

# TECHNICAL GUIDANCE MATERIAL

## for

### Supplemental Type Certificate

**SUBJECT:** TECHNICAL GUIDANCE MATERIAL FOR SUPPLEMENTAL TYPE CERTIFICATION

**EFFECTIVE DATE:** 01 APRIL 2022

#### APPLICABILITY

This TGM is applicable to approvals of major design changes to type certificated Aircraft, Engines or Propellers when such design changes are not so extensive as to require the issuance of a new or amended type certificate.

#### PURPOSE

The purpose of this technical guidance material (TGM) is to provide procedural guidelines concerning the planning and conduct of supplemental type certification activities for aeronautical products.

#### REQUIREMENTS

Part 21 Subpart 5 of the South African Civil Aviation Regulations provides the regulatory framework for the issuance of a supplemental type certificate (STC) for approval of major design changes to class 1 aeronautical products. This TGM therefore, provides guidance towards meeting compliance to regulatory requirements and applicable airworthiness design standards when carrying out STC projects.

#### 1. REFERENCE

It is intended that the following reference material be used in conjunction with this TGM:

- i. Part 21 Subpart 5 of the South African Civil Aviation Regulations (CAR's), General.
- ii. Part 21 Subpart 9 of the South African Civil Aviation Regulations (CAR's) Approval of parts and appliances.
- iii. SA-CATS 21, South African Civil Aviation Technical Standards, Airworthiness Requirements.
- iv. Aeronautical Information Circular (AIC 61.6)
- v. CAR Part 43 of the of the South African Civil Aviation Regulations CAR's
- vi. Product Type Certificate Data Sheet (TCDS)
- vii. Part 147 of the CAR's, Design Organisations for Products, Parts and Appliances.
- viii. SA-CATS 147, South African Civil Aviation Technical Standards, Design Organisations;
- ix. Part 187 of the CAR's, Fees.
  - x. Part 23 of the Federal Aviation Regulations (FAR), Normal, Utility, Acrobatic and Commuter category Aeroplanes;
  - xi. Part 25 of the FAR, Transport Category Aeroplanes;
  - xii. Part 27 of the FAR, Normal category Rotorcraft.
  - xiii. Part 29 of the FAR, Transport Category Rotorcraft.
  - xiv. Part 31 of the FAR, Manned Free Balloons.
  - xv. Part 33 of the FAR, Aircraft Engines.
  - xvi. Part 34 of the FAR, Fuel Venting and Exhaust Emission Requirements for Turbine Engine Powered Aeroplanes;
  - xvii. Part 35 of the FAR, Propellers.
  - xviii. Part 36 of the FAR, Noise Standards

## 2. TERMS AND ABBREVIATIONS

TERM	DEFINITION
Aircraft	means any information necessary to ensure that an aircraft or aircraft component can be maintained in an airworthy condition
Aircraft Type	means an aircraft as defined in the CARs, including its engines, propellers, rotor, components, parts, equipment, instruments, accessories and materials
Airworthiness Standard	detailed and comprehensive airworthiness code applicable to the aircraft, aircraft engine or propeller as detailed in CAR Part 21.
Applicant	means the applicant who is the legal entity i.e., design organization approval holder on whose behalf the application was made. This shall normally be the entity to which the Supplemental Type Certificate is issued when the certification activity is completed.
Authority	means the National Airworthiness Authority of the certifying country or State of Design
Certification Basis	The type certificate data sheet of an aircraft, engine or propeller identifies the detailed certification basis by which the type design of that aeronautical product was approved. The major components of a certification basis are the airworthiness and environmental standards, including if any, special conditions of airworthiness, findings of equivalent level of safety, and exemptions.
Certification Plan	The purpose of this document is to provide the project overview and to identify key technical aspects such as the certification basis, applicable means of compliance and the relevant compliance documents
Class I Product	means a complete aircraft, aircraft engine or propeller, that has been type certificated in accordance with the appropriate airworthiness requirements and for which the necessary type certificate or equivalent have been issued
Class II product	A major component of a Class I product or an unapproved Class I product the failure of which would jeopardise the safety of a Class I product.
Class III product	A part or component which is not a class I or class II product
Design Change	A change in the approved design of an aircraft, aircraft engine or propeller.
Equivalent level of safety	A finding where literal compliance with a specific airworthiness requirement cannot be demonstrated but compensating factors exist in the design that can be shown to provide a level of safety equivalent to that intended by the certification basis.
Exemptions	a grant of relief from the requirements of a certification specification when processed through the appropriate regulatory procedure by the SACAA
Level of Involvement	The specific involvement of the SACAA specialists as part of the certification program to make findings of compliance with specific requirements and accept associated data when satisfied that the design is compliant with applicable standards
Major Design Change	A change that has an appreciable effect on the weight, balance, structural strength, reliability, operational characteristics, or other characteristics affecting the airworthiness of an aircraft, aircraft engine or propeller
Minor Design Change	A change that is not a major change

Multiple STC	Supplemental Type Certificate that is applicable if two or more serial numbers of specific aircraft, engine or propeller models are to be modified, and it must be demonstrated that the modification can be duplicated
Not significant change	A major change that is not a significant change or a substantial change.
One-Only STC	Supplemental Type Certificate that applies to only one specific aircraft, engine, or propeller serial number only
Significant change	A major design change which is significant to the extent that it changes one or more of the following: general configuration, principles of construction or the assumptions used for initial certification, but not to the extent to be considered a substantial change.
Special Conditions	The technical requirements added to the certification basis because of novel or unusual design feature(s) that exists in a type design and the absence or inadequacy of the applicable airworthiness standards to provide a basis for the certification of such features.
State of Design	means the State which has authority over the organisation responsible for the type design of the Class I product
Statement of compliance	Statement by a Design Organisation Approval holder that the design data has been examined in accordance with established procedures and found to comply with applicable airworthiness standard(s).
Substantial change	A change which is so extensive that a substantially complete investigation of compliance is required, and consequently a new TC.
Supplemental Type Certificate	means approval of a design change to a type of certificated aircraft, engine, or propeller, when the change is not so extensive as to require a new type certificate (TC).

ABBREVIATION	DESCRIPTION
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AD	Airworthiness Directive
AED	Airworthiness Engineering Department
AFM	Aircraft Flight Manual
C of A	Certificate of Airworthiness
CAR	Civil Aviation Regulations
DCA	Director of Civil Aviation
DOA	Design Organisation Approval
E: AE	Engineer: Airworthiness Engineering
E: ASO	Executive: Aviation Safety Operations
GA	General Aviation
ICA	Instructions for Continued Airworthiness
ICAO	International Civil Aviation Organisation
IPC	Illustrated Parts Catalogue
M: AE	Manager: Airworthiness Engineering
MM	Maintenance Manual
MRB	Maintenance Review Board
NAA	National Airworthiness Authority
OEM	Original Equipment Manufacturer
SACAR	South African Civil Aircraft Register

SA-CATS	South African Civil Aviation Technical Standards
STC	Supplemental Type Certificate
TAC	Type Acceptance Certificate
TC	Type Certificate
TCDS	Type Certificate Data Sheet
TOA	Terms of Approval
VFR	Visual Flight Rules
VLA	Very Light Aircraft

### 3. BACKGROUND

#### 3.1 Regulatory Requirements

- 3.1.1 ICAO Annex 8 deals with a contracting state's responsibility of ensuring the airworthiness of aeronautical products. The guidance document ICAO Doc 9760 Airworthiness Manual further details the roles and responsibilities of the State of Design regarding approval of major design changes to class 1 aeronautical products.
- 3.1.2 The issuance of the SACAA Supplemental Type Certificate (STC) is a secondary form of approval of the design of a major modification, or enhancement of a class I product such as a type-certificated aircraft, engine or propeller. It is supplementary to the original product Type Certificate (TC) and does not supersede or change the effectiveness of the previously issued TC. When the STC is applied to an aircraft, the aircraft type design is still defined by the previously issued TC, plus the change in the type design as stated in terms of regulation 21.05.3

#### 3.2 Eligibility for Issuance

- 3.2.1 An applicant for the SACAA approval of a major design change through the Supplemental Type Certificate (STC) process must be a legal entity which is a holder of a Design Organisation Approval (DOA) in accordance with CAR part 147.
- 3.2.2 Applicants must ensure that the scope of the design change of the STC project must be within the approved scope and Terms of Approval (TOA) of the DOA. Alternatively, applications are also accepted in cases where the certification project is simultaneously being used to demonstrate applicant capability for the issuance of a new DOA and STC or extension of the existing scope or TOA of the DOA.
- 3.2.3 An application for a One only STC specific to a single serial number shall not be used as adequate demonstration of the prospective DOA holder's design capability and/or intended scope of approval.
- 3.2.4 An STC approval process is applicable to major design changes to type certificated aircraft, aircraft engines or propellers which are classified as either significant or not significant changes. In cases where design changes are classified as substantial changes, the approval process shall lead to the amendment to the relevant TC.
- 3.2.5 Approval can be issued for such changes as performance limitations, increase in pilot workload, emergency procedures, ICAs, including Airworthiness Limitations. For example, an increase to a time between overhaul (TBO) limit specified in the airworthiness limitations section of the ICA.

#### 3.3 Ineligibility for STC Issuance

3.3.1 An STC can only be issued for a type-certificated aircraft, engine, or propeller. Therefore, an STC cannot be issued for an aircraft, engine or propeller that does not have a TC or TAC. Examples include aircraft approved under CAR Part 24 regulations, aircraft certified under military standards, etc.

3.3.2 Modifications and design changes to a class 1 product that are primarily not aimed at maintaining and showing of compliance to the relevant airworthiness certification standard. Examples of these include design changes for research and development and related testing, experimental design changes for marketing to potential clients, etc.

#### **4. CERTIFICATION PROCESS OUTLINE**

4.1 The process begins with an inquiry and the request for a concept briefing meeting to the engineering section. The concept briefing meeting may yield one of the two outcomes, notably the continuation to the STC application stage or an abrupt end of the process in cases where the stakeholders find the project not viable. The continuation to the STC application stage leads to the five-phase certification process as outlined below.

4.2 The completion of each phase is concluded with the SACAA project team leader issuing a formal written letter notifying the applicant of the achievement of that milestone.

4.2.1 Phase One: Application and Establishing the Certification basis

4.2.2 Phase Two: Establish Means and Methods of Compliance and SACAA LOI

4.2.3 Phase Three: Demonstrate and Record Compliance

4.2.4 Phase Four: Supplemental Type Design Approval

4.2.5 Phase Five Post approval activities & Continuing Airworthiness responsibilities

#### **5. PHASE ONE – APPLICATION AND ESTABLISH CERTIFICATION BASIS**

##### **5.1 Pre-Application and Concept Briefing**

5.1.1 The purpose of the concept briefing is twofold, that is for the potential applicant to familiarize the SACAA with various aspects of their proposed design, on the other hand for the SACAA assess viability and direct the potential applicant to the relevant regulatory and procedural guidance material.

5.1.2 Phase one begins with the SACAA engineering manager receiving an inquiry from a potential applicant their intent and requesting guidance pertaining to the formal process of obtaining STC design change approval. The SACAA shall then invite the potential applicant for a concept briefing meeting. During a concept briefing the applicant provides the SACAA with a high-level description of the project.

5.1.3 Attention must be made on specific aspects pertaining to how compliance would be shown for novel or unusual features if applicable. The Concept Briefing is the first formal discussion and high-level presentations of how the potential applicant intends to conduct compliance activities leading to the issuance of the STC. Attendees of the briefing would normally include the applicant technical team and the SACAA project team members.

5.1.4 The agenda may include the following general topics:

- a. Aircraft, engine, or propeller overview.
- b. High level project overview
- c. Organisational capabilities, and resources.
- d. Design subcontractors and their envisaged services.
- e. Novel and unusual features.
- f. Applicable airworthiness standard proposed

5.1.5 Minutes taken during the concept meeting shall be considered as important as any other documents submitted by the client. All issues discussed and addressed during concept briefing must be closed and a decision taken as to whether the goes to the next stage or not. The SACAA shall send a formal letter, communicating the outcome of the meeting, together with the Concept briefing minutes to the external party.

## 5.2 Application

5.2.1 The next step following concept briefing meeting is to apply for the issuance of a South African Supplemental Type Certificate in accordance with the requirements of Subpart 5 of Part 21 of the CAR's and the associated technical standards SA-CATS 21. The completed application form CA 21.05 needs to be accompanied by the appropriate fee as stipulated in Subpart 187.00.2 of Part 187 of the CAR's

5.2.2 New STC Application. For all new designs, or where significant changes are made to an existing STC design, the applicant should complete and submit Form CA 21-05 and tick the box "APPLICATION FOR THE ISSUING OF A SUPPLEMENTAL TYPE CERTIFICATE". The applicant should also tick one of the three boxes for "Non-Significant, or Significant". The SACAA project team leader shall notify the applicant if it is determined that a new TC would be more appropriate because of substantial changes and implications to the design, operation, or continued airworthiness of the product.

5.2.3 STC Amendment. The STC holder who wishes to apply for amendment to an existing STC may do so due to the following reasons.

- a. The holder intends to introduce changes to the approved system as already outlined in the STC.
- b. An installation or embodiment of another system whether it is similar to the existing one or not, does not qualify as an amendment of the STC.
- c. The STC holder that went through a name change process which resulted with a new legal entity. Consequently, an application for amendment of the STC and Design Organisation Approval (DOA) would be required.
- d. A legal entity which is a prospective recipient of the STC transfer process from the original STC holder.
- e. The holder intends to add new models and has revised and upgraded the data for showing compliance.
- f. "One-only" STCs will not be amended for issuance of new or "multiple" STCs. In this case, a separate application for new STC and sufficient data should be submitted to verify that the design (manufacturing and installation) may be duplicated on the subsequent aircraft, engines, or propellers.

5.2.4 In each of the above instances, the holder shall submit Form CA 21-05 and tick the box "APPLICATION FOR AMENDMENT OF A SUPPLEMENTAL TYPE CERTIFICATE". Completed application forms, CA 21-05 may be submitted to the Airworthiness Engineering Department through either of the three ways listed below:

5.2.5 Email: eng@CAA.co.za  
Post: South African Civil Aviation Authority  
Manager: Airworthiness Engineering  
Private Bag X73  
Halfway House, 1685  
Johannesburg, South Africa

Hand: Ikhaya Lokundiza  
Building 16  
Waterfall Park  
Bekker Street

5.2.6 Once an application for the issuance/ amendment of the STC is accepted by the SACAA, the engineering manager appoints a SACAA project engineer to lead a team of project members from the engineering, manufacturing, flight operations and/or continuing airworthiness in line with the skills that may be required for the project.

### 5.3 Determine Certification Basis

5.3.1 This phase identifies the certification approach, planning and strategy which shall be used in subsequent phases leading up to the approval of the design change. The primary output is the establishment of the certification basis.

5.3.2 Once parties are satisfied that all the necessary regulatory and design standard requirements for the product's type design are adequately identified and documented in accordance with Changed Product Rule (CPR), the applicable certification basis shall be established

5.3.3 The critical step in determining the certification basis is whether to select either the latest applicable airworthiness standard or the original amendment level. Firstly, the design change must be classified whether it is significant or non-significant change.

5.3.4 For 'non-significant' changes, the certification basis shall be the original Type Certification basis of the applicable product, except when the applicant elects to comply with a later amendment.

5.3.5 For 'significant' changes, the certification basis shall be the latest applicable airworthiness standard at the date of application and shall include, if applicable, deviations and environmental protection requirements.

5.3.6 A substantial change is not applicable to this STC TGM as it is so extensive that a substantially complete investigation of compliance is required, leading to the issuance of an amended or new TC.

**Note:** Classifications of typical type design changes may be conducted with the help of examples in Appendix B. The next step is to document the applicable certification basis and associated parts in the project certification plan.

### 5.4 Create the Certification Plan

5.4.1 The main objective of the Certification Plan is to ensure **that** the proposed product design change complies with product certification basis. It is the primary document in the modification approval process that serves both as a checklist and official record of compliance. The applicant should prepare a certification plan and establish its contents with the agreement of the SACAA project team. **Appendix A** outlines a template of a Certification Plan.

5.4.2 A certification plan should include the following information:

5.4.3 **project description**, including the applicant and aircraft or aeronautical product(s) involved. It covers the aircraft, design change, manufacturing processes as well as resources used by the Design Organisation. Any unconventional features or technology where no experience is available from former projects is highlighted.

5.4.4 **proposed certification basis** - The Design Organisation shall identify the applicable airworthiness standard established that is effective on the date of application for significant design changes. Alternatively, original product certification basis may be used for non-significant design changes.

5.4.5 **special conditions** - In cases where the product has novel or unusual design features relative to the design practices on which the applicable airworthiness code is based; or the intended use of the product is

unconventional; or experience from other similar products in service or products having similar design features, has shown that unsafe conditions may develop.

- 5.4.6 **equivalent level of safety findings** - If there is the intention to provide an equivalent level of safety to compensate some specific non-compliance with any airworthiness requirement this has to be mentioned and justified here.
- 5.4.7 **the compliance checklist** – a detailed explanation of the means and methods that shall be used to show compliance with the applicable airworthiness requirements, including documentation to be provided, test plans, compliance records and schedules
- 5.4.8 **Design Subcontractors** - List of all design subcontractors involved in the project with detailed description of their tasks and responsibilities. It is noted that every external source for data used for compliance demonstration is a design subcontractor. For example, suppliers for the following.
  - a. structural tests (components, specimen, flammability, ...)
  - b. environmental testing (noise, emissions, CO<sub>2</sub>,...)
  - c. flight testing
- 5.4.9 **Agreed level of involvement** – Identifies specific compliance activities where the SACAA certification team shall take a closer monitoring role for each applicable requirement
- 5.4.10 **Project time schedule** for achieving compliance, deliverables, major milestones and action item assignments, etc.
- 5.4.11 **communication plan** - It describes communication and coordination responsibilities between the applicant and the SACAA certification team.
- 5.4.12 **conformity verification plan** - This sets out how, when and by whom conformity shall be established.

## 6. PHASE TWO – ESTABLISH MEANS AND METHODS OF COMPLIANCE AND SACAA LOI

### 6.1 Establish Means of Compliance

6.1.1 After establishing certification basis in phase 1 and SACAA Level of Involvement (LOI), a series of reviews and meetings are held as needed between the SACAA project team and the applicant. The goal is to obtain concurrence on the proposed means and methods that shall be used to demonstrate compliance for each of the requirements identified in the established certification basis. This is normally documented as part of the proposed certification plan and should include the following:

6.1.1.1 Complete breakdown of the means and methods of compliance with the applicable standards of the certification basis.

- a. applicable method of compliance and where it is documented.
- b. all the subcontracted functions involved in demonstrating compliance.
- c. the responsibility for findings of compliance (SACAA LOI).

6.1.2 The SACAA project team and the applicant may also exchange various technical issue papers to clarify and document concerns identified during the certification process and review meetings, and how the two parties arrived at a consensus. Further information on the use of issue papers can be found in the TGM for Issue Papers.



6.1.3 The applicant uses the information obtained from engagements with the SACAA counterparts to update their certification plan previously submitted to the SACAA.

## 6.2 Create LOI Matrix

6.2.1 For planning purposes, the SACAA's and the applicant's certification teams need to know in which aspects of the project the SACAA intends involvement and at what level. The heavy workloads for SACAA personnel limit involvement in certification activities to a small fraction of the whole. SACAA certification team members must review the applicant's design descriptions and project plans, determine where their attention will derive the most benefit, and coordinate their intentions with the applicant.

6.2.2 The LOI should be depicted in a "matrix format" as agreed to by both parties. Each activity, such as conducting a test, completing a report or assembling data is listed. The levels of involvement for the SACAA for each document, data element or test can then be shown next to the activity.

6.2.3 The matrix should include references to the certification schedule and to any known SACAA resource constraints that could affect the schedule. It should be possible to identify the responsibilities in the matrix at the level of the individual responsible for the activity. The level of detail that can be presented for each requirement using a LOI matrix ensures that SACAA and the applicant understand their respective expectations and obligations. The specialists and managers, both at SACAA and with the applicant, must agree to the LOI.

6.2.4 The SACAA LOI matrix may include but not limited to the following:

- a. Reports to be reviewed and accepted.
- b. Flight Manual and Airworthiness Limitation approvals.
- c. Reports received for information.
- d. Test witnessing.
- e. Conformity inspections conducted by SACAA.
- f. Engineering inspections conducted by SACAA.
- g. Flight testing activities conducted by SACAA.
- h. Activities associated with issue papers.
- i. Software process reviews on site, including those for programmable logic devices.
- j. Meetings including design review and type boards.

## 6.3 Create Action Item Database

6.3.1 Action items may result from meeting minutes, flight test debrief notes, review of reports or a multitude of other sources. The SACAA Project team leader shall work with the applicant to create an action item database.

6.3.2 Primary responsibility for maintaining the action item database is the applicant and the SACAA project team leader verifies its accuracy. The database is a shared database with input from all members of the certification team, applicant, and SACAA alike. It is the responsibility of whoever raises a new action item to advise the SACAA and applicant of the item. Ideally, the applicant, who holds control over the timing of events, controls the Action Item Database.

6.3.3 Such a database is simply a list of outstanding action items that need to be accomplished in order to reach the certification target. This could include signatures required on the Compliance Program, open action items, open

issue papers, remaining tests, reports to be submitted and accepted, or any elements of SACAA's LOI or the applicant's compliance demonstration and recording. The list diminishes over time as actions are completed.

6.3.4 The database shall remain active to the end of the certification process in order to ensure that no action items are overlooked and that all items are dealt with before the project is completed. A LOI matrix, described in Phase Two, shall complement the action item database.

6.3.5 The output of phase II is the agreed certification plan that defines the applicant's responsibility and the participation level of the SACAA specialists throughout the compliance demonstration.

## **6.4 Prepare Test Plans**

6.4.1 An agreement must be reached between the SACAA team and the applicant on the required tests and the responsibility for test witnessing. The details must be written into the Certification Plans and LOI Matrix.

6.4.2 Test Plans shall be written by the applicant and must be acceptable to the SACAA. The plan identifies the test apparatus, test vehicle and configuration, test details including conditions and pass/fail criteria, data requirements, and hazard level with risk mitigation actions. Test Plans should be written and accepted as early as possible and prior to conducting the test.

6.4.3 Applicants are cautioned that if the test plan is not accepted or if the agreed LOI test witnessing requirements are not satisfied before a test is conducted, there is a risk that SACAA shall not accept the test results.

6.4.4 Test articles shall be built to an agreed build standard and shown by the applicant to conform to that standard. In many cases the SACAA specialist shall request that an additional conformity inspection be performed before the test is conducted. The Manufacturing inspectors shall conduct this compliance inspection.

6.4.5 Test equipment and all measuring equipment used for tests are appropriately calibrated and conform to the test plan. The calibration certificate must be traceable to the national standard.

## **7. PHASE THREE – DEMONSTRATION AND FINDING OF COMPLIANCE**

### **7.1 Demonstration of compliance**

7.1.1 The demonstration of compliance requires that the applicant submit substantiating data (design data, reports, analysis, drawings, processes, material specifications, operations limitations, aircraft flight manuals, and ICA).

7.1.2 The data should be complete and in a logical format for review by the SACAA project team. Where the demonstration of compliance involves a test, a test plan should be developed and approved prior to any actual test being performed. Official certification tests are witnessed by the SACAA specialists in line with the LOI.

7.1.3 The applicant should give the SACAA access to the aeronautical product being modified in order to make any inspections, test, and engineering assessment or conduct any flight or ground test that is necessary to determine compliance with the certification item. However, the applicant should perform its own inspection and test necessary to demonstrate compliance prior to presenting the modified aeronautical product to the SACAA for testing or evaluation.

### **7.2 Finding of compliance**

- 7.2.1 Findings of compliance are made against airworthiness and environmental standards. The finding of compliance is made by the SACAA, depending on the predefined levels of involvement in the certification plan.
- 7.2.2 Following a successful demonstration of compliance by the applicant on a certification item, the SACAA team shall make a finding of compliance and subsequently sign-off on the item in the certification plan. The findings are usually accomplished by the SACAA team through one or any combination of the following actions:
- a. **Acceptance or approval of substantiating data** - Reports, analysis, drawings or similar documents are usually produced against each certification item and should be reviewed and accepted.
  - b. **Witnessing of Test** - Tests are performed and witnessed by the SACAA team where required or agreed to, in accordance with an approved test plan. The test should be conducted only after conformity with the test plan has been established for the test articles, test environment and test facilities. The SACAA does not perform the non-flight test and should remain impartial and concentrated on the test objective.
  - c. **Engineering inspection** - Any aspect of the modification, for which compliance with the certification item cannot be determined through review of drawings or reports, should receive an engineering compliance inspection. An engineering compliance inspection is to assure that an installation and its relationship to other installations on an aeronautical product comply with the design requirements.
  - d. **Conformity inspection** - Where required, conformity inspection should be performed by the SACAA team to verify conformity of the modified aeronautical product with drawings, specifications and special processes. An engineering inspection should not be confused with a conformity inspection. A conformity inspection is done to determine conformity to the engineering data, while an engineering inspection is done to determine compliance with the certification requirement;
  - e. **Flight Test** - Where required, for aircraft, an actual demonstration of flight capabilities and characteristics in accordance with an approved flight test plan.

### 7.3 Identify Special Conditions and Equivalent Level of Safety

- 7.3.1 Special conditions may be applicable in situations whereby the proposed design change consists of systems, components or parts which have not been previously certified, new materials, features and or safety challenges which may not be sufficiently covered by any of the applicable certification and/or airworthiness standards for the specific aeronautical product e.g., the use of composite materials.
- 7.3.2 In cases where special conditions exist, or when it is difficult to show compliance to a published standard, the applicant shall provide a detailed description of any such unusual design features and also to demonstrate that the design meets an alternative and equivalent level of safety as agreed upon by the project certification team.
- 7.3.3 When the need for a finding of equivalent safety becomes apparent, the parties shall ensure that discussions documenting the logic of the finding of equivalent safety are captured in a technical issue paper.

### 7.4 Conformity Inspections

- 7.4.1 The SACAA conducts conformity inspections for both quality assurance and engineering purposes. It is used for validation of the applicant's conformity of the product to the approved drawings, designs, and specifications. As part of the type certification compliance process, the SACAA must identify the minimum level of conformity inspections needed for certification. Conformity inspections should be successfully completed before any SACAA ground or flight test is conducted.
- 7.4.2 During the inspection, SACAA manufacturing inspectors base the depth of their assessment on factors such as quality of the applicant's submitted conformity documents, comparison of inspection results, and magnitude and complexity of the inspection.

- 7.4.3 The following are some of the typical conformance inspection objectives that the applicant must determine for the test article:
- a. Materials and processes conform to the specifications for the design
  - b. Parts of the product conform to the design drawings
  - c. The manufacturing processes, construction and assembly conform to those specified in the design
  - d. To verify the installation was accomplished in accordance with the approved data, with all or any discrepancies noted.

## 7.5 Engineering Inspections

7.5.1 An engineering inspection is a specific task carried out to physically inspect, review, and validate the completed work and/or finished product against the relevant design specifications, airworthiness standards and applicable civil aviation regulations. Inspections can be aimed to achieve Compliance to the regulations or Compatibility and requirements to the product design and/or functional specifications.

7.5.2 Reasons for an engineering inspection include but not limited to the following:

- a. To give perspective to the drawings and determine their adequacy.
- b. To provide familiarization with the aircraft: its layout, systems operations and structural load paths.
- c. To show possible interactions and interference between systems or components.
- d. To examine HIRF or lightning related features such as bonding or gaps in metallic enclosures.
- e. To conduct zonal inspections for the purposes of compliance to standards for flammable fluids, fire zones or interior installations; and
- f. To verify compliance with the requirements of the relevant airworthiness standard.

7.5.3 SACAA engineer conducting an engineering inspection documents the results and note any discrepancies resulting from design or conformity issues as action items for the applicant. The applicant is debriefed on the inspection and the action items recorded.

## 7.6 Issue Experimental Certificate of Airworthiness

7.6.1 In cases where the showing of compliance through flight testing is required, an application for the issuance of an Experimental Certificate of Airworthiness in accordance with Subpart 21.08.4 and 21.08.5 of CAR Part 21 is required. The Experimental Certificate of Airworthiness does not constitute an airworthiness declaration, but it is simply a permission to fly an aircraft deemed safe for flight. Such a flight permit shall have conditions and restrictions attached which can change throughout the certification program.

7.6.2 The SACAA approves Flight conditions related to safety of design, under which an Experimental Certificate of Airworthiness may be issued, amongst others, for initial flights of an aircraft modified by a change that is yet to be approved. For further details, refer to TGM for Experimental Certificate of Airworthiness.

7.6.3 After each certification flight test, the SACAA keeps record of De-brief Notes. They document the flight test results with comments and identify certification issues and/or ask questions which the applicant must action. The applicant must track the flight test debrief notes and keep SACAA project manager apprised of the status of the action items. The SACAA project manager shall always be kept informed as to flight test debrief notes related to the project.

## 7.7 Finding Of Compliance as per Compliance Matrix

7.7.1 Once the compliance demonstration process is completed and most or all the airworthiness requirements making the content of the compliance checklist are assessed and verified by the SACAA project team, the two parties shall duly sign-off compliance matrix. The achievement of this stage marks a key milestone of phase three of the design approval process. The findings of compliance outcome may be captured and recorded in the following ways:

- a. Applicant and SACAA project team agree that compliance has been demonstrated. The applicant indicates their finding or recommendation of compliance by signing the Compliance Matrix against the specific requirement. The SACAA project engineer indicates concurrence that compliance has been shown by also signing the Compliance Matrix against the requirement. This is also confirmation that all engineering inspections have been completed and the modified product has been found to meet all applicable airworthiness requirements;
- b. Compliance with limitations and/or mandated inspections: In some instances, compliance can only be found by the imposition of a limitation and/or inspection. If a limitation/inspection can enable compliance to be found, the applicant and the SACAA project leader shall sign the Compliance Matrix. SACAA must provide explicit agreement on the acceptability of the limitations before the applicant can sign. The Compliance Matrix should be annotated to include the nature and location of the limitation/inspection that enabled the finding to be made. Such limitations/inspections must also be included as part of the appropriate approved publication: e.g., Flight Manual, Airworthiness Limitations Section of the Supplemental ICA, etc. Compliance items falling into this category are fully compliant, and as such could remain as permanent situations.
- c. There is no feature or characteristic of the changed product that makes it unsafe for the intended use if it is operated in accordance with the correctly amended flight manual or other specified limitations.
- d. Non-compliance exists: Sometimes the SACAA cannot make a finding of compliance because compliance has either not been fully established or the design change has been found not to be compliant with the product certification basis. The SACAA is therefore not able to sign the Compliance Matrix. Requirements that cannot be signed off should be clearly listed and agreed reasons shall be defined for each. Compliance finding items falling into this category may require interim limitations or mandatory inspections to be imposed to assure that these are satisfactorily addressed.
- e. No conclusive agreement that compliance achieved: In cases where disagreement exists between the applicant and the SACAA concerning compliance or means and methods of compliance, the Compliance Program shall not be signed. Such a disagreement would normally result in the creation of an issue paper as a vehicle to resolve the problem.

## 7.8 STC Issue Papers

7.8.1 An issue paper provides a means for identifying and resolving significant technical, regulatory, and administrative issues occurring during the certification process. Issue papers are primarily intended to provide an overview of significant issues, a means of determining the status of issues, and a basis for a post-certification summary statement on how issues were resolved.

7.8.2 The project team leader shall ensure that agreement is reached on actions required to close the issue paper prior to certification. There may be cases where the technical solution to a problem is not available until after certification, in these cases, the agreement on the proposed solution shall be sufficient and acceptable to close the issue paper.

7.8.3 Issue papers shall be prepared by the SACAA project team and shall normally require the inclusion of a written response from the applicant detailing their position or proposed solution. The TGM for Issue Paper process can be followed as applicable.

## **8. PHASE FOUR –SUPPLEMENTAL TYPE DESIGN APPROVAL ISSUANCE**

### **8.1 Statement of Compliance**

8.1.1 On completion of the STC certification project the applicant shall provide a declaration of compliance that the type design of the changed product to be approved complies with the applicable Supplemental Type Certification Basis. The SACAA project team members subsequently issue a statement of satisfaction to the project team leader with the applicant's compliance declaration of the discipline involved.

8.1.2 On acceptance of all necessary statements of satisfaction by the certification team, the project team leader shall issue a compliance statement together with the compliance data pack to Engineering Manager confirming that the type design of the changed product complies with the Supplemental Type Certification Basis.

### **8.2 Final Certification Report**

8.2.1 For 'significant' changes, the project team, writes a report which shall record the Type Design on which the type investigation process is based, the significant subjects investigated, the details of that investigation, the process followed and the conclusions regarding compliance with the Supplemental Type Certification Basis. The SACAA project team leader shall present the final report to the Engineering Manager for approval.

8.2.2 After approval of the final report and for all projects which do not require a final report (e.g., non-significant changes) the SACAA project team leader shall finally present the data pack to management for signatures and formal closure of the technical investigation, which paves the way for issuance of the STC.

### **8.3 Issuance of the Supplemental Type Certificate**

8.3.1 When all the required data, certification tests, accompanying reports and scheduled inspections are completed satisfactorily as indicated in the certification plan as well as the determination that the design change complies with the product certification basis, applicable airworthiness design standards and relevant CARS and SA-CATS 21, the STC shall be issued to the applicant on form CA 21.03 and the project formally closed.

## **9. PHASE FIVE - POST APPROVAL ACTIVITIES AND CONTINUING AIRWORTHINESS RESPONSIBILITIES**

### **9.1 STC Holder Responsibilities and Continuing airworthiness**

9.1.1 Once the applicant is issued the applicable STC design approval certificate, the applicant now becomes the design approval document holder and assumes the responsibilities for the continued airworthiness of the product's design. Therefore, the applicant must provide the SACAA with evidence to the effect that the applicant has got the resources and capability, or access to a capability, of providing appropriate technical solutions for service difficulties when service experience warrants it,

9.1.2 The applicant is required to have a system in place to collect and analyse defects emanating from the incorporation of the design change on the class 1 product. This is normally achieved through the implementation of procedures that provide the ability to do the following.

- a. Collect Mandatory Occurrence Reports (MORs) information from STC users.
- b. Notify STC users of any airworthiness issues that may arise during the life of the STC.

- c. Provide service information to users (usually Service Information Letters).
- d. Provide modification instructions to users (usually a Service Bulletin).
- e. Notify the SACAA of any failure, malfunction or defect that may impact on safety and/or continuing airworthiness of the product.

9.1.3 The applicant may be requested to provide evidence of appropriate liaison with the affected class1 product type certificate holder, particularly in cases where certain aspects of the design or the method of showing compliance relies on OEM data.

9.1.4 Each STC holder is required to maintain a record or database providing the information of all the clients that purchased the STC's from the STC holder. For the purpose of tracking of STC users, the STC holder must provide the SACAA access to this information. Typical information must include STC number, aircraft registration, model and serial number, state of registry, etc.

9.1.5 If the STC holder permits another person/organisation to use the STC to make changes to one or more aircraft or aeronautical products, then the STC holder shall provide that person/organisation with written evidence in the form of a Permission or Authorisation letter. The Permission letter should contain the following:

- a. the STC number.
- b. identification of the holder of the STC permission letter.
- c. a statement regarding the permission and any limitations applied to the permission, defining those items that may be changed
- d. an instruction that requires the holder of the permission letter to provide the STC holder with the registration mark and/or serial number of each aircraft or aeronautical product that was changed in accordance with the STC.

## 9.2 Retention of design change data

9.2.1 The data constituting the design change are contained in records, reports, drawings and other documents that describe collectively the exact configuration of the design change when it was approved. The STC holder must ensure that the design change records are permanent and may not be destroyed and must be made available to the SACAA for such routine activities as production inspection, surveillance, design change reviews, development of corrective actions, or for any other reasons deemed necessary by the SACAA.

9.2.2 The record-keeping should consist of at least the following:

- a. the drawings and specifications, and a listing of those drawings and specifications necessary to define the configuration and design features of the modification as it was shown to comply with the requirements applicable to the aeronautical product;
- b. reports on analysis and tests undertaken to substantiate compliance with the applicable requirements;
- c. information, materials and processes used in the construction of the modification of the aircraft, engine or propeller;
- d. an approved aircraft flight manual supplement or its equivalent (type-related document), including revisions to the master minimum equipment list and configuration deviation list, if applicable;
- e. approved revisions or recommendations to the maintenance programme or equivalent document, and aircraft maintenance manual with details of revisions to the manufacturer's recommended and SACAA accepted scheduled maintenance plan and procedures guidelines; and
- f. any other data necessary to allow, by comparison, the determination of airworthiness and noise characteristics (where applicable) of modified aeronautical products of the same type.

9.2.3 For an STC applicable to only one aircraft, aircraft engine or propeller (a 'one-only' STC), the technical data need not detail the production of parts and/or the installation to the degree required for an STC covering multiple items (a 'multiple' STC).

9.2.4 For an STC applicable to multiple items, the technical data must be of a quality that enables parts and the installation to be reproduced.

### **9.3 Surrender or Revocation of certificate**

9.3.1 The holder of a supplemental type certificate who wishes to surrender their certificate may do so by notifying the Director in writing. In addition, the holder shall submit the original copy of the certificate and the applicable records of the design change to the Director.

9.3.2 Following the revocation and/or surrender of an STC, the SACAA shall formally notify the affected authorities of the states of registry which operate the affected civil aeronautical products.

9.3.3 When the revocation results from identification of unsafe condition or a non-compliance situation, the SACAA shall timeously notify the affected authorities of the states of registry of the action taken and when an unsafe condition or a non-compliance situation was identified. Furthermore, the SACAA shall investigate the unsafe condition or non-compliance situation for corrective action and notify others of the corrective action.

### **9.4 Transfer of certificate**

9.4.1 The holder who wishes to transfer their certificate to another legal entity shall firstly notify the Director in writing. The notification shall disclose the name and address of the proposed STC holder, whether they are already a holder of design organization approval or not. The holder shall also submit a copy of the certificates to the Director.

9.4.2 The prospective STC holder shall submit a completed application form CA 21-05 for amendment of the certificate to include the details of the new legal entity. The application shall also be accompanied by a completed application form CA 147-01 for amendment to the scope of approval if the applicant already holds a design organization approval. An applicant with no design organizational approval shall also submit form CA 147.01 to apply for issuance of a new design organization approval.

9.4.3 Upon successful transfer process, the SACAA shall amended and re-issue the certificate the to the type design holder.

### **9.5 Cancellation of a STC Project.**

9.5.1 If project is inactive for more than 90 days, the SACAA may cancel it by notifying the applicant. An applicant can re-start the cancelled project by resubmitting a new application.



# APPENDICES

Appendix A - Project Specific Certification Plan Template

Approved Design Organisation logo	Certification Plan	Doc.-No.
		Revision
		Date
DO Approval No: J44/000	Project Name	Page 1 of XX

Project Specific Certification Plan

Project Title

This Project Certification Plan has been developed to meet the South African Civil Aviation Regulations (SACAR) 2011, Part 21 requirements as amended.

Document Number: xxxxxxxx

Revision:

Approved Design Organisation logo	Certification Plan	Doc.-No.
		Revision
		Date
DO Approval No: J44/000	Project Name	Page 2 of XX

**Approval Sheet**

	Name and Position	Date	Signature
Prepared			
Verified			
Approved			

Approved Design Organisation logo	Certification Plan	Doc.-No.
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**Revision Record**

Revision	Nature of Revision	Date
01	Initial Issue	

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Table of Contents

## 1. Purpose

The purpose of this Certification Plan is to define and document a product/part certification programme between the South African Civil Aviation Authority (SACAA) and Applicant for issuance of product design approval in accordance with SACAR Part 21 requirements. It details how the applicant intends to comply with applicable certification requirements.

The Certification Plan shall become effective upon a mutual acceptance by the designated SACAA team and the Applicant's Project Managers. It shall be effective throughout all the five phases of the project unless it is superseded, revised, or terminated.

## 2. Project Scope and Description

This chapter contains a detailed description of the project. It covers the specific design change to be certified (e.g., TCAS installation), design and manufacturing processes as well as resources used by the applicant (e.g., approved Design Organisation). Any novel/unconventional features or technology where no previous experience is available from previous projects undertaken is highlighted.

### 2.1 Design Organisation Resources

Define in details of the personnel working on the project and give detailed information on responsibilities, experience and scope of authorisation of each staff member. The SACAA must be informed about any changes of nominated staff and the Certification Programme would also be updated.

### 2.2 Design Outsourcing/Subcontractors

List of all design subcontractors involved in the project with detailed description of their tasks and responsibilities. Every external source for data used for compliance demonstration is a design subcontractor. For example suppliers for

- Components of the aircraft also delivering design data used for compliance demonstration
- Structural tests (components, specimen, flammability, etc.)
- noise testing
- Flight testing
- test equipment
- ground vibration test and/or flutter analysis
- AMO equipment installer, test pilots, etc
- Maintenance and configuration control of test aircraft

## 3. Certification Requirements and Certification Compliance Documentation

The certification requirements consist of the applicable airworthiness standard established by SACAA effective on the date of application together with any special conditions.

### 3.1 Original Certification Basis

The Design Organisation should identify the applicable airworthiness standard as detailed in the applicable State of Design Type Certificate (TC) and Type Certificate Data Sheet (TCDS) effective on the date of issuance of the relevant Type Certificate.

An application for approval of design changes such as TC amendment, STC and Minor modification approval shall be based on the original certification basis when the aircraft was type accepted for entry into the South African Aircraft register.

### 3.2 Proposed Certification Basis

This paragraph shall state the proposed certification basis for the intended design change modification/repair design. The proposed certification basis shall include all applicable paragraphs of the relevant airworthiness standard including the applicable amendment level.

### 3.3 Exemptions

In cases where there are justifications for some exemptions from specific parts of the airworthiness requirements.

### 3.4 Special Conditions

In cases whereby the applicable airworthiness standard does not contain adequate or appropriate safety standards for the product to be certified, they could be characterised by the following:

1. The product has novel or unusual design features relative to the design practices on which the applicable airworthiness code is based;
2. The intended use of the product is unconventional;
3. Experience from other similar products in service or products having similar design features, has shown that unsafe conditions may develop.

In that case the Design Organisation shall propose special conditions to the SACAA containing safety standards to establish a level of safety equivalent to that established in the applicable airworthiness code.

### 3.5 Equivalent Level of Safety

If there is the intention to provide an equivalent level of safety to compensate the non-compliance with any airworthiness requirement this has to be mentioned and justified here.

### 3.6 Environmental Protection

The DO has to identify the applicable environmental protection requirements. This includes compliance to ICAO Annex 16 acoustic and characteristics, engine emissions and fuel venting.

## 4. Certification Process

The certification programme has to include milestones specific to particular technical areas in relation with the general planning of the project and the decision process, especially the key points where a decision of the Authority is needed before further action may be embarked upon (e.g., acceptance of test plans)

The responsible persons to manage the process must be stipulated as well as the information flow and liaison with the Authority.

### 4.1 Certification Schedule

In this section, the applicant provides information relating to planning or scheduling of the project activities and milestones to ensure that adequate resources are available.

Estimated dates for major milestones should be outlined as follows:

Activity/Milestone	Responsibility	Status	Date
Submission of application			
Familiarization Meeting			
Certification Plan			

Agreement on Certification Basis			
Agreement on Certification Plan			
Agreement on the SACAA LOI			
Create Action Item List/Database			
Structural Test Plan			
Flight Test Plan			
Agreement on Test Plans			
Production of Prototype, Test Specimen			
Conformance Inspection Plan			
Conformance Inspection schedule			
Major Ground Tests			
Major Structural Test			
Major Compliance Data packages			
Application for Approval of Flight conditions			
Granting of Experimental C of A			
Flight Test			
Final Data Package with MDL			
Declaration of Compliance			
Design Change Approval (STC Issuance)			

#### 4.2 Compliance Checklist and Means of Compliance Format

The function of the compliance checklist is to document the applicable airworthiness design standards for the certification project and how compliance with those design standards is shown.

FAR REQUIREMENT	Amdt Level	COMPLIANCE STATEMENT	MOC CODE	COMPLIANCE DOCUMENT	DOC REV
SUBPART A -		GENERAL			
25.1					
25.2					
SUBPART B -		FLIGHT			
25.21					
25.103					
25.119					
SUBPART C -		STRUCTURE			
25.301					
25.335					
25.391					
SUBPART D -		DESIGN & CONSTRUCTION			
25.601					
25.723					
25.871					
SUBPART E -		POWERPLANT			
25.901					
25.1141					
SUBPART F -		EQUIPMENT			
25.1301					



25.1303					
25.1316					
SUBPART G -		OPERATING LIMITATIONS & INFO			
25.1501					
25.1503					
25.1519					

The following code definition table may be viewed as a guideline:

MOC Codes definitions	
0-Statement	
1-Similarity	
2-Analysis	
3-Calculation	
5-Safety Assessment	
6-Laboratory Tests	
7-Ground Tests on Aircraft	
8-Flight Tests	
9-Inspection	
10-Simulation/Modelling	
11- Equipment Qualification	

#### 4.3 Equipment qualification

Part of the Type Definition is a list of installed equipment including reference to specifications, declaration of design and performance or TSO approvals if applicable. It will clearly identify if the equipment will be certified as part of the aircraft or has obtained TSO authorisation. The TSO Authorisation is the recognition by SACAA that the equipment meets predefined qualification and performance criteria. TSO Approval of the equipment will be treated as a separate process.

For equipment to be certified as part of the Product, the applicant for the TC/STC is responsible for the approval of the equipment as part of the aircraft and its installation. An acceptable means of providing compliance data in support of the equipment and its installation is to show that the equipment meets the appropriate TSO standard.

#### 4.4 Final Declaration of Compliance

After completion of the compliance demonstration, the DO shall declare that it has demonstrated compliance with the applicable type-certification basis and environmental protection requirements.

### 5. SACAA Level of Involvement

The level of involvement of the Authority in a certification project is the selection of specific compliance demonstration items that the Authority will monitor and investigate and the extent of those investigations.

#### 5.1 Rationale supporting SACAA Level of Involvement

The SACAA shall establish its level of involvement at the stage of compliance demonstration for items, or groups thereof, following a safety and environmental risk assessment, taking into account but not limited to the following criteria:

1. The novel or unusual features of the certification project, including operational, organisational and knowledge management aspects.

2. The criticality of the design or technology and the related safety and environmental risks, including those identified on similar designs; and

3. The performance and experience of the design organisation of the applicant in the domain concerned. The agreement between the applicant and the authority is key in determination of LOI items. If necessary, the applicant will be requested to present detailed information during the familiarization meeting with SACAA team whereby the involvement is classified as HIGH, LOW or no classification. The involvement classification must be confirmed or adjusted prior to commencement of certification compliance process.

## 5.2 Monitoring and further SACAA involvement adjustment

The SACAA bases its level of involvement mainly on the initial assessment in the early phase of the certification program and determines the requisite level of involvement. During the certification process, the SACAA will continuously monitor and evaluate whether there are any changes warranting amendment of the existing LOI. When unforeseen problems arise, the SACAA may have to re-evaluate its involvement classification and adjust accordingly. The parties shall notify each other on any change that could affect the classification of SACAA involvement.

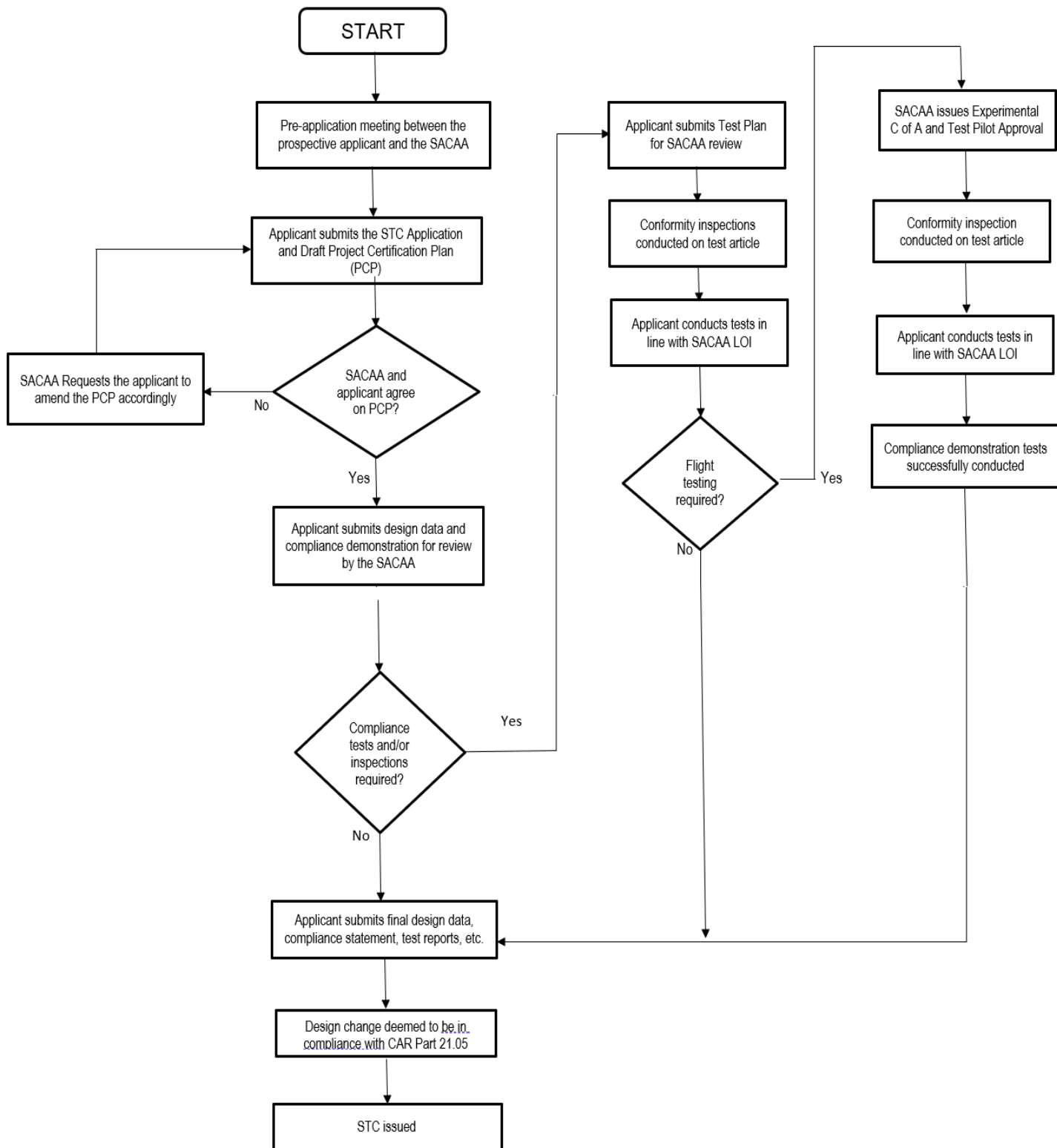
The applicant may likewise add experienced technical specialist, or switch from novel to proven technology or methodology, thereby reducing the SACAA level of involvement. Alternatively, the SACAA may also decide to lower its level of involvement following the initial compliance demonstration. The final decision for level of involvement and, a reference to the rationale thereof should be documented in the modified certification program.

## 6. Approval of Certification Plan

The SACAA and Applicant agree to the provisions of the Certification Plan as indicated by the signature of their duly authorised representatives.

Applicant Project Manager:		
Name:	Signed:	Date:
SACAA Project Engineer:		
Name:	Signed:	Date:

### Appendix B - STC Approval Process Flowchart



## Appendix C - classifications of typical type design changes

### C1 Examples of major modifications per discipline

The information below is intended to provide some examples of major changes per discipline. It is not intended to present a comprehensive list of all major changes. Examples are categorised by discipline and are applicable to all aircraft, engines and propellers. However, a particular change may involve more than one discipline, for example a change to engine controls may be covered in engines and systems (software).

- C1.1 Those involved with classification should always be aware of the interaction between disciplines and the consequences this shall have when assessing the effects of a change (e.g., operations and structures, systems and structures, systems and systems).
- C1.2 Where in this list of examples the words 'has effect' or 'affect(s)' are used, they are to be understood as being the opposite of 'no appreciable effect' as in the definition of minor change.

### C2 Structure

- C2.1 Changes such as a cargo door cut-out, fuselage plugs, change of dihedral, addition of floats.
- C2.2 Changes to materials, processes or methods of manufacture of primary structural elements, such as spars, frames and critical parts.
- C2.3 Changes that adversely affect fatigue or damage tolerance or life limit characteristics.
- C2.4 Changes that adversely affect aeroelastic characteristics.

### C3 Cabin Safety

- C3.1 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:
  - a. changes to or introduction of dynamically tested seats
  - b. change to the pitch between seat rows
  - c. change of distance between seat and adjacent obstacle like a divider
  - d. changes to cabin lay outs that affect evacuation path or access to exits
  - e. installation of new galleys, toilets, wardrobes, etc.
  - f. installation of new type of electrically powered galley inserts
  - g. changes to the pressurisation control system which adversely affect previously approved limitations.

### C4 Flight

- C4.1 Changes which adversely affect the approved performance, such as high-altitude operation, brake changes that affect braking performance.
- C4.2 Changes which adversely affect the flight envelope.

C4.3 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.

## C5 Systems

C5.1 For systems assessed under FAR or CS 25.1309 or equivalent, the classification process is based on the functional aspects of the change and its potential effects on safety.

C5.2 Where failure effect is 'Catastrophic' or 'Hazardous', the change should be classified as major.

C5.3 Where failure effect is 'major', the change should be classified as major if:

- a. aspects of the compliance demonstration use means that have not been previously accepted for the nature of the change to the system
- b. the change affects the pilot/system interface (displays, controls, approved procedures), or
- c. the change introduces new types of functions/systems such as GPS primary, TCAS, Predictive windshear, HUD.

C5.4 The assessment of the criteria for software changes to systems also needs to be performed.

C5.5 When software is involved, and where a change is made to software produced in accordance with the acceptable aviation guideline the change should be classified as major if any 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
- 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.

C5.6 For all software codes the foregoing principles are applicable and due consideration should be given to specific certification specifications/interpretations.

C5.7 A change to a system should be classified as minor where the failure effect would have no adverse safety implications of any flight operation.

## C6 Propellers

C6.1 Changes related to:

- a. diameter
- b. airfoil
- c. planform
- d. material
- e. blade retention system, etc.

## C7 Engines

C7.1 Changes:

- a. that adversely affect operating speeds, temperatures, and other limitations
- b. that affect or introduce parts identified by CS E-510 or FAR 33.75 where the failure effect has been shown to be hazardous
- c. that affect or introduce engine critical parts or their life limits
- d. to a structural part which requires a re-substantiation of the fatigue and static load determination used during certification
- e. to any part of the engine which adversely affects the existing containment capability of the structure
- f. that adversely affect the fuel, oil and air systems, which alter the method of operation, or require reinvestigation against the type-certification basis
- g. that introduce new materials or processes, particularly on critical components.

## **C8 Rotors and drive systems**

### **C8.1 Changes that:**

- a. 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:
  - i. rotor blades
  - ii. rotor hubs including dampers and controls
  - iii. gears
  - iv. drive shafts
  - v. couplings
- b. affect systems the failure of which may have hazardous or catastrophic effects. The design assessment shall include:
  - i. cooling system
  - ii. lubrication system
  - iii. rotor controls
- c. adversely affect the results of the rotor drive system endurance test, the rotor drive system being defined in applicable airworthiness design standards.
- d. adversely affect the results of the shafting critical speed analysis required by the applicable airworthiness design standards.

## **C9 Environment**

C9.1 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 a major change, are listed below. The examples are not exhaustive and shall not, in every case, result in an appreciable change to the product's environmental characteristics, and therefore, shall not per-se and in every case result in a major change classification.

C9.2 An appreciable effect is considered to be one which exceeds the ICAO criteria for a no- acoustical change or a no-emissions change or no-CO<sub>2</sub> change. For the definition of a no-acoustical change or no-emissions change or no-CO<sub>2</sub> change, refer to the section of the ICAO Environmental Technical Manual, Volume I, II and III .

C9.3 Noise

C9.3.1 A change that introduces either:

- a. an increase in the noise certification level(s), or
- b. a reduction in the noise certification level(s) for which the applicant wishes to take credit

C9.3.2 Examples of noise-related changes that might lead to a major change classification are:

- a. For jet and heavy (maximum take-off mass greater than 8618 kg) propeller-driven aeroplanes:
  - i. A change that might affect the aircraft's take-off performance including:
    - A. a change to the maximum take-off mass
    - B. a change to  $V_2$  ('take-off safety speed'), or
    - C. a change to the lift augmentation devices, including their configuration under normal take-off operating conditions.
  - ii. A change that might affect the aircraft's landing performance including:
    - A. a change to the maximum landing mass
    - B. a change to  $V_{REF}$  (reference landing speed), or
    - C. a change to the lift augmentation devices, including their deployment under normal landing operating conditions.
  - iii. A change to the Centre of Gravity (CG) limits
  - iv. A change that increases the aircraft's drag
  - v. 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
  - vi. 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)
  - vii. A change of engine or, if fitted, propeller type
  - viii. A change in engine thrust rating
  - ix. A change to the engine rotating parts or stators, such as geometry, blade profile or blade number
  - x. A change to the aerodynamic flow lines through the engine
  - xi. A change that affects the engine thermodynamic cycle, including a change to the engine's bypass ratio
  - xii. A change to the engine nacelle, including a change to the acoustic liners
  - xiii. A change to the engine exhaust
  - xiv. A change to the engine bleed valves, including bleed valve scheduling
  - xv. 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)
  - xvi. 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)
  - xvii. A change to the propeller pitch and/or propeller speed during a normal take-off or approach
  - xviii. A change that causes a change to the angle at which air flows into the propeller.
- b. For light (maximum take-off mass 8618 kg or less) propeller-driven aeroplanes:
  - i. A change that might affect the aircraft's take-off performance including:
    - A. a change to the maximum take-off mass
    - B. a change to the take-off distance
    - C. a change to the rate of climb, or
    - D. a change to  $V_y$  (best rate of climb speed).
  - ii. 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.)

- iii. A change of engine or propeller type
- iv. 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
- v. A change to the highest power in the normal operating range ('top of green arc')
- vi. 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
- vii. A change to the engine inlet or exhaust including, if fitted, the inlet or exhaust muffler
- viii. A change in propeller diameter, tip shape, blade thickness or the number of blades
- ix. The installation of a variable or adjustable pitch propeller in place of a fixed pitch propeller and vice versa
- x. A change that causes a change to the angle at which air flows into the propeller.

c. For helicopters:

- i. 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)
- ii. 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)
- iii. A change to the maximum take-off engine power or maximum continuous power
- iv. A change to the gearbox torque limits
- v. A change of engine type
- vi. A change to the engine intake or exhaust
- vii. A change to the maximum normal operating rpm of the main or tail rotors
- viii. A change to the main or tail rotors, including a change in diameter, blade thickness or blade tip profile.

#### C9.4 Emissions

C9.4.1 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. a change in engine thrust rating
- b. a change to the aerodynamic flow lines through the engine
- c. 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))
- d. a change to the compressor that might influence the combustor inlet conditions and engine overall pressure ratio
- e. a change to the combustor design (geometry)
- f. a change to the cooling of the combustor
- g. a change to the air mass flow through the combustor
- h. a change that affects the fuel spray characteristics.



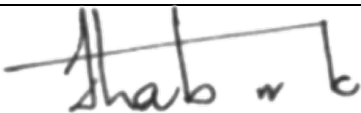

#### C10 Power plant Installation

C10.1 Changes which include:

- a. control system changes which affect the engine/propeller/airframe interface
- b. new instrumentation displaying operating limits
- c. modifications to the fuel system and tanks (number, size and configuration)



d. change of engine/propeller type.

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