

TECHNICAL GUIDANCE MATERIAL

for

Modifications

SUBJECT: TECHNICAL GUIDANCE MATERIAL FOR MODIFICATION

EFFECTIVE DATE: 10 May 2024

1. APPLICABILITY

This guidance material is applicable to Approved Maintenance Organisations (AMO), Approved Design Organisation (ADO), Aircraft Owners/Operators and other related Aviation Industry

2. PURPOSE

The purpose of this technical guidance material (TGM) is to provide procedural guidelines concerning the planning and conducting a modification on type certified aircraft or aeronautical products.

3. REGULATION REQUIREMENTS

Part 43: General Maintenance Rules, Subpart 2: 43.02.15

4. REFERENCE:

- i. ICAO Annex 8
- ii. Part 147 of the SACARs; Design Organisation
- iii. Part 185 of the SACARs, Legal and Compliance.
- iv. Part 187 of the SACARs, Fees.
- v. Part 21 of the SACARs; Certification of Products
- vi. Part 43 of the SACARs; GMR
- vii. SACATS 43, SACATS

5. TERMS AND ABBREVIATIONS:

TERM	DEFINITION
Aircraft	Means an aircraft as defined in the Act, including its engine, propellers, rotor, components, parts, equipment, instruments, accessories, and materials
Aircraft Type	Means all aircraft of the same basic design, including all modifications thereto, except those modifications which result in a change in handling or flight characteristics.
Airworthiness Data	Means any information necessary to ensure that an aircraft or aircraft component can be maintained in an airworthy condition; means the National Airworthiness Authority of the certifying
Applicant	Means the applicant who is the legal entity i.e design Organisation approval holder (ADO), aircraft maintenance Organisation (AMO)
Approved Data	Means data that can used to substantiate modifications derived from the following: <ul style="list-style-type: none"> • Type certificates data sheets

	<ul style="list-style-type: none"> • Supplemental type certificates data provided that it specifically applies to the item being modified or altered. • Airworthiness directives • Airframe, engine, and propeller manufacturers approved maintenance manuals and/or instructions
Authority	Authority of the certifying
Design Change	A change in the approved design of an aircraft, aircraft engine or propeller.
Modification	<p>means a change in the physical characteristics of aircraft, accomplished either by a change in production specifications or by alteration of items already produced.</p> <p>i. a minor modification is a design change that has a negligible, or no appreciable, effect on the mass, balance, structural strength, reliability, operational characteristics, or other characteristics affecting the airworthiness of the aeronautical product. The accomplishment of minor modifications normally involves use of standard or generally accepted practices.</p> <p>ii. a major modification has an appreciable, or other than negligible, effect on the airworthiness of an aeronautical product. The effect of a major modification is usually confined to a single area, system or component of an aircraft, engine or propeller</p>
Product	products or types of aircraft referred to in Part 21
ABBREVIATION	DESCRIPTION
AD	Airworthiness Directive
ADO	Approved Design Organisation
AED	Aircraft Engineering Department
AFM	Aircraft Flight Manual
AML	Approved Model List
AMO	Approved Maintenance Organisation
ARC	Authorised Release Certificate
ASO	Aircraft Safety Operation
C of A	Certification of Airworthiness
CAA	Civil Aviation Authority
CAR	Compatibility Assessment Report
CAR	Civil Aviation Regulation
CCA	Commissioner of Civil Aviation
COTS	Commercial/Off-The-Shelf Products
CRMA	Certificate Relating to Maintenance of an Aircraft
DAR	Designated Airworthiness Representative
EASA	European Aviation Safety Agency
EFT	Electronic Funds Transfer
ELA	Electrical Load Analysis
ELT	Emergency Locator Transmitter
EMI	Electromagnetic Interference
FAA	Federal Aviation Administration
FMAC	Final Modification Approved Certificate
FMAL	Final Modification Approved Letter
ICA	Instructions for Continued Airworthiness
ICAO	International Civil Authority Organisation
ICO	International Civil Organisation
IIM	Installation Instruments Manual
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NAA	National Aviation Authority
OEM	Original Equipment Manufacture
POH	Pilot's Operations Handbook
SACAA	South African Civil Aviation Authority
SACAR	South African Civil Aviation Regulators
SACATS	South African Aviation Technical Standards
SM	Senior Manager
STC	Supplemental Type Certificate
TGM	Technical Guidance Material

6. GENERAL

6.1. BACKGROUND

- 6.1.1. After issuance of an initial or original type certificate, there are many activities that can be performed or required by the type certificate holder, the State of Design, the State of Registry, air operators and other design organisations that will result in the modification of an aeronautical product. For example, the type certificate holder may want to develop a model derivative of the same aeronautical product, or an aircraft owner or air operator may want to replace an aircraft's existing navigation systems with state-of-the-art technology.
- 6.1.2. Modifications are intended to change a function, operation, limitation, performance, and/or characteristic of the physical or functional element(s) of an existing aircraft, engine and/or propeller for the purpose of achieving a desired feature, role, or capability for the affected aeronautical product. Modifications will vary in design philosophy, application technology, complexity, and magnitude.
- 6.1.3. As per the regulations referenced above (Section 1) the SACAA does not accept modification and design data generated by organisations not approved to design such changes. Only design data generated by organisations approved to design such changes (ADO) will be eligible as substantiation data to the applications for modification approval.
- 6.1.4. Although such data may be submitted by the applicant (AMO) or the ADO, it is important to note that the design data as generated by the ADO will only be considered if it is a complete pack and properly approved and released by the ADO concerned.

6.2. CLASSIFICATION

- 6.2.1. Design changes must be classified as either major or minor modification. A minor modification is one that has no appreciable effect on the weight, balance, structural strength, reliability, operational characteristics, or other characteristics affecting the airworthiness of an aircraft, aircraft engine or propeller. All other changes are major modifications.
- 6.2.2. On some occasions, the classification process is initiated at a time when some data necessary to make a classification decision is not yet available. Therefore, the applicant should wait for availability of data before making a decision. Wherever there is doubt as to the classification of a change, SACAA should be consulted for clarity. The reasons for a classification decision should be recorded and retained with the technical data for the design.
- 6.2.3. A complete classification checklist should be submitted together with the substantiation data.

6.3. APPLICATION

The modification approval process whether requiring data and installation approval or if using already approved data (i.e. STC) remains the same.

6.4. SUBMISSION OF APPLICATION

- 6.4.1. An applicant must submit a properly completed, latest application form (Form Number: CA 43-14) accompanied by proof of payment to eng@caa.co.za . Proof of payment can be through a stamped application form if payment was done at any of the SACAA counters or evidence of EFT payment.
- 6.4.2. Payment done through internet banking. No technical data (substantiation material) shall be submitted with the application form.

Note: For efficient processing of modification information, applicants must submit applications in advance, at least Fifteen (15) working days before installation is initiated or anticipated. For administrative purposes, no substantiation data must be submitted with the application form.

6.5. ACKNOWLEDGEMENT OF RECEIPT OF THE APPLICATION

The SACAA's allocated project leader will acknowledge receipt of the application and request that all communications and supporting data be submitted directly to him/her for review.

6.6. SUBMISSION OF SUPPORTING DATA (TECHNICAL DATA)

The applicant must submit the required supporting data or complete work-pack to the allocated SACAA project leader within Thirty (30) days after acknowledgement of receipt of the modification approval application. The allocated project leader will provide feedback within Ninety (90) days. The AMO can also make use of the DAR system to expedite the acceptable approval process.

6.7. MINIMUM SUPPORTING DATA (minor design change)

- 6.7.1. In the case of a modification approval application requiring data for installation approval, the applicant must submit a complete design pack as follows *but not limited to the below list*, which is properly approved and released by the ADO concerned:

- a. Certification Plan & Certification Basis
- b. Compatibility Assessment report
- c. ARC (8130 or EASA Form 1. etc)
- d. CRMA / Logbook entry
- e. Ground/ Functional test results ELA / Structural analysis
- f. EMI / EMC
- g. Mass & Balance report
- h. Installation Instructions Manual
- i. MDL (Master Data List)
- j. For ELT substantiation (proof of registration must be provided)
- k. Hazard Assessment report
- l. ICA (Instructions for continuing airworthiness)
- m. CA 43-04 Signed by Quality Head

6.8. MINIMUM SUPPORTING DATA (approved data)

- 6.8.1. In case of an application where the applicant is using already approved data (STC), the applicant (AMO) must submit a complete post installation documentation pack as follows *but not limited to the below list*, bearing evidence of approval by its Quality Department representative or the relevant certifying person:

- a. STC
- b. Permission letter

- c. AML
- d. Compatibility Assessment report
- e. ARC (CA 21-19, 8130 or EASA Form 1. etc)
- f. Test Report
- g. ELA / Structural analysis
- h. EMI / EMC
- i. Mass & Balance report
- j. Equipment List
- k. Installation Instructions Manual
- l. Master Data list
- m. ELT substantiation (proof of registration must be provided)
- n. ICA
- o. CRMA or Logbook Entry
- p. CA 43-04 Signed by Quality Head

6.9. EVALUATION OF SUPPORTING DATA

- 6.9.1. The SACAA will evaluate the submitted substantiation data to find compliance with the appropriate airworthiness design standards and regulatory framework. Feedback will be provided within Ninety (90) days after receipt of substantiation data. This may include inspections of the aircraft or product concerned.
- 6.9.2. A modification may require an amendment to the type certificate or STC, if:
 - a. there's a potential impact of the proposed modification on the aircraft's performance, systems, and structure.
 - b. it will affect the aircraft's flight characteristics, handling qualities or safety.
 - c. it will require changes to the aircraft's systems or structure.
 - d. the TCDS contains detailed information about the aircraft's design, including its approved configuration and limitations.
- 6.9.3. It will specify the allowable modifications that can be made without requiring an amendment to the type certificate or STC.
- 6.9.4. Contact with the State of Design as part of the assessment of a repair or modification if necessary.
- 6.9.5. If the modification is minor and does not significantly alter the noise-producing characteristics of the source, then the impact of noise requirements will likely be minimal. In this case, the modifications can be made without significant concern for noise requirements, as the changes are unlikely to cause the source to exceed the noise limits.
- 6.9.6. On the other hand, if the modification is major and significantly alters the noise-producing characteristics of the source, then the impact of noise requirements can be significant. The modifications may cause the source to exceed the noise limits, which can result in regulatory non-compliance and potential fines or other penalties.
- 6.9.7. In either case, it is important to consider noise requirements when making modifications to a source, and to take appropriate measures to ensure compliance with applicable regulations and standards. This may involve implementing noise-reducing technologies or making other changes to the source to minimize noise levels.
- 6.9.8. To evaluate the impact of mass and balance, firstly, it is important to fully understand the modification(s) being made. This includes understanding how the modification(s) will affect the aircraft's mass and balance. Secondly, if the modifications are found to have a significant impact on the aircraft's weight and balance, adjustments may need to be made. This could involve adding or removing weight from the aircraft, relocating components, or making other modifications to ensure the aircraft remains within its weight and balance limits. Finally, it's important to document any changes made to the aircraft's weight and balance. This documentation should be updated in the weight and balance manual, and pilots should be made aware of any changes that may affect the aircraft's performance or handling.

Note: AMOs are advised to make use of the DAR system for expedition.

6.10. COMPATIBILITY ASSESSMENT

- 6.10.1. A Compatibility Assessment is a process carried out by an Aircraft Maintenance Organisation (AMO) or an Approved Design Organisation (ADO) to ensure that any modifications made to an aircraft or aircraft component do not compromise the aircraft's safety, performance, or compliance with applicable regulations and standards.
- 6.10.2. The purpose of a Compatibility Assessment is to evaluate the compatibility of the proposed modification with the aircraft's existing systems, structures, and components. The assessment is typically carried out by a team of qualified engineers and technicians who review the modification design, analyse the potential impact on the aircraft, and identify any necessary changes or adjustments that need to be made to ensure compatibility.
- 6.10.3. The assessment typically involves a review of technical data, such as engineering drawings, specifications, and test reports, as well as a physical inspection of the aircraft or component. The team may also conduct simulations or tests to evaluate the modification's impact on the aircraft's performance or behaviour.
- 6.10.4. Once the assessment is complete, the AMO or ADO will issue a report detailing the findings of the assessment and any recommendations or requirements for modification. This report will serve as the basis for obtaining regulatory approval for the modification.
- 6.10.5. Overall, a Compatibility Assessment is a critical step in the modification process to ensure that the aircraft remains safe, airworthy, and compliant with applicable regulations and standards.

6.11. COMMERCIAL/OFF-THE-SHELF PRODUCTS (COTS)

- 6.11.1. COTS parts/products are parts that are generally not developed for airborne system purposes, and their design has not been approved under SACARS Part 21 nor produced under the production or manufacturing approval. Most COTS products are not developed to meet aviation design and development assurance standards and, therefore, there are risks associated with their use in an aircraft system or equipment.
- 6.11.2. An increasing number of manufacturers are offering products that are not designed or meant for aviation use, such as multifunction displays and radios. These products generally lack any formalised configuration control from the manufacturers, which may imply that:
- 6.11.3. Equipment initially fitted during a modification may differ significantly to an item purchased at a later date as a replacement part.
- 6.11.4. Embedded software may not have been verified against a known standard or tested to ensure that all software functions operate correctly without producing unexpected outcomes. Manufacturers may also change and improve the software at any time. This software may appear to function correctly but may contain latent errors.
- 6.11.5. Manufacturers may not intend to support the existing equipment configuration in the longer term.
- 6.11.6. A modification/repair design may include COTS parts, however, the requirements for approval of the proposed design applies to the entire design, including the COTS parts/ component detail design and verification of the overall design process.
- 6.11.7. The design, including the COTS part, must comply with the applicable airworthiness standards for the design. The safety effect, therefore, must be within the limits defined by the applicable airworthiness standards.

6.12. TRACEABILITY OF AIRCRAFT PARTS AND COMPONENTS

- 6.12.1. The following guidance is for the documentation to be provided by the applicant AMO to ensure the traceability of new or used aircraft parts and components to be approved for installation in an aircraft:

- 6.12.2. New Parts: Component Release Certificate (FAA 8130, EASA Form 1, or equivalent) attesting that the part or component is in a new condition.
- 6.12.3. Used Parts: Component Release Certificate (FAA 8130, EASA Form 1, or equivalent) attesting that the part or component is in a serviceable condition/ Released to Service/Overhauled.
- 6.12.4. Other traceability documents that may be requested include traceability back to birth or back to the last logbook entry from the last aircraft that the aircraft parts or components were installed or removed from.
- 6.12.5. The aircraft parts and components removed from an aircraft with the intention to install in a new aircraft or put away in storage should be in a serviceable condition and from an airworthy aircraft.

Note: Approved parts are eligible for installation on a specific aircraft if they meet the approved design data applicable to the aircraft on which they are to be installed

6.13. MODIFICATION THAT MAY HAVE FLIGHT TEST IMPLICATIONS WOULD INCLUDE:

- 6.13.1. Any modification that influences the performance or handling characteristics of the aircraft.
- 6.13.2. Any systems change with the potential to affect aircraft operation or that have consequences for the pilot and crew.
- 6.13.3. Any change that results in amendment to the Aircraft Flight Manual (AFM)
- 6.13.4. However, the need for flight testing should be considered in relation to the proposed modification. The applicable airworthiness requirements, and the regulations.

6.14. MODIFICATION THAT MAY HAVE FLIGHT TEST IMPLICATIONS WOULD INDLUDE:

- 6.14.1. Any modification that influences the performance or handling characteristics of the aircraft.
- 6.14.2. Any systems change with the potential to affect aircraft operation or that have consequences for the pilot and crew.
- 6.14.3. Any change that results in amendment to the Aircraft Flight Manual (AFM).
- 6.14.4. However, the need for flight testing should be considered in relation to the proposed modification. The applicable airworthiness requirements, and the regulations.

6.15. ADDITIONAL INFORMATION TO CONSIDER

6.16. LIMITATIONS

Detail out any limitations affecting the approval, such as limited cycles, flight hours, calendar time, operating limitations (airspeed, flight rule etc.) airworthiness limitations (mandatory inspections). If limitations are applicable to the modification, then the SACAA will stipulate such limitations on the Final Modification Approval Letter.

6.17. A CHANGE TO FLIGHT MANUAL

- 6.17.1. Must be developed and approved for designs which information is necessary for safe operation because of design, operating, or handling characteristics, such as:
 - a. designs that result in a change to limitations, procedures, performance, or loading information specified in the current AFM, pilot's operating handbook (POH) or placards.

- b. designs that include new equipment, modify equipment, or change the crew/aircraft interface or the aircraft configuration and for which the pilot would need additional information for the safe operation of the equipment or the aircraft.

6.18. MODIFICATION TRANSFER

- 6.18.1. The holder of a modification design approval may transfer the approval to another person, with the written agreement of the other person.
- 6.18.2. If an approval is transferred to another person, then a copy of the records required to be kept under such regulation must be provided to the new holder.
- 6.18.3. The new holder becomes responsible for the records. The new holder also becomes responsible for all the other ongoing obligations associated with the approval, including defect reporting under such regulation, and providing up to date ICA and AFM amendments.

6.19. RESPONSIBILITY OF THE HOLDER OF MODIFICATION APPROVAL

- 6.19.1. The holder of the modification approval remains responsible for the continued integrity of the design change to approved type design and it or its representative must continue to be the SACAA's contact point for resolving issues that may require corrective action.
- 6.19.2. To fulfil this responsibility, the holder should have the continued capability, or access to a capability, of providing appropriate technical solutions for service difficulties when service experience warrants it, or when the SACAA requires mandatory corrective action.
- 6.19.3. If the holder is no longer capable, the SACAA must act accordingly. If the approval is transferred to another holder, the SACAA should determine that the new holder is capable of fulfilling the minimum responsibilities described herein.

6.20. INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

- 6.20.1. The Aircraft Inspection Department (AID) may be involved in the approval of Instructions for Continued Airworthiness (ICA) related to minor modifications in the following way:
 - a. The AID may review the proposed modification to determine if it is considered a minor modification or not.
 - b. This determination may be based on the level of impact that the modification will have on the aircraft's systems, structures, or operations. If the modification is considered a minor one, then the AID may not need to be involved in the approval process.

Note: *AID is mostly involved where there is a major change that has an impact on maintenance limitations.*

6.21. SUSPENSION OR CANCELLATION

- 6.21.1. Suspension or Cancellation of modification approval may be carried out in accordance with SACARs Part 185
- 6.21.2. A modification approval may be suspended or cancelled if,
 - a. it was erroneously issued.
 - b. there is a safety concern with the modification.

6.22. FEEDBACK ON ASSESSMENT OF SUPPORTING DATA

The SACAA will provide feedback after evaluation of the submitted substantiation data and it is expected that the applicant to rectify the shortcomings identified during evaluation and provide evidence of rectification to the SACAA project leader at least within Thirty (30) days from the date of SACAA feedback notification.

6.23. MODIFICATION INSPECTION

- 6.23.1. The applicant should give the SACAA access to the aeronautical product being modified in order to make any inspections, tests, and engineering assessments that may be necessary to determine compliance with the approval basis of the modification.

6.23.2. The inspection is to assure that the modification and its relationship to other previous modifications on an aeronautical product comply with the design requirements, however, the applicant should perform its own inspection and test necessary to demonstrate compliance, prior to presenting the modified aeronautical product to the AED for testing or evaluation.

6.24. APPROVAL

6.24.1. The approval of the modification means that:

- a. the airworthiness requirements affected by the modification meet all the relevant requirements specified in the certification basis, including special conditions of airworthiness issued by the SACAA.
- b. all engineering and conformity inspections have been completed and the modified aeronautical product has been found to meet all pertinent requirements; and
- c. in the case of aircraft, the modified aircraft has been test flown, as required, and found to comply with all the performance requirements of the pertinent airworthiness standards.

6.24.2. Unless the modification design has been approved by either: SACAA or DAR (acting in accordance with SACAR Part 43.02.15); the aircraft is not considered to be following the Regulations and, since the airworthiness cannot be established, it is not permitted to fly.

6.24.3. Following a successful demonstration of compliance by the applicant, the SACAA will make a finding of compliance and conclude the approval process. The approval process is then concluded by the issuance of a modification approval letter.

Note: The hours worked on the supporting data review & inspections will be invoiced to the applicant using the hourly rate as per Part 187.

6.24.4. If limitations are applicable to the modification, the SACAA will stipulate such limitations on the Final Modification Approval Certificate.

6.25. CANCELLATION OR DECLINATION





6.25.1. The SACAA will approve applications found compliant and cancel or decline applications not meeting the requirements and will also provide reasons for cancellation or declination of such applications.

Note: Although the current regulations do not prohibit modifications on aircraft prior to written approval by the DCA; DARs, aircraft owners and maintenance Organisations shall be cognisant that unapproved modifications invalidate the certificate of airworthiness (C of A) of the aircraft concerned.

6.26. RECORDS

The applicant, AMO, ADO and Aircraft Owners/Operators should keep all records of approvals for modification design and installations not limited to supporting data submitted with the application.

7. DOCUMENT AUTHORIZATION

DEVELOPED BY:		
	LESEDI MOFOKENG	10 MAY 2024
SIGNATURE OF CE:	NAME IN BLOCK LETTERS	DATE
REVIEWED BY:		
	THANDI MOFOKENG	10 MAY 2024
SIGNATURE OF M: AED	NAME IN BLOCK LETTERS	DATE
VALIDATED BY:		
	LOBANG THABANTSO	10 MAY 2024
SIGNATURE OF SM: AIR	NAME IN BLOCK LETTERS	DATE
APPROVED BY:		
	DEAN KHUMALO	10 MAY 2024
SIGNATURE OF E: ASO	NAME IN BLOCK LETTERS	DATE

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