the clause "would not contribute materially to the level of safety of the changed product". Therefore, the "impracticality" clause would only be used in cases where the level of safety of the product is affected.

One industry participant to the initial work on CPR clearly stated in a meeting that his company would never declare a safety related certification specification to be impractical because of the cost of implementation. The legal risk would be too high in case of an accident (accusation: "your financial situation is your only concern, not the safety of your product").

May we suggest that the wording of this specific guidance is too much "cost" oriented and not enough "safety" oriented? The main goal of all the certification activity is to ensure a minimum safety level for the public: it is not intended to protect the finances of the designers. Of course, this is based on the assumption that the role of a certification authority is to protect the public and not to protect the industry.

Some risk is accepted as explained in GM 21A.3B(d)(4). There is also the notion of "equivalent level of safety" found in 21A.21 (c)(2) for compensating for lack of compliance with some airworthiness provisions. It seems possible to find a wording starting from the expected safety level (which is only a minimum for certification, products may be better) and explaining that this minimum safety level should be demonstrated by appropriate means, including use of equivalent safety findings and service experience.

May we suggest that the interpretative material for this "exception of impracticality (which) is a highly subjective assessment" is not appropriately

worded in light of possible action in a court of justice?

response *Noted*

Impracticality exception is allowed by the rule and the current GM guides that its acceptance should be based on whether the cost of application of the latest amendment is commensurate with the safety benefits. We do not accept that the amended wording of the new guidance is too much "cost" oriented and not enough "safety oriented. In contrary, the text changes introduced aim to limit chances for acceptance of impracticality to cases when the cost required to comply would not be commensurate with a small incremental safety gain". Further, a note has been added to make it clear that the impracticality exception should not be based on the size or financial resources of the applicant's company. By comparison the new text is considered more safety oriented then the old text.

As to the impracticality concept itself, it should be noted that the latest certification specifications have been primarily developed to be applicable for future new types and CPR requests (or not) for compliance with them on changed but already type-certificated products. The fact that the "cost/safety benefit" evaluations may lead to different results for "new" types and "old" types is not a novelty brought by the CPR. This type of "JAR-26 considerations" is already applied by other Authorities (and will be applied by the Agency in the future when legal tools are available to mandate "additional airworthiness specifications for operations"). In certain cases these evaluations for "old types" may conclude that, despite compliance would bring certain safety benefit, the related cost would be not commensurate. In the CPR wording, full compliance with the latest requirements would be "impractical".

As to the liability issue, no applicant is required to seek the impracticality exception. If an applicant is concerned about liability, they will simply not apply it.

Note that some changes have been made to the text to avoid any misinterpretation.

comment *31* comment by: *Eurocopter*

Attachment #3

Page 18 **Figure 1. Establishing the Type-Certification Basis for Changed Product**
Adequacy of Certification Basis is a key point in the establishment of the certification basis for changed product, especially for not significant changes (re Chapter 2 "Overview...", § 2.d. on page 15; Chapter 3 "The Process...", § 6.h.(3) on page 23, § 8.c. on page 25). This should be reflected in Figure 1.

Figure 1 could also show more clearly that unaffected areas can continue to comply with the existing certification basis as it is clearly stated on Page 22 Section 5. § d. "*All unaffected areas of the aircraft can continue to comply with the existing type-certification basis.*".

Recommendation:
Complete Figure 1 as in attached file to show where the existing certification basis is acceptable.

response *Partially accepted*

The flowchart has been amended in an alternative way to address the intent of this comment.

comment 32 comment by: *Eurocopter*

Page 22 **§ 6.a.(3) Changes that invalidate the assumptions used for certification**
Previously, reference was made to "*product level assumptions*". The product level notion is not retained in the new wording. Confusion may arise when assessing a change.
A clear distinction should be made between significance at product level and significance at area/system level.
A significant change at area/system level may have an effect at the product level without triggering the automatic criteria listed in § 21A.101(b)(i) and (ii), which are to be considered at the product level, and not at the area/system level, as stated on the same page in § 6.b., second sentence.

Recommendation:
Restore the product level notion for certification assumptions to read: *"A change to the product level assumptions associated with..."*.

The certification basis for a significant product level change is established starting from the latest requirements with a need for justification of possible deviations from the latest requirements, whereas the certification basis for a significant area/system level change could be established starting from the existing requirements without the need for a justification for not applying the latest requirements, the only constraint being to ensure the adequacy of type-certification basis.

Recommendation:
Complete Figure 1 as suggested previously.

response *Partially accepted*

The product level notion in 6.a.(3) has been restored and the flowchart in Figure 1 has been amended (see the resulting text).

comment 33 comment by: *Eurocopter*

Page 25 **Section 8. Selecting an Amendment Level for a Not Significant Change, § c. Adequacy of type-certification basis**
The last sentence states:
"*These airworthiness standards are to be the highest practicable level of safety for the changed product, and not just for the change itself.*"
This statement in a section related to not significant changes leaves the way open for the Agency to impose the latest amendments for not significant changes, even if the proposed certification basis is adequate. This does not seem in line with 21A.101(b).
The adequacy of Certification Basis is a general concern which would deserve a specific step in the designation of applicable regulations.
As far as not significant changes at product level are concerned, we may accept that such changes be certified against earlier requirements (not prior to the existing certification basis) instead of latest requirements as far as the earlier requirements contain adequate and appropriate safety standards.
This would allow to upgrade a type design reusing a system previously certificated on an other model in accordance with a later amendment (provided

the system has a satisfactory service experience and is properly integrated), without the need for the applicant to justify the impracticality of compliance with the latest requirements.

Recommendation:
Reword the subject last sentence as follows:
"*For a design change that contains features which are not covered in the existing certification basis, the Agency will designate the certification specifications of the applicable airworthiness code at the appropriate amendment level, beginning with the existing certification basis and progressing to the most appropriate later amendment level for the change. For a change that contains new design features that are novel and unusual for which there are no later applicable certification specifications at a later amendment level, the Agency will designate special conditions*."

response *Partially accepted*

The whole paragraph has been removed from this section but the clause referring to "*the highest practicable level of safety"* has been also removed from the definition of 'Adequate certification basis' to avoid its misinterpretation. The intent of the proposed text has been reflected in the new section 11 (step 8).

comment *34* comment by: *Eurocopter*

Page 25 § **d. Exceptions in 21A.101(b)(2) and (3).**
and **associated §§ e. and f.**
Quoted exceptions are considered for significant changes only. They should not be addressed in a section related to not significant changes.

For not significant changes, the common understanding of 21A.101 is that the existing certification basis is acceptable for certification of the changed product provided the existing certification basis is adequate. The proposed revised AC is likely to go against current practices and to put an undue burden on the applicants.

Recommendation:
Delete from Section 8. "Selecting an Amendment Level for a Not Significant Change" the subject § d. and the associated §§ e. and f. (which could have better be identified as sub-paragraphs (1) and (2)).
If deemed necessary, use the deleted information to complete Section 7. "Proposing an Amendment Level for a Significant Change".

response *Accepted*

The commented paragraphs d., e. and f. have been deleted from this section as not applicable to not significant changes.
Sections 7 and 8 have been rearranged.

comment *35* comment by: *Eurocopter*

Page 28 **b. Impractical § (3)(a)** "*The exception of impracticality is a highly subjective assessment...*"
In this sub-paragraph, the Agency seems to recommend a pragmatic approach, without undue heaviness. In this spirit, a documented formal assessment could even be avoided in some cases addressed in an additional Note.

A type design may be significantly upgraded by reusing a system previously certificated on an other model, and having a satisfactory service experience. This should be possible while keeping the certification basis (not prior to the existing certification basis) used on the model on which the system was previously certificated, without requiring the system to be recertified against the latest requirements or the use of the exceptions in § 21.101(b)(3) to be further justified.

Recommendation:
Add a Note to include a provision for an alleviation of the process in case of an upgrade from systems previously certificated on an other model of the type:
"*Note: For new derivative aircraft, the impractical exception may be accepted without further substantiation for design features taken from the existing family of derivatives with a satisfactory airworthiness experience.*"

response *Not accepted*

The recommended note has not been accepted because impracticality exception always needs to be justified. Impracticality involves recognition that there is some material contribution to safety if the latest specifications are complied with. Loss of this incremental safety benefit must be always justified. It should only be accepted based on conclusion that the cost of compliance with latest requirements is not commensurate with a small incremental safety benefit. Such substantiation cannot be avoided based on a fact that some previously certified design features/system were taken over from a previous product model. The guidance on impracticality (Appendix C) specifically excludes from these considerations previous resource expenditures for prior product changes.

comment *58* comment by: *Boeing*

Page: 19 of 105, Paragraph: 2.b.

Boeing recommends this section be clarified.

JUSTIFICATION: Boeing understands EASA's intentions for requiring a full accounting for all changes to the product up front. However, a full accounting cannot be provided at the time of initial assessment. Every developmental program will include discoveries and changes during the course of the project. It is not envisioned that the evolution of change during the course of the developmental project would cause a product level change or a group of significant product level changes to become substantial.

response *Partially accepted*

The comment was probably filed in misunderstanding of the paragraph intent. Paragraph 2.b. of Chapter 3 is addressing 'previous related design changes', i.e. past changes to TC already approved prior to the current change to TC project. Evolutionary changes encountered during the course of the development or certification of the current change is a another issue. In step 1 the applicant is certainly not required to provide up front a full accounting for these evolutionary changes that may appear at later stages of the project.
However, all evolutionary changes that occurred in the course of the project should be assessed for a need to re-validate any previous evaluations and decisions made previously in the CPR process, in particular the effect of evolutionary changes on the established type-certification basis.
The comment, however, reminded the team that there is a need to include

these considerations. Therefore, paragraph (e) was added to address evolutionary changes.

comment 59 comment by: *Boeing*

Page: 21 of 105, Paragraph: *5.a.*

Boeing recommends adding the following to Paragraph 5.a.

"It should be noted that fuselage plugs are also added for reasons other than to carry more passengers. As such, if the maximum certified passenger occupancy is not being increased, the addition of a fuselage plug does not result in the carriage of more passengers."

JUSTIFICATION: The example given in proposed Paragraph 5.a. states, *"For example, a need to carry more passengers could require the addition of a fuselage plug, which will result in a weight increase, and necessitate a thrust increase. Thus the fuselage plug, weight increase, and thrust increase are all related high level changes that will be needed to achieve the goal of carrying more passengers."*

Boeing would like to point out that there are those cases where the addition of a fuselage plug does not increase the maximum certified passenger occupancy and may be done for other reasons, such as increased cargo capacity or other efficiencies.

response *Not accepted*

It is agreed that there are cases where an addition of a fuselage plug may not increase the max certified passenger occupancy. However, the intent of paragraph 5.a. is only to illustrate one possible selected case. We disagree with the recommendation to add additional sentences not related to the example.

comment 60 comment by: *Boeing*

Page: 21 of 105, Paragraph: *5.a.*

Boeing recommends the following text that appears in proposed Paragraph 5.a.:

"However, the simultaneous introduction of a complete new interior may be considered related if it is intended that the entire new cabin (and passengers) benefit from new or additional features offered by newer or improved technology (such as, new entertainment system, new smoke detection system, use of lightweight seats, etc), where otherwise the existing interior design or features could have simply been retained for the added fuselage plug."

be replaced with:

"Similar to the avionics upgrade example, the simultaneous introduction of a complete new interior may be considered unrelated to the fuselage stretch if the maximum certified passenger occupancy is not increasing. An interior improvement is not necessarily needed to carry more passengers and therefore is not related to the fuselage stretch."

JUSTIFICATION: Our suggested text would clarify and provide consistency in the examples given.

The business decision to improve the interior is not necessarily related to the addition of a fuselage plug. As stated in this section of Paragraph 5.a.:

"A decision to upgrade the cockpit 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 stated purpose, likely just modernization). The proposed avionics upgrade would then be considered an unrelated (or a stand alone) change."

Similarly, the interior improvement is not necessarily needed to carry more passengers (if the maximum certified passenger occupancy is not increasing) and therefore is not related to the fuselage stretch.

response

Not accepted

An appreciable cabin length change will have an impact on occupant safety considerations. 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 with consequent application of upgraded certification specifications in that area. .

The text suggested by the commenter has not been carried. However, the text of 5.a. for a new cabin interior change has been amended to better explain the relation to the fuselage plug. See also Figure 2 in Appendix D.

comment

61 comment by: *Boeing*

Page: 23 of 105, Paragraph: *6.f.*

Boeing recommends the following additional information be added to Paragraph 6.f.:

"If the previous relevant design changes were compliant with the latest requirements because the applicable requirements had not changed, no previous relevant design changes need be considered for cumulative effects."

JUSTIFICATION: Additional clarification in Paragraph 6.f. for the definition of the starting point for assessing cumulative effects will reduce workload for applicants and EASA, while still fulfilling the intent of cumulative design change relative to certification basis change.

response

Not accepted

The principle of cumulative effects consideration is always applicable for the change classification (which should be made anyway and amendment levels development does not play into decision). Results of this technical considerations may be relevant for evaluation of adequacy of the proposed certification basis and a need to apply special conditions (step 8).

comment

62 comment by: *Boeing*

Page: 24 of 105, Paragraph: *6.i.*

Boeing recommends the following additional information be added to Paragraph 6.i:

"(physical changes include software changes)"

JUSTIFICATION: Additional clarification in Paragraph 6.i. that physical changes include software changes would be consistent with the definition of physical effects contained in Paragraph 9.b. of the NPA. This also would allow for the potential for simple software changes, such as changes to values in a table, to be considered for classification as secondary if they meet the rest of the criteria.

response *Partially accepted*

A reference was added in this paragraph (now designated 6 (g)) to refer to the paragraph 9 (b) of this chapter that clarifies that physical aspects of a change may include software changes and the resulting effect on systems functions.

comment *63* comment by: *Boeing*

Page: 24 of 105, Paragraph: *6.i.(3)*

Boeing recommends the following text in proposed Paragraph 6.i.(3):

"The applicant can identify an affected area as a secondary change only if the change meets the description and can be substantiated or justified as not contributing materially to the level of safety per paragraph (i) above"

be replaced with:

"The applicant can identify an affected area as a secondary change only if the change meets the description and can be substantiated or justified as not contributing materially to the level of safety per paragraph (i) above. This substantiation or justification need only be minimal since the determination is straightforward."

JUSTIFICATION: As written, the justification for secondary change in Paragraph 6.i.(3) implies the same level of detail is required as for the "does-not-contribute-materially-to-safety" exception. This negates the original intent for identification as a secondary change. The original intent was to provide relief for the applicant and EASA from the detailed justification when the determination is straightforward.

response *Partially accepted*

Similar wording to the proposed was added at the end of paragraph 6 (g).

comment *64* comment by: *Boeing*

Page: 25 of 105, Paragraph: *7.c. and d.*

Boeing recommends that paragraph 7.c be revised to read as follows:

"c. Acceptable justification to support your rationale for the application of earlier amendments must be provided 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, parts, or appliance affected by the significant change."

We also recommend that paragraph 7.d be deleted.

JUSTIFICATION: Section 7 addresses amendment levels for a "significant" change. Paragraphs 7.c. and 7.d., as written in the proposal, address a mix of unaffected and affected areas. This confuses the intent of Section 7. All discussion of interplay between unaffected and affected areas should be addressed in Section 9. (See our additional comment to Section 9.) Further, our suggested revised Paragraph 7.c. addresses all the remaining aspects covered by Paragraphs 7.c. and 7.d. in the proposed NPA.

response *Accepted*

Section 7 has been revised and the recommended text has been incorporated in paragraph 7.f. The text of paragraph 7.d. was deleted.

comment *65* comment by: *Boeing*

Page: 26 of 105, Paragraph: *9.a.*

Boeing recommends the following text in Paragraph 9.a. be deleted:

"… in other words the certification specifications associated with the unaffected area continue to be compliant to the existing amendment level without further substantiation."

and be replaced with:

"Conversely, if an area is not affected, no compliance finding is necessary for the not affected area if it is also an unchanged area."

JUSTIFICATION: The text as proposed in the NPA is confusing. We consider that our suggested revision better clarifies the paragraph's intent.

response *Partially accepted*

The commented part of paragraph 9.a. has been amended to incorporate intent of this comment while using a bit different wording than the proposed one.

comment *66* comment by: *Boeing*

Page: 27 of 105, Paragraph: *10.a.(1)*

Boeing recommends that a note be added to Paragraph 10.a.(1) for clarification that states:

"Note: A general description of the design feature would be provided in the TCDS or STC at a level that would not contain proprietary information."

JUSTIFICATION: Our recommendation adds clarification as to the level of detail necessary to document the design feature, while respecting detailed

design as proprietary information.

response *Partially accepted*

Paragraph 10.a.(1) has been amended to incorporate intent of this comment while using a bit different wording than the proposed one.

comment *77* comment by: *Rolls-Royce plc [DGJ]*

With regard to:

c. When identifying the changes being proposed as part of a modification, consider previous relevant changes that create a cumulative effect, as these may influence the decisions regarding substantial and significant changes later in the process. By previous relevant changes those design changes are meant whose effects accumulate, such as successive thrust increases, incremental weight increases, or sectional increases in fuselage length. Any previous relevant design changes that did not involve an upgrade of the existing type-certification basis should be taken into account in the next design change proposal.

It is recognised that similar text exists in the current GM.

However, it should be noted that the TC-holder is not the only entity which may implement change to a product. The TC-holder will be able to assess the cumulative effect of those changes he has implemented, but will not be able to assess the effects of any changes implemented by another entity. EASA is also considering generating procedural requirements for Replacement Parts (task 21.046) which, if adopted, might allow another type of change to be implemented outside the knowledge of the TC-holder. Equally, an entity developing (for example) an STC would not necessarily be able to assess the cumulative effects of the STC on top of those already implemented by the TC-holder. Whilst the intent of this “requirement” is understandable, it should be recognised that its ultimate impact on safety is constrained.

response *Noted*

The applicant for a change must consider for cumulative effects "only" those previous design changes that are part of the particular type design configuration the current change builds on. Only such changes are considered "relevant" for the current change. The TC Holder does not need to consider STCs or replacement parts by third parties if the TC Holder's type design change does not account for them.
Conversely, if an STC applicant plans to build their STC on top of a TC Holder's type design configuration they will need to assess for cumulative effects all previous relevant design changes by the TC Holder which have been incorporated since the last time the certification specifications applicable to the area affected by the current change were upgraded. This information must be available to the applicant for every STC, if necessary through an arrangement with the TC Holder, and they must have a demonstrated design capability to make such assessments.

comment *82* comment by: *General Aviation Manufacturers Association (GAMA)*

Chapter 3, Section 2b (page 19) - The Note in Section 2b refers to the use of previously approved compliance findings. GAMA believes the EASA seeks to

clarify that previous determinations of not significant should not been used to influence a current determination involving the same design area. GAMA recommends the first and last sentence in this note adequately explain the point without adding to confusion and we recommend the middle sentence be removed (However…).

response *Accepted*

The text of the note has been split into two parts and reworded.

comment *83* comment by: *General Aviation Manufacturers Association (GAMA)*

Chapter 3, Section 5 (page 21) - While it is only an example, the inclusion of a thrust increase as a part of the related fuselage plug and weight increase may be too broad. There are examples where thrust changes have been implemented along with changes to the fuselage however the fuselage change alone would not have an appreciable or measurable effect on performance. GAMA requests that the EASA clarify that the relation is dependent upon an appreciable change for which the other change must be made.

response *Accepted*

The wording of example has been amended to make the link between a fuselage plug and a thrust increase less strong.

comment *84* comment by: *General Aviation Manufacturers Association (GAMA)*

Chapter 3, Section 6, paragraph h(1) (page 23) - The existing sentence is confusing: “The final type-certification basis may consist of a combination of the latest, and earlier or existing TC basis certification specifications for the change”. A better way of saying the same thing might be: “The final type-certification basis may consist of a combination of certification specifications, ranging from the latest back to the original certification basis for the aircraft.”

response *Accepted*

The recommended text has been incorporated in paragraph 7.a.

comment *85* comment by: *General Aviation Manufacturers Association (GAMA)*

Chapter 3, Section 6, paragraph h(3) (page 23) – GAMA believes subparagraph (3) should be changed to a paragraph of its own (paragraph i) and the remaining paragraph numbers should be incremented. The information in h(3) does not belong under paragraph (h) as it is important regardless of the significant/non-significant finding. Whether or not the change has been classified as Significant or Not Significant, the standards must be evaluated to ensure they are adequate.
Additionally this paragraph on Adequate Standards should be clarified. If the change has been classified as Not Significant, then the appropriate requirement would be the first amendment of the standard that provided adequacy (assuming there has been a standard and CRIs were not necessary). For example, if the original certification basis didn't include lightning, then the changed certification basis would need to add lightning, but at the initial amendment that lightning was added to the certification standard, not the latest amendment.

response	*Accepted* Note also that the main information on Adequate Standards has been moved to a new section 11 (step 8 of Figure 1). In this last step of the process, the assessment is made by the Agency of adequacy of certification basis as proposed by the applicant. Paragraph b. of section 11 contains the clarification requested by the commenter.

comment	*86* comment by: *General Aviation Manufacturers Association (GAMA)* **Chapter 3, Section 6i(2) (page 24) -** It is accepted that these examples may in fact not be secondary, but it is also reasonable that these examples may not be related to a product level change. The inference is that a smoke detector that uses different technology, implemented in a physical area of the design undergoing a significant change at the product level (fuselage length), is considered related regardless of the reasons for the change. A change to the smoke detector is not required by the fuselage change, or the change was necessary as the previous technology was no longer available. In both cases, this change is independent, even though it is within the physical bounds of the fuselage plug. GAMA requests the EASA amend this paragraph to reflect these issues.
response	*Accepted* This paragraph (now 6.g.(2)) has been revised. The examples of changes which would not be considered a secondary change have been removed as several commenter's found them ambiguous or confusing. It is agreed that there may be different scenarios and reasons behind these changes which would necessitate an evaluation case by case.

comment	*87* comment by: *General Aviation Manufacturers Association (GAMA)* **Chapter 3, Section 8(c) (page 25)** - The language of Section 8c appears unnecessary when dealing with not significant changes. GAMA is uncertain as to the source of this language and is unsure why it would be appropriate in any location. The adequacy of the certification basis is governed by the certification specifications and this AC. If EASA intends to judge the entire changed product, beyond the areas of change, to establish that the prescribed airworthiness requirements ensure the highest level of safety, then this AC must include how the EASA will make that judgment. It is hoped that EASA has adequate vehicles (such as the FAA's part 26) to ensure compliance to significant safety related later standards than prescribed in the certification basis. As such, GAMA does believe it is appropriate for guidance material to include such an immeasurable obligation and we recommend this section be removed.
response	*Not accepted* Adequacy of the proposed type-certification basis for a changed product needs to be assessed regardless of whether the change is significant or not. Such assessment is to be made in respect to all areas affected by the change to check if all features of the change are adequately covered. Unaffected areas (regardless of whether the change is significant or not), continue to comply with the existing type certification basis without further substantiation. Note that adequacy of the type-certification basis is to be assessed in the last step (new step 8) which is described in section 11 of this GM.

comment	*88* comment by: *General Aviation Manufacturers Association (GAMA)* **Chapter 3, Section 8(d), (e) & (f) (page 25-26)** - It is unclear why EASA has included criteria of paragraph (d), (e) & (f). Once a not significant determination has been made, the Applicant has the option of using the existing certification basis, without further justification of impracticality etc. GAMA requests that the EASA clarify this understanding or revise this section.
response	*Accepted* Paragraphs d., e. and f. were removed from this section.

comment	*108* comment by: *Airbus SAS* **Comment on GM 21A.101, Chapter 3, Section 6.e.** , **last sentence: "The collective result may be a product considerable different from the latest updated type-certification basis for the product or model."** Airbus proposes to revise the sentence to read: "The collective result may be a product considerable different from the product that complied with latest updated type-certification basis for the product or model." Rationale: Products in the context of part 21 are always understood as an aircraft, engine, propeller, or related parts and appliances. A product can not be compared with a type certification basis. The proposed wording provides clarification and reduces the potential for misinterpretation.
response	*Partially accepted* The sentence has been reworded to better express its intent.

comment	*109* comment by: *Embraer - Indústria Brasileira de Aeronáutica - S.A.* **Chapter 3, Paragraph 3b (page 20)** The references to “design models, methodologies, and approaches” is discussing means of compliance rather than the scope of design change. A substantially complete investigation (and hence, a substantial project) could conceivably reuse the models, methodologies, and approaches used in the original certification. We believe that the first part of this paragraph adequately describes a substantial change and that the remainder, starting with the sentence that begins “In other words, the design change...extrapolated” can be deleted.
response	*Not accepted* Substantial classification of a design change is closely linked to which extent the means of compliance used in the original product certification (i.e. analytical models, methodologies, calculations, tests etc.) became invalidated for the changed product. To be classified substantial it means that most of the original demonstration means cannot be applied to the changed product and the investigation effort to prepare and demonstrate new or revised means

of compliance in respect to the latest airworthiness standards will be substantial. Conversely, if most of the original means remain valid or can be easily extrapolated, the related investigation effort would not be substantial and therefore the change would not be classified substantial.

comment

110 comment by: *Embraer - Indústria Brasileira de Aeronáutica - S.A.*

Chapter 3, Paragraph 3c (page 20)

The statement that previous relevant design changes have to be considered in the determination of substantial is not supported by the regulation. It is specifically required by §21.101(1)(1), but a similar requirement is not included in § 21.19. The proposed AC is not supported by the regulation and this part should be deleted.

response

Not accepted

The current 21A.19 is silent on how a change can reach the level at which "a substantially complete investigation of compliance" will be required with related need to apply for a new TC. However, the rule is clear that this determination is to be made by the Agency. The Agency believes it is useful to indicate upfront to applicants in this revised GM which ways may lead the Agency's to the finding that a new TC will be required. Paragraph 3.a. of this GM states it could be either a case of a single extensive change to a previously type-certificated product or a case of changed design derived through cumulative effect of a series of design changes. To support Agency's decisions, the applicant is obliged to provide sufficiently detailed information about the change including identification of any re-investigations which may be needed to show compliance of the changed product (see 21A.93).

comment

111 comment by: *Embraer - Indústria Brasileira de Aeronáutica - S.A.*

Chapter 3, Paragraph 6i (page 24)

In the first paragraph of this section, a secondary change is defined as ". . . a physical change that restores without changing the system, structural capacity, or functionality. . .", and based on this criteria, compliance with the latest regulations for a secondary change does not contribute to safety, i.e., if the first part is true then, by definition, compliance with the latest requirements does not contribute to safety. Later, in subparagraph (1), there is a description of a change that meets the first definition of secondary, but would not be considered secondary because compliance with the latest regulations would indeed contribute to safety. The introductory paragraph should be modified to make clear that there are two conditions for secondary change, as more clearly described in subparagraph (3).

Concerning the examples of changes that would contribute to safety, Embraer does not understand what contribution window plugs make.

response

Accepted

The text has been amended to address this comment.

The examples have been removed because considered ambiguous or confusing

by several commenters.

comment 112 comment by: *Embraer - Indústria Brasileira de Aeronáutica - S.A.*

Chapter 3, Paragraphs 8(d), (e), and (f) (page 25)

Are these items in the correct place? It refers to a significant change but the heading for this section is "Selecting an Amendment Level for a Not Significant Change."

These items should be rewritten under paragraph 7 of chapter 3.

response *Accepted*

The commented paragraphs d., e. and f. have been deleted from this section as not applicable to not significant changes.
Sections 7 and 8 have been rearranged.

comment 113 comment by: *Embraer - Indústria Brasileira de Aeronáutica - S.A.*

Chapter 3, Paragraphs 10 (a)(2) (page 27)

In the first bullet, there is mention of "applying later certification specifications to both new and unaltered components. " Even in a significant project, the later certification specifications will not apply to the unaffected areas of the aircraft. When (outside of a substantial change) would later certification specifications be applied to existing systems or components?

In the second bullet, the paragraph refers to a "new model airplane." Given the guidance in the GM about the irrelevance of model designations, it would be better to change this to say "newly type certificated airplane" or something similar.

response *Accepted*

In the first bullet, the commented sentence has been found unnecessary and potentially confusing and therefore has been removed.

In the second bullet (as well as in all document), unnecessary references to 'model' which are irrelevant for significant classification has been removed.

B. DRAFT DECISION - GM 21A.101 Establishing the type-certification basis of Changed Aeronautical Products - Chapter 4. Other Considerations p. 30-31

comment 36 comment by: *Eurocopter*

Page 31 **Restricted Category Aircraft**
It is not understood why no additional guidance is provided for changes to restricted type-certificates whereas the conditions for a restricted type-certificate (21A.23 refers) are not identical to the ones for a type-certificate (21A.21 refers).
An alleviation of the process could be accepted in case of special purpose

operations to be certificated under 21A.23.

Recommendation:
Add a Section 7. to cover Restricted Category Aircraft.

response

Partially accepted

Note that 21A.101 does not contain an equivalent to US CFR § 21.101 (f) in support of a different, alleviated approach for restricted category aircraft including those designed for special purpose operations.
21A.90 specifies that, in Subpart D, references to type-certificates include type-certificates and restricted type certificates. Therefore the whole 21A.101, including the top-down approach of paragraphs (a) and(b), is equally applicable to changes to type-certificates as well as changes to restricted type-certificates.

A guidance along these lines for special purpose aircraft has been added in section 5 of Chapter 4 (see the resulting text).

comment

89 comment by: *General Aviation Manufacturers Association (GAMA)*

Chapter 4, Section 2, b. & c. (page 30) – GAMA believes these items should be bullets or sub-items under a, not numbered paragraphs. They are following the last sentence of a: "….automatically considered significant if:"

response

Accepted

Paragraphs 2.b and 2.c were moved as sub-bullets to paragraph 2.a.

B. DRAFT DECISION - Appendix 1 to GM 21A.101 Classification of Changes - Examples of Changes for Small Aeroplanes (CS-23) p. 33-53

comment

67 comment by: *Boeing*

Page: 44 of 105,
Paragraph: *Table of examples of SIGNIFICANT changes for Small Aeroplanes (CS-23)*
Row: Airframe life extension

Boeing recommends deletion of the Significant Change example, *"Airframe life extension."*

JUSTIFICATION: This item lacks definition and Boeing does not consider that all such cases of airframe life extension would result in classification as a significant product level change.

response

Not accepted

The example has been decided to be kept with improved rationale.

comment

90 comment by: *General Aviation Manufacturers Association (GAMA)*

Appendix 1 (Substantial, Page 33-34 & 54) - There are a number of items that were previously shown as Significant that are now shown as Substantial. Certainly the last 4 items in this section should not be classified as substantial.

In the absence of amending certification standards, where the impact of such a change can be appropriately addressed, such a change being proposed does not follow proper Regulatory Impact Assessment (RIA) Methodologies. GAMA believes this is a typographical error and should be changed back; otherwise, if the change is intentional, GAMA objects to the new classification. Obviously adding winglets or floats should not require a complete new evaluation of the aircraft and a new Type Certificate.
In the CS 23 and CS 25 world, there are some key examples of changes to dihedral or increased wingspan on single engine piston products and business jets alike which have always been classified as significant. Would these changes have been deemed Substantial, a great number of today's products would not be in existence. GAMA believes this type of change cannot be made in guidance material but must be included in formal amendment to the certification standards. GAMA requests that at least the last 4 items be moved back to significant as there has been no certification specification change to permit such a major shift in the certification environment.

response *Not accepted*

This comment is probably a copy of the comment presented to the FAA on their corresponding draft AC. The FAA recognized incorrect location of 4 examples due to a typographical error. However, the EASA NPA did not contain this error.

comment *92* comment by: *General Aviation Manufacturers Association (GAMA)*

Appendix 1 (Significant, Page 43) – The replacement of an aviation gasoline engine with a diesel engine of approximately the same horsepower was previously listed as a not significant issue. GAMA does not believe a change of this magnitude can be accomplished through the revision of guidance material but must be accomplished through amendment of the certification standards. Previous EASA practice and guidance have defined C.S. 21.101 with respect to C.S. 23 engine changes and revising guidance cannot invalidate that definition of the existing regulations. GAMA believes this item should remain not significant. This item is of particular importance considering the coming transition away from leaded fuels.

response *Not accepted*

The example is kept 'significant' because recent experience has shown that assumptions used for certification would be invalidated. The rational in the Notes column has been corrected.

comment *93* comment by: *General Aviation Manufacturers Association (GAMA)*

Appendix 1 (Significant, Page 43, 58, 68) - With regard to "A comprehensive flight deck upgrade", GAMA disagrees with the new text of: "Example: changing from federated display (e.g. separate attitude, altitude, and airspeed) architecture to an integrated electronic flight information system."
This makes a hard example that any change from federated displays to integrated will cause the change to be considered significant. This example should state that such a change could be significant. It is difficult to understand how the simple act of moving airspeed, altitude and attitude to a single display is a comprehensive flight deck upgrade or a product level change. A complete integrated cockpit that replaces all radios, the autopilot,

moves the location of systems, changes aircraft electrical bussing, etc. could be considered a comprehensive flight deck upgrade and possibly a product level change.
GAMA also believes the intended operation of the aircraft should be considered in the determination of whether or not a comprehensive flight deck upgrade is significant or not (e.g. VFR vs IFR; especially for rotorcraft).
Also noted is that the statement "Requires new AFM" is confusing and not used consistently through the appendix. For example, this is listed in the note for the change of "A comprehensive flight deck upgrade" for a C.S. 23 airplane. Is a new AFM (this presumably means AFM *or* AFMS) a driver for the change to be considered significant? GAMA strongly disagrees if this is what is intended. A GPS navigator could be installed that requires an AFM/AFMS and certainly would not be a significant change. Also the same change listed for C.S. 25 (A comprehensive flight deck upgrade) does not state "Requires new AFM".
There is plenty of long-standing EASA interpretation of the change product regulation which would be invalidated with this proposed policy and policy cannot invalidate previously acceptable methods of compliance to existing regulations. A change to the regulation must be considered for this type of change.
We would like to see better clarification of the description of what, exactly, is considered a "comprehensive flight deck upgrade", and examples provided of cockpit upgrades that cross the line to significant, and examples of upgrades that are "not significant." The note provides some insight, but not enough, in our assessment, to objectively determine the threshold of change that is needed to determine a "significant" change from a "not significant" change.
It would be helpful if the appendix identified different types of cockpit updates and classified them as significant or otherwise. For example, is the addition of an integrated GPS/Com system with moving map a significant change? What about adding two such systems? What about adding two such systems and an autopilot? What about all of that and an electronic engine monitor? How about all of that and an electronic primary flight display? Etc. GAMA believes that none of these changes should be considered significant.
Focusing on EFIS systems, would adding a PFD with basic functions for AI, IAS, ALT and DG, while retaining all of the previous nav com equipment, be considered significant (e.g. Aspen Pilot or L3 Trilogy type display)? What if that single display EFIS includes an HSI and interfaces to the existing nav/com and autopilot (e.g. Aspen Pro). What if that EFIS system includes multiple displays with reversionary capability in a federated architecture (e.g. Aspen EFD1000 multi-display, G500/600 type systems)? We again would not consider these changes as significant, although newer rules may be needed to be included in the cert basis if the original cert basis of the aircraft did not consider this type of technology. What about updating the cockpit from one EFIS system to a different/newer EFIS system? Again, we would not consider this change as significant.
The blanket inclusion of cockpit upgrades as "significant" change may have been proposed this way to ensure that newer rules, such as HIRF and Lightning, are considered in an aircraft modification if those rules did not form part of the original certification basis of the aircraft. However, C.S. 21 allows new rules to be invoked, or special conditions to be applied, in such circumstances. A finding that the change is "significant" is not required for newer rules to be invoked if the original certification basis is not adequate to address the technology being presented for certification.
As this area of the regulations must be clearly defined as we move down the path towards the implementation and installation of SESAR equipment clear policy and guidance is necessary. As a result, GAMA has places a high degree of importance on this particular section of this proposal. Please consider

holding additional dialogue on this area with GAMA as these comments are dispositioned and addressed in the proposal because of this importance.

response

Partially accepted

The description of this example has been improved (and unified across the tables in Appendix A) to indicate that a "comprehensive flight deck upgrade" means a sufficiently complete renovation of the whole cockpit by replacement of old technology instrumentation with a new modern technology involving necessary changes to the integration and architecture concepts. Certainly addition or replacement of a single piece or two pieces of instrumentation would not fall under the new description and therefore classification 'significant' would not apply to such cases. It is not possible to address all possible scenarios of upgrades to the cockpit. Appendix A provides at least some examples of partial upgrades to the cockpit instrumentation falling outside the scope of "comprehensive" (installation of an autopilot, TAWS, IFR upgrade etc.) and classified 'Not significant'.

References to AFM have been removed from this example.

No change to the rules is needed to classify "comprehensive flight deck upgrade" significant.

comment

96 comment by: *General Aviation Manufacturers Association (GAMA)*

Appendix 1 (Not Significant, Page 52) - This part of the appendix gives an example of an “APU installation that is not flight essential” as Not Significant. GAMA believes this is a good example for comparison. This example includes the installation of a jet engine and large generator in the back of an airplane, with the integration of fuel changes, electrical changes, controls added, fire detection/protection, structural issues, etc. and this change is and has been classified as “not significant”. But per the “A comprehensive flight deck upgrade” example, installing a standalone LCD display that combines the display of attitude, altitude and airspeed, with no other functions, is classified as “significant”. This is an unreasonable discrepancy in classifications and GAMA recommends the EASA address this inconsistency in the area of flight deck upgrades with further detail to indicate the level at which a upgrade does and does not reach the significant threshold.

response

Noted

See the response to comment 93

comment

97 comment by: *General Aviation Manufacturers Association (GAMA)*

Appendix 1 (Significant/Not Significant, Page 36, 44-45, 56, 63) - There are several examples using the terms “fuselage stretch” and “fuselage plug” that are either redundant or are in conflict throughout the appendix. If “Install a plug in fuselage and add interior in the plug - no change forward or aft of plug” is considered significant, why put the next line “Fuselage stretch and entire new interior” as the next one? Wouldn’t this be obvious after answering the one above? It implies there is some meaning in the difference which is not clear to the reader. GAMA believes that if the principles of construction and general configuration of a length increase are the same a small length increase that doesn’t affect other areas is a not significant change however in the case of a greater length change it would be significant. If this

is the differentiator that the EASA is trying to get at with the terms “stretch” and “plug”, this should be clarified.

response *Accepted*

All the examples related to a change in the fuselage length (rf. "fuselage stretch" and "fuselage plug") and have been reviewed, their description revised, terminology unified and redundant examples removed.

comment *98* comment by: *General Aviation Manufacturers Association (GAMA)*

Appendix 1 (Significant / Not Significant, Page 36, 44-45, 56, 63) - There are several examples using the terms “fuselage stretch” and “fuselage plug” that are either redundant or are in conflict throughout the appendix. If “Install a plug in fuselage and add interior in the plug - no change forward or aft of plug” is considered significant, why put the next line “Fuselage stretch and entire new interior” as the next one? Wouldn’t this be obvious after answering the one above? It implies there is some meaning in the difference which is not clear to the reader. GAMA believes that if the principles of construction and general configuration of a length increase are the same a small length increase that doesn’t affect other areas is a not significant change however in the case of a greater length change it would be significant. If this is the differentiator that the EASA is trying to get at with the terms “stretch” and “plug”, this should be clarified.

response *Accepted*

See response to the comment No. 97 (Comment No. 98 repeats comment No. 97)

comment *102* comment by: *General Aviation Manufacturers Association (GAMA)*

Appendix 1 (Significant, Page 45, 57) – This section states: “New interior or revised arrangement with a new/revised attachment system for interior components (e.g., seats, galleys, or closets).” represents a significant change to both C.S. 23 Small Airplanes and C.S. 25 Transport Airplanes. GAMA believes that new and especially revised attachment systems for interior components can be changed so as not to change principles of construction and not to invalidate assumptions used during certification. For example while a new interior completion may alter or add additional attachments for a new (narrower) seat or a larger galley, the principles of attachment are generally the same and therefore do not invoke C.S. 21.101(b)(1)(i)-(ii).
Since C.S. 21.101 was created, changes of this type have been completed both as significant and non-significant changes depending on the nature of the attachment and the degree of change. GAMA believes the EASA should change this section to state: “New/revised attachment principles in new interior or revised arrangements for interior components (e.g., seats, galleys, or closets).” To assure that situations such as the re-use of existing attachment types in a similar location do not invoke a major change. Additionally, the EASA should include some discussion of what constitutes a new or revised attachment system.

response *Partially accepted*

After a discussion it was concluded that the example could be a significant change or a not significant change, depending on the nature and degree of the

change in the attachment system. The majority of these changes not changing the principles of attachment will be not classified significant. However, there could be cases where the change is significant at the product level. Due to possibilities of different types of changes, this will be handled on a case by case basis, and the example is removed from tables of Appendix A.

comment

114 comment by: *Embraer - Indústria Brasileira de Aeronáutica - S.A.*

Appendix 1 - Classification of Changes

Page 40, Weight increase that places the aircraft into the commuter category (i.e., above 12,500 lbs) and Page 44, Conversion from normal category to commuter category airplane

What is the difference in the two entries concerning a change from normal category to commuter category? We do not understand how this type of modification is considered to change the general configuration (page 44)?

We propose to delete the example on page 44 (Conversion from normal category to commuter category airplane).

response

Partially accepted

The specific examples concerning a weight increase and seating increase leading to a need to change from the normal to the commuter category have been removed. One general example of "conversion from normal category to commuter category aeroplane" is kept and covers all reasons.

comment

115 comment by: *Embraer - Indústria Brasileira de Aeronáutica - S.A.*

Page 40 - Increase in cabin pressurisation; Page 56 - Change to pressurized cabin, including the introduction of a pressurization system; and Page 61- Change to airplane's cabin operating altitude, or operating pressure change to airplane's design limit

Similar to our comment about the five percent criterion for wing loads, Embraer believes that the ten percent standard, as used for design weights and thrust, is a more reasonable threshold for significance for changes to cabin pressurization. Below this there is typically no change in general configuration (only local structural reinforcement and minor system control changes) and no change to certification assumptions (no change to methodology).

response

Accepted

The 5% threshold criteria in these examples has been changed to 10%.

comment

116 comment by: *Embraer - Indústria Brasileira de Aeronáutica - S.A.*

Pages 41- 42 and 60-61, Expansion of an aircraft's operating envelope

We do not believe that it is necessary to single out wing loads as a criterion for significance. The example modification of an increase in range of C.G. would

have a larger impact on empennage loads, yet the modification would be considered significant only if it increased wing loads by more than five percent.

We think that the criteria for design weights and the existing criteria for envelope expansion are adequate and it is not necessary to add this specific example of wing loads. In addition, a five percent increase in design weights would nominally increase loads by approximately five percent, so the ten percent criterion for design weights would likely become moot because the five percent criterion on wing loads would always be controlling.

If EASA believes that wing loads must be considered in determination of significance, then further guidance on how "wing load" is to be determined would be helpful. Normally, there is no single value of wing load, but rather it is calculated in many different wing locations for different load conditions, e.g. maneuver, landing, inertial. Would the increase of a single load case (even though it may not be a critical case) be sufficient for the modification to be considered significant? That does not appear to meet the "product level change" type modification that Changed Product Rule was intended to address.

response *Accepted*

The text in the Notes column (both for small and large aeroplanes) has been amended to remove the 5% wing load threshold as a leading criterion triggering classification 'significant'. All the criteria affecting the envelope expansion (design weight, maximum altitude, airspeed) will have to be evaluated for "appreciable" effect which would make such change significant when invalidating the assumptions (on the product level) used for original certification. The Note column also indicates that merely operating a product to an expanded envelope for which it was originally designed is generally not a significant change.

comment *117* comment by: *Embraer - Indústria Brasileira de Aeronáutica - S.A.*

Pages 52 and 65 No fuselage stretch but complete new interior and Existing type design - complete new interior but no new/revised attachment system, i.e. Green completion

These two examples appear to be the same change. It would be helpful if you would clarify what the difference, if any, exists here. If does not, we propose to delete one of them.

response *Accepted*

The second example has been removed as redundant.

B. DRAFT DECISION - Appendix 1 to GM 21A.101 Classification of Changes - Table of examples of changes for Large Aeroplanes p. 54-66

comment *44* comment by: *ERIC BODIN*

In the table of examples of changes for Large Aeroplanes (page 56 and 57 of NPA), when change introduce new/revised attachment system for interior components (e.g. seats, galleys, or closets) the answer to the following questions is YES and consequently change is considered as significant:

- Is there a change to the principles of construction?
- Have the assumptions used for certification been invalidated?

In many case change introduce new or revised attachment system with similar principe of construction and showing of compliance and change is not considered as significant.
Could it be possible to explain more precisely the wording new/revised attachment system (some example would be appreciate).

response *Partially accepted*

See the response to comment No 102.

comment *50* comment by: *KLM EASA DOA 21J.012*

Ref:

Table of examples page 65: "Existing type design – complete new interior but no new/revised attachment system, i.e. Green completion".

Comment:

We assume this wording reflects the means of attachment of monuments and seats to the aircraft structure (e.g. tie rods for top attachments & hard points for floor attachments for installation of galleys and closets, and studs in seat tracks for seat installations).

To our understanding the relocation of existing means of attachment - and the installation of new ones of the same design - or the installation of seat tracks to floor structure intercostals for the purpose of relocating existing monuments and seats, does not introduce a “new or revised attachment system” and is therefore not classified as a “significant change”.
Similarly the installation of the same means of attachments as already incorporated in the approved aircraft type design to support the installation of new/additional seats and/or monuments is not considered a significant change.

Proposal:

EASA should clarify the meaning of “new/revised attachment systems”

response *Partially accepted*

See the response to comment No 102.

comment *52* comment by: *LHT DO*

Please note that the current original examples of changes have been derived from real projects and were provided by the FAA and JAA. It seems that the NPA is now using synthetically modified and restructured examples that do not in every case reflect real data.

The intent of the rule as originally communicated by the authorities was to categorize changes in accordance to their repercussion on the product. This was originally called product level changes. The new defined examples do not in every case reflect this intention.

Please re-categorizes following example to be not-significant because it does

neither change the principles of construction nor invalidate the assumptions used for certification on a product level: “New interior or revised arrangement with a new/revised attachment system for interior components (e.g. seats, galleys, or closets)”.

response *Noted*

See the response to comment No 102.

comment *54* comment by: *LHT DO*

Please avoid that technically independent changes are combined in one example. This leads to a misjudgement of the separated changes if not applied in parallel.

Please separate the following example into two different once (as in the existing released AMC&GM): “Fuselage stretch (or shortening) and entire new interior”.
It might be correct, that a fuselage length change has to be categorized as significant (refer to the two different examples in the existing AMC&GM, one is significant, one is not-significant).
On the other hand it has been discussed in the original working group and mutually agreed among the industry team members and the team of the authorities, that the installation of an aircraft interior is neither a change to the principles of construction nor does it invalidate the assumptions used for certification on a product level.

response *Accepted*

The request for example separation has been satisfied by removal of the 'entire new interior' part.

comment *68* comment by: *Boeing*

Page: 56 of 105
Paragraph: *Table of examples of SIGNIFICANT changes for Large Aeroplanes (CS-25)*
Row: Fuselage length change – stretch (or shortening) and entire new interior

Boeing recommends that clarification be added in the Notes section for the Significant Change example on *“Fuselage stretch (or shortening) and entire new interior,”* as follows:

“Notes: A new interior is a change in architecture (e.g., ceilings, bins, sidewalls, and door linings package) that results in an update to the look and feel of the interior. The portion of the interior considered “significant” is limited to those aspects associated with the new architecture. The other aspects would remain “not significant” if the maximum passenger capacity is not increasing.”

JUSTIFICATION: Our suggested text serves to clarify what constitutes an *“entire new interior”* at the product level.

response *Not accepted*

The comment recommendation cannot be accommodated in this example since the 'entire new interior' part of the example has been removed. In addition,

the Notes column has been revised to clarify that the (existing) cabin interior may become an affected area if the functional effects of the fuselage length change have implications to occupants safety.

New cabin interior with no fuselage stretch remains not significant. The Notes column has been revised to describe this and to indicate it may be necessary to apply special conditions to have adequate standards for any novel features if not available in the existing TC or later specifications.

comment *69* comment by: *Boeing*

Page: 56 of 105,
Paragraph: *Table of examples of SIGNIFICANT changes for Large Aeroplanes (CS-25)*
Row: Install a plug in fuselage and add interior in the plug – with no interior changes forward or aft of the plug

Boeing recommends that clarification be added in the Notes section for the Significant Change example, *"Install a plug in fuselage and add interior in the plug – with no interior changes forward or aft of the plug,"* as follows:

"Notes: The stretching of the fuselage is the significant product level change.

The unchanged interior forward and aft of the plug is not part of the significant product level change. The interior that fills the plug and the "interior interface changes" to complete the installation of the plug are considered part of the significant change, but do not drive the classification of the plug to be significant if the maximum passenger count is not increasing. This interior change may be a candidate to be considered a secondary change. An example of interior changes at the plug interface area would be the bin installation where the bin size could change to accommodate the standard length bin."

JUSTIFICATION: Our suggested text serves to clarify:

1. which aspects are considered a significant change at the product level; and
2. that there can be changes to the interior to smoothly integrate the existing interior with the added plug section.

response *Not accepted*

As explained in the response to the comment No 68, not just the new cabin interior in the plug but the entire cabin interior becomes an affected area if the functional effects of the fuselage length change have implications on occupant safety. Such a change would not qualify under the "not materially contributing to the level of safety" exception and the interior in the plug could therefore not be considered secondary.

This example has been anyhow decided to be removed as not adding to clarity.

comment *70* comment by: *Boeing*

Page: 56-57 of 105,
Paragraph: *Table of examples of SIGNIFICANT changes for Large Aeroplanes*

(CS-25)
Row: New interior or revised arrangement with a new/revised attachment system for interior components (e.g., seats, galleys, or closets)

Boeing recommends that clarification be added in the Notes section for the significant change example, *"New interior or revised arrangement with a new/revised attachment system for interior components (e.g., seats, galleys, or closets),"* as follows:

"Notes:

A new interior is a change in architecture (e.g., ceilings, bins, sidewalls, and door linings package) that results in an update to the look and feel of the interior.

A new/revised attachment system is defined as a completely different principle of attachment and new technology. A revision to an attachment system that rearranges or revises parts while utilizing the same methodology is not a new/revised attachment system. A change from hard point mounted to seat track mounted (or vice-versa) is not considered a new/revised attachment system.

When there is a new/revised attachment system, the portion of the interior considered 'significant' is limited to those aspects associated with the new attachment system. The other aspects would remain " 'not significant' if it is determined that there is no effect."

JUSTIFICATION: The addition of our suggested text would:

1. clarify what constitutes a "new interior" or revised arrangement at the product level, and to clarify what is considered a new/revised attachment system for interior components;

2. clarify that a "new interior" or a revised arrangement are not-significant unless a new/revised attachment system for the interior components has occurred; and

3. be consistent with the *Not Significant* section on Page 65, as well as following the guidance on Page 22, which addresses what changes are evaluated at the product (airplane) level.

Appendix 4 defines Product Level Change – a change or combination of changes that makes the product distinct from other models of the product (for example, range, payload, speed, design philosophy). Product level change is defined at the aircraft, aircraft engine, or propeller level of change.

This comment also applies to the comparable CS-23 item.

response *Noted*

See the response to comment No 102.

comment *71* comment by: *Boeing*

Page: 65 of 105

Paragraph: *Table of examples of NOT SIGNIFICANT changes for Large Aeroplanes (CS-25)*
Row: No fuselage stretch but complete new interior.

Boeing recommends that the description of change for the "not significant" change example, *"No fuselage stretch but complete new interior,"* be revised as follows:

"No fuselage stretch but a complete new interior architecture (e.g., ceilings, bins, sidewalls, and door linings package), that results in an update to the look and feel of the interior, without a new/revised attachment system for those changed interior items."

We also recommend that clarification be added in the Notes section as follows:

"Notes: A new/revised attachment system is defined as a completely different principle of attachment and new technology. A revision to an attachment system that rearranges or revises parts while utilizing the same methodology is not a new/revised attachment system. For example, a change from hard point mounted to seat track mounted (or vice-versa) is not considered a new/revised attachment system."

JUSTIFICATION: Our recommended changes serve to clarify what constitutes a *"complete new interior"* and to clarify what is considered a new/revised attachment system.

This comment also applies to the comparable CS-23 item.

response *Partially accepted*

The recommended text has not been carried since the example of a new/revised attachment system was removed from tables to be handled on case by case basis. However, changes have been made to the Notes column to describe new cabin interior change.

comment *72* comment by: *Boeing*

Page: 65 of 105,
Paragraph: *Table of examples of NOT SIGNIFICANT changes for Large Aeroplanes (CS-25)*
Row: Existing type design – complete new interior but no new/revised attachment system, i.e. Green completion

Boeing recommends that clarification be added in the Notes section for the "not significant" change example, *"Existing type design - complete new interior but no new/revised attachment system, i.e. Green completion,"* as follows:

"Notes: A new/revised attachment system is defined as a completely different principle of attachment and new technology. A revision to an attachment system that rearranges or revises parts while utilizing the same methodology is not a new/revised attachment system. For example, a change from hard point mounted to seat track mounted (or vice-versa) is not considered a new/revised attachment system."

JUSTIFICATION: Our recommended changes serve to clarify what is considered a *"new/revised attachment system."*

This comment also applies to the comparable CS-23 item.

response *Not accepted*

The recommended text has not been carried since the example of a new/revised attachment system has been removed from tables to be handled on case by case basis. This specific example (Green completion) has been also removed.

comment *73* comment by: *Boeing*

Page: 65 of 105,
Paragraph: *Table of examples of NOT SIGNIFICANT changes for Large Aeroplanes (CS-25)*

Boeing recommends adding the following “Not Significant” change example:

“Existing type design - A rearrangement of an interior (e.g., seats, galleys, lavatories, closets, etc.) without a new/revised attachment system.

Notes: A new/revised attachment system is defined as a completely different principle of attachment and new technology. A revision to an attachment system that rearranges or revises parts while utilizing the same methodology is not a new/revised attachment system. For example, a change from hard point mounted to seat track mounted (or vice-versa) is not considered a new/revised attachment system.”

JUSTIFICATION: Rearrangement of interiors for customer-specific configurations using standard principles of construction and maintaining certification assumptions is considered a “not significant” change. Adding this example will ensure a consistent approach.

response *Partially accepted*

A new example has been added to "Not Significant" table as requested by the commenter to cover a re-arrangement of an interior.
The text on a new/revised attachment system not included since the issue was agreed to be removed from examples.

comment *74* comment by: *Boeing*

Page: 58 of 105,
Paragraph: *Table of examples of SIGNIFICANT changes for Large Aeroplanes (CS-25)*
Row: Change in type or number of emergency exits or an increase in the number of passengers demonstrated

Boeing recommends that the description be revised for the significant change example, *“Change in type or number of emergency exits or an increase in the number of passengers demonstrated,”* as follows:

“An increase in door type capacity (e.g., increasing from a Type 1 to a Type A), or a change in the number of emergency exits, or an increase in the number of passengers demonstrated.”

We also recommend that clarification be added in the Notes section, as follows:

"Notes: The new emergency egress requirements exceed those previously substantiated. The de-rating of an exit (e.g., a Type A to a Type C) is considered 'not-significant.'"

JUSTIFICATION: Our suggested text serves to clarify that it is the increase in door type capacity that makes the change "significant."

This comment also applies to the comparable CS-23 item.

response *Not accepted*

The language of this example has not changed since the original issuance of the AC/GM, and we are not aware of any difficulties resulting from the example. No change has been made.

comment *91* comment by: *General Aviation Manufacturers Association (GAMA)*

Appendix 1 (Substantial, Page 33-34 & 54) - There are a number of items that were previously shown as Significant that are now shown as Substantial. Certainly the last 4 items in this section should not be classified as substantial. In the absence of amending certification standards, where the impact of such a change can be appropriately addressed, such a change being proposed does not follow proper Regulatory Impact Assessment (RIA) Methodologies. GAMA believes this is a typographical error and should be changed back; otherwise, if the change is intentional, GAMA objects to the new classification. Obviously adding winglets or floats should not require a complete new evaluation of the aircraft and a new Type Certificate.
In the CS 23 and CS 25 world, there are some key examples of changes to dihedral or increased wingspan on single engine piston products and business jets alike which have always been classified as significant. Would these changes have been deemed Substantial, a great number of today's products would not be in existence. GAMA believes this type of change cannot be made in guidance material but must be included in formal amendment to the certification standards. GAMA requests that at least the last 4 items be moved back to significant as there has been no certification specification change to permit such a major shift in the certification environment.

response *Not accepted*

This comment is probably a copy of the comment presented to the FAA on their corresponding draft AC. The FAA recognized incorrect location of 4 examples due to a typographical error. However, the EASA NPA did not contain this error.

comment *94* comment by: *General Aviation Manufacturers Association (GAMA)*

Appendix 1 (Significant, Page 43, 58, 68) - With regard to "A comprehensive flight deck upgrade", GAMA disagrees with the new text of: "Example: changing from federated display (e.g. separate attitude, altitude, and airspeed) architecture to an integrated electronic flight information system."
This makes a hard example that any change from federated displays to integrated will cause the change to be considered significant. This example should state that such a change could be significant. It is difficult to understand how the simple act of moving airspeed, altitude and attitude to a

single display is a comprehensive flight deck upgrade or a product level change. A complete integrated cockpit that replaces all radios, the autopilot, moves the location of systems, changes aircraft electrical bussing, etc. could be considered a comprehensive flight deck upgrade and possibly a product level change.
GAMA also believes the intended operation of the aircraft should be considered in the determination of whether or not a comprehensive flight deck upgrade is significant or not (e.g. VFR vs IFR; especially for rotorcraft).
Also noted is that the statement "Requires new AFM" is confusing and not used consistently through the appendix. For example, this is listed in the note for the change of "A comprehensive flight deck upgrade" for a C.S. 23 airplane. Is a new AFM (this presumably means AFM *or* AFMS) a driver for the change to be considered significant? GAMA strongly disagrees if this is what is intended. A GPS navigator could be installed that requires an AFM/AFMS and certainly would not be a significant change. Also the same change listed for C.S. 25 (A comprehensive flight deck upgrade) does not state "Requires new AFM".
There is plenty of long-standing EASA interpretation of the change product regulation which would be invalidated with this proposed policy and policy cannot invalidate previously acceptable methods of compliance to existing regulations. A change to the regulation must be considered for this type of change.
We would like to see better clarification of the description of what, exactly, is considered a "comprehensive flight deck upgrade", and examples provided of cockpit upgrades that cross the line to significant, and examples of upgrades that are "not significant." The note provides some insight, but not enough, in our assessment, to objectively determine the threshold of change that is needed to determine a "significant" change from a "not significant" change.
It would be helpful if the appendix identified different types of cockpit updates and classified them as significant or otherwise. For example, is the addition of an integrated GPS/Com system with moving map a significant change? What about adding two such systems? What about adding two such systems and an autopilot? What about all of that and an electronic engine monitor? How about all of that and an electronic primary flight display? Etc. GAMA believes that none of these changes should be considered significant.
Focusing on EFIS systems, would adding a PFD with basic functions for AI, IAS, ALT and DG, while retaining all of the previous nav com equipment, be considered significant (e.g. Aspen Pilot or L3 Trilogy type display)? What if that single display EFIS includes an HSI and interfaces to the existing nav/com and autopilot (e.g. Aspen Pro). What if that EFIS system includes multiple displays with reversionary capability in a federated architecture (e.g. Aspen EFD1000 multi-display, G500/600 type systems)? We again would not consider these changes as significant, although newer rules may be needed to be included in the cert basis if the original cert basis of the aircraft did not consider this type of technology. What about updating the cockpit from one EFIS system to a different/newer EFIS system? Again, we would not consider this change as significant.
The blanket inclusion of cockpit upgrades as "significant" change may have been proposed this way to ensure that newer rules, such as HIRF and Lightning, are considered in an aircraft modification if those rules did not form part of the original certification basis of the aircraft. However, C.S. 21 allows new rules to be invoked, or special conditions to be applied, in such circumstances. A finding that the change is "significant" is not required for newer rules to be invoked if the original certification basis is not adequate to address the technology being presented for certification.
As this area of the regulations must be clearly defined as we move down the path towards the implementation and installation of SESAR equipment clear

policy and guidance is necessary. As a result, GAMA has places a high degree of importance on this particular section of this proposal. Please consider holding additional dialogue on this area with GAMA as these comments are dispositioned and addressed in the proposal because of this importance.

response *Partially accepted*

See response to the comment No 93.

comment *99* comment by: *General Aviation Manufacturers Association (GAMA)*

Appendix 1 (Significant / Not Significant, Page 36, 44-45, 56, 63) - There are several examples using the terms “fuselage stretch” and “fuselage plug” that are either redundant or are in conflict throughout the appendix. If “Install a plug in fuselage and add interior in the plug - no change forward or aft of plug” is considered significant, why put the next line “Fuselage stretch and entire new interior” as the next one? Wouldn’t this be obvious after answering the one above? It implies there is some meaning in the difference which is not clear to the reader. GAMA believes that if the principles of construction and general configuration of a length increase are the same a small length increase that doesn’t affect other areas is a not significant change however in the case of a greater length change it would be significant. If this is the differentiator that the EASA is trying to get at with the terms “stretch” and “plug”, this should be clarified.

response *Accepted*

All the examples related to a change in the fuselage length (rf. "fuselage stretch" and "fuselage plug") have been reviewed, description revised, terminology unified and redundant examples removed.

comment *100* comment by: *General Aviation Manufacturers Association (GAMA)*

Appendix 1 (Significant / Not Significant, Page 36, 44-45, 56, 63) - There are several examples using the terms “fuselage stretch” and “fuselage plug” that are either redundant or are in conflict throughout the appendix. If “Install a plug in fuselage and add interior in the plug - no change forward or aft of plug” is considered significant, why put the next line “Fuselage stretch and entire new interior” as the next one? Wouldn’t this be obvious after answering the one above? It implies there is some meaning in the difference which is not clear to the reader. GAMA believes that if the principles of construction and general configuration of a length increase are the same a small length increase that doesn’t affect other areas is a not significant change however in the case of a greater length change it would be significant. If this is the differentiator that the EASA is trying to get at with the terms “stretch” and “plug”, this should be clarified.

response *Accepted*

See response to the comment No.99 (Comment No. 100 repeats comment No. 99)

comment *101* comment by: *General Aviation Manufacturers Association (GAMA)*

Appendix 1 (Significant, Page 60-61) – This section states changes to the operating envelope are “normally” significant. If this is stating that something

like a 5% change is the threshold that will cause the change to be "normal" and therefore become a significant change, then GAMA is in agreement. If it is saying that ANY change to an airspeed limitation, for example, is "normally" significant, then GAMA disagrees and believes some allowance for small changes should be provided. GAMA recommends this item be clarified.
Further, GAMA request the EASA clarify that the Note on page 46 of the existing GM 21A.101 remains applicable. It is important to recognize that minor expansions of the envelope would not necessarily invalidate the assumptions used for certification of the baseline product design and that results for the changed product may be predictable and/or not require significant physical changes to the product. Such an elimination of this means of compliance cannot be accomplished by policy or guidance but must be made through rule change.

response *Accepted*

The text in the Notes column has been amended to indicate, among others, that merely operating a product to an expanded envelope for which it was originally designed is generally not a significant change. All the criteria affecting envelope expansion (design weight, maximum altitude, airpeed) will have to be evaluated for "appreciable" effect which would make the change only significant when invalidating the assumptions on product level used for certification of the baseline product.

comment *103* comment by: *General Aviation Manufacturers Association (GAMA)*

Appendix 1 (Significant, Page 45, 57) – This section states: “New interior or revised arrangement with a new/revised attachment system for interior components (e.g., seats, galleys, or closets).” represents a significant change to both C.S. 23 Small Airplanes and C.S. 25 Transport Airplanes. GAMA believes that new and especially revised attachment systems for interior components can be changed so as not to change principles of construction and not to invalidate assumptions used during certification. For example while a new interior completion may alter or add additional attachments for a new (narrower) seat or a larger galley, the principles of attachment are generally the same and therefore do not invoke C.S. 21.101(b)(1)(i)-(ii).
Since C.S. 21.101 was created, changes of this type have been completed both as significant and non-significant changes depending on the nature of the attachment and the degree of change. GAMA believes the EASA should change this section to state: “New/revised attachment principles in new interior or revised arrangements for interior components (e.g., seats, galleys, or closets).” To assure that situations such as the re-use of existing attachment types in a similar location do not invoke a major change. Additionally, the EASA should include some discussion of what constitutes a new or revised attachment system.

response *Partially accepted*

See response to comment No 102.

comment *104* comment by: *General Aviation Manufacturers Association (GAMA)*

Appendix 1 (Significant, Page 61) – GAMA disagrees that the conversion from hydraulically actuated to electrically actuated brakes is a significant change in all cases. It is possible to make such a change locally without impacting host landing gear for example. Such a design change may be

considered significant if there is measurable performance change due to brake performance, weight changes associated with the performance advantage and/or if control systems become of a highly integrated nature. However, in many cases, weight changes are not significant and any performance benefit is traded for payload gain – thus creating a minimal net effect to the assumptions or originally approved envelope of the product. GAMA recommends this item be clarified.

response

Not accepted

Disagreed that this change is not a significant change.

However, we revised this example by changing the criteria "Change to general configuration" and "Change to the principles of construction" from "Yes" to "No"
Also, references to "New TSO" and "change in applicable regulations" have been removed as this does not drive whether a change is significant or not.

comment

116 ❖ comment by: *Embraer - Indústria Brasileira de Aeronáutica - S.A.*

Pages 41- 42 and 60-61, Expansion of an aircraft's operating envelope

We do not believe that it is necessary to single out wing loads as a criterion for significance. The example modification of an increase in range of C.G. would have a larger impact on empennage loads, yet the modification would be considered significant only if it increased wing loads by more than five percent.

We think that the criteria for design weights and the existing criteria for envelope expansion are adequate and it is not necessary to add this specific example of wing loads. In addition, a five percent increase in design weights would nominally increase loads by approximately five percent, so the ten percent criterion for design weights would likely become moot because the five percent criterion on wing loads would always be controlling.

If EASA believes that wing loads must be considered in determination of significance, then further guidance on how "wing load" is to be determined would be helpful. Normally, there is no single value of wing load, but rather it is calculated in many different wing locations for different load conditions, e.g. maneuver, landing, inertial. Would the increase of a single load case (even though it may not be a critical case) be sufficient for the modification to be considered significant? That does not appear to meet the "product level change" type modification that Changed Product Rule was intended to address.

response

Accepted

The text in the Notes column (both for small and large aeroplanes) has been amended to remove the 5% wing load threshold as a leading criterion triggering classification 'significant' in this example. All the criteria affecting envelope expansion (design weight, maximum altitude, airspeed) will have to be evaluated for "appreciable" effect which would make such change significant when invalidating the assumptions on the product level used for original certification. The Note also indicates that merely operating a product to an expanded envelope for which it was originally designed is generally not a significant change.

comment

117 ❖ comment by: *Embraer - Indústria Brasileira de Aeronáutica - S.A.*

Pages 52 and 65 No fuselage stretch but complete new interior and Existing type design - complete new interior but no new/revised attachment system, i.e. Green completion

These two examples appear to be the same change. It would be helpful if you would clarify what the difference, if any, exists here. If does not, we propose to delete one of them.

response *Accepted*

The second example has been removed as redundant.

comment *118* comment by: *Embraer - Indústria Brasileira de Aeronáutica - S.A.*

Page 54, Change of empennage configuration for larger aeroplanes (cruciform vs. 'T' or 'V' tail)

Since this modification would have little or no impact on mechanical or electrical/avionics systems, propulsion, interior/cabin safety, or structure outside the modified area, it is difficult to understand how this change by itself would require a substantially complete investigation of compliance that is necessary to term something a substantial change. We believe it is not a substantial change by itself. Thus we propose to delete this.

response *Not accepted*

In contrary to the commenter's view, this change is considered to be a product level change so extensive that a number of design models, methodologies and approaches used to demonstrate previous compliance finding (in particular Subparts B, C and D of CS-25) cannot be used in a similarity argument and would have to be revised and newly demonstrated to apply to the changed product. The related effort and depth of investigation is expected to be 'substantial'.

This example has been added by the IIT Authorities in this revised version of the GM/AC to reflect recent certification experience gained.

comment *119* comment by: *Embraer - Indústria Brasileira de Aeronáutica - S.A.*

Page 56, Fuselage stretch and entire new interior and Page 56, Install a plug in fuselage and add interior in the plug - no change forward or aft of plug

The two examples about a fuselage stretch and adding a plug (which we understand to be the same change) are not clear. The first example (fuselage stretch plus entirely new interior) meets one of the automatic criteria, while the second example (same stretch/plug with interior added only to the stretch area), which is a significantly smaller project (previous interior is unchanged unlike the first example), meets all three criteria. Embraer suggests deleting the second example ("Install a plug in fuselage and add interior in the plug—with no interior changes forward or aft of the plug"), or at least to make clear what type of modification is being described.

response *Accepted*

All the examples related to a change in the fuselage length (rf. "fuselage

	stretch" and "fuselage plug") have been reviewed, description revised, terminology unified and redundant examples removed.

B. DRAFT DECISION - Appendix 1 to GM 21A.101 Classification of Changes - Table of examples of Changes for Rotorcraft p. 67-77

comment	*38* comment by: *Eurocopter* **Change to the general configuration.** On page 68, the answer to the question "*Is there a change to the general configuration?*" is reversed for the following examples of significant changes for rotorcraft: - Comprehensive flight deck upgrade - (Fixed) flying controls from mechanical to fly by wire No additional information is provided which could explain the change in the assessment to be made at the product level. *Recommendation:* Provide further guidance on what means "*general configuration*" at the product level.
response	*Not accepted* One of the objectives of this revision to the AC/GM guidance was to check for the same or similar examples in this appendix which are applicable to several categories of products and remove any unjustified inconsistencies in classification or description. For the two mentioned examples it was agreed to align classifications made for rotorcraft (CS-27/CS-29 table) with the classifications made for small/large aeroplanes (CS-23/CS-25 tables). The rationale was that, similarly to small/large aeroplanes, these changes when applied to a rotorcraft do not change the general configuration at the product level. The recommendation, however, has not been carried since all the examples in this appendix serve as a guidance on what constitutes (or not) a change to the general configuration.

comment	*39* comment by: *Eurocopter* **Change to the principles of construction.** On page 68, the answer to the question "*Is there a change to the principles of construction?*" is reversed for the following examples of significant changes for rotorcraft: - (Fixed) flying controls from mechanical to fly by wire - Addition of an engine... No additional information is provided which could explain the change in the assessment to be made at the product level. *Recommendation:* Provide further guidance on what means "*principles of construction*" at the product level.
response	*Noted* As to the first example, ((Fixed) flying controls from mechanical to fly by wire), the classification has been reversed because it was found not justified to

classify this change differently for rotorcraft and for small/large aeroplanes.

As to the second example (Addition of engine) the answer has been changed from "No" to "Yes" since it has been concluded that operating characteristics are changed at the product level.

The recommendation, however, has not been carried since all the examples in this appendix serve as guidance on what constitutes a change to the general configuration and what does not.

comment

40 comment by: *Eurocopter*

Assumptions used for certification.
On page 70, for the example of significant change for rotorcraft "Change of the number of rotor blades", the answer to the question "*Have the assumptions used for certification been invalidated?*" is reversed.
No additional information is provided which could explain the change in the assessment to be made at the product level.

Recommendation:
Provide further guidance on what means "*certification assumptions*" at the product level.

response

Noted

The previous AC/GM incorrectly identified the certification assumptions as remaining valid. This example has been revised to correctly reflect that the assumptions of certification are invalidated when the number of rotor blades is changed.

comment

41 comment by: *Eurocopter*

Page 71 **Special purpose operations**
Rotorcraft "Firefighting equipment" and "Agricultural configuration" are two examples relating to special purpose operations for which adequate safety with regard to the intended use is to be ensured.
Such special purpose operations generally require the installation of removable mission equipment, and the provisions for such equipment do not require a significant change to the original product, so that the significance may be found more at the area/system level than at the product level.
In addition, the application of the latest regulations for such operations could be considered not to contribute materially to the level of safety or be practical for the intended use.
An adequate safety could be ensured based on a certification basis adequacy analysis.

Recommendation:
Add a note to refer to the suggested additional Chapter 4 Section 7. dealing with restricted category aircraft (see comment 36):
"Refer to Chapter 4. "Other Considerations" Paragraph 7. "Restricted Category Aircraft" for establishing the certification basis for products changed for special purpose operations."

response

Partially accepted

If an applicant is changing a passenger configuration to a special purpose configuration, such as fire fighting or agricultural, it is typically considered a

significant change per 21A.101 based on changes in general configuration and certification assumptions. While it may be removable, firefighting equipment when installed in a helicopter does change its configuration and may invalidate certification assumptions at the product level when these configurations were not addressed in the previous type certification of the product. It may even lead to a need to issue a restricted type certificate (for a number of modified tail number helicopters) or a restricted certificate of airworthiness (for a single tail number modified helicopter) because the changed product failed to show compliance with some certification specifications of the prescribed type-certification basis.

Nevertheless, a note was added suggesting that evaluation may depend on the actual firefighting/agricultural configuration.

As to the applicability of the two exceptions allowing to derogate from the use of the latest specifications ("do not materially contribute to the level of safety" and "impracticality"), it is agreed that they may be found acceptable, if properly justified.

A note was added to refer to paragraph 5. of Chapter 4. "Restricted Category Aircraft" (see also the response to the comment 36)

comment *42* comment by: *Eurocopter*

External loads

Page 71: HEC certification approval.
The answer to the question "*Have the assumptions used for certification been invalidated?*" is "*Yes*". It is not clear as how the product level assumptions used for certification are invalidated. The certification assumptions seem to be more changed at the area/system level than at the product level.

Recommendation:
Delete the item.
Complete the note for the external cargo hoist example on page 75 (see below).

Page 75: External cargo hoist.
The note was changed to exclude HEC.

Recommendation:
Retain the former note which did not exclude HEC, and add a note to highlight the need for an adequate certification basis in case of HEC.

response *Not accepted*

If the assumptions used for the original type-certification did not consider HEC certification approval (which is now requested under a change to TC), then these original assumptions are no longer valid for the changed product. Such a change is per the requirements of 21A.101(a)(1)(ii) considered a significant change and the latest specifications applicable for the HEC approval must be complied with to obtain operational approval.

comment *43* comment by: *Eurocopter*

IFR minimum flight crew

The IFR minimum flight crew is addressed under the same heading "Reducing the number of pilots for IFR from 2 to 1 " on page 71/72 as a significant change and on page 77 as a not significant change with reservations as regards the magnitude of the change.

Recommendation:
Delete the item on page 71/72.
or
Delete the item on page 77 and add a note on page 71/72 to make clear that the change should not automatically be classified as significant.

response *Partially accepted*

The entry in the table of Not significant examples has been deleted because it is a significant change based on invalidated certification assumptions.

comment *45* comment by: *INAER*

Most of our customers are involved in fire-fighting activities. We design several changes to those helicopters and I do not understand the new examples given in “Table of examples of Changes for Rotorcraft”.

Could you be so kind to give a further explanation (and examples) about why you understand that the following new example in page 71 of 105 is a significant change?

Passenger configured helicopter to a fire fighting equipment configured helicopter…

1)… changes the general configuration
2)… invalidates the assumptions used for certification?

response *Noted*

See the response to the comment No 41.

comment *46* comment by: *Eurocopter*

Interiors
Changes in interiors are addressed in examples for small and large aeroplanes. For rotorcraft only EMS configurations are addressed. It should be made clear that, for rotorcraft, changes in interiors are normally not product level changes and, as such, are not to be classified as significant (principles of construction at the product level and assumptions used for certification at the product level are normally not affected, including in the case of a new or revised interior with a new or revised attachment system).

response *Not accepted*

Changes to interiors are addressed for rotorcraft under other specific changes in product configuration (EMS, passenger to fire fighting, passenger to agricultural).

comment *95* comment by: *General Aviation Manufacturers Association (GAMA)*

Appendix 1 (Significant, Page 43, 58, 68) - With regard to “A comprehensive flight deck upgrade”, GAMA disagrees with the new text of:

"Example: changing from federated display (e.g. separate attitude, altitude, and airspeed) architecture to an integrated electronic flight information system."
This makes a hard example that any change from federated displays to integrated will cause the change to be considered significant. This example should state that such a change could be significant. It is difficult to understand how the simple act of moving airspeed, altitude and attitude to a single display is a comprehensive flight deck upgrade or a product level change. A complete integrated cockpit that replaces all radios, the autopilot, moves the location of systems, changes aircraft electrical bussing, etc. could be considered a comprehensive flight deck upgrade and possibly a product level change.
GAMA also believes the intended operation of the aircraft should be considered in the determination of whether or not a comprehensive flight deck upgrade is significant or not (e.g. VFR vs IFR; especially for rotorcraft).
Also noted is that the statement "Requires new AFM" is confusing and not used consistently through the appendix. For example, this is listed in the note for the change of "A comprehensive flight deck upgrade" for a C.S. 23 airplane. Is a new AFM (this presumably means AFM *or* AFMS) a driver for the change to be considered significant? GAMA strongly disagrees if this is what is intended. A GPS navigator could be installed that requires an AFM/AFMS and certainly would not be a significant change. Also the same change listed for C.S. 25 (A comprehensive flight deck upgrade) does not state "Requires new AFM".
There is plenty of long-standing EASA interpretation of the change product regulation which would be invalidated with this proposed policy and policy cannot invalidate previously acceptable methods of compliance to existing regulations. A change to the regulation must be considered for this type of change.
We would like to see better clarification of the description of what, exactly, is considered a "comprehensive flight deck upgrade", and examples provided of cockpit upgrades that cross the line to significant, and examples of upgrades that are "not significant." The note provides some insight, but not enough, in our assessment, to objectively determine the threshold of change that is needed to determine a "significant" change from a "not significant" change.
It would be helpful if the appendix identified different types of cockpit updates and classified them as significant or otherwise. For example, is the addition of an integrated GPS/Com system with moving map a significant change? What about adding two such systems? What about adding two such systems and an autopilot? What about all of that and an electronic engine monitor? How about all of that and an electronic primary flight display? Etc. GAMA believes that none of these changes should be considered significant.
Focusing on EFIS systems, would adding a PFD with basic functions for AI, IAS, ALT and DG, while retaining all of the previous nav com equipment, be considered significant (e.g. Aspen Pilot or L3 Trilogy type display)? What if that single display EFIS includes an HSI and interfaces to the existing nav/com and autopilot (e.g. Aspen Pro). What if that EFIS system includes multiple displays with reversionary capability in a federated architecture (e.g. Aspen EFD1000 multi-display, G500/600 type systems)? We again would not consider these changes as significant, although newer rules may be needed to be included in the cert basis if the original cert basis of the aircraft did not consider this type of technology. What about updating the cockpit from one EFIS system to a different/newer EFIS system? Again, we would not consider this change as significant.
The blanket inclusion of cockpit upgrades as "significant" change may have been proposed this way to ensure that newer rules, such as HIRF and Lightning, are considered in an aircraft modification if those rules did not form

part of the original certification basis of the aircraft. However, C.S. 21 allows new rules to be invoked, or special conditions to be applied, in such circumstances. A finding that the change is “significant” is not required for newer rules to be invoked if the original certification basis is not adequate to address the technology being presented for certification.
As this area of the regulations must be clearly defined as we move down the path towards the implementation and installation of SESAR equipment clear policy and guidance is necessary. As a result, GAMA has places a high degree of importance on this particular section of this proposal. Please consider holding additional dialogue on this area with GAMA as these comments are dispositioned and addressed in the proposal because of this importance.

response *Partially accepted*

See response to the comment No 102.

B. DRAFT DECISION - Appendix 1 to GM 21A.101 Classification of Changes - Examples for Engines and Propellers p. 78-90

comment *9* comment by: *Francis Fagegaltier Services*

Turbofan to geared-fan.

The "yes" in the "assumptions" column cannot be understood. There is no identifiable assumption which would be involved in such a change.

In the "notes" column, it is true that the change would affect the engine in terms of FOD, containment. This is also true for many changes in an engine: this is not a valid comment with regard to the 3 criteria "general configuration", "principles of construction", "assumptions".

There should be a "no" in the "assumptions" column.

response *Not accepted*

This and several other examples for which (in the Notes column) there was an indication "Note that this change is most likely substantial under 21A.19" have been reclassified from "Significant" to "Substantial" with consequent replacement of Yes/No answers to N/A. The Notes column has been amended accordingly. This is justified by the fact that these changes are 'most likely' so extensive that the design models, methodologies, and approaches used to demonstrate a previous compliance finding could not be used and a substantially complete investigation of compliance with the applicable certification specifications would be required.

comment *10* comment by: *Francis Fagegaltier Services*

Low by-pass to high by-pass.

The "yes" in the "general configuration column" cannot be understood. The size of the fan is not a change in general configuration. The difference between "low by-pass" and high by-pass" is minor. What is considered low by-pass ? Is a modern engine with a 10:1 by pass ratio a high by-pass engine when compared to recent engines with only a 5:1 ratio which would then be "low by pass" engines ?

There should be a "no" in the "general configuration" column.

The "yes" in the assumptions" column should also be a "no". The statement "assumptions for certification may no longer be valid in terms of ingestion, icing, etc." in the "notes" column cannot be understood :the certification criteria for birds, icing, etc. are in CS-E and are certification specifications, not assumptions.

response

Not accepted

See response to the comment No 9.

comment

11 comment by: *Francis Fagegaltier Services*

turbojet to turbofan

The "yes" in the assumptions" column should be a "no". The statement "assumptions for certification may no longer be valid in terms of ...." in the "notes" column cannot be understood :the certification criteria for birds, icing, etc. are in CS-E and are certification specifications, not assumptions.

response

Not accepted

See response to the comment No 9.

comment

12 comment by: *Francis Fagegaltier Services*

Turbo-shaft to turbo-propeller

The "yes" in the "assumptions" column may be correct. However, it should be noted that the assumptions which are noted (mission profile, flight envelop) are assumptions with the CS-E30 meaning. The question is to determine if they are assumptions with 21A.101 meaning (reminder: 21A.101 assumptions are not defined).

response

Not accepted

See response to the comment No 9.

comment

13 comment by: *Francis Fagegaltier Services*

Combining military modules.

The general concern behind this topic may perhaps be identified by an informed reader However, as worded it is not clear.

Is the intent to deal with incorporation of modules from a fighter engine into an unrelated commercial engine? This is a very improbable situation because the module would likely not fit into the engine.

Is the intent to deal with the case of a commercial core engine based originally on a military core engine? The changes made over the years in both the commercial and the military engines would likely lead to a difficulty to fit the military module into the commercial engine.

Is the intent to deal with commercial engines used by military organisations? In this case, the military engines cannot always be considered as being

"uncertified" (some are certified by EASA and FAA). Incorporation of "civil" modules used by military organisations into a commercial engine would then be relevant to Part 145, not to Part 21.

This subject, mixing certification aspects with maintenance aspects, should then be clarified.

response

Noted

It is the first scenario that was intended to be addressed by this new example but, because it is agreed that such scenario is not very probable/frequent, the example has been withdrawn. If an application for such a change is presented, it will be dealt with on case by case basis.

comment

14 comment by: *Francis Fagegaltier Services*

Increase/decrease in the number of compressor/turbine stages.

The "no" in the "general configuration" column is highly surprising! Especially when the size of the fan would change the configuration (second engine example in that appendix) but not the addition of 10 compressor stages and 5 turbine stages! Even more surprising: to change a "disk +blades" into a "blisk" would change the engine configuration (next example in this appendix).

The use of "yes" and "no" in this table should be based on logical criteria, not on arbitrary ones.

The arguments found in the "notes" column would be more appropriate for justifying a "yes" in the "general configuration" column.

The "yes" in the "assumptions" column should be a "no" (same rationale as for other comments).

response

Partially accepted

The commenter's arguments for the "general configuration" have been accepted. The "No" has been changed to "Yes".

However, no change in the "assumptions" column since it is considered a product level change to the original design/engineering assumptions with related invalidation of the analytical models, methodologies or fundamental approaches used to demonstrate compliance in the original certification. This response is valid for several other comments where the same commenter is proposing to change "Yes" in the "assumptions" column to "No".

comment

15 comment by: *Francis Fagegaltier Services*

blisk

To change the design of the fan blade and fan hub or to change a "disk + blade" into a "blisk" would not change significantly the engine. In any case the general configuration would not be changed and no assumption would need to be modified. The rationale in the "notes" column cannot be understood because it is not relevant to the example.

The change to the fan diameter is dealt with in another example (low by-pass to high by-pass).

The "yes" in the "general configuration" column is even more surprising when we see that addition of dozens of new compressor and turbine stages would not change the general configuration (in the example above this one) !

There should be "no" in all columns. Furthermore, this example is hardly a significant change. It should be added to the "non significant" examples.

response *Not accepted*

The classification of the change remains "significant" for the reasons explained in the "Notes" column which are confirmed.

comment *16* comment by: *Francis Fagegaltier Services*

Hydro-mechanical to FADEC.

The "yes" in the "assumptions" column should be a "no". The statement in the "notes" column is not related to any assumption but indicates only some items for certification which are part of CS-E certification specifications.

Furthermore, this would provide consistency with the same change in the piston engines which has a "no" in the "assumptions" column.

response *Accepted*

The commenter's arguments for the "assumptions" have been in this particular case accepted. The "Yes" has been changed to "No".

comment *17* comment by: *Francis Fagegaltier Services*

Change in containment.

The "yes" in the "assumptions" column should be reverted back to a "no" as in original table. There is no argument justifying any effect on any assumption. In the "notes" column, the only arguments are justifying the change in principles of construction.

response *Accepted*

The commenter's arguments for the "assumptions" have been accepted in this particular case. The "Yes" has been changed back to "No".

comment *18* comment by: *Francis Fagegaltier Services*

Change in gas generator.

The "yes" in the "assumptions" column should be changed into a "no" because no assumption would be affected by such a change.

response *Not accepted*

Changes to the operational limitations unlikely to be solved by an extrapolation from the previous analysis.

comment *19* comment by: *Francis Fagegaltier Services*

	air cooled cylinder to liquid cooled. The "yes" in the "assumptions" column should be a "no". No assumption would be affected by such a change.
response	*Not accepted* Certification assumptions invalidated: Change in operating envelope and engine temperature requirements unlikely to be solved by an extrapolation from the previous analysis.

comment	*20* comment by: *Francis Fagegaltier Services* spark ignition to compression ignition. The "yes" in the "assumptions" column should be changed to a "no" because no assumption would be affected by such a change.
response	*Noted* Certification assumptions invalidated: Change in operating envelope and performance unlikely to be solved by an extrapolation from the previous analysis.

comment	*21* comment by: *Francis Fagegaltier Services* non significant turbine engines: increase/ decrease in the number of compressor/turbine stages. The "no" in the "general configuration" cannot be understood at all : it is obvious that the engine configuration would be significantly changed. The only difference between this example and the one classified as "significant" is an effect on operational performance: this criteria by no means affects the engine configuration. This is a significant change because the general configuration of the engine is changed.
response	*Not accepted* Not considered to be a product level change.

comment	*22* comment by: *Francis Fagegaltier Services* In many cases, we find a note "component level change". This note cannot be understood and by no means provides any useful guidance. Worse, it is confusing on the necessary certification tasks. Whatever the design change, the applicant must demonstrate that the changed product still complies with the applicable certification basis. Certification is at engine level, not at component level. This note should be deleted in all places where it appears.
response	*Accepted*

The intent of the note was to indicate the change has not reached the product level. However, since considered redundant to "Not significant" classification, these notes have been removed from this and other examples.

comment

23 comment by: *Francis Fagegaltier Services*

For propellers, to be consistent with the examples given for turbine engines, it would be interesting to know if a change in blades number is to be considered as a significant change (this might also be a substantial change).

response

Accepted

The example has been added and classified as a 'substantial' change.

comment

25 comment by: *Francis Fagegaltier Services*

It is interesting to note that 50% of the examples of significant changes for turbine engines would in fact be classified as substantial changes, not as significant changes. This illustrates another comment : there is no longer a need for 21A.19, the job being done by 21A.101 (a).

It is suggested deleting these examples from the table because they are not examples of "significant changes".

response

Partially accepted

6 examples for which (in the Notes column) there was an indication "Note that this change is most likely substantial under 21A.19" have been reclassified from "Significant" to "Substantial" with consequent replacement of Yes/No answers to N/A. The Notes column has been amended accordingly. This is based on the fact that these changes are 'most likely' so extensive that the design models, methodologies, and approaches used to demonstrate a previous compliance finding could not be used and a substantially complete investigation of compliance with the applicable certification specifications would be required.

comment

26 comment by: *Francis Fagegaltier Services*

It is surprising to note that, in the turbine engine examples, as they are proposed in the NPA, all have at least one "yes" in one of the 3 columns representing the cases where the change is automatically considered as being significant.

Does this mean that there is no significant change for turbine engine outside these automatic cases ?

Note that, if some of our other comments are accepted, there would be such examples.

response

Noted

Whilst we admit that 21A.101 rule does not exclude a possibility, there can be theoretically other changes considered significant - without triggering any of the 'automatic' criteria - the guidance material issued for 21A.101/CFR § 21.101 from the beginning of CPR does not support such a case. This has been concluded from so far international certification experience (e.g. see section 6 in the current GM 21A.101, Step 4 of Figure 1, paragraph d.).

This approach is going to be maintained also in this revision to GM 21A.101/AC 21.101-1A (see the resulting text in Chapter 3, paragraphs 6.(c) and (e).)

B. DRAFT DECISION - Appendix 4 to GM 21A.101. Definitions and Terminology p. 103-104

comment *27* comment by: *Francis Fagegaltier Services*

The definition of "significant change" is incorrect because it implies that only the changes trigerring one of the 3 automatic conditions are significant (first sentence in the definition). This does not comply with 21A.101.

According to 21A.101, a significant change is a change which is neither "not significant" nor "substantial".

response *Not accepted*

The definition is in line with the interpretation of the rule as provided in this guidance material. See also the response to the comment No. 26.

comment *29* comment by: *Eurocopter*

Page 103 **Adequate Type-certification Basis.**
The last sentence states: "*These airworthiness standards are to be the highest practicable level of safety for the changed product, and not just for the change itself.*"
Such a definition does not seem to be fully in line with 21A.101 which allows to keep the existing certification basis for unaffected areas or for not significant changes (if covered in the existing certification basis), without further justification.

Recommendation: Delete the subject last sentence.

response *Accepted*

The clause has been removed.

comment *30* comment by: *Eurocopter*

Page 103 **Significant change.**
The last sentence states: "*Not all changes or product level changes are significant.*"
Previously, significant changes were clearly defined as product level changes. This was consistent with the statements made in the proposed GM 21A.101, on page 22, Chapter 3., Section 6. Step 5 of Figure 1., § a., second sentence: "*Significant changes are product level changes...*" and § b., second sentence: "*These 3 criteria are assessed at the product level.*".
A risk of confusion may arise from the proposed new definition.
A clear explanation of the terminology used is essential for a correct implementation of the guidance material.
A clarification is more especially needed as regards significance assessment at product level (21A.101(b)(1) refers) and at area/system level (Certification Basis adequacy assessment).
A significant change at area/system level could be defined as a change that contains features which are not covered in the existing certification basis. For

such a change, later amendments to the existing certification basis and/or special conditions (21A.101(d) refers) need to be prescribed.

Recommendation:
Restore the initial definition of significant change in the first and last sentences of the new definition to read as follows:
First sentence: "*A product level change to the type-certificate to the extent that it changes...*"
Last sentence: "*Not all product level changes are significant.*"
If deemed necessary, address significant changes at area/system level in a note.

response *Accepted*

The definition has been amended to clarify a change must be a product level change to qualify for significant classification. The last sentence intended to explain that the implication significant change → product level change does not apply vice versa. Text was corrected.

B. DRAFT DECISION - Appendix 5 to GM 21A.101. Related Part-21 Requirements p. 105

comment *28* comment by: *Francis Fagegaltier Services*

In the list of related Part 21 requirements, those of subpart O for APUs have been forgotten.

response *Accepted*

A reference to 21A.604 has been added.

comment *37* comment by: *Eurocopter*

Related Part-21 Requirements.
21A.23 "Issue of a restricted type-certificate" should also be referenced.

Recommendation:
Add a reference to 21A.23 in Appendix 5 to GM 21A.101.

response *Accepted*

A reference to 21A.23 has been for the purpose of CRD added to the list. Note however that if/when Opinion 3/2009 (Restricted TC and restricted C of A) is adopted, the paragraph will disappear from Part-21 and the reference will no longer be valid. We will check the final status of 21A.23 before the related Decision for this task is issued.

Appendix I – Resulting Text after CRD (including tracked changes)

The text changes as compared to the current GM 21A.101 text are shown as follows:

1. deleted text is shown with a strike through: ~~deleted~~
2. new text is highlighted with grey shading: new

However, for readability reasons this change tracking was only applied to Appendices A and C where the core body of the text remained unchanged.

The text changes as compared to the NPA text are shown as follows:

1. deleted text is shown with a blue strike through: ~~deleted~~ (in blue)
2. new text is in red underlined: new (in red)

This change tracking aims to help readers to see what changes have been introduced in consequence of the NPA comments.

Book 2

SUBPART D CHANGES TO TYPE-CERTIFICATES AND RESTRICTED TYPE-CERTIFICATES

Replace existing GM 21A.101 with the following:

GM 21A.101 Establishing the type-certification basis of Changed Aeronautical Products

Foreword

This GM provides guidance for the application of the Changed Product Rule, 21A.101 and 21A.19, for changes made to type-certificated aeronautical products.

Chapter 1. Introduction

1. Purpose

a. The Agency wrote this GM to provide guidance for establishing the type-certification basis for changed aeronautical products and to help identify if it will be necessary to apply for a new type-certificate (TC) under 21A.19. The guidance describes the process for establishing the type-certification basis for changes to type certificates or restricted type-certificates, supplemental type certificates (STC) and amended STCs, detailing evaluations, classifications, and decisions made throughout the process.

b. The content of this GM is divided into 4 Chapters and 5 Appendices:

(1) Chapter 1 explains the purpose of this GM, describes its content, specifies the intended audience, and clarifies which changes are within the scope of applicability of this GM. Chapter 1 also contains definitions and terminology used in this GM for application of 21A.101 and 21A.19.

(2) Chapter 2 provides a general overview of 21A.101 and 21A.19 clarifies the principles and safety objectives and directs applicants to the applicable guidance contained in subsequent chapters of this GM.

(3) Chapter 3 contains guidance for implementation of 21A.101(b) to establish the type-certification basis for changed aeronautical products. Chapter 3 describes in detail the various steps of the "top-down" certification basis development approach. Chapter 3 also addresses 21A.19 considerations to identify conditions under which an applicant for a type design change is required to submit application for a new TC and provides guidance at which stage of the process this assessment is to be performed.

(4) Chapter 4 contains considerations for design related operating requirements, guidance for establishing type-certification basis for changes on certain small aeroplanes and rotorcraft under specified maximum weight ("excepted products"), guidance for use of special conditions under 21A.101 (d), guidance on the effective period of an application, guidance for establishing the type-certification basis for changes on aircraft designed or modified for a special purpose (to operate under a restricted certificate of airworthiness) and guidance for documentation of revisions to the type-certification basis.

(5) Appendix A contains examples of typical type design changes for small aeroplanes, large aeroplanes, rotorcraft, engines, and propellers which are categorized by the Agency into individual tables according to the classifications to the level of design change - substantial, significant, and not significant.

(6) Appendix B provides detailed guidance with examples for evaluating when compliance would be impractical under the "impracticality" exception in the rule.

(7) Appendix C provides guidance with examples on 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 certification specifications.

(8) Appendix D contains figures and tables considered useful for understanding of the basic terms used and their mutual relations to assist correct application of this GM.

(9) Appendix E contains cross references to relevant requirements of Part-21 related to application of 21A.19 and 21A.101.

~~**c.** The intent of 21A.101 is to enhance safety through the incorporation of the latest certification specifications in the type-certification basis for changed products to the greatest extent practicable. This GM describes the application of 21A.101 and details the conditions when the latest airworthiness certification specifications for the certification of changes to aircraft, aircraft engines, and propellers must be used, and in which cases it is possible to use earlier amendments to these specifications.~~

~~**d.** 21A.19 identifies the conditions under which an applicant for a type design change is required to submit application for a new type certificate. This GM provides guidance on the stage of the process at which this assessment is to be performed and helps explain the criteria for application of 21A.19 for the determination of substantial changes.~~

~~**e.** All changes within the scope of this GM must be approved by the Agency. The applicant may comply with earlier amendments of the airworthiness code consistent with the requirements of 21A.101(b) and (c) discussed later in this GM.~~

~~**f**~~**c.** This GM describes an acceptable means, but not the only means to comply with 21A.101 and 21A19. However, if an applicant chooses to use the means described in this GM, they must follow it entirely.

~~**Note**: This GM is not intended to be used to determine the applicable environmental protection requirements (aircraft noise, fuel venting and exhaust emission requirements) for changed products.~~

2. ~~Intended~~ Audience

This GM is for applicants applying for:

- major changes to type design of products under 21A.97 and to type design of Auxiliary Power Units (APUs) under 21A.604(b)),
- ~~for applicants applying for~~ supplemental type-certificates (STCs) under 21A.113, or ~~applying for~~
- major changes to STCs under 21.117 (b).

3. Applicability

a. *Reserved.*

b. This GM applies to major type design changes under 21A.101 for aeronautical products type-certificated, restricted type-certificated, ~~or~~ supplemental type-~~-~~certificated or ETSO approved (APU) under Part-21 (ref. 21A.21. 21A.23, 21A.115, 21A.604), with application ~~and~~ for the type-certification basis of the airworthiness code of the applicable CS (CS-VLA, CS-22, CS-23, CS-25 etc.)~~, CS-27, CS-29, CS-VLR, CS-31HB, CS-E, CS-P and CS-APU)~~.

c. Minor type design changes are ~~approved under 21A.95, and are~~ automatically ~~not~~ considered ~~to be~~ not significant under 21A.101(b) and the existing type-certification basis is considered adequate for their approval under 21A.95.

d. *Reserved.*

~~This GM also applies to changes requiring a new type-certificate under 21A.19.~~

e. For the purpose of this GM the term aeronautical products, or products, means type-certificated or restricted type-certificated aircraft, engines, and propellers or ETSO approved ~~Auxiliary Power Units (~~APUs~~)~~.

f. This GM is not intended to be used to determine the applicable environmental protection requirements (aircraft noise, fuel venting and exhaust emission requirements) for changed products.

4. Definitions and Terminology.

Adequate Type-certification Basis – The type-certification basis for a changed product under 21A.101 is considered adequate when the Agency determines that it provides adequate standards for the design change, i.e when the ~~designated~~ certification specifications of the applicable airworthiness code ~~(referenced in existing type-certification basis, later or latest amendments)~~ and prescribed special conditions ~~ensure that physical features, performance characteristics and/or functions introduced by the design change,~~ provide an appropriate level of safety for the changed product and do not result in any unsafe design features. ~~These airworthiness standards are to be the highest practicable level of safety for the changed product, and not just for the change itself.~~

Aeronautical product – The terms aeronautical product or product(s) used in this guidance material include type-certificated or restricted type-certificated aircraft, engines, propellers and ETSO approved Auxiliary Power Units (APUs).

Type-certification basis – The certification specifications of the applicable airworthiness code as established in 21A.17 and 21A.101, as appropriate; special conditions; and equivalent level of safety findings applicable to the product to be certificated.

Design Change – A change in the type design of an aeronautical product ~~or a change in the certificated configuration of the product~~. In the context of this document the terms “change”, “design change” and “type design change” are synonymous.

Earlier certification specifications – The certification specifications of the applicable airworthiness code in effect prior to the date of application for the change, but not prior to the existing type-certification basis.

Existing type-certification basis – The certification specifications of the applicable airworthiness code, special conditions and equivalent level of safety findings incorporated by reference in the type-certificate of the product to be changed.

Latest certification specifications – The certification specifications of the applicable airworthiness code in effect on the date of application for the change.

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 certification specifications were applied.

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

Secondary change – A change is a secondary change if compliance to the latest amendment would not contribute materially to the level of safety and where it is part of and consequential to an overall significant change.~~A secondary change is a physical change that is part of and consequential to an overall significant change.~~ A secondary change is a physical change that restores without changing the system, structural capacity, or functionality, but is necessary to support a significant change.

Significant change – A change to the type-certificate is significant ~~to the extent that~~ if it changes at the product level 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 certification specifications of the applicable airworthiness code. Not all ~~changes or~~ product level changes are significant.

Significant change in an area (for excepted aircraft under 21A.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.

Substantial change – A change which is so extensive that a substantially complete investigation of compliance with the applicable type-certification basis is required, and consequently a new type certificate, in accordance with 21A.19.

Chapter 2. Overview of 21A.19 and 21A.101

1. 21A.19

a. 21A.19 requires an applicant to obtain a new type-certificate (TC) for a changed product if the change in design, power, thrust, or weight is found by the Agency so extensive that a substantially complete investigation of compliance with the applicable type-certification basis is required. ~~The applicant should propose whether the type design change will require a new type-certificate. The Agency will review the proposal and determine if a new TC is required. When a new type-certificate is required the type-certification basis is determined in accordance with 21A.17.~~

b. Changes that require a substantial re-evaluation of the product's compliance findings ~~(~~ are referred to as "substantial changes"~~).~~ ~~will require application for a new type-certificate as required by 21A.19.~~ For guidance see section 3 of Chapter 3. ~~below and a~~Appendix ~~1~~A in this GM ~~for~~ provides examples of type design changes that will require a application for a new ~~type-certificate~~TC.

c. If the Agency has determined through 21A.19 that the proposed design change does not require a new ~~type-certificate~~ TC, then ~~see~~refer to 21A.101 for the applicable certification specifications to ~~develop~~ establishthe type-certification basis for the proposed design change. For guidance, refer to Chapter 3 and the examples in Appendix A of this GM.

2. 21A.101

a. 21A.101(a) requires a change to a ~~type-certificate~~ TC to comply with the certification specifications of the latest amendment of the applicable airworthiness code, unless the change meets the criteria ~~one of the criteria~~ for the exceptions identified in 21A.101(b) and (c). The intent of 21A.101 is to enhance safety through the incorporation of the latest regulatory standards in the type-certification basis for changed products to the greatest extent practicable.

b. An applicant can comply with certification specifications of an earlier amendment of the airworthiness code consistent with the requirements of 21A.101(b), when:

- a change is not significant (see 21A.101(b)(1)), or
- an area, system, ~~component,~~ part or appliance is not affected by the change (see 21A.101 (b) (2)), or
- compliance with the latest amendment for a significant change does not contribute materially to the level of safety (see 21A.101(b)(3)), or
- compliance with the latest amendment would be impractical (see 21A.101(b)(3)).

c. Note that earlier amendments may not precede ~~either~~ the corresponding amendment of the airworthiness code incorporated by reference in the type-certificate.

d. 21A.101(b) ~~pertains~~ allows a changed product to comply with an earlier amendment of the applicable airworthiness code ~~to changes for which an~~, provided one of the criteria in 21A.101(b)(1),(2) or (3) are met and the earlier amendment ~~of the airworthiness code provides~~ is considered adequate ~~standards~~. ~~In cases where~~ However, when a proposed design change~~s~~ involve features or characteristics considered novel or unusual, or the intended use of the changed product is unconventional, or experience from other similar products in service or products having similar design features has shown that unsafe conditions may develop, ~~that have no associated airworthiness standard in the existing type-certification basis, the Agency will review the proposed type-certification basis to ensure the adequacy of the certification specifications for the proposed design change.~~ and the proposed airworthiness standards do

not contain adequate or appropriate standards for the changed product, ~~l~~later amendments and/or special conditions will be applied ~~if the earlier standards are deemed inadequate to cover the proposed change~~.

e. ~~21A.101(b)(1) allows the applicant to comply with an earlier amendment when the Agency determines the change is not significant.~~ 21A.101(b)(1)(i) and (ii) ~~pertain to changes that meet~~ describe the automatic criteria establishing ~~where the~~ that a change is significant. ~~21A.101(b)(2) and (b)(3) allows the use of an earlier amendment for significant changes for areas, systems, components, parts or appliances of the product not affected by the change and for cases where compliance to the latest certification specifications would not contribute materially to the level of safety or would be impractical. Note that earlier amendments may not precede the corresponding airworthiness code incorporated in the type-certificate.~~

f. 21A.101(c) provides an exception from the requirements of 21A.101(a) for a change to certain aircraft with less than specified maximum weight. If ~~the~~ an applicant applies for a type design change to an aircraft (other than rotorcraft) of 2 722 kg (6,000 pounds) or less maximum weight, or to a non-turbine powered rotorcraft of 1 361 kg (3,000 pounds) or less maximum weight, the applicant can show that the changed product complies with the type-certification basis incorporated by reference in the ~~type certificate~~ TC . The applicant can also ~~choose~~ elect to comply, or may be required to comply, with a later amendment. ~~Note that if the Agency finds that the change is significant in an area, it will designate compliance with a later amendment to the type-certification basis incorporated by reference in the type-certificate that applies to the change and any certification specification the Agency finds directly related, unless the Agency finds it would not contribute materially to the level of safety of the changed product or would be impractical.~~ See chapter 4, section 2 in this GM for specific guidance on this provision.

g. 21A.101(d) provides for the use of special conditions, under 21A.16B, when the proposed ~~type certification basis~~ amendment of the applicable airworthiness code and any later amendment do not provide adequate standards to the proposed change~~.~~.

h. 21A.101(e) prescribes the effective period an application will remain valid for a change. This section is consistent with the requirements of 21.17 for a new ~~type certificate~~ TC.

Chapter 3. The Process for Establishing the Type-certification Basis for Changed Products 21A.101 (a) and (b)~~(1)~~

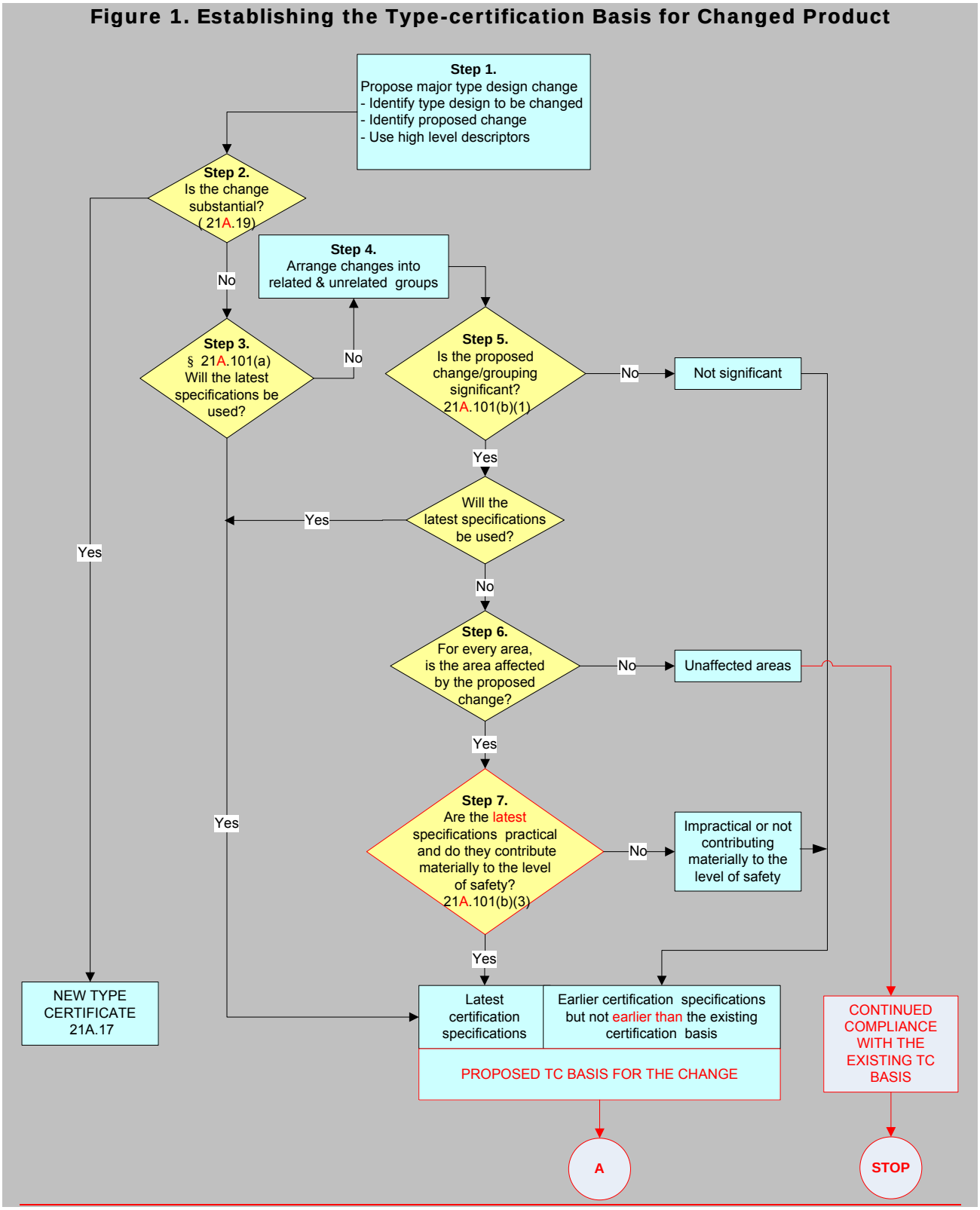
1. Overview

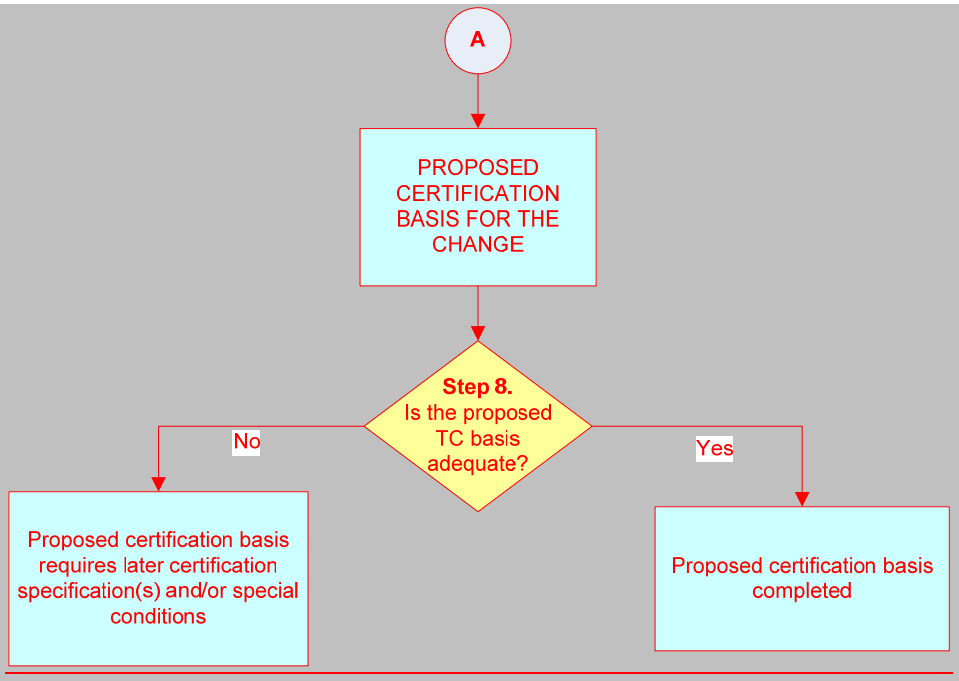
a. Both the applicant and the Agency have responsibility under 21A.101(a) and (b). The applicant must show that the change complies with the latest applicable certification specifications unless use of an exception per 21A.101(b) is justified. If an exception is proposed, the applicant should make a preliminary classification whether the change is significant or not significant, and propose an appropriate type-certification basis. The Agency ~~has the responsibility to~~ determines whether the applicant's classification of the change and proposal for the type-certification basis are ~~acceptable~~ consistent with the applicable rules and their interpretation, but should not be dependent on whether the TC holder or applicant for a STC is originating the change. The type-certification basis can vary depending on the magnitude and scope of the change. The steps below present a streamlined approach for making this determination. In addition to assisting in the determination of significance and establishing the type-certification basis, this guidance will help to establish the appropriate amount of coordination required between the applicant and the Agency.

b. Classifications of typical type design changes are in ~~the tables of a~~Appendix ~~1~~A, *Classification of Changes*. See paragraph ~~5~~6(c) of this chapter for instructions on how to use ~~the a~~Appendix ~~1~~A ~~tables~~.

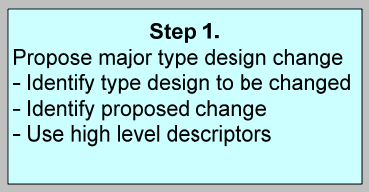
c. In cases where the examples in ~~a~~Appendix ~~1~~A are not applicable for the proposed change, use the following steps in conjunction with Figure 1 on the next page to develop the appropriate type-certification basis for the type design change. ~~All other areas of the aircraft are considered to be unchanged or not affected by the change and may continue to comply with the existing type-certification basis.~~

Figure 1. Establishing the Type-certification Basis for Changed Product





2. Step 1 of Figure 1. Identify The Proposed Type Design Change To An Aeronautical Product



a. Prior to describing the proposed change(s), it is important to clearly identify the type design configuration to be changed. A series of derivative aircraft, ~~(or~~ engines, or propellers~~, etc.)~~ (for example, x-100, x-200, x-300) may evolve based on predecessor type designs, each with its own design changes that make it distinct from the other series. The applicant should identify which ~~series or~~ model ~~number~~ or series within that ~~series~~ model is the specific configuration that will be modified.

Note: An STC is not a product; it is a change to a product.
When changing or amending an STC the starting point is the existing modified product (TC with existing STC installed). For example, if an applicant were amending an STC for an external cargo locker and the applicant proposed changing the configuration of the locker, then the starting point would be the existing TC with the existing STC installed. The applicant would then compare that configuration (TC with existing STC installed) to the changed product (TC with proposed amended STC installed).

b. Changes to a product can include physical design changes, changes to an operating envelope and/or performance changes. The change can be a single change or a collection of changes. The purpose of this process step is to identify and describe the change to the aeronautical product. The applicant for a type design change should consider all previous related design changes and the amendment level of the type-certification basis for these changes. ~~For example, for a change to a type certificate, the related design changes to be considered are those incorporated since the last time the applicable certification specifications for the change in the type certification basis were upgraded.~~

Note 1: By definition all previously incorporated changes have been approved. The purpose of step 1 is to consider the net cumulative effect of the changes since the last time the certification basis for the changed/affected area was upgraded from that of the original type design.

Note 2: Substantiating data for the proposed type design change can include compliance findings from a previously approved design change, in supporting compliance findings for the proposed change. However, ~~the applicant's proposal to use~~ for the purpose of classifying the proposed design change, such previously approved ~~compliance findings~~ design and compliance data should be now considered ~~part of~~ in relation to the ~~entire~~ proposed type design change and should be ~~approved as~~ taken into account as a part of the proposed design change classification. ~~Previous classification (such as significant yes/no determination) of a previous design bears no relevance for the proposed design change.~~

c. When identifying the changes being proposed as part of a modification, consider previous relevant changes that create a cumulative effect, as these may influence the decisions regarding substantial and significant changes later in the process. By previous relevant changes those design changes are meant whose effects accumulate, such as successive thrust increases, incremental weight increases, or sectional increases in fuselage length. Any previous relevant design changes in the area affected by the current change that did not involve an upgrade of the existing type-certification basis should be taken into account in the next design change proposal.

(1) **Example 1:** A 5% weight increase is currently being proposed, but a previous 10% and another 15% weight increase has been incorporated into this aircraft without upgrading the existing type-certification basis. In the current proposal for a 5% weight increase, the cumulative effects of the two previous weight increases that did not involve upgrade of the type-certification basis will now be accounted for as an approximately 30% increase in weight, for the purpose of making the substantial and/or significant decisions. Note that the cumulative effects to be considered are only those incremental increases from the last time the applicable certification specifications in the type-certification basis were upgraded.

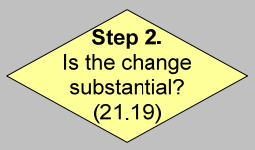
(2) **Example 2:** The ~~type certificate~~ TC for aeroplane model X lists three series, namely X-300, X-200, and X-100. The X-300 is a derivative of the X-200 which is a derivative of the original X-100 series. An applicant proposes a design change to the X-300 series aeroplane. During the review of the X-300 type-certification basis and the certification specifications affected by the proposed change, it was identified that one certification specification, CS-25.571 (damage tolerance), remained at the same amendment level as the X-100 original type-certification basis (derogation from 21A101(a) was allowed). Since the amendment level for this particular ~~regulation~~ certification specification was not changed for the two subsequent aeroplane series (X-200 and X-300), the cumulative effects of these two previous design changes that are related to the proposed change and the damage tolerance requirements should now be addressed.

d. To identify and describe the proposed changes to any aeronautical product, use a high-level description of the design change that characterises 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 complete new ~~or complete~~ interior, an avionics system upgrade, or a passenger-to-cargo conversion are all high-level descriptions that characterise typical changes to the aircraft, each driven by a specific goal, objective or purpose.

e. Evolutionary Changes. Evolutionary changes that occur during the course of a certification program may require re-evaluation of the type-certification basis and may result in re-classification of the change. That is, any evolution in the proposed design change after the

type-certification basis has been agreed to (or established) will necessitate a revisit of the type-certification basis to ensure that "evolved" aspects of the design change are still covered by the agreed upon certification basis.

3. Step 2 of Figure 1. Is the change substantial?



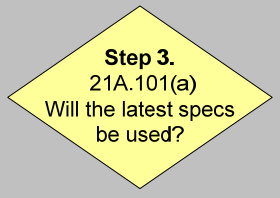
a. 21A.19 requires an applicant to ~~obtain~~ apply for a new ~~type certificate (~~TC~~)~~ for a changed product if the proposed change in design, power, thrust, or weight is so extensive that a substantially complete investigation of compliance with the applicable regulations is required. A new TC could be required for either an extensive change to a previously type-certificated product or for a ~~new~~ changed design derived through the cumulative effect of a series of design changes from a previously type-certificated product.

b. A "substantially complete investigation" of compliance is required when most of the existing substantiation is not applicable to the changed product. A substantial change proposal will require the need to ~~re-~~comply with ~~a large percentage (if not~~ all~~)~~ ~~of~~ the certification specifications applicable to a particular category of product~~aircraft~~. ~~It is not simply t~~The number of certification specifications to which compliance must be re-established for the changed product ~~that determines~~ may not necessarily be the sole determination criteria as to whether ~~it~~ the change is substantial, but rather the extent of effort to establish compliance, or the depth of investigation required to be done. In other words, the design change may be considered 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, since the data for the new model would most likely be extrapolated. A change is considered substantial when these approaches, models or methodologies of how compliance was shown must be re-validated to apply to the changed product. Also, extrapolation from previous data becomes unreliable or impossible, as the new product has changed to the extent that the baseline data is no longer relevant~~.

c. To address the question if a change is substantial at the beginning of the process, the applicant should evaluate the total or combined effect of all the proposed changes identified in Step 1, including the cumulative effects of previous relevant design changes since the last update of the type-certification basis (as explained in Step 1).

d. If it is not initially clear that a new TC is required, ~~a~~Appendix ~~1~~A provides some examples of substantial changes to aid in this classification. A substantial change requires application for a new TC~~.~~ ~~Reference~~ under 21A.17 and 21A.19. If the change is not substantial, then follow the 21A.101 process.

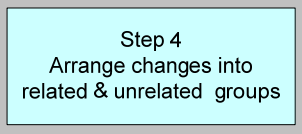
4. Step 3 of Figure 1. Will the Latest Certification Specifications be Used?



a. The applicant can use the latest certification specifications for their proposed type design change. If the latest certification specifications are used, the applicant will ~~have met~~ meet the

intent of 21A.101 and no further classification (significant or not significant) and justification is needed. However, the decision to voluntarily comply with the latest certification standards for a design change sets a new regulatory baseline for all future related changes in the same affected area. Even though one applicant elects to use the latest certification requirements, another applicant could apply 14 CFR § 21.101 for a similar design change proposal, and use the exceptions in accordance with 14 CFR § 21.101(b). If the latest certification specifications are not used, then proceed as follows:

5. Step 4 of Figure 1. Relation of Changes



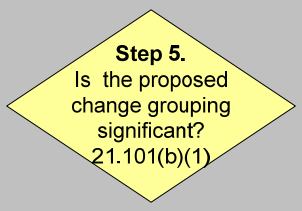
a. Once the proposed changes are identified using high-level descriptions, the next step is to determine if any of these changes are related to each other. Related changes are those that cannot exist without another, are ~~inter~~co-dependent, or a prerequisite of another. For example, a need to carry 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 that will be needed to achieve the goal of carrying more passengers. A decision to upgrade the cockpit 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 modernisation). The proposed avionics upgrade would then be considered an unrelated (or a stand-alone) change. However, the simultaneous introduction of a complete new interior may be considered related ~~if it is intended that the entire new cabin (and passengers) benefit from new or additional features offered by newer or improved technology (such as new entertainment system, new smoke detection system, use of lightweight seats, etc.), where otherwise the existing interior design or features could have simply been retained for the added fuselage plug~~ since a cabin length change will have an impact on occupant safety considerations. 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.

b. Once the change(s) are organised into groupings of those that are related and those that are unrelated (or stand-alone), the applicant is ready for Step 5 of Figure 1. The grouping of related and unrelated changes is particularly relevant to the significant Yes/No decision, (21A.101(b)(1)), described in Step 5 of Figure 1. Each group of related changes and each unrelated (stand-alone) change is evaluated on its own merit for significance. ~~As such, there will be as many evaluations for significance as there are many groupings of related and unrelated changes.~~

c. After describing the groupings and the associated or supporting technical details for each change, the applicant should identify areas, systems, ~~components,~~ parts or appliances of the product that are affected by the design change and the corresponding ~~regulatory standards~~ certification specifications associated with these areas. For each group, the applicant should assess the physical and/or functional effects of the change on other areas, systems, ~~components,~~ parts, 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, parts~~,~~ ~~component~~ and appliances, software in combination with the affected hardware. Examples of functional characteristics are performance, handling qualities, ~~fire protection,~~ 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 being changed should be updated or rewritten.

~~**d.** All unaffected areas of the aircraft can continue to comply with the existing type certification basis.~~

6. Step 5 of Figure 1. Is the Proposed Change Significant? (21A.101(b)(1))



a. In Step 5 it is the applicant's responsibility to justify that a grouping of related changes or an unrelated change does not qualify as a significant change. Significant changes are product level changes ~~and~~which ~~–~~are distinct from the vast majority of major changes. In general, these changes are either the result of an accumulation of changes or occur through an isolated extensive change that makes the changed product distinct from its predecessors. Step 1 explains the accumulation of changes that should be considered. ~~Additionally,~~ 21A.101(b)(1) defines a significant change as existing when one or more of three automatic criteria apply:

(1) **Changes where the general configuration is not retained (significant change to general configuration)**. A change to the general configuration at the product level 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 aircraft model number, although this is not required. For examples see ~~a~~Appendix ~~1~~A in this GM.

(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 affect the overall products' operating characteristics or inherent strength and would require extensive reinvestigation to show compliance. For examples see ~~a~~Appendix ~~1~~A in this GM.

(3) **Changes that invalidate the assumptions used for certification (significant change to the assumptions used for certification)**. A change to the assumptions at the product level associated with the compliance demonstration, performance or operating envelope that by itself is so different that the original assumptions or methodologies of demonstrating compliance are invalidated. For examples see ~~a~~Appendix A~~1~~ in this GM.

Note: The word "assumptions" in 21A.101 bears a meaning different from CS E-30 and CS-P-30. CS-E and CS-P address the conditions that may be imposed on the engine or propeller when it is eventually installed in the aircraft and are published in the installation manual.

b. The above criteria are used to determine if each change grouping and each stand-alone change is significant. These ~~3~~three criteria are assessed at the product level. ~~When~~ In applying the automatic criteria ~~and the examples in appendix 1,~~ the applicant should focus on ~~the technical merits of~~ the design change itself. Consideration of only the regulatory importance or safety benefit ~~only~~ of the latest certification specifications is not a justification by itself to cause a design change to be classified or re-classified as a significant change.

c. Appendix ~~1~~A includes tables of typical changes for large aeroplanes, small aeroplanes, rotorcraft, and engines/propellers that meet the definition of significant. The appendix also includes typical changes that do not achieve the significant level. In these tables, one or more

of the three automatic criteria in 21A.101(b)(1) apply for each case where the changes are identified as significant. Experience has shown the concept of having only the three automatic criteria seems to fit most projects. The tables can be used in one of two ways:

(1) To classify a proposed change that is listed in the table, or

(2) In conjunction with the three automatic criteria, to help classify a proposed change not listed in the tables of the appendix by ~~comparison~~ comparing the proposed change to ~~to determinations made for~~ changes ~~with~~ which are similar in type and/or magnitude.

~~**d**. 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.~~

~~**c**~~**d.** Design changes can trigger one or more of the automatic criteria listed in 21A.101(b)(1)(i) and (ii) for the proposed design change. When assessing the design change grouping, consider the cumulative effect of previous relevant design changes. ~~These d~~Design changes may have been incorporated ~~through earlier changes in the type certificate on changed areas related to the current proposed change and all the other areas, systems, components, parts, or appliances otherwise affected by the proposed change~~over time with no change in the type-certification basis and the final product may be significantly different than would be represented by the existing type-certification basis. ~~The collective result may be a product considerably different from the latest updated type certification basis for the product or model.~~

~~**f**~~**e.** Each grouping of related changes and each unrelated (stand-alone) change, identified using high-level descriptions, will be evaluated to determine if it is a significant or not significant change. Use the tables in ~~a~~Appendix ~~1~~A as guidance to make the classification of significant or not significant. ~~One or more of the three automatic criteria in 21A.101(b)(1) were found in all cases where the changes were identified as significant. Experience has shown the concept of having only the three automatic criteria seems to fit most projects.~~ Only when one or more of the three criteria is met can the type design change be considered significant for that grouping or unrelated change. The starting point for assessing the cumulative effects of previous relevant design changes is from the last time the applicable certification specifications in the type-certification basis for the affected area, system, ~~component,~~ part, or appliance was upgraded.

~~**g**~~**f.** Typically, a change to a single area, system, part~~component,~~ or appliance may not result in a product level change. However, there may be distinct cases where the change to a single system or part ~~component~~ may, in fact, result in a significant change due to its effect on the product overall. Examples may include addition of winglets, leading edge slats or change in primary flight controls to fly-by-wire system.

~~**h.** If an unrelated (stand-alone) change or a grouping of related changes is classified as:~~

~~(1) Significant (21A.101(a)). The applicant will comply with the latest amendment of the airworthiness code for certification of the changed product unless they can justify use of one of the exceptions provided in 21A.101(b)(2) and/or (3) to show compliance with earlier amendment(s). The final type-certification basis may consist of a combination of the latest, and earlier or existing TC basis certification specifications for the change.~~

~~(2) Not Significant (21A.101(b)(1)). The use of the earlier certification specifications, but not earlier than those which are recorded in the existing type-certification basis for the change or group of related changes being evaluated, is acceptable, unless the standards in the proposed type-certification basis are deemed inadequate. In cases where inadequate or no airworthiness standards are defined in the proposed type-certification basis for the design change but applicable standards already exist in a subsequent amendment to the airworthiness code, the subsequent amendment will be made part of the type-certification basis.~~

~~(3) Adequate Standards (21A.101(d) and 21A.21(b)(2)). Regardless of whether the change is significant or not, your proposed type certification basis may be deemed inadequate – that is, the change includes features that were not foreseen in the proposed type certification basis. The change must comply with later airworthiness standards (such as, a later amendment or a special condition). An example is adding a flight critical system such as an electronic air data display on a CS-25 aeroplane whose existing type certification basis did not have lightning and high intensity radiated fields (HIRF) protection certification specifications. In this case, compliance with the certification specifications for lightning and HIRF protection will be required for this not significant change.~~

~~i~~g. ~~Secondary Changes.~~ A change is a secondary change if compliance to the latest amendment would not contribute materially to the level of safety and where it ~~A secondary change is a physical change that~~ is part of and consequential to an overall significant change. A secondary change is a physical change that restores without changing the system, structural capacity or functionality, but is necessary to support a significant change. Based on this description, a secondary change is not required to comply with the latest certification specifications because it is considered "not contributing materially to the level of safety", and therefore eligible for an exception under 21A.101(b)(1)(3). Determining whether a change meets the description for secondary change, and thus is eligible for an exception, should be straightforward. Hence the substantiation or justification need only be minimal. If this determination is not straightforward, then the proposed change is very likely not a secondary change.

(1) In some cases~~, however,~~ the change which restores functionality may in fact contribute materially to the level of safety by meeting a later amendment. If this is the case, it would not be considered a secondary change. ~~For example, a simple rerouting of a wire to accommodate the installation of a cargo door may not add any new capacity, but it may implicate a later amendment such as 25.981, fuel tank ignition prevention.~~

(2) An example of secondary change is lengthening existing control cables passing through the new fuselage plug, to restore existing functions to systems that could be situated within or beyond the new plug. The lengthening of these cables can be accepted as not adding system capacity or capability, so these changes can be identified as secondary changes and not be required to meet the latest amendment. ~~An example of what would not be considered a secondary change would be the replacement of existing smoke detectors with newer technology, addition of a circuit breaker in existing wiring, or replacing passenger windows with window plugs.~~

~~(3) The applicant can identify an affected area as a secondary change only if the change meets the description and can be substantiated or justified as not contributing materially to the level of safety according to paragraph (i) above. If the applicant plans to use the 21A.101(b)(3), the necessary supporting rationale should be provided.~~

~~j~~h. A new model number designation to a changed product is not necessarily indicative that the design change is significant under 21A.101. Conversely, retaining the existing model designation does not mean that the design change is not significant. All changes are considered in light of the magnitude of the type design change.

~~k~~i. Making the determination. The final determination of whether a design change is significant or not significant is retained by the Agency. To assist the applicant in their assessment, the Agency has predetermined the classification of several typical design changes that can be used for reference, and these examples are listed in ~~a~~Appendix ~~1~~A in this GM.

~~i~~j. At this point, the determination of significant or not significant for each of the groupings of related changes and each stand-alone change has been made. For significant changes, if the applicant proposes to comply with an earlier requirement, the procedure outlined in paragraph 7 below should be used.

7. Proposing an Amendment Level for a Significant Change

a. If an unrelated (stand alone) change or a grouping of related changes is classified as significant, the applicant will comply with certification specifications of the latest amendment of the applicable airworthiness code for certification of the changed product, unless the applicant can justify use of one of the exceptions provided in 21A.101(b)(2) and/or (3) to show compliance with earlier amendment(s). The final type-certification basis may consist of a combination of certification specifications of the applicable airworthiness code at different amendment levels ranging from the original type-certification basis to the most current amendments.

~~a~~b. If the classification of the change is significant, ~~the applicant~~ all areas, systems, parts or appliances affected by the change must comply with certification specifications of the applicable airworthiness code at the amendment level in effect on the date of application for the change ~~(ref. 21A.101 (a))~~, ~~unless they~~. The applicant ~~can~~ will need to show that an area, system, part or appliance is not affected by the change to justify use of the exception~~s~~ in 21A.101(b)(2) ~~and (3) to show compliance with an earlier amendment but no earlier than the one in existing type-certification basis~~(see Section 9 for guidance on whether or not an area is affected by the proposed change).

~~b~~c. *Reserved.*

~~c~~d. ~~For areas not affected by the change, or areas affected by the change but compliance with later amendments in these areas would not contribute materially to the level of safety or would be impractical, the applicant should provide acceptable justification to support your rationale for the application of earlier amendments.~~ 21A.101(b)(3) provides two more exceptions applicable to areas, systems, parts or appliances which are affected by the significant change but for which compliance with the latest requirements would either not contribute materially to the level of safety or would be impractical (see Section 10 for more guidance)

~~d~~e. ~~It is important when seeking to use earlier amendments that you demonstrate to us that an area, system component, parts, or appliance is not affected by the change or, when affected by the change, compliance with the latest amendment would not contribute materially to the level of safety, or would be impractical.~~ *Reserved.*

f. The applicant should provide acceptable justification for the application of earlier amendments for areas affected by a significant change. Your justification should show that compliance with later amendment 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, part or appliance affected by the significant change.

~~e~~g. The final type-certification basis may combine certification specifications at the latest amendment level, earlier (intermediate) amendment levels, and the amendment level of the existing type-certification basis, but cannot contain certification specifications preceding the existing type-certification basis.

h. Note that should an applicant decide to use the latest certification specifications without any exceptions, no further evaluations and justifications are needed. In such a case, proceed to step 8 (section 11).

8. Selecting an Amendment Level for a Not Significant Change

a. When ~~the type design~~ a change is classified not significant, the rule (21A.101(b)(1) allows ~~compliance with~~ the use of the earlier certification specifications, ~~amendments of~~ but not dated prior to the existing type-certification basis. Within this limit, the applicant is allowed to propose an amendment level for each certification specification for the affected area. However, the applicant should be aware that their proposal for the type-certification basis will be reviewed by the Agency to ensure that the type-certification basis is adequate for the proposed change (see paragraph 8.d).

b. *Reserved*

c. ~~The applicant can elect to comply with certification specifications at later amendments, but should consult the Agency to ensure that compliance will also be shown with any other certification specifications the Agency finds directly related. Some later certification specifications may be less restrictive. Ensure compliance with all associated certification specifications.~~ When choosing the above option of the existing type-certification basis, an applicant can elect to comply with a specific certification specification or a subset of certification specifications at later amendments. In such a case, the applicant should consult with the Agency to ensure the type-certification basis includes other certification specifications that are directly related. Some later certification specifications may be less restrictive; therefore, the applicant may see advantage in using them on the elect to comply basis. However, the applicant is recommended not to make a final decision until has learned from the Agency which other certification specifications are found directly related.

d. For a design change that contains features which are not covered in the proposed type-certification basis, i.e. when the type-certification basis is not considered "adequate" (see the definition of "adequate type-certification basis" in 1.d of Chapter 1), the Agency will designate the applicable certification specifications at the appropriate amendment level, beginning with the existing type certification basis and progressing to the most appropriate later amendment level for the change. For a change that contains new design features that are novel or unusual, for which there is no later applicable certification specification, the Agency will designate special conditions.

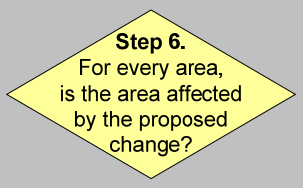
~~**c.** Adequacy of type-certification basis: The type-certification basis for a changed product under 21A.101 is considered adequate when the Agency determines that the designated certification specifications of the applicable airworthiness code (referenced in existing type-certification basis, later, or latest amendments) and prescribed special conditions ensure that physical features, performance characteristics and/or functions introduced by the design change do not result in any unsafe design features. These airworthiness standards are to be the highest practicable level of safety for the changed product, and not just for the change itself.~~

~~**d.** Exceptions in 21A.101(b)(2) and (3). Use the following steps with figure 1 when you wish to comply with an earlier requirement for a significant change:~~

~~**e.** For a group of related design changes or an unrelated design change that has been determined to be significant, 21A.101(b)(2) and (3) provide exceptions from the requirement of 21A.101(a). The applicant can comply with an earlier amendment level or with the existing type-certification basis for areas not affected by the change, and any areas affected by the change for which compliance with the latest certification specifications would not contribute materially to the level of safety or would be impractical.~~

~~**f.** The earlier amendments may not precede the corresponding certification specifications in the existing type-certification basis. It is important when seeking to use earlier amendments that the applicant can demonstrate to the Agency that compliance with the latest certification specifications does not contribute materially to the level of safety, or is impractical.~~

9. Step 6 of Figure 1. Is the Area Affected By the Proposed Change? (21A.101(b)(2))



a. A not affected area is any area, system, ~~component,~~ part~~s~~, or appliance ~~and their associated certification specifications~~ that ~~are~~ is not affected by the proposed type design change. For a type design change, it is important that the effects of such change on other areas, systems, ~~components,~~ parts, or appliances of the product are properly assessed 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. If the significant change does not affect the area, then the type-certification basis of that area needs not to be revisited, in other words, ~~the certification specifications associated with~~ the unaffected area continue to ~~be compliant~~ comply ~~to~~ with the existing amendment level without further substantiation.

b. To determine whether an area is affected or not, ~~C~~consider the following aspects of a type design change:

- (1) ~~–~~Physical aspects. The physical aspects include direct changes to structures, systems, parts, ~~components~~ and appliances (physical aspects may include software/airborne electronic hardware changes and the resulting effect on ~~hardware or~~ systems functions).

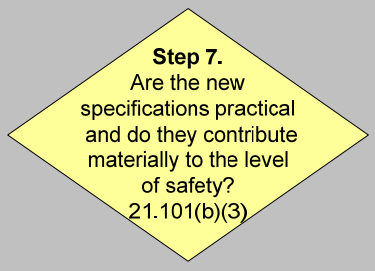
- (2) Performance/functional characteristics. The less obvious aspect of the word “areas” covers general characteristics of the type-certificated product, such as performance features, handling qualities, emergency egress, structural integrity, aeroelastic characteristics, or crashworthiness. These characteristics may be affected by a product level change. For example, adding a fuselage plug could affect performance and handling qualities, and thus ~~regulations~~ specifications 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 aeroplane’s unchanged fuel tanks being affected. Thus, the entire fuel system (changed and unchanged areas) becomes part of the affected area due to the change in functional characteristics.

Note: Substantiating data for the affected area for a proposed type design change can include compliance findings from a previously approved design change, in supporting compliance findings for your proposal. However, your proposal to use previously approved compliance data must be considered part of the entire proposed type design change and should be approved as part of your proposed design change.

c. All areas affected by the proposed design change must comply with the latest certification specifications, unless the applicant can show that demonstrating compliance with the latest amendment of a certification specification would not contribute to the level of safety or would be impractical. Step 7 provides further explanation.

10. Step 7 of Figure 1. Are the ~~New~~ Latest Certification Specifications Practical and Do They

Contribute Materially to the Level of Safety? (21A.101(b)(3))



a. ~~Not contributing materially to the level of safety.~~ Compliance with the latest certification specifications could be considered "not to 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 certification specifications. The applicant should provide sufficient justification to allow the Agency to make this determination. This exception could be applicable in the situations described in the paragraphs below:

Note: Compliance with later certification specifications would not be required where the amendment is of an administrative nature and has been made only to correct inconsequential errors or omissions, consolidate text, or clarify an existing certification specification.

(1) Design features that exceed the existing type-certification basis specifications, but do not meet the latest certification specifications, can be used as a basis for granting an exception under the "does not contribute materially" exception. These design features, if accepted as a justification for an exception, must be incorporated in the amended type design configuration and recorded in the TCDS or STC, where necessary, as an integral part ~~in~~ of the type-certification basis ~~of certification~~. For example[2], an applicant proposes to install winglets on a Part-25 airplane~~, .~~ ~~and p~~Part of the design involves adding a small number of new wing fuel tank fasteners. The latest § 25.981 at amendment 25-102 requires structural lightning protection. The applicant proposes 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.

(2) ~~Design:~~

~~• This provision gives the opportunity to consider the consistency of design.~~ Consistency of design should be considered when applying the latest certification specifications. Below, an aeroplane example is provided for describing how this provision may be used; however, the rationale in this example may be applied to any product covered by this GM.

- 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 certification specifications. ~~Similarly, there may be no safety benefit in applying later certification specifications to both new and unaltered components. Compliance of the new areas with the existing~~

[2] This example is taken from the FAA experience gained prior to the Agency's start, therefore the references to the FAA sections and amendments are kept.

~~type-certification basis may be acceptable.~~

- However, if a fuselage plug is large enough in relation to the original certificated aircraft structure, seats, bins, doors, and cargo compartment, the change may require compliance with the latest certification specifications, comparable with what will be required for a new ~~model airplane~~aeroplane. In these circumstances the proposed type-certification basis should encompass the certification specifications in effect on the date of application for the change.

(3) Service experience: Relevant service experience, such as ~~experience based on~~ fleet performance or utilisation over time (relevant flight hours or cycles), is one way of showing that a later amendment may not contribute materially to the level of safety, so the use of earlier certification specifications could be appropriate. Appendix ~~3~~C provides additional guidance on the use of service experience, along with examples.

- There may be cases for rotorcraft and small aeroplanes where relevant data may not be sufficient or not available at all because of the reduced utilisation and the different amount and type of data available. In such cases, other service history information may provide sufficient data to justify the use of earlier certification specifications, 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.

- The service experience levels necessary to demonstrate the appropriate level of safety as they relate to the proposed design change would have to be reviewed and agreed to by ~~us~~the Agency.

b. Impractical. Compliance with the latest certification specifications may be considered impractical if the applicant can justify that it would result in additional resource requirements that are not commensurate with the incremental safety benefit (difference between the latest and the proposed type-certification basis). 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.

(1) The position that compliance is impractical should be supported with a substantiating data and analyses. ~~The Agency must agree with this position and w~~While evaluating the applicant's position and their substantiating data regarding impracticality, the Agency may consider other factors (for example, the costs and safety benefits for a comparable new design).

(2) A review of large aeroplane projects showed that in certain cases, where an earlier amendment to applicable certification specifications was allowed, design changes were made to nearly comply with the latest amendments. In ~~this~~ these cases, the applicants were able to successfully demonstrate 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 the "impracticality" exception.

(3) Appendix ~~2~~B provides additional guidance and examples for determining procedures for evaluating impracticality of applying latest certification specifications to a changed product rule.

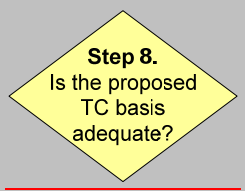
(a) The exception of impracticality is a ~~highly subjective~~ qualitative and/or quantitative cost/safety benefit assessment for which it is difficult to specify clear criteria. Experience to~~-~~ date with applicants has shown that justification of impracticality is more feasible when both applicant and authority 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 ~~financial~~ cost/safety benefit analysis (although ~~financial~~ cost analysis could always be used to support an appropriate amendment level).

Note: The impractical exception should not be based on the size of the applicant's company or their financial resources. Costs to comply with a later amendment should be evaluated against the safety benefit of complying with the later amendment. Applicants ~~with fewer resources~~ that may not be able to afford the cost ~~of a product level change~~ because of reasons such as fewer resources, will not be granted the impractical exception when ~~it~~the cost is comparable to the safety benefit achieved by complying with a later amendment.

(b) For example, a complex redesign of an area of ~~a new derivative~~ the baseline aircraft may be required to comply with a new certification specification, and that redesign may make the ~~new derivative model~~ changed product uncommon with respect to design and manufacturing processes from the existing family of derivatives. Relevant service experience of the existing fleet of the ~~derivative~~ 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 that would be realised by complying with the later amendment would be minimal, and this would be justified with a demonstrated acceptable service experience in relation to the hazard that the new ~~rule~~ certification specification addresses.

11. Step 8 of Figure 1. Is the Proposed Type-certification Basis Adequate?



a. Regardless of whether the change is significant or not, the applicant's proposed type-certification basis may be deemed inadequate – that is, the change includes features or characteristics that were not foreseen during the initial (or previously approved) type-certification. These features or characteristics, if not adequately addressed, may make the product unsafe for the uses for which certification is requested. This would obstruct issuance of the requested approval for the change. The change must comply with later standards (such as, a later amendment or a special condition). An example is adding a flight critical system such as an electronic air data display on Part-25 aeroplane whose existing type-certification basis did not have lightning protection requirements. In this case, compliance with the certification specification for lightning protection will be required, even though this is not a significant change.

b. In cases where inadequate or no airworthiness standards exist for the change in the proposed type-certification basis, but adequate standards exist in a subsequent amendment of the applicable airworthiness code, the subsequent amendment will be made part of the type-certification basis to assure its adequacy.

c. In cases where no adequate standard exist in any subsequent amendment of the applicable airworthiness code because of one or more reasons specified in 21A.16B(a), the Agency will

prescribe special conditions containing necessary safety standard per 21A.16B(b). 21A.101(d) allows for the application of special conditions, or for changes to the existing special conditions, to address the changed designs where the proposed type-certification basis does not provide adequate standards with respect to the proposed change. Reference section 3 of Chapter 4 for additional information pertaining to special conditions.

d. *Reserved*

e. The final type-certification basis may consist of a combination of the certification specifications of the applicable airworthiness code at different amendment levels ranging from the original type-certification basis to the most current amendments, and special conditions.

Chapter 4. Other Considerations

1. Design Related Operating Requirements. The use of exceptions under 21A.101 is not intended to alleviate or preclude compliance with applicable operating ~~regulations~~ rules or directives ~~(such as EU-OPS)~~ that prescribes compliance with the applicable ~~retroactive~~ additional airworthiness (design-related) ~~requirements~~ specifications for operations..

2. Excepted Products under 21A.101(c)

a. An applicant for a design change to an excepted product may show that the changed product complies with the existing type-certification basis incorporated by reference in the TC. If the Agency finds that the change is significant "in an ~~affected~~ area", the Agency will require compliance with a later amendment to the existing type-certification basis that applies to that affected area and any certification specification the Agency finds is directly related. For excepted products, changes that meet one of the following criteria, in the area of change, are automatically considered significant if:

- ~~**b.**~~ The general configuration or the principles of construction are not retained, or
- ~~**c.**~~ The assumptions used for certification of the product to be changed do not remain valid.

~~**d**~~**b.** However, the Agency may allow the applicant to comply with an earlier amendment to the airworthiness code initially designated or with the existing type-certification basis if the Agency agrees to the applicant's justification.

~~**e**~~**c.** For a design change to an excepted product that contains new features, which are not covered in the existing type-certification basis, the Agency will designate the applicable certification specifications at the appropriate amendment level, beginning with the existing type-certification basis and progressing to the most appropriate later amendment level for the change. For a change that contains new design features that are novel and unusual for which there are no later applicable certification specifications at a later amendment level, the Agency will designate special conditions~~. Special conditions may also be applied~~ under 21A.16B ~~when the intended use of the changed product is unconventional or experience from other similar products in service or products having similar design features, has shown that unsafe conditions may develop~~.

~~**f**~~**d.** The exception provided for excepted products under 21A.101(c) applies ~~to~~at the aircraft level only. Design changes to type-certificate~~-~~d engines and propellers installed on these excepted aircrafts are assessed as separate products using 21A.101(a) and (b).

3. Special Conditions, 21A.101(d). 21A.101(d) allows for the application of special conditions, or for changes to existing special conditions, to address the changed designs where the proposed type-certification basis ~~has missing or in~~does not provide adequate standards for an area, system, ~~component,~~ part or appliance related to the change and no adequate standard exist in any subsequent amendment of the applicable airworthiness code up to the airworthiness code in effect at the date of the application for the change. The objective is to achieve a level of safety consistent with that provided for other areas, systems, ~~components,~~ parts or appliances affected by the change by the other certification specifications of the proposed type-certification basis. The application of special conditions to a design change is not, in itself, a reason for it to be classified as either a substantial change or a significant change. When the change is significant with earlier certification specifications allowed through exceptions, or not significant, the level of safety intended by the special conditions should be consistent with the agreed type-certification basis. Note that ~~S~~special conditions may also be applied under 21A.16B when the intended use of the changed product is unconventional or experience from other similar products in service or products having similar design features, has shown that unsafe conditions may develop.

4. Effective Period for an Application to Change a Type-Certificate~~,~~ (21A.101(e))~~.~~

~~According to~~ Per 21A.101(e), an application for, or a change to, a ~~type-certificate~~ TC for large aeroplanes and large rotorcraft is effective for 5 years, and an application for a change to any other ~~type-certificate~~ TC is effective for 3 years. This is intended to ensure that the type-certification basis for the changed product is as current as practical. ~~This is consistent with the requirements of 21A.17 for a new type-certificate and defines the process of updating the type-certification basis if these time limits are exceeded.~~According to 21A.101(e) (1) and (2), in a case where the change has not been approved, or it is clear that it will not be approved under the time limit established under this subparagraph, the applicant may:

1. File a new application for a change to the type-certificate and comply with all the provisions of paragraph (a) applicable to an original application for a change; or

2. File for an extension of the original application and comply with the provisions of paragraph (a) for an effective date of application, to be selected by the applicant, not earlier than the date which precedes the date of approval of the change by the time period established under this subparagraph for the original application for the change.

This is consistent with the requirements of 21A.17 for a new TC and defines the process of updating the type-certification basis if these time limits are exceeded.

5. ~~*Reserved*~~ **Special purpose aircraft**

When a change is proposed to aircraft which is designed or modified for a special purpose to operate in restricted airworthiness category (under a restricted certificate of airworthiness), the process of establishing the type-certification basis of the changed product is in principle the same as for aircraft with a standard certificate of airworthiness. 21A.101 is equally applicable to those special purpose aircraft except that the applicable certification specifications, the proposed change must comply with, can exclude the paragraphs of the applicable airworthiness code that the Agency finds inappropriate for the special purpose for which the aircraft is to be used and may include possible alternative specifications to address that special purpose. Nevertheless, the "top-down" approach under 21A.101(a) and (b) (and the guidance in Chapter 3 of this GM) generally applies also to special purpose aircraft unless the aircraft is meeting the criteria in 21A.101(c) for excepted products, for which "bottom-up" approach applies (see above section 2 in this Chapter). All the exception routes under 21A.101(b)(1), (2) and (3) are still available, in particular the "not materially contributing to the level of safety" and "impractical" exceptions may found justifiable considering the intended special purpose of the aircraft.

6. *Reserved*

7. Documentation. All changes that result in a revision to the product's type-certification basis ~~must~~ should be reflected on the amended TC or STC. The resulting type-certification basis should be retained as it forms part of the compliance record required by the applicable Agency's internal working procedures.

Appendix ~~1~~A. to GM 21A.101

Classification of Changes

~~Appendix 1 includes tables of typical changes for small aeroplanes (figure 1), large aeroplanes (figure 2), rotorcraft (figure 3), and engines/propellers (figure 4) that meet the definition of a significant change or substantial change for each product line. The Appendix also includes typical changes that do not achieve the significant level.~~

~~a) The examples in the tables were developed from data collected from regulatory files and included industry review and input. They clearly are changes that we have seen in the past and will likely continue to see in the future. The Agency has made the determination, based on applying the automatic criteria, that these changes are significant or not significant.~~

~~b) The columns "Change to General Configuration", "Change to Principles of Construction" and "Assumptions of Certification" reflect the automatic criteria of 21A.101(b)(1)(i) and (ii). The "Notes" column provides typical rationales that are considered in evaluating the designation of the criteria.~~

~~c) The tables may be used in one of two ways:~~

~~(i) to classify a proposed change that is listed in the table, or~~

~~(ii) in conjunction with the three automatic criteria, to understand the logic used in the table to help classify a proposed change not in the table.~~

~~d) The classification may change due to cumulative effects and/or combinations of individual changes~~.

The following ~~tables~~ examples of substantial, ~~and~~ significant and not significant changes are adopted by the Federal Aviation Administration (FAA), European Aviation Safety Agency (EASA) EASA and Transport Canada Civil Aviation (TCCA) through an international collaboration. The classification may change due to cumulative effects and/or combinations of individual changes. The "N/A" indicated in the substantial example tables indicates "Not Applicable" at the "21A.19 Substantial Evaluation" phase.

~~**Figure 1. Table of c**~~

Table 1.Examples of Changes for Small Aeroplanes (CS-23)

The following examples are for SUBSTANTIAL changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration? 21A.101(b)(1)(i)**	**Is there a change to the principles of construction? 21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated? 21A.101(b)(1)(ii)**	**Notes**
Change in wing location (tandem, forward, canard, high/low).	~~Yes~~ N/A	~~No~~ N/A	~~Yes~~ N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
Fixed wing to tilt wing.	~~Yes~~ N/A	~~Yes~~ N/A	~~Yes~~ N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
Increase or decrease in the number of engines ~~from one to two~~.	~~Yes~~ N/A	~~Yes~~ N/A	~~Yes~~ N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
Replacement of piston or turbo-prop engines with turbojet or turbofan engines.	~~Yes~~ N/A	~~Yes~~ N/A	~~Yes~~ N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.

The following examples are for SUBSTANTIAL changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration? 21A.101(b)(1)(i)**	**Is there a change to the principles of construction? 21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated? 21A.101(b)(1)(ii)**	**Notes**
Change in engine configuration (tractor/pusher).	~~Yes~~ N/A	~~Yes~~ N/A	~~Yes~~ N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
Increase from subsonic to supersonic flight regime.	~~Yes~~ N/A	~~No~~ N/A	~~Yes~~ N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
Change from an all metal aeroplane to all composite primary structure (fuselage, wing, empennage).	~~No~~ N/A	~~Yes~~ N/A	~~Yes~~ N/A	~~Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.~~ ~~Change in principles of construction and design from conventional practices.~~ ~~Likely change in design/certification assumptions.~~ Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable

The following examples are for SUBSTANTIAL changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration? 21A.101(b)(1)(i)**	**Is there a change to the principles of construction? 21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated? 21A.101(b)(1)(ii)**	**Notes**
				regulations is required.

The following examples are for SIGNIFICANT changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
Conventional tail to T-tail or Y-tail, or vice versa.	Yes	No	Yes	Change in general configuration. Requires extensive structural, flying qualities and performance reinvestigation. Requires a new AFM to address performance and flight characteristics.
Changes in wing configuration such as~~, addition of tail strakes or~~ change in dihedral, ~~or~~ changes in wing span, flap or aileron span, ~~angle of incidence of the tail,~~ addition of winglets~~,~~ or increase of more than 10% of the original wing sweep ~~of more than 10%~~ 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 wingtip are not significant changes. See table for not significant changes.
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 a new AFM to address performance and flight characteristics. **Note:** Small changes to tail are not significant changes.

The following examples are for SIGNIFICANT changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
Tricycle/tail wheel undercarriage change or addition of floats.	Yes	No	No	Change in general configuration. ~~Likely, at aeroplane level, general configuration~~ Principles of construction and certification assumptions remain valid.
~~Increase in seating capacity resulting in a different certification category (e.g., from normal to commuter category) where configuration or principles of construction changes or assumptions do not remain valid.~~	~~Yes~~	~~Yes~~	~~Yes~~	~~Change in general configuration. Change in principles of construction. Requires extensive construction re-assessment. Change in certification assumptions. Requires new AFM and pilot type rating.~~
Passenger to freighter configuration conversion which involves the introduction of a cargo door or an increase in floor loading of more than 20%, 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.
~~A fuselage stretch would be considered significant if it would invalidate the existing substantiation, or~~	~~Yes~~	~~No~~	~~Yes~~	~~Likely extensive changes to fuselage structure, aerodynamics, aircraft systems performance, and operating~~

The following examples are for SIGNIFICANT changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
~~would change the primary structure, aerodynamics, or operating envelope sufficiently to invalidate the assumptions of certification.~~				~~envelope. Requires new AFM to address performance and flight characteristics.~~
Replace reciprocating engines with the same number of turbo-propeller engines where the operating envelope is expanded.	No	No	Yes	Invalidates certification assumptions. Requires a new AFM to address performance and flight characteristics.
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 a new AFM to address performance and flight characteristics.
The replacement of an engine of higher rated power or increased thrust would be considered significant if it would invalidate the existing substantiation, or would change the primary structure, aerodynamics or operating envelope sufficiently to	No	Yes	Yes	Invalidates certification assumptions. Requires a new AFM to address performance and flight characteristics. Likely changes to primary structure. Requires extensive construction re-investigation.

The following examples are for SIGNIFICANT changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
invalidate the assumptions of certification.				
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.
Change involving appreciable increase in design speeds Vd, Vmo, Vc, or Va.	No	No	Yes	Certification assumptions invalidated. Requires a new AFM to address performance and flight characteristics.
Short take-off and landing ("STOL") kit.	No	No	Yes	Certification assumptions invalidated. Requires a new AFM to address performance and flight characteristics.

The following examples are for SIGNIFICANT changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
A change in the rated power or thrust is likely to be regarded as significant if the design speeds are thereby changed so that compliance needs to be re-justified with a majority of specifications.	No	No	Yes	Certification assumptions invalidated. Requires a new AFM to address performance and flight characteristics.
Fuel state: such as compressed gaseous fuels, or fuel cells. This could completely alter the fuel storage and handling systems and possibly affect the aeroplane structure.	No	No	Yes	Changes in design/certification assumptions. Extensive alteration of fuel storage and handling systems.
A design change that alters the aircraft flight characteristics or performance from the type design would normally be significant if it appreciably changes the kinematics or dynamics of the ~~airplane~~aeroplane.	No	No	Yes	Certification assumptions invalidated. Requires a new AFM to address performance and flight characteristics.

The following examples are for SIGNIFICANT changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
~~Weight increase that places the aircraft into the commuter category (i.e., above 5670 kg (12,500 lbs)).~~	~~No~~	~~No~~	~~Yes~~	~~Changes in design and certification assumptions. Certification assumptions invalidated. Requires new AFM. Compliance with commuter category rules is required. This change may be determined a substantial change.~~
A change in the flight control concept for an aircraft, for example 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 a new AFM.
Change to aeroplane's cabin operating altitude, or operating pressure.	No	No	Yes	An increase greater than 10% in maximum cabin pressure differential invalidates certification assumptions and the fundamental approach used in decompression, structural strength, and fatigue.

The following examples are for SIGNIFICANT changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
~~Addition of~~ Increase in cabin pressurisation.	No	~~Yes~~No	Yes	Typically, ~~A~~a change greater than ~~5~~10% in operational cabin pressure differential. May require ~~E~~extensive airframe changes affecting load paths, fatigue evaluation, aeroelastic characteristics, etc. ~~Requires extensive construction reinvestigation.~~ Invalidates design assumptions.
Addition of cabin pressurization system.	No	Yes	Yes	Extensive airframe changes affecting load paths, fatigue evaluation, aeroelastic characteristics, etc. Invalidates design assumptions.
Changes in types and number of emergency exits or an increase in maximum certificated passenger capacity ~~in excess of maximum passenger capacity demonstrated for the aircraft type~~.	~~No~~Yes	No	Yes	Emergency egress requirements exceed those previously substantiated. Invalidates assumptions of certification. ~~Commuter category emergency egress requirements apply.~~

The following examples are for SIGNIFICANT changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
A change in the required number of flight crew, which necessitates a complete cockpit re-arrangement, and/or an increase in pilot workload would be a significant change.	No	No	Yes	Extensive changes to avionics and aircraft systems. Invalidates certification assumptions. Requires new AFM.
~~An appreciable~~ eExpansion of an aircraft's operating envelope ~~or operating capability would normally be a significant change. e.g., an increase in maximum altitude limitation, approval for flight in known icing conditions, an increase in airspeed limitations~~.	No	No	Yes	~~Invalidates certification assumptions. Requires new AFM to address performance and flight characteristics.~~ An appreciable expansion of operating capability would normally be a significant change (e.g., an increase in maximum altitude limitation, approval for flight in known icing conditions, or an increase in airspeed limitations). ~~An increase in cg range (5% mean aerodynamic chord) will typically cause a significant increase in wing loads, as compared to moving the aft cg limit further aft. The change in cg limit should be considered with~~

The following examples are for SIGNIFICANT changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
				~~any increases or decreases in aircraft weight. An increase in wing loads of greater than 5% is considered to be a significant change."~~ Merely operating a product to an expanded envelope 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.
Replacement of an aviation gasoline engine with an ~~diesel~~ engine of approximately the same horsepower utilizing diesel fuel.	No	No	Yes	~~Although a~~A major change to the aeroplane~~, likely~~. ~~t~~The ~~original~~ general configuration~~,~~ and principles of construction will usually remain valid~~, and~~; however ~~certification~~ the assumptions for certification~~remain valid~~ are invalidated.

The following examples are for SIGNIFICANT changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
~~A major~~ ~~c~~Comprehensive flight deck 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	~~Extensive changes to avionics and electrical systems design.~~ ~~Invalidates certification assumptions.~~ ~~Extensive re-assessments of systems integration, flight crew workload, human factors evaluation are required.~~ ~~The degree of change is so extensive that it a~~Affects ~~basic~~ avionics and electrical systems integration~~,~~ and architecture concepts, or philosophies. Th~~is may drive a complete re-assessment of flight crew workload or other human factor issues, or requires a re-evaluation of the original design assumptions used for the cockpit. Example: changing from federated display (e.g. separate attitude, altitude, and airspeed) architecture to an integrated electronic flight information system. Requires new AFM to~~

The following examples are for SIGNIFICANT changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
				~~address performance and flight characteristics.~~
Introduction of auto-land.	No	No	Yes	Invalidates original design assumptions.
~~Conventional tail to T-tail or Y-tail, or vice versa~~	~~Yes~~	~~No~~	~~Yes~~	~~Change in general configuration. Requires extensive structural, flying qualities and performance re-investigation.~~ ~~Requires new AFM to address performance and flight characteristics.~~
Conversion from normal category to commuter category aeroplane.	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 Agency determination under 21A.19.
Airframe life extension.	No	No	Yes	This modification pertains to fuselage and/or wing limits, and ageing aeroplane concerns. An increase from the original life limit which constitutes a re-evaluation of

The following examples are for SIGNIFICANT changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
				certification design assumptions.
~~Install a plug in fuselage and add interior in the plug – no change forward or aft of plug.~~	~~Yes~~	~~Yes~~	~~Yes~~	
Extensive structural airframe modification, such as a large opening in fuselage	Yes	No	No	Requires extensive changes to fuselage structure, affects aircraft systems, and requires a new AFM to address performance and flight characteristics.
Fuselage stretch ~~and entire new interior~~ or shortening in the cabin or pressure vessel.	Yes	~~Yes~~No	Yes	
New interior or revised arrangement with a new/revised attachment system for interior components (e.g. seats, galleys or closets).	No	Yes	Yes	

The following examples are for NOT SIGNIFICANT changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
Addition of wingtip modifications (not winglets).	No	No	No	A major change to the aeroplane. Likely the original general configuration, principles of construction and certification assumptions remain valid.
Installation of skis or wheel skis.	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction and certification assumptions remain valid.
FLIR or surveillance camera installation.	No	No	No	Additional flight or structural evaluation may be necessary, but the change does not alter basic aeroplane certification.
Litter, berth and cargo tie down device installation.	No	No	No	~~Not an aeroplane level change.~~
Increased tire size, including tundra tires.	No	No	No	~~Not an aeroplane level change.~~
Replacement of one propeller type with another (irrespective of increase in number of blades).	No	No	No	Although a major change to the ~~airplane~~aeroplane, likely the original general configuration, principles of construction and certification

The following examples are for NOT SIGNIFICANT changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
				assumptions remain valid.
Addition of a turbo-charger that does not change the power envelope, operating range, or limitations (e.g. a turbo-normalised engine, where the additional power is used to enhance high altitude or hot day performance).	No	No	No	~~Not an aeroplane level change.~~
~~Replace a petrol engine with a diesel engine or approximately the same horsepower.~~	~~No~~	~~No~~	~~No~~	~~Although a major change to the airplane, likely the original general configuration, principles of construction and certification assumptions remain valid.~~
Substitution of one method of bonding for another (e.g. change in type of adhesive).	No	No	No	~~Not an aeroplane level change.~~
Substitution of one type of metal for another.	No	No	No	~~Not an aeroplane level change.~~
Any change in construction or fastening not involving primary structure.	No	No	No	~~Not an aeroplane level change.~~
A new fabric type for fabric skinned aircraft.	No	No	No	~~Not an aeroplane level change.~~

The following examples are for NOT SIGNIFICANT changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
Increase in flap speed or undercarriage limit speed.	No	No	No	Although a major change to the ~~airplane~~aeroplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
Structural strength increases	No	No	No	Although a major change to the ~~airplane~~aeroplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
Instrument flight rules (IFR) upgrades involving installation of components (where the original certification does not indicate that the aeroplane is not suitable as an IFR platform, e.g. special handling concerns).	No	No	No	~~Not an aeroplane level change.~~
Fuel lines, where engine horsepower is increased but fuel flow is not increased beyond the certificated maximum amount.	No	No	No	~~Not an aeroplane level change.~~

The following examples are for NOT SIGNIFICANT changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
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 aeroplane level change.~~
Limited changes in a pressurisation system, e.g. number of outflow valves, type of controller or size of pressurised compartment, but the system must be re-substantiated if the original test data are invalidated.	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
Install a quieter exhaust system.	No	No	No	~~Not an aeroplane level change.~~
Changes in engine cooling or cowling.	No	No	No	~~Not an aeroplane level change.~~
~~Fuel type: AvGas to Diesel/Jet A, AvGas to Ethanol/Methanol. Changing to multiple fuel systems containing fuel types (other than systems used for starting): such as AvGas/Ethanol, or~~	~~No~~	~~No~~	~~No~~	~~Although a major change to the aeroplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.~~

The following examples are for NOT SIGNIFICANT changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
~~Jet A/AutoGas (turbine). Unrestricted mixtures in one fuel system of different fuel types: such as AvGas/Diesel or Jet A/Ethanol.~~				
Changing ~~F~~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 (although Jet A to Jet B may be considered significant due to the fact that Jet B is considered potentially more explosive).	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
Fuels that specify different levels of "conventional" fuel additives that do not change the primary fuel type. Different additives ~~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 aeroplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
A change to the maximum take-off weight of less than 5%, unless assumptions	No	No	No	Although a major change to the aeroplane, likely the original general

The following examples are for NOT SIGNIFICANT changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
made in justification of the design are thereby invalidated.				configuration, principles of construction, and certification assumptions remain valid. (Unless this weight increase would result in a shift to commuter category.)
An additional aileron tab (e.g., on the other wing).	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
Larger diameter flight control cables with no change in routing, or other system design.	No	No	No	~~Not an aeroplane level change.~~
Auto-pilot installation (for instrument flight rules (IFR) use, where the original certification does not indicate that the aeroplane is not suitable as an IFR platform).	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
Increased battery capacity or relocate battery.	No	No	No	~~Not an aeroplane level change.~~
Replace generator with alternator.	No	No	No	~~Not an aeroplane level change.~~
Additional lighting (e.g. navigation lights, strobes).	No	No	No	~~Not an aeroplane level change.~~

The following examples are for NOT SIGNIFICANT changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
Higher capacity brake assemblies.	No	No	No	~~Not an aeroplane level change.~~
Increase in fuel tank capacity.	No	No	No	Not an aeroplane level change, unless it is tied with an increase in gross weight..
Addition of an oxygen system.	No	No	No	~~Not an aeroplane level change.~~
Relocation of a galley.	No	No	No	~~Not an aeroplane level change.~~
Passenger to freight (only) conversion with no change to basic fuselage structure.	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction, and certification assumptions remain valid. Requires certification substantiation applicable to freighter requirements.
~~No fuselage stretch but complete n~~New cabin interior with no fuselage length change.	No	No	No	Not significant unless you are using a new/revised attachment system.
Existing type design – complete new interior but no new/revised attachment system, i.e. green completion.	No	No	No	Not significant (assuming no new attachment system).
Installation of new seat belt or shoulder harness.	No	No	No	~~Not an aeroplane level change.~~

The following examples are for NOT SIGNIFICANT changes for Small Aeroplanes (CS-23):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
A small increase in cg range.	No	No	No	At ~~aeroplane~~ a product level, no change in general configuration, principles of construction, and certification assumptions.
APU installation that is not flight essential	No	No	No	Although ~~A~~a major change to the aeroplane level, likely the original general configuration, principles of construction, and certification assumptions remain valid. ~~Requires certification substantiation applicable to APU installation requirements.~~
An alternative auto-pilot.	No	No	No	~~Not an aeroplane level change.~~
Addition of Class B Terrain Awareness and Warning Systems (TAWS).	No	No	No	~~Not an aeroplane level change.~~

~~Figure 2.~~ **Table 2. ~~of c~~Examples of changes for Large Aeroplanes (CS-25)**

The following examples are for SUBSTANTIAL changes for Large Aeroplanes (CS-25):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
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.	~~Yes~~ N/A	~~No~~ N/A	~~Yes~~ N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
Change from a high-wing to low-wing configuration.	~~Yes~~ N/A	~~No~~ N/A	~~Yes~~ N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
Change from an all-metal aeroplane to all composite primary structure (fuselage, wing and empennage).	~~Yes~~ N/A	~~Yes~~ N/A	~~Yes~~ N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
Change of empennage configuration for larger aeroplanes (cruciform vs. 'T' or 'V' tail).	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
Increase from subsonic to supersonic flight regime.	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially

The following examples are for SUBSTANTIAL changes for Large Aeroplanes (CS-25):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
				complete investigation of compliance with the applicable regulations is required.

The following examples are for SIGNIFICANT changes for Large Aeroplanes (CS-25):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
~~Derivative model, e.g., increased passenger payload, freighter version or complete update of a certified aeroplane.~~	~~Yes~~	~~Yes~~	~~Yes~~	~~Multiple changes packaged into a new model. Increased payload new freighter would change the general configuration and assumptions. Updated aeroplane could change principles of construction.~~
Reduction in the number of flight crew (in conjunction with flight deck update).	Yes	No	No	Extensive changes to avionics and aircraft systems. Impact to crew workload and human factors, pilot type rating.
Modify an aeroplane for flight in known icing conditions by adding systems for ice detection and elimination.	Yes	No	Yes	New aircraft operating envelope. Requires major new systems installation and aircraft evaluation. Operating envelope changed.
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.

The following examples are for SIGNIFICANT changes for Large Aeroplanes (CS-25):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
~~Change to pressurised cabin, including the introduction of a pressurisation system.~~ Increase in cabin pressurisation system	No	No	Yes	Typically, ~~A~~a change greater than ~~5~~10% in operational cabin pressure differential. ~~Essentially a recertification of airframe and systems associated with operating envelope change.~~ May require extensive airframe changes affecting load paths, fatigue evaluation, aeroelastic characteristics, etc. Invalidates design assumptions.
Addition of leading edge slats.	Yes	No	No	Requires extensive changes to wing structure, adds aircraft systems, and requires a new ~~aeroplane flight manual~~ AFM to address performance and flight characteristics.
Fuselage ~~length change – lengthen or shorten fuselage~~ stretch ~~(~~or shortening~~) and entire new interior~~ in the cabin or pressure vessel.	Yes	No	No	~~Requires extensive changes to fuselage structure, affects aircraft level systems, and requires a new aeroplane flight manual to address performance and flight characteristics.~~Cabin interior changes are related changes since occupant safety considerations are

The following examples are for SIGNIFICANT changes for Large Aeroplanes (CS-25):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
				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.
~~Install a plug in fuselage and add interior in the plug – with no interior changes forward or aft of the plug.~~	~~Yes~~	~~Yes~~	~~Yes~~	
~~New interior or revised arrangement with a new/revised attachment system for interior components (e.g. seats, galleys, or closets).~~	~~No~~	~~Yes~~	~~Yes~~	

The following examples are for SIGNIFICANT changes for Large Aeroplanes (CS-25):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
Extensive structural airframe modification, such as installation of a large telescope with large opening in fuselage.	Yes	No	No	Requires extensive changes to fuselage structure, affects aircraft systems, and requires a new ~~aeroplane flight manual~~ AFM to address performance and flight characteristics.
Changing the number of axles or number of landing gear done in context with a product change that involves changing the aeroplane gross weight.	Yes	No	No	Requires extensive changes to aircraft structure, affects aircraft systems, and requires AFM changes.
Primary structure changes from metallic material to composite material.	No	Yes	No	Change in principles of construction and design from conventional practices.
Airframe life extension	No	No	Yes	

The following examples are for SIGNIFICANT changes for Large Aeroplanes (CS-25):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
Typically, an increase in design weight of more than 10%.	No	No	Yes	~~When it r~~Requires extensive re-substantiation of aircraft structure, aircraft performance and flying qualities and associated systems.
Installation of winglets	Yes	No	Yes	
Wing changes in span, sweep, tip designs or wing chord. ~~(NOTE: Potentially substantial if it is a change from a high wing to a low wing, or a new wing.)~~	Yes	No	~~No~~Yes	When it requires extensive changes to wing structure, adds aircraft systems, and requires a new ~~aeroplane flight manual~~ AFM to address performance and flight characteristics. (NOTE: Potentially substantial if it is a change from a high wing to a low wing, or a new wing.)
Change in type or number of emergency exits ~~in conjunction with~~ or an increase in the maximum certificated number of passengers ~~demonstrated~~.	~~No~~Yes	No	Yes	The new emergency egress requirements exceed those previously substantiated.
Comprehensive flight deck upgrade, such as conversion from	No	No	Yes	Affects avionics and electrical systems integration and

The following examples are for SIGNIFICANT changes for Large Aeroplanes (CS-25):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
entirely federated, independent electro-mechanical flight instruments to highly integrated and combined electronic display systems with extensive use of software and possibly complex hardware.				architecture concepts and philosophies. ~~This drives a re-assessment of flight crew workload and other human factors issues, and requires a re-evaluation of the original design assumptions used for the cockpit.~~
Change in primary flight controls to fly by wire (FBW) system. (Some aeroplanes have some degree of FBW. Achieving full FBW may be a not significant change on some aeroplanes.)	~~Yes~~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 flight crew workload, handling qualities, and performance evaluation, which are different from the original design assumptions.
Replace reciprocating with turbo-propeller engines.	Yes	No	No	Requires extensive changes to airframe structure, addition of aircraft systems, and a new ~~aeroplane flight manual~~ AFM to address performance and flight characteristics.

The following examples are for SIGNIFICANT changes for Large Aeroplanes (CS-25):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
Typically a thrust increase of more than 10 %.	No	No	Yes	~~When it r~~Requires re-substantiation of powerplant installation, and has a marked affect on aircraft performance and flying qualities.
Initial installation of an auto-land system.	No	No	Yes	Baseline aeroplane not designed for auto-land operation, potential crew workload and systems compatibility issues.
Installation of a new fuel tank, (horizontal stabiliser tank or auxiliary fuel tank in the fuselage outside the wing in conjunction with increased maximum take-off weight and takeoff thrust).	No	No	Yes	Requires changes to airframe, systems and AFM. Results in performance changes.
Main deck cargo door installation.	Yes	No	No	Redistribution of internal loads, change in aeroelastic characteristics, system changes.
Expansion of an aircraft's operating envelope.	No	No	Yes	An expansion of operating capability would normally be a significant change (e.g. an increase in maximum altitude limitation, approval for flight

The following examples are for SIGNIFICANT changes for Large Aeroplanes (CS-25):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
				in known icing conditions, or an increase in airspeed limitations). ~~An increase in cg range (5% mean aerodynamic chord) will typically cause a significant increase in wing loads, as compared to moving the aft cg limit further aft. The change in cg limit should be considered with any increases or decreases in aircraft weight. An increase in wing loads of greater than 5% is considered to be a significant change.~~ Merely operating a product to an expanded envelope 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

The following examples are for SIGNIFICANT changes for Large Aeroplanes (CS-25):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
				effects or can be demonstrated without significant physical changes to the product.
Conversion from a passenger floor to a cargo floor and installation of a cargo handling system.	No	No	Yes	Completely new floor loading and design. Redistribution of internal loads, change in cabin safety requirements, system changes.
Initial installation of an APU essential for aircraft flight operation.	No	No	Yes	Changes emergency electrical power requirements, change in ~~flight manual~~ AFM and operating characteristics.
Conversion from hydraulically actuated brakes to electrically actuated brakes.	~~Yes~~No	~~Yes~~No	Yes	~~Completely new electro-mechanical actuators in lieu of hydraulic pistons in each brake – assembly, no hydraulic hoses, new wire bundles, new ETSO, change in applicable specifications~~. Assumptions of certification for aeroplane performance are changed.
Change to aeroplane's cabin operating altitude, or operating pressure ~~change~~	~~Yes~~No	No	Yes	An increase greater than ~~5~~10% in maximum cabin pressure differential

The following examples are for SIGNIFICANT changes for Large Aeroplanes (CS-25):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
~~to aeroplane's design limit.~~				invalidates ~~a basic~~ certification assumptions and the fundamental approach used in decompression. ~~the~~ structural strength, and fatigue analysis.
Installation of engine thrust reversers	Yes	No	Yes	

The following examples are for NOT SIGNIFICANT changes for Large Aeroplanes (CS-25):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **1A.101(b)(1)(ii)**	**Notes**
Alternate engine installation or hush kit at same position.	No	No	No	~~Although an aeroplane level change,~~ Typically, it is not significant any longer as there is not more than a 10% increase in thrust or a change in the principles of propulsion.
A small change in ~~F~~fuselage length due to~~changes – lengthen or shorten fuselage~~ - ~~-~~refairing the aft body or radome.	No	No	No	~~A small change in fuselage length due to refairing the aft body or radom f~~For cruise performance reasons, where such changes do not require extensive structural, systems, aerodynamic, or AFM changes.
Refairing of wing tip caps (~~e.g.~~ 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.
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.

The following examples are for NOT SIGNIFICANT changes for Large Aeroplanes (CS-25):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **1A.101(b)(1)(ii)**	**Notes**
~~General avionics changes.~~	~~No~~	~~No~~	~~No~~	~~These modifications are generally adaptive* in nature, and do not change the original certification assumptions, alter basic cockpit design architecture concepts and philosophies, and do not have a major impact on crew workload or man/machine.~~ ~~*Adaptive means the change adapts to the existing airplane buses, power, structure, …~~
Installation of an auto-pilot system.	No	~~No~~ ~~N/A~~No	~~No~~ See note	It may be possible that the ~~M~~modification is ~~generally~~ adaptive in nature, with no change to original certification assumptions. However, in certain cases the installation of an auto-pilot may include extensive changes and design features which change ~~both the general configuration and~~ the assumptions for certification (i.e. installation of the auto-pilot may introduce a number of additional mechanical and electronic failure modes and change the hazard classification of given aircraft level failures).
~~Integrated~~	~~No~~	~~No~~	~~No~~	~~The basic functionality of the~~

The following examples are for NOT SIGNIFICANT changes for Large Aeroplanes (CS-25):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **1A.101(b)(1)(ii)**	**Notes**
~~modular avionics~~				~~systems are unchanged. No change from analog to digital.~~
~~Installation or rearrangement of an interior in an aircraft.~~	~~No~~No	~~No~~No	~~No~~No	~~Special conditions could be used for new and novel features~~
Change from assembled primary structure to monolithic or integrally machined structure.	No	No	No	Method of construction must be well understood.
Modification to ice protection systems.	No	No	No	Recertification required, but certification basis is adequate.
Brakes: design or material change, e.g. steel to carbon.	No	No	No	Recertification required, but certification basis is adequate.
Redesign floor structure.	No	No	No	By itself, not a significant product ~~level~~ change. It ~~could be a~~ is significant if part of a cargo conversion of a passenger aeroplane.
~~No fuselage stretch but complete new interior.~~ New cabin interior with no fuselage length change	No	No	No	~~Not significant unless you are using a new/revised attachment system.~~A new cabin interior includes new ceiling and sidewall panels, stowage, galleys, lavatories, and seats. New and novel features in the cabin interior may require special conditions. Many interior related requirements are incorporated in

The following examples are for NOT SIGNIFICANT changes for Large Aeroplanes (CS-25):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **1A.101(b)(1)(ii)**	**Notes**
				operational rules. Even though the design approval holder may not be required to comply with these requirements, the operator may be required to comply.
~~Existing type design –~~ A re-arrangement of ~~complete new~~ an interior (e.g. seats, galleys, lavatories, closets, etc) ~~but no new/revised attachment system, i.e. Green completion.~~	No	No	No	~~Not significant (assuming no new attachment system).~~ Re-arrangement requires the use of the existing floor mounting structure.
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 specifications that adequately address these features.
Initial installation of a non-essential APU.	No	No	No	A stand-alone initial APU installation on an ~~airplane~~ aeroplane originally designed to use ground/airport supplied electricity, and air-conditioning. In this case, the APU would be an option to be independent of airport power.

~~Figure 3. Table of examples of Changes for Rotorcraft~~

~~The following are examples of substantial changes:~~

Table 3. ~~of c~~Examples of Changes for Rotorcraft (CS-27 and 29)

The following examples are for SUBSTANTIAL changes for Rotorcraft (CS-27 and CS-29):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
Change from the number and/or configuration of rotors (e.g. main & tail rotor system to two main rotors).	~~Yes~~ N/A	~~No~~ N/A	~~Yes~~ N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.
Change from an all metal rotorcraft to all composite rotorcraft.	~~Yes~~ N/A	~~Yes~~ N/A	~~Yes~~ N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.

The following examples are for SIGNIFICANT changes for Rotorcraft (CS-27 and CS-29):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
Comprehensive flight deck 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.	~~Yes~~ No	No	Yes	~~The degree of change is so extensive that it a~~Affects ~~basic~~ avionics and electrical systems integration~~,~~ and architecture concepts ~~and or~~ and philosophies. ~~This drives may drive a complete reassessment of the flight crew workload or other human factor issues, and or requires a re-evaluation of the original design assumptions used for the cockpit. Example: changing from federated display (e.g. separate attitude, altitude, and airspeed) architecture to an integrated electronic flight information system.~~
Certification for flight into known icing conditions.	No	No	Yes	
(Fixed) flying controls from mechanical to fly by wire.	~~Yes~~ No	~~Yes~~ No	Yes	This drives a complete reassessment of the rotorcraft controllability and flight control failure.
Addition of an engine, e.g. from single to twin or reduction of the number of engines, e.g.,	Yes	~~No~~ Yes	Yes	May be a substantial change depending upon project details.

The following examples are for SIGNIFICANT changes for Rotorcraft (CS-27 and CS-29):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
from twin to single.				
A change of rotor drive system primary gearbox splash type lubrication system to a pressure lubricated system due to an increase in horsepower of an engine or changing a piston engine to a turbine engine.	No	Yes	Yes	
A fuselage or tail boom modification that changes the primary structure, aerodynamics, ~~or~~ and operating envelope sufficiently to invalidate the certification assumptions.	Yes	No	Yes	
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 increased performance).	No	Yes	Yes	

The following examples are for SIGNIFICANT changes for Rotorcraft (CS-27 and CS-29):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
Extensive primary structure changes from metallic material to composite material.	No	Yes	Yes	Change in principles of construction and assumptions used for certification for the product level change. Changes of a few individual elements from metal to composite are not typically considered a significant change.
Emergency Medical Service (EMS) ~~C~~configuration with primary structural changes sufficient to invalidate the certification assumptions.	No	No	Yes	~~Any~~ 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.
Skid landing gear to wheel landing gear or wheel landing to skid.	Yes	No	Yes	~~If the rotorcraft is such that the skid or wheel configuration is inherent in the basic certification design, the change may be not significant.~~
Change of the number of rotor blades.	Yes	No	~~No~~ Yes	~~The addition/deletion of rotor blades may not be significant provided the remainder of the basic propulsion system remains essentially unchanged.~~

The following examples are for SIGNIFICANT changes for Rotorcraft (CS-27 and CS-29):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
Change tail anti-torque device (e.g. tail rotor, ducted fan or other technology).	Yes	Yes	No	
Passenger configured helicopter to a fire fighting equipment configured helicopter.	Yes	No	Yes	Depends on the fire fighting configuration.
Passenger configured helicopter to an agricultural configured helicopter.	Yes	No	Yes	Depends on the agricultural configuration.
A new Category A certification approval to an existing configuration.	No	No	Yes	
Instrument Flight Rules (IFR) upgrades involving installation of upgraded components for new IFR configuration.	No	No	Yes	
Human External Cargo (HEC) certification approval.	No	No	Yes	Must comply with the latest HEC Certification specifications in order to obtain operational approval. HEC include fatigue, Quick Release Systems, HIRF, OEI performance and OEI procedures.
Reducing the	No	No	Yes	Significant change, if

The following examples are for SIGNIFICANT changes for Rotorcraft (CS-27 and CS-29):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
number of pilots for IFR from 2 to 1.				there are extensive equipment and design changes such that the certification assumptions are invalidated

The following examples are for NOT SIGNIFICANT changes for Rotorcraft (CS-27 and CS-29):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
Emergency floats	No	No	No	Must comply with the specific applicable specifications 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, or 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.
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.

The following examples are for NOT SIGNIFICANT changes for Rotorcraft (CS-27 and CS-29):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
Helicopter Terrain Awareness Warning System (HTAWS) for operational credit.	No	No	No	Certificated per rotorcraft HTAWS AC guidance material and FAA TSO-C194.
Health Usage Monitoring System (HUMS) for Maintenance Credit.	No	No	No	Certificated per rotorcraft HUMS AC guidance material.
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, ratings structure).	No	No	No	Expanding an operating envelope (such as operating altitude and temperature) and mission profile (such as passenger carrying operations to external load operations, or 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.
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
Windscreen installation	No	No	No	Does not change the rotorcraft overall product configuration.

The following examples are for NOT SIGNIFICANT changes for Rotorcraft (CS-27 and CS-29):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
Snow skis, “Bear Paws”	No	No	No	Must comply with specific certification specifications 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, or 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.
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

The following examples are for NOT SIGNIFICANT changes for Rotorcraft (CS-27 and CS-29):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
				altitude and temperature) and mission profile (such as passenger carrying operations to external load operations, excluding HEC, or 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.
IFR upgrades involving installation of upgraded components ~~(where the original certification does not indicate that the rotorcraft is not suitable as an IFR platform, e.g., special handling concerns)~~ to replace existing components.	No	No	No	Not a rotorcraft level change.
~~An upgrade to CAT A certification approval~~	~~No~~	~~No~~	~~No~~	~~Typically these are engine and drive systems rating changes appropriate for CAT A and rotorcraft performance requirements. Rotorcraft modifications, if any necessary, do not typically invalidate the~~

The following examples are for NOT SIGNIFICANT changes for Rotorcraft (CS-27 and CS-29):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
				~~certification assumptions, or change the general configuration of principles of construction.~~
~~Reducing the number of pilots for IFR from 2 to 1.~~	~~No~~	~~No~~	~~No~~	~~May be significant if there are extensive equipment and design changes such that the certification assumptions are invalidated or the general configuration of the rotorcraft is changed.~~

~~Figure 4. Engines and Propellers~~

~~The following are examples of significant changes:~~

~~Turbine engines~~

Table 4. Examples for Engines ~~and Propellers~~ (CS-E)

The following are examples of SUBSTANTIAL changes for Engines (CS-E):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
Turbine Engines				
Traditional turbofan to geared-fan engine.	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required. **Note:** There may be certain circumstances where this change would be significant.
Low by-pass ratio engine to high by-pass ratio engine with an increased inlet area.	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required. **Note:** There may be certain circumstances where this change would be significant.

The following are examples of SUBSTANTIAL changes for Engines (CS-E):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
Turbojet to Turbofan	N/A	N/A	N/A	Change in general configuration. Likely change in model designation. Not interchangeable Assumptions for certification may no longer be valid in terms of lifting, ingestion, icing, blade out criteria etc. Note that this change is most likely substantial under 21A.19.
Turbo-shaft to turbo-propeller	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required. **Note:** There may be certain circumstances where this change would be significant.
Conventional ducted fan to unducted fan.	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of

The following are examples of SUBSTANTIAL changes for Engines (CS-E):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
				compliance with the applicable regulations is required. **Note:** There may be certain circumstances where this change would be significant.
Turbine engine for subsonic operation to afterburning engine for supersonic operation	NA	NA	NA	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.

The following are examples of SIGNIFICANT changes for Engines ~~and Propellers~~ (CS-E ~~and CS-P~~):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
Turbine Engines				
~~Traditional turbofan to geared fan engine.~~	~~Yes~~	~~No~~	~~Yes~~	~~This change would affect the engine in terms of foreign object ingestion (FOD), containment etc.~~ ~~Note that this change is most likely substantial under 21A.19.~~
~~Low by-pass ratio engine to high by-pass ratio engine with an increased inlet area.~~	~~Yes~~	~~No~~	~~Yes~~	~~Change in general configuration.~~ ~~Likely change in model designation.~~ ~~Not interchangeable~~ ~~Assumptions for certification may no longer be valid in terms of ingestion, icing etc.~~ ~~Note that this change is most likely substantial under 21A.19.~~

The following are examples of SIGNIFICANT changes for Engines ~~and Propellers~~ (CS-E ~~and CS-P~~):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
~~Turbojet to Turbofan~~	~~Yes~~	~~No~~	~~Yes~~	~~Change in general configuration.~~ ~~Likely change in model designation.~~ ~~Not interchangeable~~ ~~Assumptions for certification may no longer be valid in terms of lifting, ingestion, icing, blade out criteria etc.~~ ~~Note that this change is most likely substantial under 21A.19.~~
~~Turbo-shaft to turbo-propeller~~	~~Yes~~	~~No~~	~~Yes~~	~~Change in configuration such as an additional gearbox.~~ ~~Change in model designation.~~ ~~Change in mission profile.~~ ~~Assumptions for certification may no longer be valid in terms of flight envelope, ratings etc.~~ ~~Note that this change is most likely substantial under 21A.19.~~
~~Conventional ducted fan to~~	~~Yes~~	~~Yes~~	~~Yes~~	~~Change in~~

The following are examples of SIGNIFICANT changes for Engines ~~and Propellers~~ (CS-E ~~and CS-P~~):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
~~unducted fan.~~				~~configuration.~~ ~~Change in type.~~ ~~Not interchangeable~~ ~~Assumptions for certification may no longer be valid.~~ ~~Note that this change is most likely substantial under 21A.19.~~
~~Conventional engine for subsonic operation to afterburning engine for supersonic operation.~~	~~Yes~~	~~Yes~~	~~Yes~~	~~Change in configuration.~~ ~~Change in type.~~ ~~Not interchangeable~~ ~~Assumptions for certification may no longer be valid.~~ ~~Change in operating envelope.~~ ~~Note that this change is most likely substantial under 21A.19.~~
~~Combining engine modules from uncertified (military) and Agency approved into a single engine configuration.~~	~~No~~	~~No~~	~~Yes~~	~~Uncertified (military) engines are not approved or monitored using Agency approved standards. Flight cycles, missions, maintenance programs and experience of the military engine are not~~

The following are examples of SIGNIFICANT changes for Engines ~~and Propellers~~ (CS-E ~~and CS-P~~):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
				~~known. The combined modules have structural and operational characteristics that have not been evaluated and do not meet Agency's approved certification basis. This change requires an establishment of a new performance centreline and could be considered substantial.~~
Increase/decrease in the number of compressor/turbine stages with resultant change in approved operational limitations* (*exclude life limits)	~~No~~Yes	No	Yes	Change is associated with other changes ~~that would affect~~ to the ratings and operating limitations; ~~of the~~ engine ~~and have affected the~~ dynamic behaviour, in terms of backbone bending, torque spike effects on casing, surge and stall characteristics, etc.
New design fan blade and fan hub, or a bladed fan disk to a blisk, or a fan diameter	Yes	No	Yes	~~Likely change in model designation.~~ Change is associated with

The following are examples of SIGNIFICANT changes for Engines ~~and Propellers~~ (CS-E ~~and CS-P~~):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
change, that could not be retrofitted.				other changes ~~that would affect~~ to the engine thrust, ratings and ~~/power~~ operating limitations ~~and have affected the~~ engine dynamic behaviour ~~of the engine~~ in terms of backbone bending, torque spike effects on casing, foreign object ingestion behaviour, burst model protection for the aircraft. If there is a diameter change, installation will be also affected.
Hydro-Mechanical control to FADEC/EEC without hydro mechanical back-up.	Yes	~~Yes~~ No	~~Yes~~No	Change in engine control configuration. ~~Likely change in model designation.~~ Not interchangeable Likely fundamental change to engine operation.~~Assumptions used for certification are no longer valid or were not addressed~~

The following are examples of SIGNIFICANT changes for Engines ~~and Propellers~~ (CS-E ~~and CS-P~~):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
				~~in the original certification, i.e. HIRF and Lightning Protection, Fault Tolerance, Software Certification and other aspects associated with FADEC/EEC's systems.~~
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	~~No~~ ~~Yes~~No	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.
Replace gas generator (core, turbine/compressor /combustor) with a different one that is associated with changes in approved operational limitations*. *Exclude life limits.	No	No	Yes	Change is associated with other changes that would affect engine thrust/power and have affected the dynamic behaviour of the engine. Assumptions used for certification may no longer be valid.

The following are examples of SIGNIFICANT changes for Engines ~~and Propellers~~ (CS-E ~~and CS-P~~):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
Piston Engines				
Convert from Mechanical to Electronic Control System.	Yes	Yes	No	Change in engine configuration: ~~i~~Installation interface of engine changed. Changes to principles of construction: digital controllers and sensors require new construction techniques and environmental testing.
Add Turbocharger that increases performance and changes in overall product.	Yes	No	Yes	Change in general configuration: ~~i~~Installation interface of engine changed (exhaust system). Certification assumptions invalidated~~.~~: ~~Change in engine configuration~~ ~~c~~Change in operating envelope and performance.
Convert from air cooled cylinders to liquid cooled cylinders.	Yes	No	Yes	Change to general configuration: ~~i~~Installation interface of engine changed (cooling lines from radiator, change to

The following are examples of SIGNIFICANT changes for Engines ~~and Propellers~~ (CS-E ~~and CS-P~~):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
				cooling baffles). Certification assumptions invalidated~~.~~: ~~c~~Change in operating envelope and engine temperature requirements.
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.
~~**Propellers**~~				
~~Introduction of a different principle of blade retention.~~	~~Yes~~	~~Yes~~	~~No~~	~~Change in propeller configuration.~~ ~~Likely change in model designation.~~ ~~Propeller's operating characteristics and inherent strength require re-evaluation.~~

The following are examples of NOT SIGNIFICANT changes for Engines ~~and Propellers~~ (CS-E ~~and CS-P~~):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
Turbine Engines				
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. ~~No likely change in model designation.~~ Assumptions are still valid.
Increase/decrease in the number of compressor/turbine stages without resultant change in operational performance envelope.	No	No	No	No change in performance. ~~Model designation may or may not change.~~ Assumptions are still valid.
New components internal to the FADEC/EEC the introduction of which does 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.
Software changes	No	No	No	
Rub-strip design changes	No	No	No	~~Component level change~~
A new combustor that does not change the approved limitations, or dynamic behaviour* *exclude life limits.	No	No	No	~~Component level change~~
Bearing changes	No	No	No	~~Component level change~~
New blade designs with similar material that can	No	No	No	~~Component level change~~

The following are examples of NOT SIGNIFICANT changes for Engines ~~and Propellers~~ (CS-E ~~and CS-P~~):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
be retrofitted.				
Fan blade redesign that can be retrofitted.	No	No	No	~~Component level change~~
Oil tank redesign	No	No	No	~~Component level change~~
Change from one hydro-mechanical control to another hydro-mechanical control.	No	No	No	~~Component level change~~
Change to limits on life limited components.	No	No	No	~~Component level change~~
Changes to limits on exhaust gas temperature.	No	No	No	
Changes in certification maintenance requirements (CMR) with no configuration changes.	No	No	No	
Bump ratings within the product's physical capabilities that may be enhanced with gas path changes such as blade restaggered, cooling hole patterns, blade coating changes, etc.	No	No	No	

The following are examples of NOT SIGNIFICANT changes for Engines ~~and Propellers~~ (CS-E ~~and CS-P~~):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
A change in principal physical properties and mechanics of load transfer of a material of primary structure or highly loaded components. For example, change from traditional metal to either an exotic alloy or a composite material on a highly loaded component.	No	No	No	~~Component level change~~
Piston Engine				
A change in principal physical properties and mechanics of load transfer of a material of primary structure or highly loaded components. For example, change from traditional metal to either an exotic alloy or a composite material on a highly loaded component.	No	No	No	~~Component level change~~
New or redesigned cylinder head, or valves, or pistons.	No	No	No	
Changes in crankshaft.	No	No	No	~~Component level change~~
Changes in crankcase.	No	No	No	~~Component level change~~
Changes in carburettor	No	No	No	~~Component level change~~
Changes in mechanical fuel injection system.	No	No	No	~~No controversy No comments~~
Changes in mechanical fuel	No	No	No	~~Component level change~~

The following are examples of NOT SIGNIFICANT changes for Engines ~~and Propellers~~ (CS-E ~~and CS-P~~):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
injection pump.				
Engine model change to accommodate new aeroplane installation. No change in principles of operation of major subsystems; no significant expansion in power or operating envelopes or in limitations.	No	No	No	
No change in basic principles of operation, or a simple mechanical change. For example, change from dual magneto to two single magnetos on a model.	No	No	No	
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	

The following are examples of NOT SIGNIFICANT changes for Engines ~~and Propellers~~ (CS-E ~~and CS-P~~):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
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
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
~~**Propellers**~~				
~~Change in the material of a blade bearing.~~	~~No~~	~~No~~	~~No~~	~~Component level change~~
~~Change to a component in the control system.~~	~~No~~	~~No~~	~~No~~	~~Component level change~~
~~Change to a propeller de-icer boot.~~	~~No~~	~~No~~	~~No~~	~~Component level change~~

Table 5. Examples of Changes for Propellers (CS-P)

The following are examples of SUBSTANTIAL changes for Propellers (CS-P):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
Change in the number of blades	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable regulations is required.

The following are examples of SIGNIFICANT changes for Propellers (CS-P):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
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.
Introduction of a different principle of blade retention such as a single row to a dual row bearing.	Yes	Yes	No	~~Change in propeller configuration. Likely change in model designation. Propeller's operating characteristics and~~ Requires extensive modification of the propeller hub and blade structure. The inherent strength require re-evaluation.
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.
Changing the method of mounting the propeller to the engine such as a spline to a flange	Yes	Yes	No	Requires extensive modification of the propeller hub structure. **Note:** Such a

The following are examples of SIGNIFICANT changes for Propellers (CS-P):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
mount				change could be considered not-significant if implemented without a change in general configuration or principals of construction.
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.
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.
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 were not

The following are examples of SIGNIFICANT changes for Propellers (CS-P):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
				addressed in the original certification, i.e., high intensity radio frequency (HIRF) and lightning protection, fault tolerance, software certification and other aspects. The propeller will require special conditions under 14 CFR § 21.16.

The following are examples of NOT SIGNIFICANT changes for Propellers (CS-P):				
Description of change	**Is there a change to the general configuration?** **21A.101(b)(1)(i)**	**Is there a change to the principles of construction?** **21A.101(b)(1)(i)**	**Have the assumptions used for certification been invalidated?** **21A.101(b)(1)(ii)**	**Notes**
Change in the material of a blade bearing.	No	No	No	~~Component level change~~
Change to a component in the control system.	No	No	No	~~Component level change~~
Change to a propeller de-icer boot.	No	No	No	~~Component level change~~
Changes to the operational design envelope such as an increase in power	No	No	No	Propeller's operating characteristics and inherent strength require re-evaluation.
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 ~~2~~B to GM 21A.101
PROCEDURE FOR EVALUATING IMPRACTICALITY OF APPLYING LATEST CERTIFICATION SPECIFICATIONS TO A CHANGED PRODUCT

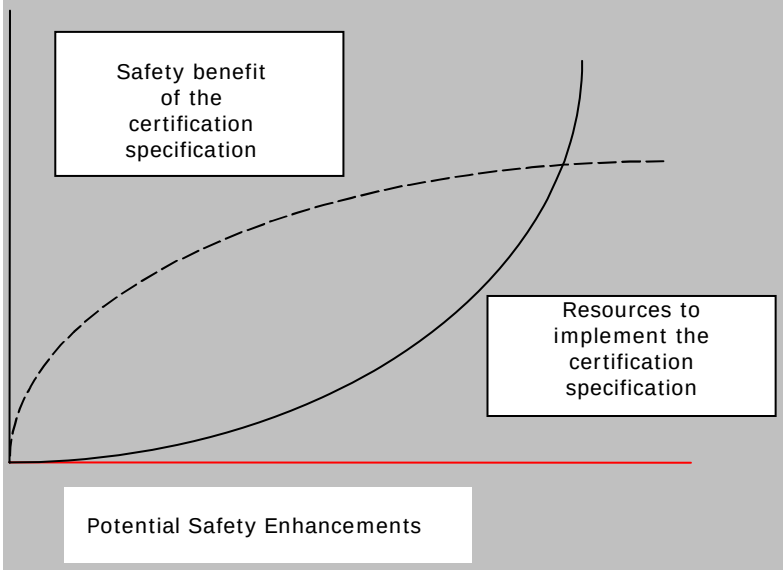
1. Introduction

a. The basic principle of enhancing the level of safety of changed aeronautical products is to apply the latest certification specifications for significant design changes to the greatest extent practical. In certain cases, the cost of complying fully with a later certification specification may not be commensurate with the small safety benefit achieved. It is recognised that the existing fleet and newly produced aeroplanes, engines and propellers are safe, and any unsafe condition is immediately addressed through the airworthiness directive process. These factors form the basis where compliance with the latest certification specification may be considered impractical, thereby allowing compliance with an earlier certification specification. This appendix gives one method of determining if compliance with a later requirement standard is impractical, however, this does not preclude the use of other methods for improving the safety of aeronautical products.

b. This GM recognises 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 should show that a proposed type-certification basis is able to achieve a positive safety benefit for the overall product.

c. In this regard, any method used should 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 the accompanying figure. 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 2. Safety Benefits vs. Resources



d. Typically, one will find that there are proposals that can achieve a positive safety benefit and 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 standards relative to the respective cost to reach this point.

e. This ~~a~~Appendix to GM 21A.101 provides procedural guidance for determining the practicality of applying a certification specification at a particular amendment level to a changed product. This guidance can be used to evaluate the safety benefit and resource impact of implementing the latest airworthiness certification specifications in the type-certification basis of a changed product. The procedure is generic in nature and describes the steps and necessary inputs that any applicant can use on any project to develop a position.

f. 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 certification specifications. It provides a means, but not the only means, for an applicant to present its position in regard to impracticality.

g. The type-certification basis for a change to a product will not be at an amendment level earlier than the existing type-certification basis. Therefore, when determining the impracticality of applying a certification specification at the latest amendment level, only the increase in safety benefits and costs beyond compliance with the existing type-certification basis should be considered.

2. Procedure for Evaluating Impracticality of Applying Latest Certification Specifications to a Changed Product

The following are steps to determine the impracticality of applying a certification specification at a particular amendment level. The first step will be to identify the regulatory change being evaluated.

a. Step 1: Identify the Regulatory Change Being Evaluated.

In this step, it will be necessary to document:

(1) The specific certification specification (for example, CS 25.365),

(2) The amendment level of the existing type-certification basis for the certification specification, and

(3) The latest amendment level of the certification specification.

b. Step 2: Identify the Specific Hazard that the Requirement Certification Specification Addresses

(1) Each certification specification and subsequent amendments are intended to address a hazard or hazards. In this step the specific hazard(s) is/are identified. This identification will allow for a comparison of the effectiveness of amendment levels of the certification specification at addressing the hazard.

(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 available background information from development and adoption of this certification specification (Explanatory Note and Comment/Response Document to the NPA. It may also be helpful to discuss the hazard with the Agency).

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

(1) Once the hazard has been identified, it is possible to identify the types of consequences that may occur because of the presence of the hazard. More than one consequence can be attributed for the same hazard. Typical examples of consequences would include, but are not be limited to:

- Incidents where only injuries occurred;
- Accidents where less than 10% of the passengers died;
- Accidents where 10% or more passengers died; and
- Accidents where a total hull loss occurred.

(2) The background information from development and adoption of the certification specification may provide useful information regarding the consequences of the hazard the requirement is intended to address.

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

(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 hazard occurrence can be determined. It is important to recognise that the frequency of occurrence may be higher or lower in the future. Therefore, it is also necessary to predict the frequency of future occurrences.

(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.

(3) The background information from development and adoption of the certification specification may provide useful information regarding the frequency of occurrence.

e. Step 5: Determine How Effective Full Compliance with the Latest Amendment of the Requirement Would Be at Addressing the Hazard

(1) When each amendment is promulgated, it is usually expected that compliance with the certification specification would be completely effective at addressing the associated hazard. It is expected that the hazard would be eliminated, avoided, or dealt with. However, in a limited number of situations, this may not be the case. It is also possible that earlier amendment levels may have addressed the hazard but were not completely effective. Therefore, in comparing the benefits of compliance with the existing type-certification basis to the latest amendment level, it is useful to estimate the effectiveness of both amendment levels in dealing with the hazard.

(2) It is recognised that the determination of levels of effectiveness is normally of a subjective nature. These are relative assessments of a qualitative nature that should not be treated as absolute determinations. 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.

(3) The following five levels of effectiveness are provided as a guideline:

(a) Fully effective in all cases.
Compliance with the requirement eliminates the hazard or provides a means to avoid the hazard completely.

(b) Considerable potential for eliminating or avoiding the hazard.
Compliance with the requirement eliminates the hazard or provides a means to avoid completely the hazard for all probable or likely cases, but it does not cover all situations or scenarios.

(c) Adequately deals with 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.

(d) 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.

(e) 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.

f. Step 6: Determine Resource Costs and Cost Avoidance

(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 certification specification may also facilitate certification of a product by the competent authority of a third country.

(2) When determining the impracticality of applying a certification specification at the latest amendment level, only the incremental costs and safety benefits from complying with the existing type-certification basis should be considered.

(3) When evaluating the incremental cost, it may be beneficial for the applicant to compare the increase in cost to comply with the latest certification specifications to the cost to incorporate the same design feature in a new aeroplane. In many cases an estimate for the cost of incorporation in a new aeroplane is provided in the regulatory evaluation by the Agency, which was presented when the corresponding certification specification was first promulgated. 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:

(a) Costs: The accuracies of fleet size projections, utilisation, etc. may be different than that experienced for derivative product designs and must be validated.

• Labour: 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 labour requirements, including training, 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, and expendables.

• Revenue/Utility Loss: Costs resulting from earning/usage capability reductions from departure delays, product downtime, capability reductions of performance loss due to seats, cargo, range, or airport restrictions.

(b) Cost Avoidance:

• Avoiding cost of accidents, including investigation of accidents, lawsuits, public relations activities, insurance, and lost revenue.

• Foreign Certification: Achieve a singular effort that would demonstrate compliance to the requirements of most certifying agencies, thus minimizing certification costs.

g. Step 7: Document Conclusion. Once the information from previous steps has been documented and reviewed, the applicant's position and rationale regarding practicality can be documented. Examples of possible positions would include, but are not limited to:

(1) Compliance with the latest certification specification is necessary. The applicant would pursue the change at the latest amendment level.

(2) Compliance with an amendment level between the existing type-certification basis and the latest amendment would adequately address the hazard at an acceptable cost, while meeting the latest amendment level would be impractical. The applicant would then propose the intermediate amendment level of the certification specification.

(3) The increased level of safety is not commensurate with the increased costs associated with meeting the latest amendment instead of the existing type-certification basis. Therefore, the applicant would propose the existing type-certification basis.

(4) The results of this analysis were inconclusive. Further discussions with the Agency are warranted.

Note: This process may result in a required type-certification basis that renders the proposed modification economically not viable.

3. Examples of How to Certify Changed Aircraft. The following examples are for large aeroplanes and illustrate the typical process an applicant follows. The process will be the same for all product types.

a. Example 1: CS 25.963 (e) Fuel Tank Access Covers

(1) This change is part of a significant large aeroplane change that increases passenger payload and gross weight by extending the fuselage by 20 feet. To accommodate the higher design weights and increased braking certification specification, 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 new model ~~airplane~~aeroplane will be required to comply with the latest applicable regulations based on the date of application.

(2) 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 recognises that the scatter pattern and impact loading on the wing from debris being thrown from the landing gear will change, he proposes that it would be impractical to redesign the fuel tank access covers.

(3) **Step 1: Identify the Regulatory Change Being Evaluated**

(a) The existing certification basis of the aeroplane that is being changed is CS-25 prior to Amendment3.

(b) Amendment 3 to CS-25 added the requirement that fuel tank access covers on large aeroplanes be designed to minimise penetration by likely foreign objects, and be fire resistant.

(4) **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~~aeroplane. Amendment 3 ensures that all access covers on all fuel tanks are designed or located to minimise penetration by likely foreign objects, and are fire resistant.

(5) **Step 3: Review the History of the Consequences of the Hazard(s)**

Occurrences with injuries and with more than 10% deaths.

(6) **Step 4: Identify the Historical and Predicted Frequency of Each Consequence**

(a) In 200 million departures of large jets:
- One occurrence with more than 10% deaths; and
- One occurrence with injuries.

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

(7) **Step 5: Determine How Effective Full Compliance with the Latest Amendment of the Regulation Would Be at Addressing the Hazard**

(a) Considerable potential for eliminating or avoiding the hazard.

(b) Compliance with Amendment 3 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.

(8) **Step 6: Determine Resource Costs and Cost Avoidance**

(a) Costs:

• For a newly developed aeroplane, there would be minor increases in labour resulting from design and fabrication.

• There would be a negligible increase in costs related to materials, operating costs, and revenue utility loss.

(b) Cost Avoidance:

• There were two accidents in 200 million departures. The applicant believes that it will manufacture more than 2,000 of these aeroplanes or derivatives of these aeroplanes. These aeroplanes 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 type-certification basis for the Agency and foreign regulations.

(9) **Conclusion.** It is concluded that compliance with the latest certification specification increases the level of safety at a minimal cost to the applicant. Based on the arguments and information presented by the applicant through the Certification Review Item (CRI) process, the Agency determined that meeting the latest amendment would be practical.

b. Example 2: 14 CFR § 25.365 Pressurised Compartment Loads

NOTE: This example is taken from the FAA certification experience gained before the Agency's start, so references to FAR sections and amendments are kept.

(1) This example is a passenger to freighter conversion STC.

(2) This change affects the floor loads on the airplane as well as the decompression venting.

(3) **Step 1: Identify the Regulatory Change Being Evaluated**

(a) The existing certification basis of the airplane that is being changed includes 14 CFR § 25.365 at Amendment 25-~~54~~40. The initial release of 14 CFR § 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.

(b) Amendment 25-54 revised 14 CFR § 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 14 CFR § 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.

(c) Amendment 25-71/72 (Amendments 25-71 and 25-72 are identical) extended the requirement to all pressurised compartments, not just passenger compartments, and to the pressurisation of unpressurised areas. ~~The later requirement~~ Pressurisation of unpressurised areas had previously been identified as an unsafe feature under 14 CFR § 21.21(b)(2).

(d) 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 “pressurisation into unpressurised 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.

(4) **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.

(5) **Step 3: Review the History of the Consequences of the Hazard(s)**

Occurrences with injuries, less than 10% deaths, and more than 10% deaths.

(6) **Step 4: Identify the Historical and Predicted Frequency of Each Consequence**

(a) In 200 million departures of large jets:

- Two occurrences with more than 10% deaths;
- One occurrence with less than 10% deaths; and
- One occurrence with injuries.

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

(7) **Step 5: Determine How Effective Full Compliance with the Latest Amendment of the Regulation Would Be at Addressing the Hazard**

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

(b) Design changes made to the proposed derivative airplane bring it closer to full compliance with 14 CFR § 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 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.

(8) **Step 6: Determine Resource Costs and Cost Avoidance**

(a) Costs: There would be savings in both labour 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.

(b) Cost Avoidance:

(1) There were four 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 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.

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

(9) **Step 7: Document Conclusion Regarding Practicality.** The design complies with 14 CFR § 25.365 at Amendment 25-0, 25-71/72, and 25-87, and is nearly in full compliance with Amendment 25-54 (and certain aspects of Amendments 25-71/72 and 25-87). 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 14 CFR § 25.365 at Amendment 25-0.

Appendix ~~3~~C to GM 21A.101.

THE USE OF SERVICE EXPERIENCE IN THE CERTIFICATION PROCESS

1. Introduction.
Service experience may support the application of an earlier airworthiness standard 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 certification specifications. The applicant must provide sufficient substantiation to allow the Agency to make this determination. A statistical approach may be used, subject to the availability and relevance of data, but sound engineering judgment should be used as a minimum. For service history to be acceptable, the data must be both sufficient and pertinent. The essentials of the process involve:

a. A clear understanding of the requirement change and the purpose for the change and hazard addressed;

b. A determination based on detailed knowledge of the proposed design feature;

c. The availability of pertinent and sufficient service experience data; and

d. A comprehensive review of that service experience data.

2. Guidelines.

The Certification Review Item (CRI) process (either a stand-alone CRI or included in the CRI.A-1) would be used, and the applicant should provide documentation to support the following:

a. The identification of the differences between the certification specification in the existing basis and the certification specification as amended, and the effect of the change in the certification specification.

b. A description as to what aspect(s) of the latest certification specifications the proposed changed product would not meet.

c. Evidence showing that the proposed type-certification basis for the changed product, together with applicable service experience, relative to the hazard, provides a level of safety consistent with complying with the latest certification specifications.

d. A description of the design feature and its intended function.

e. Data for the product pertinent to the certification specification.

(1) Service experience from such data sources as the following:

(a) Accident reports;

(b) Incident reports;

(c) Service bulletins;

(d) Airworthiness directives;

(e) Repairs;

(f) Modifications;

(g) Flight hours/cycles for fleet leader and total fleet;

(h) World airline accident summary data;

(i) Service difficulty reports;

(j) Reports from Accident Investigation Boards

(k) Warranty, repair and parts usage data.

(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.

(3) Show that the service experience is relevant to the hazard.

(4) Identification and evaluation of each of the main areas of concern with regard to:

(a) Recurring and/or common failure modes;

(b) Cause;

(c) Probability, by qualitative reasoning; and

(d) Measures already taken and their effects.

(5) Relevant data pertaining to aircraft of similar design and construction may be included.

(6) Evaluation of failure modes and consequences through analytical processes. The analytical processes should be supported by:

(a) A review of previous test results;

(b) Additional detailed testing as required;

(c) Review aircraft Functional Hazard Assessments (FHA) and any applicable System Safety Assessments (SSA) as required.

f. A conclusion that draws together the data and the rationale.

g. These guidelines are not intended to be limiting, either in setting 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 certification specification to be addressed.

3. Example:

NOTE: This example is taken from a FAA certification gained prior to the Agency's start, so references to FAR sections and amendments are kept.

a. The following example, for transport airplanes (14 CFR § 25.1141(f) Auxiliary Power Unit (APU) Fuel Valve Position Indication System), illustrates the typical process an applicant follows. The process will be the same for all product types.

b. This example comes from a derivative 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 derivatives of large aeroplanes with extensive service history, and illustrates the process, following the guidelines in this appendix, but does not include the level of detail normally required.

(1) Determine ~~T~~the differences between the regulation in the existing certification basis and the regulation as amended, and the effect of the change in the requirement.

The existing certification basis of the airplane that is being changed is the initial release of Part-25. Amendment 25-40 added requirement 14 CFR § 25.1141(f), which mandates that power-assisted valves must have a means to indicate to the flight crew 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

(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 flight crew with fuel valve position or transition indication and, therefore, does not comply with the requirements of 14 CFR § 25.1141(f).

(3) Evidence that the proposed type-certification basis for the changed product, together with applicable service experience and other compliance measures provide an acceptable level of safety

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 14 CFR § 25.1141(f). 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. In addition, the system design for the changed product incorporates features that increase the level of functionality and safety.

(4) 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 flight deck, 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 flight crew, but the system does not indicate valve position as required by 14 CFR § 25.1141(f).

(5) Data for the product pertinent to the requirement

The FAA and applicant record the data in an issue paper (G-1 or a technical issue paper). An issue paper was coordinated, included data, or referenced reports, documenting relevant service experience that has been 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 14 CFR § 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.

(6) The conclusion, drawing together the data and rationale

Conclusion 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 14 CFR § 25.1141 at Amendment 25-11 would provide an acceptable level of safety for the proposed product change.

Appendix ~~4~~D to GM 21A.101.

TABLES AND FIGURES TO ASSIST CPR UNDERSTANDING

~~**DEFINITIONS AND TERMINOLOGY**~~

~~**Adequate Type-certification Basis** – The type-certification basis for a changed product under 21A.101 is considered adequate when the Agency determines that the designated certification specifications of the applicable airworthiness code (referenced in existing type-certification basis, later or latest amendments) and prescribed special conditions ensure that physical features, performance characteristics and/or functions introduced by the design change, do not result in any unsafe design features. These airworthiness standards are to be the highest practicable level of safety for the changed product, and not just for the change itself.~~

~~**Aeronautical product** – The terms aeronautical product or product(s) used in this guidance material include type-certificated aircraft, engines, propellers and approved Auxiliary Power Units (APUs).~~

~~**Type-certification basis** – The certification specifications of the applicable airworthiness code as established in 21A.17 and 21A.101, as appropriate; special conditions; and equivalent level of safety findings applicable to the product to be certificated.~~

~~**Design Change** – A change in the type design of an aeronautical product or a change in the certificated configuration of the product. In the context of this document the terms "change", "design change" and "type design change" are synonymous.~~

~~**Earlier certification specifications** – The certification specifications of the applicable airworthiness code in effect prior to the date of application for the change, but not prior to the existing type-certification basis.~~

~~**Existing type-certification basis** – The certification specifications of the applicable airworthiness code, special conditions and equivalent level of safety findings incorporated by reference in the type-certificate of the product to be changed.~~

~~**Latest certification specifications** – The certification specifications of the applicable airworthiness code in effect on the date of application for the change.~~

~~**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 certification specifications were applied.~~

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

~~**Secondary change** – A secondary change is a physical change that is part of and consequential to an overall significant change. A secondary change is a physical change that restores without changing the system, structural capacity, or functionality, but is necessary to support a significant change.~~

~~**Significant change** – A change to the type-certificate is significant 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 certification specifications of the applicable airworthiness code. Not all changes or product level changes are significant.~~

~~**Substantial change** – A change which is so extensive that a substantially complete investigation of compliance with the applicable type-certification basis is required, and consequently a new type-certificate, in accordance with 21A.19.~~

Figure 3: Affected and Not affected area

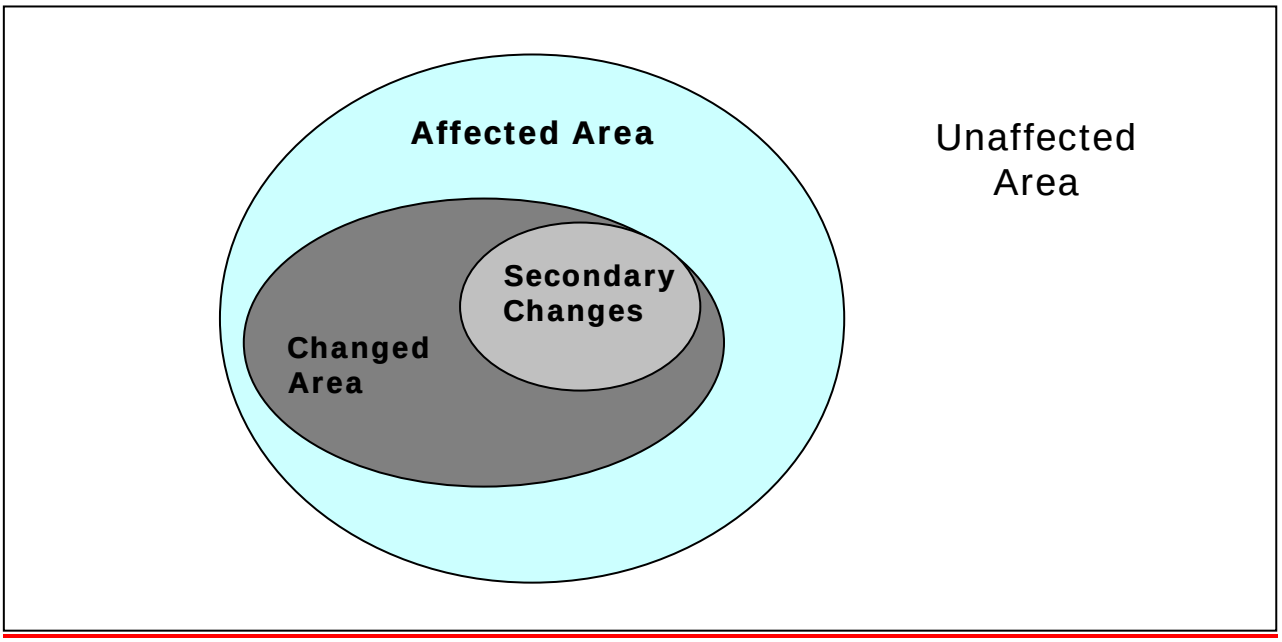


Figure 4: Example of Related and Unrelated changes

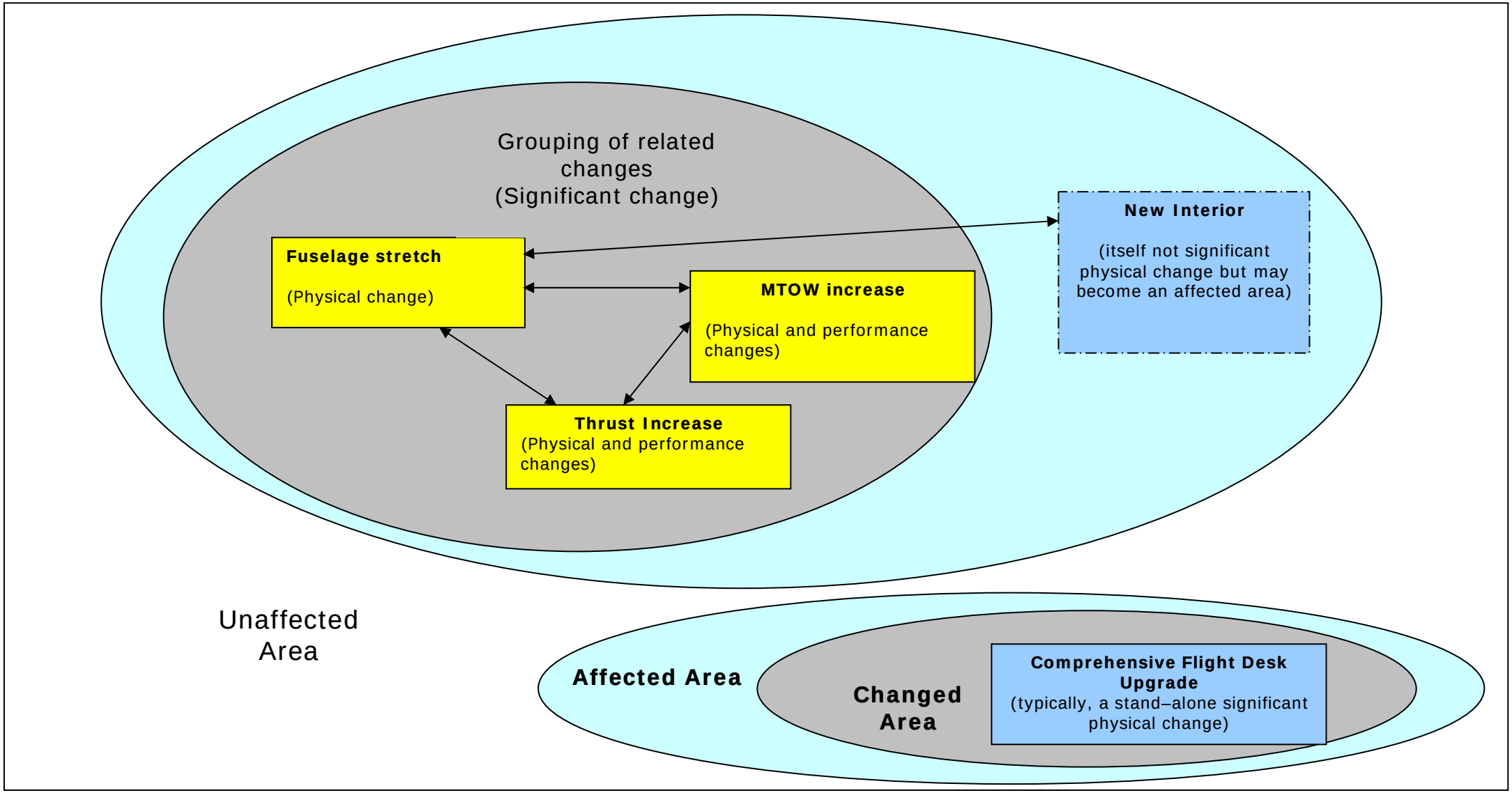


Figure 5: Establishing TC basis for Substantial, Significant and Not significant changes

<table>
<tr><th>Substantial
(21A.19)</th><th colspan="3">Significant
(21A.101) (a) and (b))</th><th colspan="2">Not significant
(21A.101)(b)(1)</th></tr>
<tr><td rowspan="3">Full product

New showing of compliance for full changed product required.

Previously approved type design and compliance data may be allowed if valid for the changed product.</td><td colspan="3">Affected area
(Changed areas and/or unchanged but 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 TC basis.

The applicant may elect to comply with later certification specifications</td><td rowspan="3">Affected area
(Changed areas and/or unchanged but affected areas)

New showing of compliance is required

The applicant may propose a certification basis using an earlier amendment but not earlier than 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 TC basis

The applicant may elect to comply with later certification specifications</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 an earlier amendment but not earlier than the existing TC basis</td><td>Secondary (and not secondary)

The applicant may propose a certification basis using an earlier amendment but not earlier than the existing TC basis</td></tr>
<tr><td colspan="6">TC basis proposed by the Applicant</td></tr>
<tr><td colspan="2">Certification specifications of the latest amendment
+ elects to comply</td><td colspan="2">Certification specifications of an earlier amendment
+ elects to comply</td><td>Elects to comply (later than the existing TC basis</td><td>An earlier amendment
+ elects to comply</td><td>Elects to comply (later than the existing TC basis</td></tr>
<tr><td colspan="6">TC basis recorded by the Agency</td></tr>
<tr><td>Certification specifications of the latest amendment
+ SC
(if the latest amendment is not adequate)

+ elects to comply</td><td>Certification specifications of the proposed amendment
or,
if not adequate, the first appropriate later amendment (if available)
or SC
+ elects to comply</td><td>Certification specifications of the proposed amendment (if adequate)
or,
if not adequate, the first appropriate later amendment (if available)
or SC
+ elects to comply</td><td>Elects to comply as proposed</td><td>The proposed amendment (if adequate)
or
First appropriate later amendment (if available) or SC

+ elects to comply</td><td>Elects to comply as proposed</td></tr>
</table>

Figure 6: Establishing TC basis for a Change on Excepted Products (21A.101(c))

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

New showing of compliance is required</td><td>Unaffected area

No new showing of compliance is required.

Unaffected area continues to comply with the existing TC basis

The applicant may elect to comply with later certification specifications</td></tr>
<tr><td colspan="5">TC basis proposed by the Applicant</td></tr>
<tr><td colspan="4">The existing TC basis + elects to comply</td><td>Elects to comply
(later than the existing TC basis)</td></tr>
<tr><td colspan="3">Found by the Agency ‘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">TC basis recorded by the Agency</td></tr>
<tr><td>Certification specifications of a later amendment designated by the Agency
+ SC

+elects to comply</td><td>The existing TC basis
or,
if not adequate, the first appropriate later amendment
(if available)
or (if not)
SC
+elects to comply</td><td>The existing TC basis
or,
if not adequate, the first appropriate later amendment
(if available)
or (if not)
SC

+elects to comply</td><td>The existing TC basis
or,
if not adequate, the first appropriate later amendment
(if available)
or (if not)
SC
+elects to comply</td><td>Elects to comply
(later than the existing TC basis)</td></tr>
</table>

Appendix ~~5~~E to GM 21A.101. Related Part-21 Requirements

- 21A.16A, Airworthiness codes
- 21A.16B, Special conditions
- 21A.17, Type-certification basis
- 21A.18, Designation of applicable environmental protection requirements and certification specifications
- 21A.19, Changes requiring a new type-certificate
- 21A.21, Issue of type-certificate
- 21A.90, Scope
- 21A.91, Classification of changes in type design
- 21A.93, ~~Classification of changes in type design~~Application
- 21A.95, Minor changes
- 21A.97, Major changes
- 21A.101, Designation of applicable certification specifications and environmental protection requirements
- 21A.103, Issue of approval
- 21A.111, Scope
- 21A.113, Application for a supplemental type-certificate
- 21A.114, Showing of compliance
- 21A.115, Issue of a supplemental type-certificate
- 21A.117, Changes to that part of a product covered by a supplemental type-certificate

Appendix II - Attachments

GAMA10-27, NPA2010-02, GM 21A.pdf
Attachment #1 to comment #78

L390-10-2001 Comments.pdf
Attachment #2 to comment #106

CPR.pdf
Attachment #3 to comment #31