FOREWORD

This Guidance Material (GM: Part- 21) is interpretative material and provides guidance for the compliance of the airworthiness requirements of ANO Part- 21 "Airworthiness and Environmental Requirement for Products, Parts and Appliances". Section numbering of this GM is synchronized with that of regulations and AMCs of ANO Part-21.

This GM is effective from the date of publication of the ANO Part- 21, Issue 1.

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Guidance Material on

ANO Part-21

GM 21.A.11 Scope

The Type Acceptance Certificate TAC has no holder as such. The TAC is issued to recognize a foreign type-certificate in the Bangladesh. Once issued, any subsequent aircraft of that type may enter Bangladesh without going through the type acceptance process.

All aircraft must go through the entry process for the issue of an airworthiness certificate.

Acceptance of the aircraft's type-certificate (TC) will imply acceptance of the associated engine and/or propeller type-certificate.

GM 21.A.91 Classification of changes to a type certificate (TC)

1. PURPOSE OF CLASSIFICATION

Classification of changes to a type certificate (TC) into MAJOR or MINOR is to determine the approval route to be followed in Part-21 Subpart D, i.e., either 21.A.95 or 21.A.97, or alternatively whether application and approval has to be made in accordance with Part-21 Subpart E.

2. INTRODUCTION

2.1 21.A.91 proposes criteria for the classification of changes to a TC as minor or major.

(a) his GM is intended to provide guidance on the term 'appreciable effect' affecting the airworthiness of the product or affecting any of the other characteristics mentioned in 21.A.91, where 'airworthiness' is interpreted in the context of a product in conformity with type design and in condition for safe operation. It provides complementary guidelines to assess a change to the TC in order to fulfil the requirements of 21.A.91 and 21.A.117 where classification is the first step of a procedure.

Note: For classification of Repairs see GM 21.A.435(a).

(b) Although this GM provides guidance on the classification of major changes, as opposed to minor changes as defined in 21.A.91, the GM and 21.A.91 are deemed entirely compatible.

2.2 For an ETSO authorisation, 21.A.611 gives specific requirements for design changes to ETSO articles. For APU, this GM 21.A.91 should be used.

3. ASSESSMENT OF A CHANGE FOR CLASSIFICATION

3.1 Changes to the TC

21.A.91 addresses all changes to any of the aspects of a TC. This includes changes to a type design, as defined in 21.A.31, as well as to the other constituents of a TC, as defined in 21.A.41. This GM provides further guidance on changes to the type design and changes to the operational suitability data (OSD). A change to a TC can include a change to the type design and/or a change to the OSD.

3.2 Reserved

3.3 Classification process (see also the flow chart 'Classification process' in Appendix A to GM 21.A.91)

21.A.91 requires all changes to be classified as either major or minor, using the criteria of 21.A.91.

Wherever there is doubt as to the classification of a change, CAAB should be consulted for clarification.

When the strict application of the paragraph 3.4 criteria results in a major classification, the applicant may request reclassification, if justified, and CAAB could take the responsibility for reclassifying the change.

A simple design change planned to be mandated by an airworthiness directive may be re-classified as minor due to the involvement of State of Design in the continued airworthiness process.

The reasons for a classification decision should be recorded.

3.4 Complementary guidance for classification of changes

A change to the TC is judged to have an 'appreciable effect on the mass, balance, structural strength, reliability, operational characteristics, noise, fuel venting, exhaust emission, operational suitability or other characteristics affecting the airworthiness, environmental protection or operational suitability of the product' and, therefore, should be classified as major, in particular but not only, when one or more of the following conditions are met:

(a) where the change requires an adjustment of the type-certification basis or the OSD certification basis (special conditions or equivalent safety findings) other than elect to comply with later certification specifications;

(b) where the applicant proposes a new interpretation of the certification specifications used for the type certification basis or the OSD certification basis that has not been published as AMC material or otherwise agreed with the CAAB;

(c) where the demonstration of compliance uses methods that have not been previously accepted as appropriate for the nature of the change;

(d) where the extent of new substantiation data necessary to comply with the applicable certification specifications and the degree to which the original substantiation data has to be re-assessed and re-evaluated is considerable;

(e) where the change alters the airworthiness limitations or the operating limitations;

(f) where the change is made mandatory by an airworthiness directive or the change is the terminating action of an airworthiness directive (ref. 21.A.3B), see Note 1;
and

(g) where the design change introduces or affects functions where the failure effect is classified as catastrophic or hazardous.

Note-1: A change previously classified as minor and approved prior to the airworthiness directive issuance decision needs no reclassification. However, CAAB retains the right to review the change and reclassify/reapprove it if found necessary.

Note 2: The conditions listed in (a) through (g) above are an explanation of the criteria noted in 21.A.91.

For an understanding of how to apply the above conditions, it is useful to take note of the examples given in Appendix A to GM 21.A.91

3.5 Complementary guidance on the classification of changes to OSD

This paragraph provides firstly general guidance on minor OSD change classification, and secondly additional guidance specific to each OSD constituent.

Changes to OSD are considered minor when they:

— incorporate optional information (representing improvements/enhancements);

— provide clarifications, interpretations, definitions or advisory text; or

— do not change the intent of the OSD document, e.g. changes to:

- titles, numbering, formatting, applicability;
- order, sequence, pagination; or
- sketches, figures, units of measurement, and correction of editorial mistakes such as:
  - spelling; or
  - reference numbers.

Given the structure and individual intent of the separate OSD constituents, the interpretation of 'appreciable' is also affected by the specific nature of the applicable certification specifications (CS) for that constituent. Therefore, specific guidance on each of the OSD constituents is provided hereafter.

(a) Master minimum equipment list (MMEL)

(1) A change to the MMEL is judged to have an 'appreciable effect on the operational suitability of the aircraft' and, therefore, should be classified as major, in particular but not only when one or more of the following conditions are met:

(i) where the change requires an adjustment of the OSD certification basis;

(ii) where the applicant proposes changes to the means of compliance with the requirements used for the OSD certification basis (i.e. MMEL safety methodology);

(iii) where the extent of substantiation data and the degree to which the substantiation data has to be assessed and evaluated is considerable, in particular but not only when:

(A) the substantiation data involving the review of failure conditions that are classified as hazardous or catastrophic has to be evaluated;

(B) the assessment of the failure effects (including next worst failure/event effects) on crew workload and the applicable crew procedures has to be evaluated; or

(C) the capability of the aircraft to perform types of operation (e.g. extended-range twin operations (ETOPS), instrument flight rules (IFR)) under MMEL is extended.

(2) A change to the MMEL is judged not to have an 'appreciable effect on the operational suitability of the aircraft' and, therefore, should be classified as minor, in particular but not only when one or more of the following conditions are met:

Modifications to an existing item when:

(i) the change only corresponds to the applicability of an item for configuration management purposes;

(ii) the change corresponds to the removal of an item;

(iii) the change corresponds to the increase in the number of items required for dispatch; and

(iv) the change corresponds to a reduction in the rectification interval of an item.

Addition of a new item when:

(v) it is considered as non-safety-related (refer to EASA CS-MMEL, GM2 MMEL.110); or

(vi) it is indicated as eligible for minor change classification in 1 to GM1 EASA CS-MMEL-145.

(b) Flight crew data (FCD)

(1) FCD change related to change to the type design

When classifying the FCD change as minor or major, the method of CS-FCD, Subpart D should be used.

(i) An analysis should be performed to assess the change impact on the FCD through the allocation of difference levels realized with operator difference requirement (ODR) tables as per EASA CS FCD.400. In this case, the base aircraft is the aircraft without the type design change, whereas the candidate aircraft is the aircraft which includes the type design change.

(A) If a no more than level B difference is assigned for training, checking and currency for the candidate aircraft, the related FCD change should be classified as minor.

(B) If a difference level C, D or E for training, checking and currency is assigned to the candidate aircraft, the related FCD change should be classified as major.

(ii) Notwithstanding the above, the change to FCD should be classified as major when a T1 or T2 test is found necessary by the applicant to confirm that the aircraft with the type design change is not a new type for pilot type rating.

(2) Stand-alone changes to FCD are not related to any type design changes. They may be triggered for example by in-service experience or by the introduction of data at the request of the applicant after type certification.

(i) Introduction of credits in training, checking or currency should be classified as major. Example: addition of further-differences training, common take-off and landing credits, etc.

(ii) Stand-alone changes to FCD that correspond to a change of the intent of a data should be classified as major. Example: addition of a training area of special emphasis (TASE) or prerequisite, expansion of a TASE.

(c) Cabin crew data (CCD)

(1) OSD change related to change to the type design

When classifying the OSD CCD change as minor or major, the method from EASA CS-CCD, Subpart B should be used.

(i) An analysis should be performed to assess the change impact on the OSD CCD through the identification of the difference and its impact on operation in the aircraft difference table (ADT) as per EASA CS CCD.200. In this case, the base aircraft is the aircraft without the type design change, whereas the candidate aircraft is the aircraft which includes the type design change.

(A) If the difference has no impact on the operation of an element of the ADT for the candidate aircraft, the related OSD CCD change should be classified as minor.

(B) If the difference has an impact on the operation of an element of the ADT for the candidate aircraft, the related OSD CCD change should be classified as major.

(ii) Notwithstanding the above, the change to OSD CCD should be classified as major when an ADT analysis is found necessary by the applicant to confirm that the aircraft with the type design change is not a new type for cabin crew.

(2) Stand-alone changes to OSD CCD are not related to any type design changes.

They may be triggered for example by in-service experience or by the introduction of data at the request of the applicant after type certification.

(i) Stand-alone changes to cabin aspects of special emphasis (CASE) should be classified as major. Example: addition of further CASE, expansion of CASE.

(ii) When classifying stand-alone changes to type-specific data for cabin crew the method from CS-CCD, Subpart B should be used. An analysis should be performed to assess the change impact on the type-specific data through the identification of the difference and its impact on operation in the ADT as per EASA CS CCD.200.

(A) If the change does not concern a determination element of EASA CS CCD.205, the stand-alone change should be classified as minor.

(B) If the change has no impact on the operation of an element of the ADT, the stand-alone change should be classified as minor.

(C) If the change has an impact on the operation of an element of the ADT, the stand-alone change should be classified as major.

(d) Simulator data (SIMD)

The OSD constituent 'simulator data' does not include the data package that is necessary to build the simulator. It includes only the definition of the scope of validation source data to support the objective qualification of a simulator. So, when this guidance discusses changes to 'simulator data', this concerns only changes to the 'definition of scope of validation source data' and not changes to the data package.

(1) A change to the SIMD should be classified as major, in particular but not only when one or more of the following conditions are met:

(i) when a change to the SIMD introduces validation source data from an engineering platform where the process to derive such data has not been audited by the Agency in the initial SIMD approval; or

(ii) when the process to derive validation source data from an engineering platform is changed.

(2) A change to the SIMD could be classified as minor, in particular but not only when one or more of the following conditions are met:

(i) changes to engineering validation data independent of the aircraft due to improvements or corrections in simulation modelling (e.g. aerodynamics, propulsion);

(ii) configuration changes to the aircraft where the process to derive validation source data from an engineering platform is unchanged;

(iii) changes to validation source data by using better, more applicable flight test data; or

(iv) editorial changes to the validation data roadmap (VDR).

(e) Maintenance certifying staff data (MCSD)

[Reserved]

3.6 Complementary guidance for the classification of changes to aircraft flight manuals (AFMs)

The following changes to the AFM are deemed to be minor:

(a) revisions to the AFM associated with changes to the type design that are classified as minor in accordance with point 21.A.91;

(b) revisions to the AFM that are not associated with changes to the type design (also identified as stand-alone revisions) which fall into one of the following categories:

(1) changes to limitations or procedures that remain within already certified limits (e.g. weight, structural data, noise, etc.);

(2) consolidation of two or more previously approved and compatible AFMs into one, or the compilation of different parts taken from previously approved and compatible AFMs that are directly applicable to the individual aircraft (customization); and

(3) the introduction into a given AFM of compatible and previously approved AFM amendments, revisions, appendices or supplements; and

(c) administrative revisions to the AFM, defined as follows:

(1) for the AFMs issued by the TC holder:

(i) editorial revisions or corrections to the AFM;

(ii) changes to parts of the AFM that do not require approval by State of Design;

(iii) conversions of previously State of Design -approved combinations of units of measurement added to the AFM in a previously approved manner;

(iv) the addition of aircraft serial numbers to an existing AFM where the aircraft configuration, as related to the AFM, is identical to the configuration of aircraft already covered by that AFM;

(v) the removal of references to aircraft serial numbers no longer applicable to that AFM; and

(2) for AFM supplements issued by STC holders:

(i) editorial revisions or corrections to the AFM supplement;

(ii) changes to parts of the AFM supplement that are not required to be approved by State of Design;

(iii) conversions of previously State of Design -approved combinations of units of measurement added to the AFM supplement in a previously approved manner;

(iv) the addition of aircraft serial numbers to an existing AFM supplement where the aircraft configuration, as related to the AFM supplement, is identical to that of the aircraft already in that AFM supplement;

'identical' means here that all the aircraft have to belong to the same type and model/variant;

(v) the addition of a new STC to an existing AFM supplement, when this supplement is fully applicable to the new STC;

(vi) the removal of references to aircraft serial numbers that are no longer applicable to that AFM supplement;

3.7 Complementary guidance for classification of changes to environmental protection characteristics See Section 8 of Appendix A to GM 21.A.91.

Appendix A to GM 21.A.91 Examples of Major Changes per

The information below is intended to provide a few major change examples per discipline, resulting from application of 21.A.91 and paragraph 3.3 conditions. It is not intended to present a comprehensive list of all major changes. Examples are categorized per discipline and are applicable to all products (aircraft, engines and propellers). However a particular change may involve more than one discipline, e.g., a change to engine controls may be covered in engines and systems (software).

Those involved with classification should always be aware of the interaction between disciplines and the consequences this will have when assessing the effects of a change (i.e., operations and structures, systems and structures, systems and systems, etc.; see example in paragraph 2 (ii).

Specific rules may exist which override the guidance of these examples.

In the Part 21 a negative definition is given of minor changes only. However in the following list of examples it was preferred to give examples of major changes.

Where in this list of examples the words 'has effect' or 'affect(s)' are used, they have always to be understood as being the opposite of 'no appreciable effect' as in the definition of minor change in 21.A.91. Strictly speaking the words 'has appreciable effect' and 'appreciably affect(s)' should have been used, but this has not been done to improve readability.

1. Structure

   (i) changes such as a cargo door cut-out, fuselage plugs, change of dihedral, addition of floats;

   (ii) changes to materials, processes or methods of manufacture of primary structural elements, such as spars, frames and critical parts;

   (iii) changes that adversely affect fatigue or damage tolerance or life limit characteristics;

   (iv) changes that adversely affect aeroelastic characteristics.

2. Cabin Safety

   (i) changes which introduce a new cabin layout of sufficient change to require a re-assessment of emergency evacuation capability or which adversely affect other aspects of passenger or crew safety.

   Items to consider include, but are not limited to, :

   — changes to or introduction of dynamically tested seats.

   — change to the pitch between seat rows.

   — change of distance between seat and adjacent obstacle like a divider.

   — changes to cabin lay outs that affect evacuation path or access to exits.

   — installation of new galleys, toilets, wardrobes, etc.

   — installation of new type of electrically powered galley insert.

   (ii) changes to the pressurisation control system which adversely affect previously approved limitations.

3. Flight

Changes which adversely affect the approved performance, such as high altitude operation, brake changes that affect braking performance.

Changes which adversely affect the flight envelope.

Changes which adversely affect the handling qualities of the product including changes to the flight controls function (gains adjustments, functional modification to software) or changes to the flight protection or warning system.

4. Systems

For systems assessed under CS 25.1309, the classification process is based on the functional aspects of the change and its potential effects on safety.

(i) Where failure effect is 'Catastrophic' or 'Hazardous', the change should be classified as major.

(ii) Where failure effect is 'major', the change should be classified as major if:

— aspects of the compliance demonstration use means that have not been previously accepted for the nature of the change to the system; or

— the change affects the pilot/system interface (displays, controls, approved procedures); or

— the change introduces new types of functions/systems such as GPS primary, TCAS, Predictive windshear, HUD.

The assessment of the criteria for software changes to systems also needs to be performed. When software is involved, account should be taken also of the following guidelines:

Where a change is made to software produced in accordance with the guidelines of the latest edition of AMC 20-115 the change should be classified as major if either of the following apply, and the failure effect is Catastrophic, Hazardous or Major:

(i) the executable code for software, determined to be Level A or Level B in accordance with the guidelines, is changed unless that change involves only a variation of a parameter value within a range already verified for the previous certification standard; or

(ii) the software is upgraded to or downgraded from Level A, Level B or Level C; or

(iii) the executable code, determined to be level C, is deeply changed, e.g., after a software re-engineering process accompanying a change of processor.

For software developed to guidelines other than the latest edition of AMC 20-115, the applicant should assess changes in accordance with the foregoing principles.

For other codes the principles noted above may be used. However, due consideration should be given to specific certification specifications/interpretations.

In the context of a product information security risk assessment (PISRA), a change that may introduce the potential for unauthorised electronic access to product systems should

be considered to be 'major' if there is a need to mitigate the risks for an identified unsafe condition. The following examples do not provide a complete list of conditions to classify a modification as major, but rather they present the general interactions between security domains. Examples of modifications that should be classified as 'major' are when any of the following changes occur:

— A new digital communication means, logical or physical, is established between a more closed, controlled information security domain, and a more open, less controlled security domain.

— For example, in the context of large aircraft, a communication means is established between the aircraft control domain (ACD) and the airline information services domain (AISD), or between the AISD and the passenger information and entertainment services domain (PIESD) (see ARINC 811).

As an exception, new simplex digital communication means (e.g. ARINC 429) from a controlled domain to a more open domain is not considered as major modification, if it has been verified that the simplex control cannot be reversed by any known intentional unauthorised electronic interaction (IUEI).

— A new service is introduced between a system of a more closed, controlled information security domain and a system of a more open, less controlled security domain, which allows the exploitation of a vulnerability of the service that has been introduced, creating a new attack path.

For example:

— opening and listening on a User Datagram Protocol (UDP) port in an end system of an already certified topology;

— activating a protocol in a point-to-point communication channel.

— The modification of a service between a system of a more closed, controlled security domain and a system of a more open, less controlled security domain.

— The modification of a security control between a system of a more closed, controlled information security domain and a system of a more open, less controlled security domain.

5. Propellers

Changes to:

— diameter

— airfoil

— planform

— material

— blade retention system, etc.

6. Engines

Changes:

(i) that adversely affect operating speeds, temperatures, and other limitations.

(ii) that affect or introduce parts identified by CS E-510 where the failure effect has been shown to be hazardous.

(iii) that affect or introduce engine critical parts (CS E-515) or their life limits.

(iv) to a structural part which requires a re-substantiation of the fatigue and static load determination used during certification.

(v) to any part of the engine which adversely affects the existing containment capability of the structure.

(vi) that adversely affect the fuel, oil and air systems, which alter the method of operation, or require reinvestigation against the type-certification basis.

(vii) that introduce new materials or processes, particularly on critical components.

7. Rotors and drive systems

Changes that:

(i) adversely affect fatigue evaluation unless the service life or inspection interval are unchanged. This includes changes to materials, processes or methods of manufacture of parts, such as

— rotor blades

— rotor hubs including dampers and controls

— gears

— drive shafts

— couplings

(ii) affect systems the failure of which may have hazardous or catastrophic effects. The design assessment will include:

— cooling system

— lubrication system

— rotor controls

(iii) adversely affect the results of the rotor drive system endurance test, the rotor drive system being defined in CS 27/29.917.

(iv) adversely affect the results of the shafting critical speed analysis required by CS 27/29.931.

8. Environment

The introductory text to Appendix A to GM 21.A.91 describes how in Part 21 a negative definition is given of minor changes only. This philosophy is similar to the manner in which the ICAO Standards and Recommended Practices for environmental protection (ICAO Annex 16) and the associated Guidance Material (ICAO Environmental Technical Manual) define changes affecting a product's environmental characteristics in terms of 'no-acoustical changes', 'no- emissions changes' and 'no-CO_2 changes' (i.e. changes which do not appreciably affect the product's environmental characteristics).

Following the general philosophy of this Appendix, however, it is preferred to give examples of changes which might have an appreciable effect on a product's environmental characteristics (i.e. the effect might be greater than the no-acoustic change, no-emissions change and no-CO_2 change criteria) and might therefore lead to a 'major change' classification.

Where a change is made to an aircraft or aircraft engine, the effect of the change on the product's environmental characteristics should be taken into account. Examples of changes that might have an appreciable effect on the product's environmental characteristics, and might therefore be classified as major changes, are listed below. The examples are not exhaustive and will not, in every case, result in an appreciable change to the product's environmental characteristics, and therefore, will not per se and in every case result in a 'major change'classification.

An appreciable effect is considered to be one which exceeds the ICAO criteria for a no-acoustical change, a no-emissions change or a no-CO_2 change. For the definition of a no-acoustical change refer to the section of the ICAO Environmental Technical Manual, Volume I (ICAO Doc 9501, Volume I – Procedures for the Noise Certification of Aircraft) concerning changes to aircraft type designs involving no-acoustical changes (see also the definitions of a 'derived version' in ICAO Annex 16, Volume I). For the definition of a no-emissions change, refer to the section of the ICAO Environmental Technical Manual, Volume II (ICAO Doc 9501, Volume II – Procedures for the Emissions Certification of Aircraft Engines) concerning no-emissions changes. For the definition of a no-CO_2 change, refer to ICAO Doc 9501 'Environmental Technical Manual', Volume III 'Procedures for the CO_2 Emissions Certification of Aeroplanes', 1st Edition 2018, concerning no-CO_2 changes.

(i) Noise: A change that introduces either:

— an increase in the noise certification level(s); or

— a reduction in the noise certification level(s) for which the applicant wishes to take credit.

Examples of noise-related changes that might lead to a major change classification are:

(1) For jet and heavy (maximum take-off mass greater than 8 618 kg) propeller-driven aeroplanes:

— A change that might affect the aircraft's take-off performance including:

— a change to the maximum take-off mass;

— a change to V2 ('take-off safety speed'); or

— a change to the lift augmentation devices, including their configuration under normal take-off operating conditions.

— A change that might affect the aircraft's landing performance including:

— a change to the maximum landing mass;

— a change to VREF (reference landing speed); or

— a change to the lift augmentation devices, including their deployment under normal landing operating conditions.

— A change to the Centre of Gravity (CG) limits;

— A change that increases the aircraft's drag;

— A change that alters the external profile of the aircraft, including the installation or change of shape or size of any item on the external surface of the aircraft that might protrude into the airflow such as winglets and vortex generators; generally the installation of small antennas does not represent an acoustical change;

— A change that introduces an open-ended hollow cavity at more or less right angles to the airflow (e.g. hollow pins in undercarriage assemblies);

— A change of engine or, if fitted, propeller type;

— A change in engine thrust rating;

— A change to the engine rotating parts or stators, such as geometry, blade profile or blade number;

— A change to the aerodynamic flow lines through the engine;

— A change that affects the engine thermodynamic cycle, including a change to the engine's bypass ratio;

— A change to the engine nacelle, including a change to the acoustic liners;

— A change to the engine exhaust;

— A change to the engine bleed valves, including bleed valve scheduling;

— A change in the operation of engine power off-takes (e.g. the operation of the Environmental Control System (ECS) during a normal take-off or approach);

— A change to the Auxiliary Power Unit (APU), including associated operating limitations (e.g. a change that allows the APU to be operated during a normal approach when previously it was not allowed);

— A change to the propeller pitch and/or propeller speed during a normal take-off or approach;

— A change that causes a change to the angle at which air flows into the propeller.

(2) For light (maximum take-off mass 8 618 kg or less) propeller-driven aeroplanes:

— A change that might affect the aircraft's take-off performance including:

— a change to the maximum take-off mass;

— a change to the take-off distance;

— a change to the rate of climb; or

— a change to Vy (best rate of climb speed).

— A change that increases the aircraft's drag (e.g. the installation of external cargo pods, external fuel tanks, larger tyres to a fixed undercarriage, floats etc.);

— A change of engine or propeller type;

— A change in take-off power including a change in engine speed (tachometer 'red line') or, for piston engines, a change to the manifold pressure limitations;

— A change to the highest power in the normal operating range ('top of green arc');

— In the case of an aircraft where take-off power/engine speed is time limited, a change in the period over which take-off power/engine speed may be applied;

— A change to the engine inlet or exhaust including, if fitted, the inlet or exhaust muffler;

— A change in propeller diameter, tip shape, blade thickness or the number of blades;

— The installation of a variable or adjustable pitch propeller in place of a fixed pitch propeller and vice versa;

— A change that causes a change to the angle at which air flows into the propeller.

(3) For helicopters:

— A change that might affect the take-off and/or landing performance, including a change in take-off mass and VY (best rate of climb speed);

— A change to VNE (never-exceed airspeed) or to VH (airspeed in level flight obtained using the torque corresponding to minimum engine installed, maximum continuous power available for sea level pressure, 25°C ambient conditions at the relevant maximum certificated mass);

— A change to the maximum take-off engine power or maximum continuous power;

— A change to the gearbox torque limits;

— A change of engine type;

— A change to the engine intake or exhaust;

— A change to the maximum normal operating rpm of the main or tail rotors;

— A change to the main or tail rotors, including a change in diameter, blade thickness or blade tip profile.

Note: The effect on the helicopter's noise characteristics of either carrying external loads or the installation of external equipment need not be considered.

(ii) Emissions: A change that introduces an increase or decrease in the emissions certification levels. Examples of smoke and gaseous engine emission-related changes that might lead to a major change classification are:

— A change in engine thrust rating;

— A change to the aerodynamic flow lines through the engine;

— A change that affects the engine thermodynamic cycle, specifically relevant engine cycle parameters (e.g. combustor pressure P3, combustor entry temperature T3, Air Fuel Ratio (AFR));

— A change to the compressor that might influence the combustor inlet conditions and engine overall pressure ratio;

— A change to the combustor design (geometry);

— A change to the cooling of the combustor;

— A change to the air mass flow through the combustor;

— A change that affects the fuel spray characteristics.

(iii) CO_2: a change that introduces either:

— an increase in the CO_2 emissions certification level; or

— a decrease in the CO_2 emissions certification level for which an applicant wishes to take credit.

Examples of CO_2 emission-related changes that may lead to a 'major change' classification are:

— a change to the maximum take-off mass;

— a change that may affect the aeroplane's specific air range performance, including one or several of the following:

— a change that increases the aircraft's drag;

— a change of engine or, if fitted, propeller type;

— a change in the engine design that affects the engine specific fuel consumption in cruise.

— a change to the aeroplane's reference geometric factor (RGF).

9. Power plant Installation

Changes which include:

(i) control system changes which affect the engine/propeller/airframe interface;

(ii) new instrumentation displaying operating limits;

(iii) modifications to the fuel system and tanks (number, size and configuration);

(iv) change of engine/propeller type.

10. Stand-alone changes to non-ALS ICA that require additional work to demonstrate compliance with the applicable certification basis as follows:

(i) changes related to accomplishment instructions (e.g. to the aircraft maintenance manual) related to the CDCCL, or the EWIS ICA, for which the technical content (e.g. gaps, steps) of the procedures is changed;

(ii) the introduction of novel technology for inspection purposes related to an ALS task;

(iii) changes that adversely affect the certification assumptions: e.g. some specific inspection procedures, such as inspection procedures for use after a hard landing, may include a decision-making chart based on the level of exceedance of the load in comparison with the certified limit loads; such criteria, and adverse changes, need to be agreed with State of Design.

GM.21.A.95 Scope

The term 'changes to the type certificate' is consistently used in Part 21 Subpart D and E, as well as in the related AMC and GM. This term does not refer to changing the document that reflects the type certificate (TC) but to the elements of the TC as defined in 21.A.41. It means that the processes for the approval of changes, as described in the said two Subparts, do not only apply to changes to the type design, but may also apply to changes to:

— the operating limitations;

— the type certificate data sheet (TCDS) for airworthiness and emissions;

— the applicable type-certification basis and environmental protection requirements with which the applicant has to demonstrate compliance;

— any other conditions or limitations prescribed for the product by State of Design;

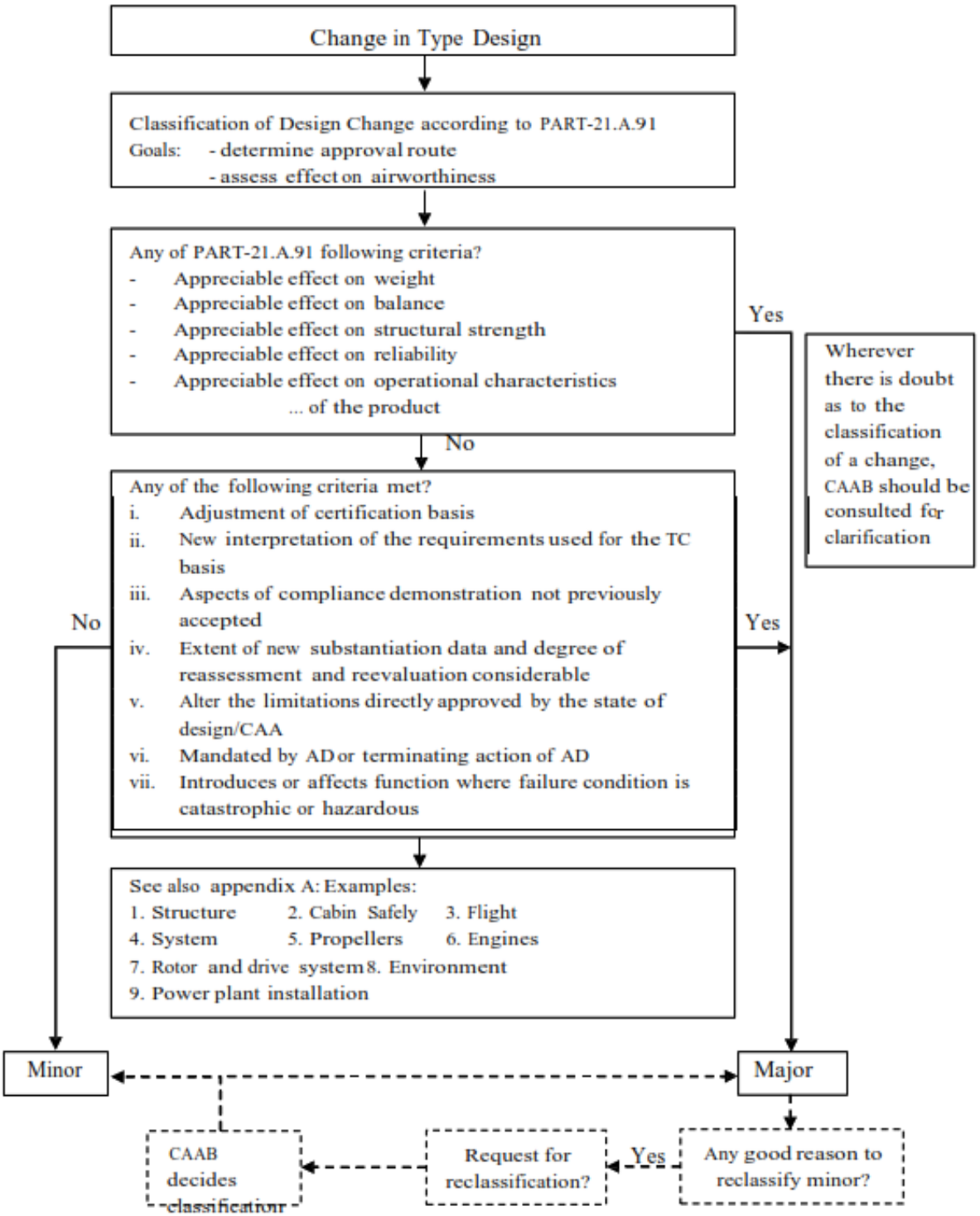
— the applicable operational suitability data (OSD) certification basis;

— the OSD; and

— the TCDS for noise.

NOTE: OSD is only applicable to aircraft TCs and not to engine or propeller TCs. Therefore, changes to OSD are only relevant for changes to aircraft TCs.

Flowchart 1 to GM 21.A.91 – Classification process



GM 21.A.101 Classification of design changes

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

A.1 Examples of Substantial, Significant, & Not Significant Changes for Small Aeroplanes (CS-23).

A.1.1 Table A-1 contains examples of changes that are 'substantial' for small aeroplanes (CS-23).

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

Example	Description of Change	Notes
1.	Change to wing location (tandem, forward, canard, high/low).	Proposed change to design is so extensive that a substantially complete investigation of compliance with the applicable certification basis is required.
2.	Fixed wing to tilt wing.	
3.	A change to the number of engines.	
4.	Replacement of piston or turboprop engines with turbojet or turbofan	
5.	Change to engine configuration (tractor/pusher).	
6.	Increase from subsonic to supersonic flight regime.	
7.	Change from an all-metal to all-composite aeroplane.	Proposed change to design is so extensive that a substantially complete investigation of compliance with the applicable certification basis is required.
8.	Certifying a CS-23 (or predecessor basis, such as JAR-23) aeroplane into another certification category, such as	—

A.1.2 Table A-2 contains examples of changes that are 'significant' for small aeroplanes (CS-23).

Table A-2. Examples of Significant Changes for Small Aeroplanes (CS-23)

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
1.	Conventional tail to T-tail or V-tail, or vice versa.	Yes	No	Yes	Change to general configuration. Requires extensive, structural flying qualities and performance reinvestigation. Requires new aeroplane flight manual (AFM) to address performance and flight characteristics.
2.	Changes to wing configuration, such as change to dihedral, changes to wing span, flap or aileron span, addition of winglets, or increase of more than 10 per cent of the original wing sweep at the quarter chord.	Yes	No	Yes	Change to general configuration. Likely requires extensive changes to wing structure. Requires new AFM to address performance and flight characteristics. Note: Small changes to the wingtip or winglet are not significant changes. See table for 'not significant'
3.	Changes to tail configuration, such as the addition of tail strakes or angle of incidence of the tail.	Yes	No	Yes	Change to general configuration. Likely requires extensive changes to tail structure. Requires new AFM to address performance and flight characteristics. Note: Small changes to tail are not significant
4.	Tricycle/tail wheel undercarriage change or addition of floats.	Yes	No	No	Change to general configuration. Likely, at aeroplane level, general configuration and certification assumptions remain valid.
5.	Passenger-to-freighter configuration conversion that involves the introduction of a cargo door or an increase in floor loading of more than 20 per cent, or provision for carriage of passengers and freight together.	Yes	No	Yes	Change to general configuration affecting load paths, aeroelastic characteristics, aircraft-related systems, etc. Change to design assumptions.

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
6.	Replace reciprocating engines with the same number of turbo- propeller engines.	Yes	No	No	Requires extensive changes to airframe structure, addition of aircraft systems, and new AFM to address performance and flight characteristics.
7.	Addition of a turbo- charger that changes the power envelope, operating range, or limitations.	No	No	Yes	Invalidates certification assumptions due to changes to operating envelope and limitations. Requires new AFM to address performance and flight characteristics.
8.	The replacement of an engine of higher rated power or increase thrust would be considered significant if it would invalidate the existing substantiation, or would change the primary structure, aerodynamics, or operating envelope sufficiently to invalidate the assumptions of certification.	No	Yes	Yes	Invalidates certification assumptions. Requires new AFM to address performance and flight characteristics. Likely changes to primary structure. Requires extensive construction reinvestigation.
9.	A change to the type of material, such as composites in place of metal, or one composite fibre material system with another (e.g. carbon for fiberglass), for primary structure would normally be assessed as a significant change.	No	Yes	Yes	Change to principles of construction and design from conventional practices. Likely change to design/certification assumptions.
10.	10. A change involving appreciable increase in design speeds VD, VB, VMO, VC, or VA.	No	No	Yes	Certification assumptions invalidated. Requires new AFM to address performance and flight characteristics.
11.	Installation of a short take-off and landing (STOL) kit.	No	No	Yes	Certification assumptions invalidated. Requires new AFM to address performance and flight characteristics.
12.	A change to the rated power or thrust could be a significant change if the applicant is taking credit for increased design	No	No	Yes	Certification assumptions invalidated. Requires new AFM to address performance and flight characteristics.
13.	Fuel state, such as compressed gaseous fuels or fuel cells. This could completely alter the fuel storage and handling systems and possibly affect the aeroplane structure.	No	No	Yes	Changes to design/certification assumptions. Extensive alteration of fuel storage and handling systems.
14.	A change to the flight control concept for an aircraft, e.g. to fly-by-wire (FBW) and side-stick control, or a change from hydraulic to electronically actuated flight controls, would in isolation normally be regarded as a significant change.	No	No	Yes	Changes to design and certification assumptions. Requires extensive systems architecture and integration reinvestigation. Requires new AFM.
15.	Change to aeroplane's operating altitude, or cabin operating pressure greater than 10 per cent in maximum cabin pressure differential.	No	No	Yes	This typically invalidates certification assumptions and the fundamental approach used in decompression, structural strength, and fatigue. May require extensive airframe changes affecting load paths, fatigue evaluation, aeroelastic characteristics, etc. Invalidates design assumptions.

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
16.	Addition of a cabin pressurisation system.	No	Yes	Yes	Extensive airframe changes affecting load paths, fatigue evaluation, aeroelastic characteristics, etc. Invalidates design
17.	Changes to types and number of emergency exits or an increase in maximum certified passenger capacity.	Yes	No	Yes	Emergency egress certification specifications exceed those previously substantiated. Invalidates assumptions of certification.
18.	A change to the required number of flight crew that necessitates a complete flight deck rearrangement, and/or an increase in pilot workload.	No	No	Yes	Extensive changes to avionics and aircraft systems. Invalidates certification assumptions. Requires new AFM.
19.	Expansion of an aircraft's operating envelope.*	No	No	Yes* *Some changes may be deemed 'not significant' depending on the extent of the expansion.	An expansion of operating capability is a significant change (e.g. an increase in maximum altitude limitation, approval for flight in icing conditions, or an increase in airspeed limitations).
20.	Replacement of an aviation gasoline engine with an engine of approximately the same horsepower utilising, e.g. diesel, hybrid, or electrical power.	No	No	Yes	A major change to the aeroplane. The general configuration and principles of construction will usually remain valid; however, the assumptions for certification are invalidated.
21.	Comprehensive flight deck upgrade, such as conversion from entirely federated, independent electromechanical flight instruments to highly integrated and combined electronic display systems with extensive use of software and/or complex electronic hardware.	No	No	Yes	Affects avionics and electrical systems integration and architecture concepts and philosophies. This drives a reassessment of the human–machine interface, flight-crew workload, and re- evaluation of the original design flight deck assumptions.
22.	Introduction of autoland.	No	No	Yes	Invalidates original design assumptions.
23.	Conversion from a safe life design to a damage- tolerance-based design.	No	No	Yes	Where the airframe-established safe life limits change to damage-tolerance principles, then use of an inspection program in lieu of the safe life design limit invalidates the original assumptions used during certification.
24.	Extensive structural airframe modification, such as a large opening in the fuselage.	Yes	No	No	Requires extensive changes to fuselage structure, affects aircraft systems, and requires a new AFM to address performance and flight characteristics.
25.	Fuselage stretch or shortening in the cabin or pressure vessel.	Yes	No	Yes	Cabin interior changes are related changes since occupant safety considerations are impacted by a cabin length change. Even if a new cabin interior is not included in the product-level change, the functional effect of the fuselage plug has implications on occupant safety (e.g. the dynamic environment in an emergency landing, emergency evacuation, etc.), and thus the cabin interior becomes an

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
26.	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
27.	Installation of a full authority digital engine control (FADEC) on an aeroplane that did not previously have a FADEC installed.	No	No	Yes	—

A.1.3 Table A-3 contains examples of changes that are 'not significant' for small aeroplanes (CS-23).

Table A-3. Examples of Not Significant Changes for Small Aeroplanes (CS-23)

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
1.	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.
2.	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.
3.	Forward looking infrared (FLIR) or surveillance camera installation.	No	No	No	Additional flight or structural evaluation may be necessary, but the change does not alter basic aeroplane certification.
4.	Litter, berth, and cargo tie down device installation.	No	No	No	Not an aeroplane-level change.
5.	Not an aeroplane-level change.	No	No	No	Not an aeroplane-level change.
6.	Replacement of one propeller type with another (irrespective of increase in number of blades).	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
7.	Addition of a turbo- charger that does not change the power envelope, operating range, or limitations (e.g. a turbo- normalised engine, where the additional power is used to enhance high-altitude or hot-day performance).	No	No	No	Not an aeroplane-level change.
8.	Substitution of one method of bonding for another (e.g. change to type of adhesive).	No	No	No	Not an aeroplane-level change.
9.	Substitution of one type of metal for another.	No	No	No	Not an aeroplane-level change.

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
10.	Any change to construction or fastening not involving primary structure.	No	No	No	Not an aeroplane-level change.
11.	A new fabric type for fabric-skinned aircraft.	No	No	No	Not an aeroplane-level change.
12.	Increase in flap speed or undercarriage limit speed.	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
13.	Structural strength increases.	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
14.	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.
15.	Fuel tanks where fuel is changed from gasoline to diesel fuel and tank support loads are small enough that an extrapolation from the previous analysis would be valid. Chemical compatibility would have to be substantiated.	No	No	No	Not an aeroplane-level change.
16.	Limited changes to 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.
17.	Install a different exhaust system.	No	No	No	Not an aeroplane-level change.
18.	Changes to engine cooling or cowling.	No	No	No	Not an aeroplane-level change.
19.	Changing fuels of substantially the same type, such as AvGas to AutoGas, AvGas (80/87) to AvGas (100LL), ethanol to isopropyl alcohol, Jet B to Jet A.	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
20.	Fuels that specify different levels of 'conventional' fuel additives that do not change the primary fuel type. Different additive levels (controlled) of MTBE, ETBE, ethanol, amines, etc., in AvGas would not be considered a significant change.	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.
21.	A change to the maximum take-off weight of less than 5 per cent, unless assumptions made in justification of the design are thereby invalidated.	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction, and certification assumptions remain valid.

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
22.	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.
23.	Larger diameter flight control cables with no change to routing, or other system design.	No	No	No	Not an aeroplane-level change.
24.	Autopilot installation (for IFR use, unless the original certification indicates 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.
25.	Increased battery capacity or relocate battery.	No	No	No	Not an aeroplane-level change.
26.	Replace generator with alternator.	No	No	No	Not an aeroplane-level change.
27.	Additional lighting (e.g. navigation lights, strobes).	No	No	No	Not an aeroplane-level change.
28.	Higher capacity brake assemblies.	No	No	No	Not an aeroplane-level change.
29.	Increase in fuel tank capacity.	No	No	No	Not an aeroplane-level change.
30.	Addition of an oxygen system.	No	No	No	Not an aeroplane-level change.
31.	Relocation of a galley.	No	No	No	Not an aeroplane-level change.
32.	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 certification specifications.
33.	New cabin interior with no fuselage length change.	No	No	No	—
34.	Installation of new seat belt or shoulder harness.	No	No	No	Not an aeroplane-level change.
35.	A small increase in centre of gravity (CG) range.	No	No	No	At aeroplane level, no change to general configuration, principles of construction, and
36.	Auxiliary power unit (APU) installation that is not flight-essential.	No	No	No	Although 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 certification specifications.
37.	An alternative autopilot.	No	No	No	Not an aeroplane-level change.
38.	Addition of Class B terrain awareness and warning system (TAWS).	No	No	No	Not an aeroplane-level change.
39.	Extending an established life limit.	No	No	No	This extension may be accomplished by various methods, such as ongoing fatigue testing, service life evaluation, component level replacement, and inspections based on damage-tolerance principles.

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
40.	Flight deck replacement of highly integrated and combined electronic display systems with other highly integrated and combined electronic display systems.	No	No	No	Not significant if the architecture concepts, design philosophies, human–machine interface, or flight-crew workload assumptions are not impacted.
41.	Interior cabin reconfigurations are generally considered not significant. This includes installation of in-flight entertainment (IFE), new seats, and rearrangement of furniture.	No	No	No	—
42.	Modification to ice protection systems.	No	No	No	Recertification required, but certification basis should be evaluated for adequacy.

A.2 Examples of Substantial, Significant, and Not Significant Changes for Large Aeroplanes (CS-25).

A.2.1 Table A-4 contains examples of changes that are 'substantial' for large aeroplanes (CS-25).

Table A-4. Examples of Substantial Changes for Large Aeroplanes (CS-25)

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

A.2.2 Table A-5 contains examples of changes that are 'significant' for large aeroplanes (CS-25).

Table A-5. Examples of Significant Changes for Transport Large Aeroplanes (CS-25)

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

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
4.	Conversion from a cargo to passenger configuration.	Yes	No	Yes	Completely new floor loading and design. Redistribution of internal loads, change to cabin safety certification specifications, system changes.
5.	Increase in cabin pressurisation greater than 10 per cent.	No	No	Yes	A change greater than 10 per cent in operational cabin pressure differential is a significant change since it requires extensive airframe changes affecting load paths, fatigue evaluation, or aeroelastic characteristics, invalidating the certification assumptions.
6.	Addition of leading- edge slats.	Yes	No	Yes	The addition of leading-edge slats is significant since it requires extensive changes to wing structure, adds aircraft systems, and requires a new AFM to address performance and flight characteristics.
7.	Fuselage stretch or shortening in the cabin or pressure vessel.	Yes	No	Yes	Cabin interior changes are related changes since occupant safety considerations are impacted by a cabin length change. Even if a new cabin interior is not included in the product-level change, the functional effect of the fuselage plug has implications on occupant safety (e.g. the dynamic environment in an emergency landing, emergency evacuation, etc.), and thus the cabin interior becomes an affected area.
8.	Extensive structural airframe modification, such as installation of a large telescope with large opening in the fuselage.	Yes	No	No	These types of structural modifications are significant since they require extensive changes to fuselage structure, affect aircraft systems, and require a new AFM to address performance and flight characteristics.
9.	Changing the number of axles or number of landing gear done in context with a product change that involves changing the aeroplane's gross weight.	Yes	No	No	This type of landing gear change with an increase in gross weight is significant since it requires changes to aircraft structure, affects aircraft systems, and requires AFM changes, which invalidate the certification assumptions.
10.	Primary structure changes from metallic material to composite material.	No	Yes	No	Change to principles of construction and design from conventional practices.
11.	An increase in design weight of more than 10 per cent.	No	No	Yes	Design weight increases of more than 10 per cent result in significant design load increase that invalidates the assumptions used for certification, requiring re- substantiation of aircraft structure, aircraft performance, and flying qualities and associated systems.
12.	Installation of winglets, modification of existing winglets, or other changes to wing tip design.	Yes	No	Yes	Significant if it requires extensive changes to wing structure or aircraft systems, or if it requires a new AFM to address performance and flight characteristics. It may also affect the wing fuel tanks, including fuel tank lightning protection, fuel tank ignition source prevention, and fuel tank flammability exposure.
13.	Changes to wing span, chord, or sweep.	Yes	No	Yes	Significant if it requires extensive changes to wing structure or aircraft systems, or if it requires a new AFM to address performance and flight characteristics. It may also affect the wing fuel tanks, including fuel tank lightning protection, fuel tank ignition source prevention, and fuel tank flammability exposure.

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
14.	A change to the type or number of emergency exits or an increase in the maximum certified number of passengers.	Yes	No	Yes	—
15.	A comprehensive avionics upgrade that changes a federated avionics system to a highly integrated avionics system.	No	No	Yes	This change refers to the avionics system that feeds the output to displays and not the displays themselves.
16.	An avionics upgrade that changes the method of input from the flight crew, which was not contemplated during the original certification.	No	No	Yes	A change that includes touchscreen technology typically does not invalidate the assumptions used for certification. A change that incorporates voice-activated controls or other novel human–machine interface would likely invalidate the assumptions used for certification.
17.	Change to primary flight controls to FBW system. (Some aeroplanes have some degree of FBW. Achieving full FBW may be a not significant change on some aeroplanes.)	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.
18.	Replace reciprocating with turbo-propeller engines.	Yes	No	No	Requires extensive changes to airframe structure, addition of aircraft systems, and new AFM to address performance and flight characteristics.
19.	Maximum continuous or take-off thrust or power increase of more than 10 per cent or, for turbofans, an increase of the nacelle diameter.	No	No	Yes	A thrust or power increase of more than 10 per cent is significant because it does have a marked effect on aircraft performance and flying qualities, or requires re-substantiation of powerplant installation. An increase of the nacelle diameter as a result of an increase in the bypass ratio is significant because it results in airframe-level effects on aircraft performance and flying qualities. However, a small increase of the nacelle diameter would not have such an airframe-level effect and would not be considered a significant change.
20.	Initial installation of an autoland system.	No	No	Yes	Baseline aeroplane not designed for autoland operation, potential flight- crew workload, and systems compatibility issues.
21.	Installation of a new fuel tank, e.g. installation of an auxiliary fuel tank in a cargo bay or installation of an auxiliary fuel tank that converts a dry bay into a fuel tank (such as a horizontal stabiliser tank).	No	No	Yes	Requires changes to airframe, systems, and AFM. Results in performance changes. These changes typically affect fuel tank lightning protection, fuel tank ignition source prevention, and fuel tank flammability exposure.
22.	Main deck cargo door installation.	Yes	No	No	Redistribution of internal loads, change to aeroelastic characteristics, system changes.
23.	Expansion of an aircraft's operating envelope.*	No	No	Yes**Some changes may be deemed 'not significant' depending on the extent of the expansion.	An expansion of operating capability is a significant change (e.g. an increase in maximum altitude limitation, approval for flight in icing conditions, or an increase in airspeed limitations).

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
24.	Changing the floor from passenger-carrying to cargo- carrying capability.	Yes	No	Yes	Completely new floor loading and design. Redistribution of internal loads, change to cabin safety certification specifications, system changes. If a cargo handling system is installed, it would be a related change.
25.	Initial installation of an APU essential for aircraft flight operation.	No	No	Yes	Changes to emergency electrical power certification specifications, change to aircraft flight manual and operating characteristics.
26.	Conversion from hydraulically actuated brakes to electrically actuated brakes.	No	No	Yes	Assumptions of certification for aeroplane performance are changed.
27.	Installation of engine thrust reversers.	Yes	No	Yes	
28.	Request for extended- range operations (ETOPS) type design approval for: (a) aeroplanes without an existing ETOPS type design approval, and (b) extension of an aeroplane's diversion time.	No	No	Yes	An expansion of diversion capability for ETOPS would normally be a significant change. However, expanding the diversion capability for which it was originally designed is generally not a significant change. In this case, the assumptions used for certification of the basic product remain valid, and the results can be applied to cover the changed product with predictable effects or can be demonstrated without significant physical changes to the product.
29.	Installation of an engine with a FADEC on an aeroplane that did not previously have a FADEC engine installed.	No	No	Yes	A change from a mechanical control engine to a FADEC engine may be so extensive that it affects basic aircraft systems integration and architecture concepts and philosophies. This drives a complete reassessment of flight-crew workload, handling qualities, and performance evaluation, which are different from the original design assumptions.

A.2.3 Table A-6 contains examples of changes that are 'not significant' for large aeroplanes (CS-25).

Table A-6. Examples of Not Significant Changes for Transport Large Aeroplanes (CS-25)

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

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
3.	Re-fairing of wing tip caps (for lights, fuel dump pipes) and addition of splitter plates to the trailing edge thickness of the cruise aerofoil.	No	No	No	Does not require extensive structural, AFM, or systems changes.
4.	Additional power used to enhance high- altitude or hot-day performance.	No	No	No	Usually no change to 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 to certification assumptions.
5.	Installation of an autopilot system.	No	N/A	See notes	It may be possible that the modification is adaptive in nature, with no change to original certification assumptions. However, in certain cases the installation of an autopilot may include extensive changes and design features that change both the general configuration and the assumptions for certification (i.e. installation of the autopilot may introduce a number of additional mechanical and electronic failure modes and change the hazard classification of given aircraft-level failures).
6.	Change from assembled primary structure to monolithic or integrally machined structure.	No	No	No	Method of construction must be well understood.
7.	Modification to ice protection systems.	No	No	No	Recertification required, but certification basis is adequate.
8.	Brakes: design or material change, e.g. steel to carbon.	No	No	No	Recertification required, but certification basis is adequate.
9.	Redesign floor structure.	No	No	No	By itself, not a significant product change. It is significant if part of a cargo conversion of a passenger aeroplane.
10.	New cabin interior with no fuselage length change.	No	No	No	A new cabin interior includes new ceiling and sidewall panels, stowage, galleys, lavatories, and seats. Novel or unusual design features in the cabin interior may require special conditions. Many interior- related certification specifications are incorporated in operational rules. Even though the design approval holder may not be required to comply with these certification specifications, the operator may be required to comply.
11.	A rearrangement of an interior (e.g. seats, galleys, lavatories, closets, etc.).	No	No	No	—
12.	Novel or unusual method of construction of a component.	No	No	No	The component change does not rise to the product level. Special conditions could be required if there are no existing certification specifications that adequately address these features.
13.	Initial installation of a non-essential APU.	No	No	No	A stand-alone initial APU installation on an aeroplane originally designed to use ground- or airport-supplied electricity and air conditioning. In this case, the APU would be an option to be independent of airport power.

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
14.	Increasing the life limit as CS 25.571 fatigue testing progresses for a recently type- certified aeroplane.	No	No	No	For example, a recently type-certified aeroplane may undergo fatigue testing as part of compliance with CS 25.571. In this case, the TC holder may specify an initial life limit in the airworthiness limitations section (ALS) and gradually increase that life limit as fatigue testing progresses. Such change to the ALS is considered not significant.
15.	Extending limit of validity (LOV)	No	No	No	Extending an LOV without any other change to the aeroplane is not a significant change. However, if extending the LOV requires a physical design change to the aeroplane, the design change is evaluated to determine the level of significance of the design change.
16.	Airframe life extension.	No	No	No	This does not include changes that involve changes to design loads, such as pressurisation or weight increases. Also, this does not include changing from safe life to damage tolerance.
17.	Changes to the type or number of emergency exits by de-rating doors or deactivating doors with corresponding reduction in passenger capacity.	No	No	No	The new emergency egress does not exceed that previously substantiated because the certified number of passengers is reduced.
18.	Request for ETOPS type design approval for a type design change of a product with an existing ETOPS type design approval.	No	No	No	A change to a product with an existing ETOPS type design approval without a change to diversion capability would normally not be significant. However, if the existing ETOPS type design approval was based on policy prior to the adoption of transport category ETOPS airworthiness standards, then there is not an adequate certification basis to evaluate the type design change for ETOPS. In this case, the change is still not significant, and the appropriate transport category ETOPS airworthiness standards would apply.
19.	An avionics change from federated electromechanical displays to federated electronic displays.	No	No	No	Changing an electromechanical display to an electronic display is not considered significant.
20.	An avionics change replacing an integrated avionics system with another integrated avionics system.	No	No	No	The assumptions used to certify a highly integrated avionics system should be the same for another highly integrated avionics system.

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

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

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

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

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

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

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
1.	Comprehensive flight deck upgrade, such as conversion from entirely federated, independent electromechanical flight instruments to highly integrated and combined electronic display systems with extensive use of software and/or complex electronic hardware.	No	No	Yes	Affects avionics and electrical systems integration and architecture concepts and philosophies. This drives a reassessment of the human–machine interface, flight-crew workload, and re- evaluation of the original design flight deck assumptions.
2.	Certification for flight into known icing conditions.	No	No	Yes	
3.	(Fixed) flying controls from mechanical to fly- by-wire.	No	No	Yes	This drives a complete reassessment of the rotorcraft controllability and flight control failure.
4.	Addition of an engine; e.g. from single to twin or reduction of the number of engines; e.g. from twin to single.	Yes	Yes	Yes	—
5.	A change of the rotor drive primary gearbox from a splash-type lubrication system to a pressure-lubricated system due to an increase in horsepower of an engine or changing from a piston engine to turbine engine.	No	Yes	Yes	—
6.	A fuselage or tail boom modification that changes the primary structure, aerodynamics, and operating envelope sufficiently to invalidate the certification assumptions.	Yes	No	Yes	—
7.	Application of an approved primary structure to a different approved model (e.g. installation on a former model of a main rotor that has been approved on a new model, and that results in increased performance).	No	Yes	Yes	—
8.	Emergency medical service (EMS) configuration with primary structural changes sufficient to invalidate the certification assumptions.	No	No	Yes	Many EMS configurations will not be classified as significant. Modifications made for EMS are typically internal, and the general external configuration is normally not affected. These changes should not automatically be classified as significant. Note: Door addition or enlargement involving structural change would be significant.
9.	Skid landing gear to wheel landing gear or wheel landing to skid.	Yes	No	Yes	—
10.	Change of the number of rotor blades.	Yes	No	Yes	—
11.	Change of tail anti-torque device (e.g. tail rotor, ducted fan, or other technology).	Yes	Yes	No	—
12.	Passenger-configured helicopter to a firefighting-equipment- configured helicopter.	Yes	No	Yes	Depends on the firefighting configuration.

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
13.	Passenger-configured helicopter to an agricultural-configured helicopter.	Yes	No	Yes	Depends on the agricultural configuration.
14.	An initial Category A certification approval to an existing configuration.	No	No	Yes	—
15.	IFR upgrades involving installation of upgraded components for new IFR configuration.	No	No	Yes	Changes to architecture concepts, design philosophies, human-machine interface, or flight-crew workload.
16.	Human external cargo (HEC) certification approval.	No	No	Yes	Must comply with the latest HEC certification specifications in order to obtain operational approval. Assumptions used for certification are considered invalidated when this leads to a significant re-evaluation, for example, of fatigue, quick- release systems, HIRF, one- engine-inoperative (OEI) performance, and OEI procedures.
17.	Reducing the number of pilots for IFR from two to one.	No	No	Yes	—
18.	An avionics upgrade that changes a federated avionics system to a highly integrated avionics system.	No	No	Yes	This change refers to the avionics system that feeds the output to displays and not the displays themselves.
19.	An avionics upgrade that changes the method of input from the flight crew, which was not contemplated during the original certification.	No	No	Yes	A change that includes touchscreen technology typically does not invalidate the assumptions used for certification. A change that incorporates voice-activated controls or other novel human-machine interface would likely invalidate the assumptions used for certification.

A.3.3 Table A-9 contains examples of changes that are ‘not significant’ changes for rotorcraft (CS-27 and CS-29).

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

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
1.	Emergency floats.	No	No	No	Must comply with the specific applicable certification 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, 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-certified-product level.
2.	Forward looking infrared (FLIR) or surveillance camera installation.	No	No	No	Additional flight or structural evaluation may be necessary but the change does not alter the basic rotorcraft certification.

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
3.	Helicopter terrain awareness warning system (HTAWS) for operational credit.	No	No	No	Certified under rotorcraft HTAWS AMC guidance material and ETSO-C194. Does not alter the basic rotorcraft configuration.
4.	Health usage monitoring system (HUMS) for maintenance credit.	No	No	No	Certified under rotorcraft HUMS GM guidance material. Does not alter the basic rotorcraft configuration.
5.	Expanded limitations with minimal or no design changes, following further tests/justifications or different mix of limitations (CG limits, oil temperatures, altitude, minimum/ maximum weight, minimum/ maximum external temperatures, speed, engine ratings).	No	No	No	Changes to an operating envelope (such as operating altitude and temperature) and mission profile (such as passenger-carrying operations to external-load operations, flight over water, or operations in snow conditions) that are not so different that the original certification assumptions remain valid.
6.	Change from a single- channel FADEC to a dual- channel FADEC.				Change does not change the overall product configuration or the original certification assumptions.
7.	Installation of a new engine type, equivalent to the former one, leaving aircraft installation and limitations substantially unchanged.	No	No	No	Refer to AMC 27 or AMC 29 for guidance. Does not alter the basic rotorcraft configuration, provided there is no additional capacity embedded in the new design.
8.	Windscreen installation.	No	No	No	Does not change the rotorcraft overall product configuration.
9.	Snow skis, 'Bear Paws.'	No	No	No	Must comply with specific 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, 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-certified-product level.
10.	External cargo hoist.	No	No	No	Must comply with the specific applicable certification specifications for external loads. This installation, in itself, does not change the rotorcraft configuration, overall performance, or operational capability. Expanding an operating envelope (such as operating altitude and temperature) and mission profile (such as passenger- carrying operations to external- load operations (excluding HEC), flight over water, or operations in snow conditions) are not by themselves so different that the original certification assumptions are no longer valid at the type-certified-product level.
11.	IFR upgrades involving installation of upgraded components to replace existing components.	No	No	No	Not a rotorcraft-level change.
12.	An avionics change from federated electromechanical displays to federated electronic displays.	No	No	No	Changing an electromechanical display to an electronic display on a single avionics display is not considered significant.

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
13.	An avionics change replacing an integrated avionics system with another integrated avionics system.	No	No	No	The assumptions used to certify a highly integrated avionics system should be the same for another highly integrated avionics system.
14.	Flight deck replacement of highly integrated and combined electronic display systems with other highly integrated and combined electronic display systems.	No	No	No	Not significant if the architecture concepts, design philosophies, human–machine interface, flight-crew workload design and flight-deck assumptions are not impacted.
15.	IFR upgrades involving installation of upgraded components for new IFR configuration.	No	No	No	No changes to architecture concepts, design philosophies, human–machine interface, or flight-crew workload.
16.	Flight deck replacement or upgrade of avionics systems in non-Appendix ‘B’ (IFR) or non-CAT ‘A’ rotorcraft that can enhance safety or pilot awareness.	No	No	No	—
17.	Modifications to non- crashworthy fuel systems intended to improve its crashworthiness.	No	No	No	—
18.	Changing the hydraulic system from one similar type of fluid to another, e.g. a fluid change from a highly flammable mineral oil-based fluid (MIL-H-5606) to a less flammable synthetic hydrocarbon-based fluid (MIL-PRF-87257)	No	No	No	—
19.	An ETSO C-127 dynamic seat installed in a helicopter with an existing certification basis prior to addition of CS 29.562, Emergency landing dynamic conditions.	No	No	No	

A.4 Examples of Substantial, Significant, and Not Significant Changes for Engines (CS-E)

A.4.1 Table A-10 contains examples of changes that are ‘substantial’ for engines (CS-E).

Table A-10. Examples of Substantial Changes for Engines (CS-E)

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

A.4.2 Table A-11 contains examples of changes that are 'significant' for engines (CS-E).

Table A-11. Examples of Significant Changes for Engines (CS-E)

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
	Turbine				
1.	Increase/decrease in the number of compressor/turbine stages with resultant change to approved operational limitations.	Yes	No	Yes	Change is associated with other changes that would affect the rating of the engine and the engine dynamic behaviour, such as backbone bending, torque spike effects on rotors and casing, surge and stall characteristics, etc.
2.	New design fan blade and fan hub, or a bladed fan disk to a blisk, or a fan diameter change, that could not be retrofitted.	Yes	No	Yes	Change is associated with other changes to the engine thrust/power, ratings, and operating limitations; engine dynamic behaviour in terms of backbone bending, torque spike effects on casing, foreign object ingestion behaviour (birds, hail, rain, ice slab); blade-out test and containment; induction system icing capabilities; and burst model protection for the aircraft. If there is a diameter change, installation will be also affected.
3.	Hydromechanical control to FADEC/electronic engine control (EEC) without hydromechanical backup.	Yes	No	No	Change to engine control configuration. Not interchangeable. Likely fundamental change to engine operation.
4.	A change to the containment case from hard-wall to composite construction or vice versa that could not be retrofitted without additional major changes to the engine or restricting the initial limitations or restrictions in the initial installation manual.	No	Yes	Yes	Change to 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.
5.	A change to the gas generator (core, turbine/compressor/ combustor) in conjunction with changes to approved operating limitations.	No	No	Yes	Change is associated with other changes that would affect engine thrust/power and operating limitations, and have affected the dynamic behaviour of the engine, foreign object ingestion behaviour (birds, hail storm, rain, ice shed), induction system icing capabilities. Assumptions used for certification may no longer be valid.
6.	A change from traditional metal to composite materials on an assembly or structure that provides a load path for the engine affecting the engine dynamic behavior and/or the engine inherent strength.	No	Yes	Yes	Change to principles of construction and design.
	Piston Engines				
7.	Convert from mechanical to electronic control system.	Yes	Yes	No	Change to engine configuration: installation interface of engine changed. Changes to principles of construction: digital controllers and sensors require new construction techniques and environmental testing.
8.	Add turbocharger that increases performance and changes to overall product.	Yes	No	Yes	Change to general configuration: installation interface of engine changed (exhaust system). Certification assumptions invalidated: change to operating envelope and performance.
9.	Convert from air-cooled cylinders to liquid-cooled cylinders.	Yes	No	Yes	Change to general configuration: installation interface of engine changed (cooling lines from radiator, change to cooling baffles). Certification assumptions invalidated: change to operating envelope and engine temperature certification specifications.

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
10.	A change from traditional metal to composite materials on an assembly or structure that provides a load path for the engine affecting the engine dynamic behavior and/or the engine inherent strength.	No	Yes	Yes	Change to principles of construction and design.
11.	Convert from spark- ignition to compression- ignition.	Yes	No	Yes	Change to general configuration: installation interface of engine changed (no mixture lever). Certification assumptions invalidated: change to operating envelope and performance.

A.4.3 Table A-12 contains examples of changes that are 'not significant' for engines (CS-E).

Table A-12. Examples of Not Significant Changes for Engines (CS-E)

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
	Turbine				
1.	Change to the material from one type of metal to another type of metal of a compressor drum.	No	No	No	No change to performance. Assumptions are still valid.
2.	Increase/decrease in the number of compressor/turbine stages without resultant change to operational performance envelope.	No	No	No	No change to performance. Assumptions are still valid.
3.	Hardware design changes to the FADEC/EEC, the introduction of which does not change the function of the system.	No	No	No	No change to configuration. Retrofitable. Assumptions used for certification are still valid. Possible changes to principles of construction are insignificant.
4.	Software changes.	No	No	No	—
5.	Rub-strip design changes.	No	No	No	Component-level change.
6.	A new combustor that does not change the approved limitations or dynamic behaviour.* (*Exclude life limits.)	No	No	No	Component-level change.
7.	Bearing changes.	No	No	No	Component-level change.
8.	New blade designs with similar material that can be retrofitted.	No	No	No	Component-level change.
9.	Fan blade redesign that can be retrofitted.	No	No	No	Component-level change.
10.	Oil tank redesign.	No	No	No	Component-level change.
11.	Change from one hydromechanical control to another hydromechanical control.	No	No	No	Component-level change.
12.	Change to limits on life-limited components supported by data that became available after certification.	No	No	No	Extending or reducing the life limits. For example, extending life limits based on credits from service experience or new fatigue data.
13.	Changes to limits on exhaust gas temperature.	No	No	No	
14.	Changes to the Airworthiness Limitations section with no configuration changes.	No	No	No	—

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
15.	Bump ratings within the product's physical capabilities that may be enhanced with gas path changes, such as blade re-staggering, cooling hole patterns, blade coating changes, etc.	No	No	No	—
Piston Engines					
16.	New or redesigned cylinder head, valves, or pistons.	No	No	No	—
17.	Changes to crankshaft.	No	No	No	Component-level change.
18.	Changes to crankcase.	No	No	No	Component-level change.
19.	Changes to carburettor.	No	No	No	Component-level change.
20.	Changes to mechanical fuel injection system.	No	No	No	
21.	Changes to mechanical fuel injection pump.	No	No	No	Component-level change.
22.	Engine model change to accommodate new aircraft installation. No change to principles of operation of major subsystems; no significant expansion in power or operating envelopes or in limitations.	No	No	No	—
23.	A simple mechanical change, or a change that does not affect the basic principles of operation. For example, change from dual magneto to two single magnetos on a model.	No	No	No	—
24.	Subsystem change produces no changes to base engine input parameters, and previous analysis can be reliably xtended. For example, a change to turbocharger where induction system inlet conditions remain unchanged, or if changed, the effects can be reliably extrapolated.	No	No	No	—
25.	Change to 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.
26.	Change to material that retains the physical properties and mechanics of load transfer. For example, a change to trace elements in a metal casting for ease of pouring or to update to a newer or more readily available alloy with similar mechanical properties.	No	No	No	Component-level change.

A.5 Examples of Substantial, Significant, and Not Significant Changes for Propellers (CS-P).

A.5.1 Table A-13 contains an example of a change that is 'substantial' for propellers (CS-P).

Table A-13. Example of a Substantial Change for Propellers (CS-P)

Example	Description of Change	Notes
1.	Change to the number of blades.	Proposed change to design is so extensive that a substantially complete investigation of compliance with the applicable type-certification basis is required.

A.5.2 Table A-14 contains examples of changes that are 'significant' for propellers (CS-P).

Table A-14. Examples of Significant Changes for Propellers (CS-P)

Example	Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
1.	Principle of pitch change, such as a change from single acting to dual acting.	Yes	Yes	Yes	Requires extensive modification of the pitch change system with the introduction of backup systems. The inherent control system requires re-evaluation.
2.	Introduction of a different principle of blade retention, such as a single row to a dual row	Yes	Yes	No	Requires extensive modification of the propeller hub and blade structure. The inherent strength requires re-evaluation.
3.	A hub configuration change, such as a split hub to a one-piece hub.	Yes	Yes	No	Requires extensive modification of the propeller hub structure. The inherent strength requires re-evaluation.
4.	Changing the method of mounting the propeller to the engine, such as a spline to a	Yes	Yes	No	Requires extensive modification of the propeller hub structure. The inherent strength requires re-evaluation.
5.	Change to hub material from steel to aluminium.	Yes	Yes	No	Requires extensive modification of the propeller hub structure and change to method of blade retention. The inherent strength requires re-evaluation.
6.	Change to 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.
7.	Change from hydromechanical to electronic control.	Yes	Yes	Yes	Electronic manufacturing and design methods required. Assumptions used for certification are no longer valid or not addressed in the original certification, i.e. HIRF and lightning protection, fault tolerance, software certification, and other aspects.

A.5.3 Table A-15 contains examples of changes that are 'not significant' for propellers (CS-P).

Table A-15. Examples of Not Significant Changes for Propellers (CS-P)

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

GM 21.A.431A Scope

Manuals and other instructions for continued airworthiness (such as the Manufacturers Structural Repair Manual, Maintenance Manuals and Engine Manuals provided by the holder of the type-certificate, supplemental type-certificate, or APU ETSO authorisation as applicable) for operators, contain useful information for the development and approval of repairs.

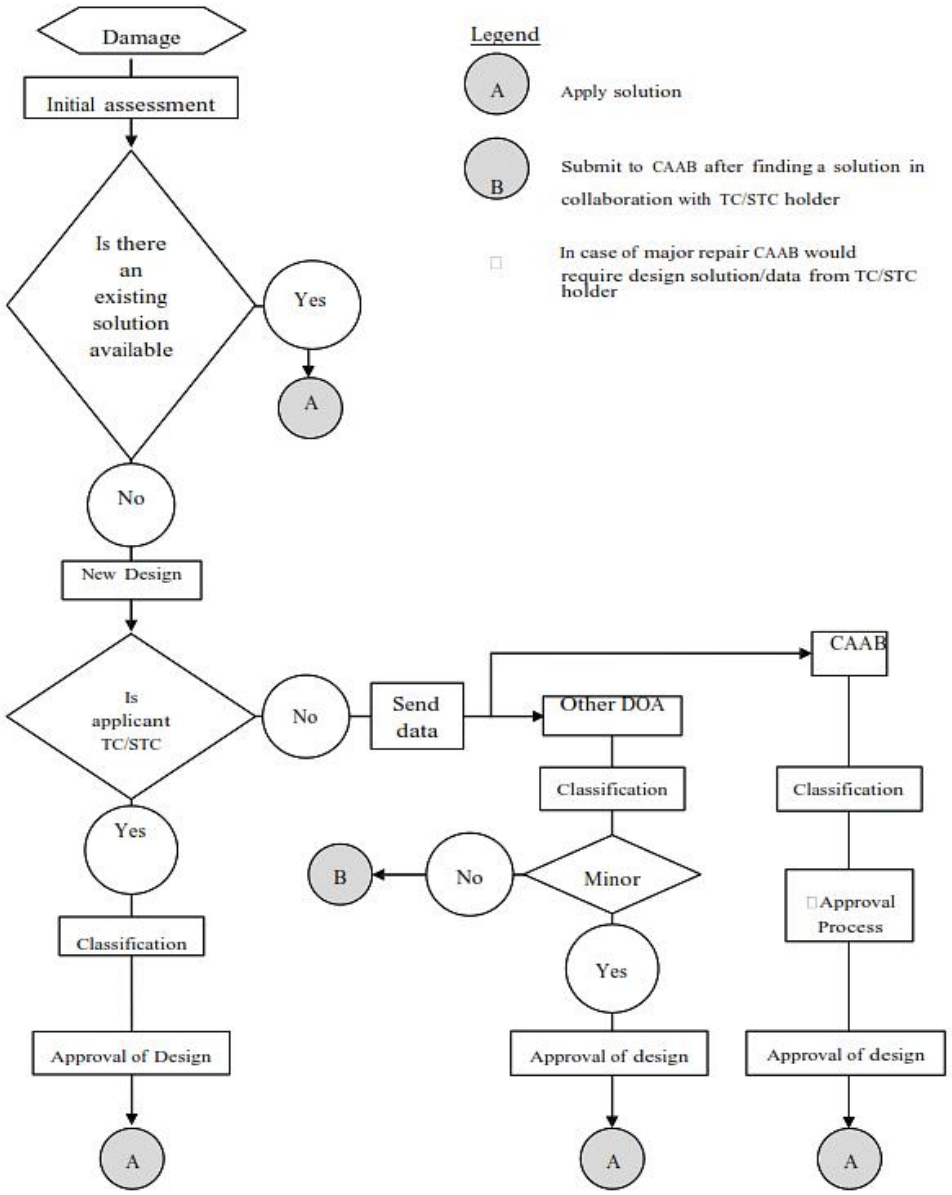
When these data are explicitly identified as approved, they may be used by operators without further approval to cope with anticipated in-service problems arising from normal usage provided that they are used strictly for the purpose for which they have been developed.

Approved data is data which is approved either by the Agency, or by an appropriately approved design organisation.

When specific repair data is approved outside of the Community, conditions for acceptance may be defined in the bilateral arrangements between the Community and the competent authority of a third country. In the absence of such arrangement, the repair data shall follow the approval route as if it was designed and approved within the Community.

Flow chart 1 to GM 21.A.431(a) addresses the procedures that should be followed for approval of a repair.

Flowchart 1 to GM 21.A.431(a) – Repair approval procedure



GM 21.A.431A(d) Repairs to ETSO article other than APU

A repair to an ETSO article other than an APU can be either be seen:

1. In the context of an ETSO authorisation, i.e., when an article as such is specifically approved under Subpart O, with dedicated rules that give specific rights and obligations to the designer of the article, irrespective of any product type design or change to the type design. For a repair to such an article, irrespective of installation on any aircraft, Subpart O, and 21.A.611 in particular, should be followed; or

2. When an airline or a maintenance organisation is designing a new repair (based on data not published in the TC holder or Original Equipment Manufacturer documentation) on an article installed on an aircraft, such a repair can be considered as a repair to the product in which the article is installed, not to the article taken in isolation. Therefore Subpart M can be used for the approval of this repair, that will be identified as ‘repair to product x affecting article y’, but not ‘repair to article y’.

GM 21.A.435(a) Classification of repairs

1. Clarification of the terms Major/Minor

   In line with the definitions given in 21.A.91, a new repair is classified as 'major' if the result on the approved type design has an appreciable effect on structural performance, weight, balance, systems, operational characteristics or other characteristics affecting the airworthiness of the product, part or appliance. In particular, a repair is classified as major if it needs extensive static, fatigue and damage tolerance strength justification and/or testing in its own right, or if it needs methods, techniques or practices that are unusual (i.e., unusual material selection, heat treatment, material processes, jigging diagrams, etc.)

   Repairs that require a re-assessment and re-evaluation of the original certification substantiation data to ensure that the aircraft still complies with all the relevant requirements, are to be considered as major repairs.

   Repairs whose effects are considered minor and require minimal or no assessment of the original certification substantiation data to ensure that the aircraft still complies with all the relevant requirements, are to be considered ‘minor’.

   It is understood that not all the certification substantiation data will be available to those persons/organisations classifying repairs. A qualitative judgement of the effects of the repair will therefore be acceptable for the initial classification. The subsequent review of the design of the repair may lead to it being re-classified, owing to early judgements being no longer valid.

2. Airworthiness concerns for Major/Minor classification

   The following should be considered for the significance of their effect when classifying repairs. Should the effect be considered to be significant then the repair should be classified 'Major'. The repair may be classified as 'Minor' where the effect is known to be without appreciable consequence.

   i) Structural performance

      Structural performance of the product includes static strength, fatigue, damage tolerance, flutter and stiffness characteristics. Repairs to any element of the structure should be assessed for their effect upon the structural performance.

   ii) Weight and balance

      The weight of the repair may have a greater effect upon smaller aircraft as opposed to larger aircraft. The effects to be considered are related to overall aircraft centre of gravity and aircraft load distribution. Control surfaces are particularly sensitive to the changes due to the effect upon the stiffness, mass distribution and surface profile which may have an effect upon flutter characteristics and controllability.

   iii) Systems

      Repairs to any elements of a system should be assessed for the effect intended on the operation of the complete system and for the effect on system redundancy. The

consequence of a structural repair on an adjacent or remote system should also be considered as above, (for example: airframe repair in area of a static port).

iv) Operational characteristics

Changes may include:

— stall characteristics
— handling
— performance and drag
— vibration

v) Other characteristics

— changes to load path and load sharing
— change to noise and emissions
— fire protection / resistance

Note: Considerations for classifying repairs 'Major/Minor' should not be limited to those listed above.

3. Examples of 'Major' repairs

i) A repair that requires a permanent additional inspection to the approved maintenance programme, necessary to ensure the continued airworthiness of the product. Temporary repairs for which specific inspections are required prior to installation of a permanent repair do not necessarily need to be classified as 'Major'. Also, inspections and changes to inspection frequencies not required as part of the approval to ensure continued airworthiness do not cause classification as 'Major' of the associated repair.

ii) A repair to life limited or critical parts.

iii) A repair that introduces a change to the Aircraft Flight Manual.

GM 21.A.437 Issue of repair design approval

1. Approval by DOA holder

The DOA may approve repairs through the use of procedures in the handbook without requiring CAAB involvement. However, the owner or operator shall provide the CAAB:

(i) Notification before incorporation of modification by sending all the documents relevant to the modification

(ii) Any instructions for continued airworthiness issued by the design organization

2. Previously approved data for other applications

When it is intended to use previously approved data for other applications, it is expected that applicability and effectiveness would be checked with an appropriately approved design organisation. After damage identification, if a repair solution exists in the available approved data, and if the application of this solution to the identified damage remains justified by the previous approved repair design, (structural justifications still valid, possible airworthiness limitations unchanged), the solution can be considered approved and can be used again.

3. Temporary repairs.

   These are repairs that are life limited, to be removed and replaced by a permanent repair after a limited service period. These repairs should be classified under PART- 21.A.435 and the service period defined at the approval of the repair.

4. Fatigue and damage tolerance.

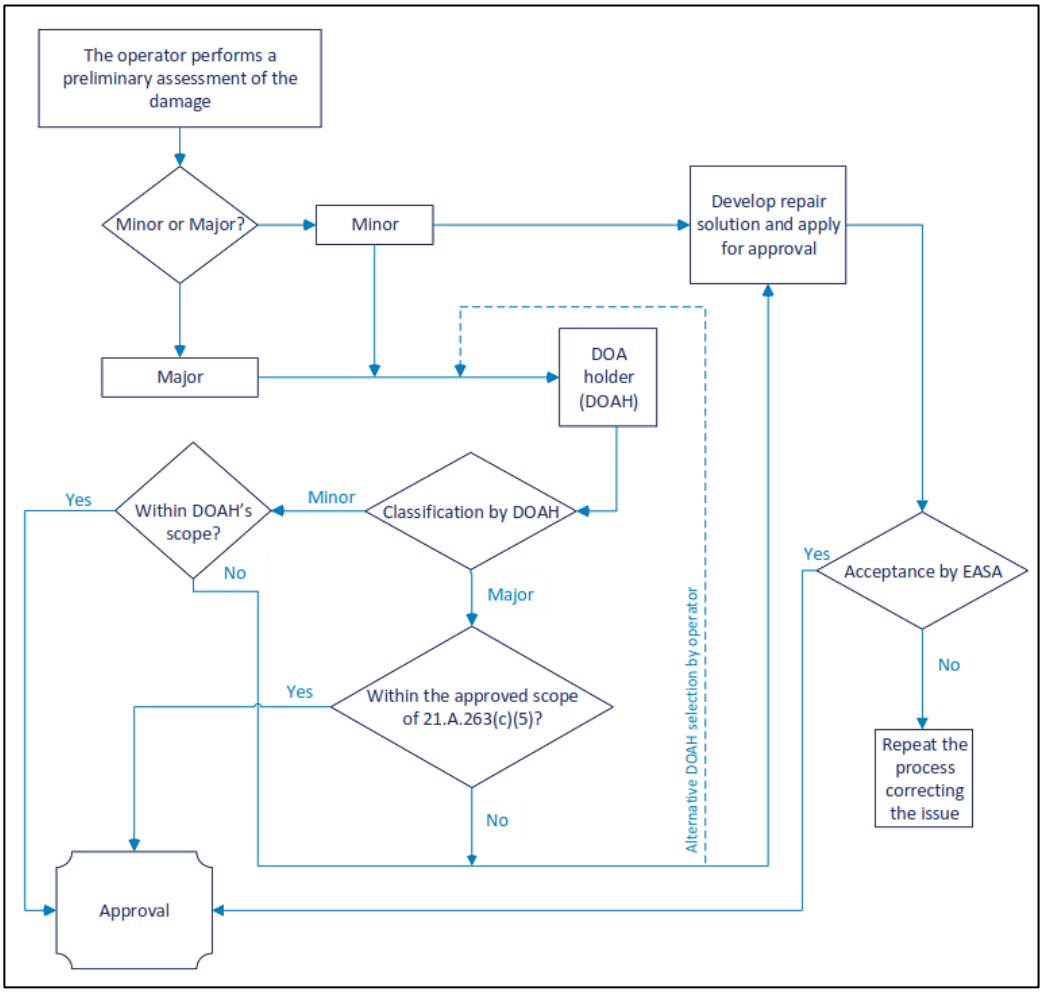
   When the repaired product is released into service before the fatigue and damage tolerance evaluation has been completed, the release should be for a limited service period, defined at the issue of the repair.

GM 21.A.439 Production of Repair Parts

A maintenance organisation may manufacture Parts for its own repair purposes when expressly authorised by the CAAB.

GM 21.A.445 Unrepaired damage

This is not intended to supersede the normal maintenance practices defined by the type-certificate holder, (e.g., blending out corrosion and re-protection, stop drilling cracks, etc.), but addresses specific cases not covered in the manufacturer's documentation.



GM SubPart P Permit to Fly

The process allowing a flight under a permit to fly can be described as follows:

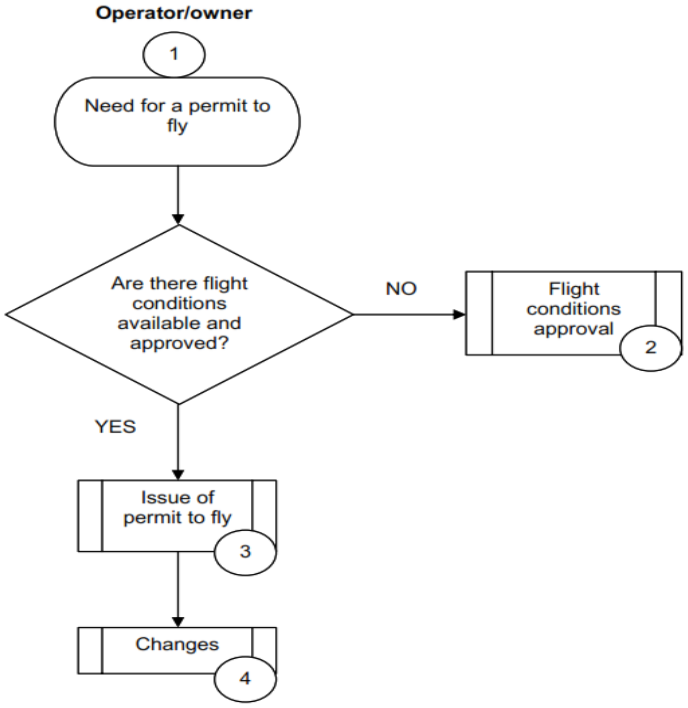
Flowchart 1 – Overview

Flowchart 2 – Approval of flight conditions

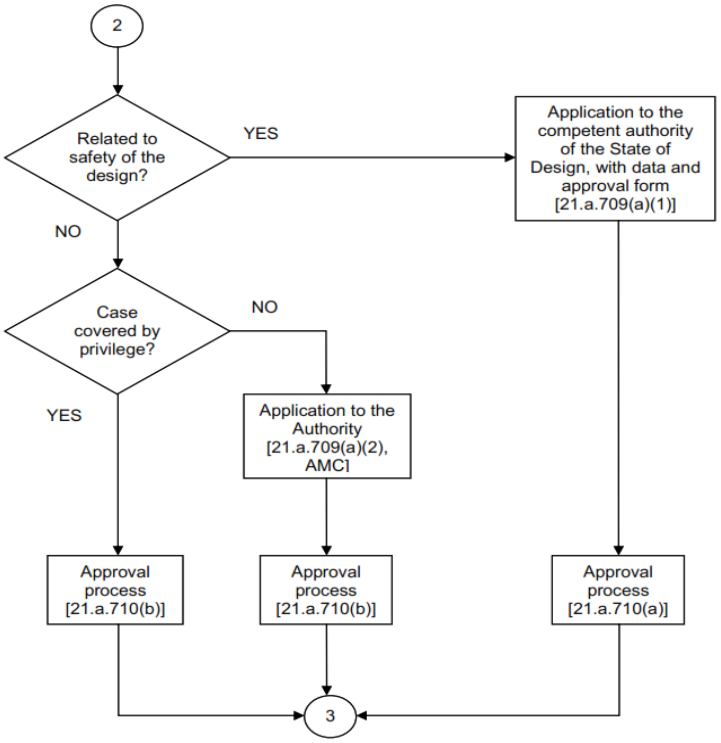
Flowchart 3 – Issue of permit to fly

Flowchart 4 – Changes after the first issue of permit to fly

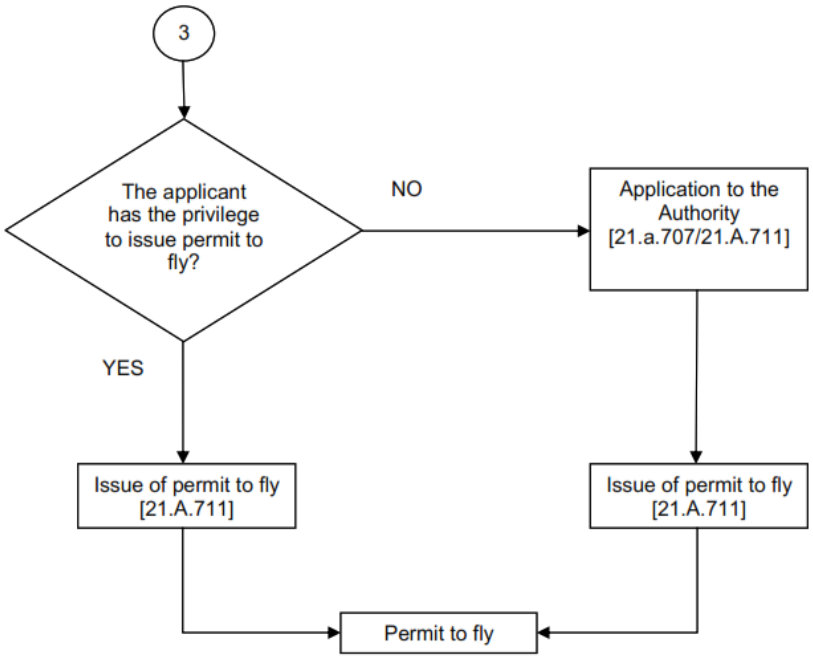
Flowchart 1 to GM Subpart P – Overview



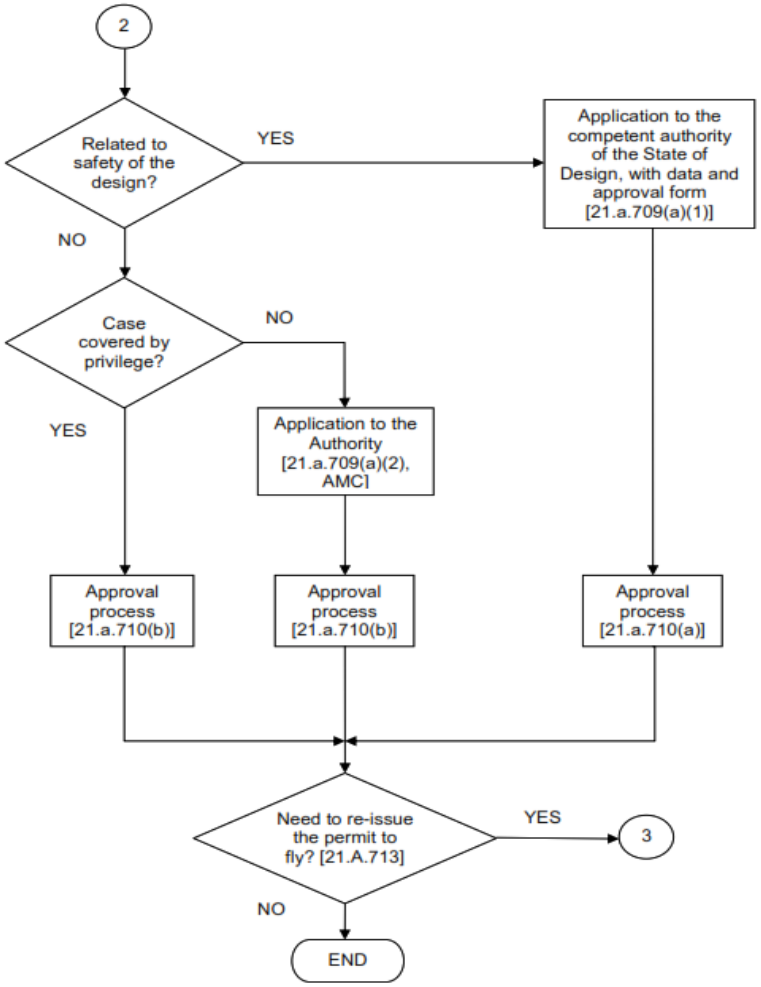
Flowchart 2 to GM SubPart P – Approval of flight conditions



Flowchart 3 to GM Subpart P – Issue of permit to fly



Flowchart 4 to GM Subpart P – Changes after the first issue of permit to fly



GM 21.A.701(A) Permit to fly when Certificate of Airworthiness is not appropriate

A *certificate of airworthiness* may not be appropriate for an individual aircraft or aircraft type when it is not practicable to comply with the normal continued airworthiness requirements and the aircraft is to a design standard that is demonstrated to be capable of safe flight under defined conditions. Point 21.A.701 identifies cases where the issuance of a *certificate of airworthiness* may not be possible or appropriate and this GM provides further information and typical examples for clarification where appropriate:

Note: This list of examples is not exhaustive

(1) Demonstration of compliance with regulations or certification specifications:

- Certification flight-testing for type certification, supplemental type certificates, changes to type certificates or STSO authorisation;

(2) Flying the aircraft for customer acceptance:

- Before the aircraft is sold and/or registered.

(3) Delivering or exporting the aircraft:

- Before the aircraft is registered in the State where the C of A will be issued.

(4) Flying the aircraft for the CAAB acceptance:

- In the case of inspection flight test by the CAAB before the C of A is issued.

(5) Exhibition and air show:

- Flying the aircraft to an exhibition or show and participating to the exhibition or show before the design approval is issued or before conformity with the approved design has been shown.

(6) Flying the aircraft to a location where maintenance or airworthiness review are to be performed, or to a place of storage:

- Ferry flights in cases where maintenance is not performed in accordance with approved programmes, where an AD has not been complied with where certain equipment outside the Master Minimum Equipment List (MMEL) is unserviceable or when the aircraft has sustained damage beyond the applicable limits.

(7) Flying an aircraft at a weight in excess of its maximum certificated take-off weight for flight beyond the normal range over water, or over land areas where adequate landing facilities or appropriate fuel is not available:

- Oversees ferry flights with additional fuel capacity.

(8) Record breaking, air racing or similar competition:

- Training flight and positioning flight for this purpose are included

(9) Flying aircraft meeting the applicable certification specifications before conformity to the environmental requirements has been found:

- Flying an aircraft, which has been demonstrated to comply with all applicable certification specifications but not with environmental requirements.

(10) For non-commercial flying activity on individual non-complex aircraft or types for which a certificate of airworthiness or restricted certificate of airworthiness is not appropriate.

- For aircraft which cannot practically meet all applicable certification specifications, such as certain aircraft without TC holder ('generically termed orphan aircraft') or aircraft which have been under national systems of Permit to Fly and have not been demonstrated to meet all applicable requirements. The option of a permit to fly for such an aircraft should only be used if a *certificate of airworthiness* or cannot be issued due to conditions which our outside the direct control of the aircraft owner, such as the absence of properly certified spare parts.

(11) Flying an aircraft for troubleshooting purposes or to check the functioning of one or more systems, parts or appliances after maintenance.

- After maintenance, when the diagnosis of the functioning of an aircraft system needs to be made in flight and the design approval holder has not issued instructions to perform this diagnosis within the approved aircraft limitations, the flight should be conducted under a permit to fly. Further guidance is available in subparagraph (b) of GM M.A.301(i) of the AMC and GM to Part-M.

Note: The above listing is of cases when a permit to fly MAY be issued; it does not mean that in the described cases a permit to fly MUST be issued. If other legal means are available to allow the intended flight(s) they can also be used.

GM 21.A.708(b)(6) Continuing airworthiness

In most cases a simple reference to existing maintenance requirements will suffice for aircraft that have a temporarily invalid C of A.

For other aircraft it will have to be proposed by the applicant as part of the flight conditions. For approved organisations they can be included in their procedures.

GM No 1 to 21.A.708(c) Safe Flight

Safe flight normally means continued safe flight and landing but in some limited cases (e.g. higher risk flight testing) it can mean that the aircraft is able to fly in a manner that will primarily ensure the safety of overflown third parties, the flight crew and, if applicable other occupants.

This definition of 'safe flight' should not be interpreted as allowing a test pilot, equipped with a parachute and operating over a sparsely populated area, to set out on a test flight in the full knowledge that there is a high probability of losing the aircraft. The applicant should take reasonable care to minimise safety risks and to be satisfied that there is a reasonable probability that the aircraft will carry out the flight without damage or injury to the aircraft and its occupants or to other property or persons whether in the air or on the ground.

GM No 2 to 21.A.708(c) Substantiations

The substantiations should include analysis, calculations, tests or other means used to determine under which conditions or restrictions the aircraft can perform safely a flight.

GM No 3 to 21.A.708(c) Operation of Overweight Aircraft

This GM provides information and guidance with respect to permit to fly for operating an aircraft in excess of its maximum certificated take-off weight, for flight beyond the normal range over water, or over land areas where adequate landing facilities or appropriate fuel is not available.

1. GENERAL.

The excess weight that may be authorized for overweight operations should be limited to additional fuel, fuel carrying facilities, and navigational equipment necessary for the flight.

It is recommended that the applicant discuss the proposed flight with the TC holder of the aircraft to determine the availability of technical data on the installation of additional fuel carrying facilities and/or navigational equipment.

2. CRITERIA USED TO DETERMINE THE SAFETY OF ADDITIONAL FACILITIES.

In evaluating the installation of additional facilities, the Agency or the design organisation must find that the changed aircraft is safe for operation. To assist in arriving at such a determination, the following questions are normally considered:

a. Does the technical data include installation drawings, structural substantiating reports, weight, balance, new centre of gravity limits computations, and aircraft performance limitations in sufficient detail to allow a conformity inspection of the aircraft to be made?

b. In what ways does the aircraft not comply with the applicable certification specifications?

c. Are the fuel tanks vented to the outside? Are all areas in which tanks are located ventilated to reduce fire, explosion, and toxicity hazards?

d. Are the tanks even when empty strong enough to withstand the differential pressure at maximum operating altitude for a pressurized aircraft?

e. Have means been provided for determining the fuel quantity in each tank prior to flight?

f. Are shutoff valves, accessible to the pilot, provided for each additional tank to disconnect these tanks from the main fuel system?

g. Are the additional fuel tank filler connections designed to prevent spillage within the aircraft during servicing?

h. Is the engine oil supply and cooling adequate for the extended weight and range?

3. LIMITATIONS.

The following types of limitations may be necessary for safe operation of the aircraft:

a. Revised operational airspeeds for use in the overweight condition.

b. Increased pilot skill requirements.

c. A prescribed sequence for using fuel from various tanks as necessary to keep the aircraft within its centre of gravity range.

d. Notification to the control tower of the overweight take-off condition to permit use of a runway to minimize flight over congested areas.

e. Avoidance of severe turbulence. If encountered, the aircraft should be inspected for damage as soon as possible.

EXAMPLE of operating limitations which may be prescribed as part of the permit to fly:
Aircraft type: xxxxxx Model: yyyy

Limitations:

1. Maximum weight must not exceed 8 150 pounds.
2. Maximum quantity of fuel carried in auxiliary tanks must not exceed 106 gallons in fwd tank, 164 gallons in centre tank, and 45 gallons in aft tank.
3. Centre of gravity limits must not exceed (fwd) +116.8 and (aft) +124.6.
4. Aerobatics are prohibited.
5. Use of autopilot while in overweight condition is prohibited.
6. Weather conditions with moderate to severe turbulence should be avoided.
7. When an overweight landing is made or the aircraft has been flown through moderate or severe turbulence while in an overweight condition, the aircraft must be inspected for damage after landing. The inspections performed and the findings must be entered in the aircraft log. The pilot must determine, before the next take-off, that the aircraft is airworthy.
8. When operated in the overweight condition, the cruising speed (Vc) shall not exceed 185 m.p.h. and the maximum speed (Vne) shall not exceed 205 m.p.h.
9. Operation in the overweight condition must be conducted to avoid areas having heavy air traffic, to avoid cities, towns, villages, and congested areas, or any other areas where such flights might create hazardous exposure to person or property on the ground.

GM 21.A.708 (d) Control of aircraft configuration

The applicant should establish a method for the control of any change or repair made to the aircraft, for changes and repairs that do not invalidate the conditions established for the permit to fly.

All other changes should be approved in accordance with 21.A.713 and when necessary a new permit to fly should be issued in accordance with 21.A.711.

GM 21.A.711(e) Additional conditions and restrictions

The conditions and restrictions prescribed by the competent authority may include airspace restrictions to make the conditions approved under 21.A.710 more concrete, or conditions outside the scope of the ones mentioned in 21.A.708 (b) such as a radio station license.

GM 21.A.713 Changes

Changes to the conditions or associated substantiations that are approved but do not affect the text on the permit to fly do not require issuance of a new permit to fly.

In case a new application is necessary, the substantiation for approval of the flight conditions only needs to address the change.