Civil Aviation Safety Authority
of Papua New Guinea

Advisory Circular

AC43-8

Modifications, Repairs and form CA 337

Issue 1

31 October 2022

GENERAL

Civil Aviation Safety Authority Advisory Circulars (AC) contain information about standards, practices and procedures that the Director has found to be an Acceptable Means of Compliance (AMC) with the associated rule.

An AMC is not intended to be the only means of compliance with a rule, and consideration will be given to other methods of compliance that may be presented to the Director. When new standards, practices or procedures are found to be acceptable, they will be added to the appropriate Advisory Circular.

This Advisory Circular also includes Explanatory Material (EM) where it has been shown that further explanation is required. Explanatory Material must not be regarded as an acceptable means of compliance.

PURPOSE

This Advisory Circular provides methods, acceptable to the Director, for showing compliance with the requirements of Part 43 relating to modifications and repairs and provides explanatory material to assist in showing compliance.

RELATED CAR

This AC relates specifically to Civil Aviation Rule Part 43.

CHANGE NOTICE

This AC replaces the Initial Issue, dated 01 July 2002

APPROVAL

This AC has been approved for publication by the Director of Civil Aviation.

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1. Introduction

Anyone who has ventured very far in modifying or changing an aircraft, or any type certificated product, has been confronted with rules, procedures, and terminology that may have been confusing. What is an aircraft modification? How do you determine if a modification is major? What is approved and acceptable data? Who is responsible for determining if a modification is major or if the data is approved? What kind of modification requires a form CA 337? Who can complete a form CA 337? What is the correct procedure for obtaining the various modification approvals? What are the differences between one-aircraft-only approval and an approval for duplication by the original modifier?

There are two reasons for the confusion—

- The innumerable variety of modifications that may be performed on a wide variety of aircraft that range from the very simple to the most complex design
- The wide range of training, experience, ingenuity, technical expertise, and competence of the licensed aircraft maintenance engineers, the holders of inspection authorisations, and the design engineers who are involved in design, approval, performance, and certification for return to service of major modifications.

Before World War II, there were relatively few aircraft and correspondingly few modifications. After the war, many military surplus aircraft were bought by the aviation industry and converted or modified for use in civil aviation. In the 1950's civil aircraft became more complex and more sophisticated equipment became available for them, increasing the number of modifications to adapt older aircraft to the newer equipment. As the age of the aircraft fleet increases, the number of modifications and, in particular, repairs increases to assure the continuing airworthiness of the older aircraft

The modification procedure reflected in the new rules has been taken from the Federal Aviation Administration system and adapted for use in Papua New Guinea.
In summary—

- The data is assessed to determine if it is acceptable technical data or if the data requires approval
- If the data requires approval, the descriptive and substantiating data is submitted to a Part 146 Aircraft Design Organization for approval
- The design organization may approve the data, advise whether the modification is major or not, or recommend that a supplemental type certificate be raised if that is more appropriate for the proposal
- The person embodying the modification must determine if the modification is major, and if so require the holder of an inspection authorisation or an appropriately authorised person to certify the conformity of the modification to the applicable technical data. **[Note: Appendix B specifies a tabulated list of modifications that require approval by the Director prior to its embodiment on PNG registered aircraft]**
- The embodiment of the modification is recorded in the maintenance records. The form CA 337 is included in the maintenance records and a copy forwarded to the CASA.

This process requires a significant amount of judgement. The licensed aircraft maintenance engineer is required to use experience, training, and familiarity with the tasks to determine when external assistance is

required. The holders of inspection authorisations and Part 146 organisations are points of contact to assist the licensed engineer in making these determinations.

This advisory circular provides further guidance in the interpretation of modifications, the requirements to be met before embodying a modification, and the use of the form CA 337.

Note:

*All the information contained in this AC is explanatory material therefore all items may be regarded as tagged **EM**.*

2. General

2.1 Design changes

Most aircraft have been modified or repaired during their life. These modifications and repairs, or design changes, result from improved equipment, increased safety requirements, and increased or different aircraft utilisation.

Part 43 recognises the need for design changes to aircraft and equipment and provides the regulatory requirements that must be met. Where Part 43 provides for this practical application of design changes, Part 21 provides the certification basis and procedures that ensure the configurations of products are approved.

Aircraft and other type certificated products can be changed in a number of ways:

(a) **Changes to the type certificate** - These changes are proposed by the type certificate holder if the design change is significant enough to justify an amended type certificate. Part 21, Subpart C provides the requirements for type acceptance certificate amendments, which in turn are derived from changes to a type certificate, including new power limitations, new speed limitations, new configurations, and new principles of operation.

(b) **Supplemental type certificates** - For design changes that are not significant enough to require a change to the type certificate a supplemental type certificate may be required. *CASA PNG is not a State of Design and therefore Part 21 does not prescribe the requirements in regard to supplemental type certificates.*

(c) **Repairs** - Repairs are normally required to rectify an individual problem and retain the airworthiness of the product. Part 21, Subpart G states that repairs are to be treated the same as modifications for the approval and embodiment requirements of Parts 21 and 43.

(d) **Modifications** - Modifications are design changes that are not changes to type certificates nor supplemental type certificates. Like repairs, modifications are normally individual changes, although under specific conditions a series of aircraft may be modified in accordance with one modification package.

The last type of design change, the modification, is probably the most common and this advisory circular provides guidance on—

- the process of applying for the approval of a modification by the approval of the associated technical data; and
- determining if a modification is major or not; and
- completing the form CA 337.

2.2 Definitions

For the purpose of this Advisory Circular, the following definitions apply:

IA means the holder of a inspection authorisation;

LAME means a licensed aircraft maintenance engineer;

Maintenance, in relation to an aircraft or aircraft component, means all work and inspections performed to ensure the continued airworthiness of the aircraft or aircraft component, and all modifications:

Major modification means a modification that, where potentially, incorrect embodiment could affect the safety of an aircraft or its occupants through one or more of the following incidents occurring—

- structural collapse
- loss of control
- failure of motive power
- unintentional operation of, or inability to operate, any systems or equipment essential to the safety or operational function of the aircraft
- incapacitating injury to any occupant
- unacceptable unserviceability or maintainability:

Major repair means a repair where potentially, incorrect embodiment could affect the safety of an aircraft or its occupants through one or more of the following incidents occurring —

- structural collapse
- loss of control
- failure of motive power
- unintentional operation of, or inability to operate, any systems or equipment essential to the safety or operational function of the aircraft
- incapacitating injury to any occupant
- unacceptable unserviceability or maintainability:

Technical data are drawings, instructions, or other data required to be used for product certification, approvals, and authorisations under Part 21 or for the maintenance, modification, and repair of products, their components, and appliances under Part 43.

2.3 Conduct of maintenance

Part 91 requires that an aircraft be maintained in an airworthy condition. An airworthy condition is the condition of an aircraft, including its components, fuel, and other materials and substances essential to the manufacture and operation of the aircraft, that ensures compliance with all the requirements prescribed by the Civil Aviation Rules relating to design, manufacture, maintenance, modification, repair, and safety.

In regard to maintenance, this is achieved by complying with the requirements of Part 43 including the embodiment of any modifications. **[Note: Appendix B specifies a tabulated list of modifications that require approval by the Director prior to its embodiment on PNG registered aircraft]**

Rule 43.53 requires that acceptable methods, techniques, and practices be used in the conduct of

maintenance and that an aircraft be returned to its original or properly modified condition. These requirements are all encompassing and many aspects of maintenance are based upon them. In relation to these requirements, modifications must be embodied so that the applicable airworthiness requirements are met and embodiment is in accordance with acceptable or approved data.
The data must be—

- appropriate for the product, component, or appliance
- directly applicable to the work being carried out
- not conflict with other data provided by the manufacturer of the product or assembly on which the modification is to embodied.

2.4 Recording of modifications

Rule 43.69 requires details of the maintenance to be entered into the appropriate maintenance records.

A description of the work performed should be sufficient in detail to permit a person unfamiliar with the work to understand what was done and the methods and procedures used. In the case of modifications the detail in the technical data package can be fairly extensive and a suitable reference to the modification package would be considered acceptable. This entry should briefly describe the modification and the affected items as well as indicating the modification approval reference.

There are two occasions when the form CA 337 is required. Part 21 requires the use of the form CA 337 for the approval of technical data. Part 43 requires the use of the form CA 337 to record the check of a major modification for conformity with the technical data.

In both cases, to ensure the supporting information is available, the CA 337 used must be included in the maintenance records. The CA 337 provides detail to maintenance persons and the IA when assessing the continuing airworthiness of the airframe, engines, propellers, rotors, and other equipment.

2.5 Acceptable versus approved

The terms acceptable and approved are used in the Civil Aviation Rules and advisory circulars. The interpretation of these terms has been the topic of many discussions.

To have something approved and to have something accepted both require the presentation of that item to the Director. The obvious difference is that the Civil Aviation Rules have defined approved to mean approved in writing by the Director (unless used with reference to another person).

In general—

- Acceptable is used when the CASA does not require constant oversight of the data
- Approved is used when data is required to be specifically controlled by the CASA.

Part 21 Appendix C lists acceptable technical data. This list includes data that has been approved by overseas authorities and is considered acceptable for use in Papua New Guinea. The list also includes that data approved by the Director. This means that data which once approved for a particular application can be regarded as acceptable for further applications without further referral to the CASA provided the same circumstances apply.

Considering data acceptable does not necessarily approve that data for use in a particular application. Acceptable data may not be relevant to the particular aircraft or equipment or type of operation. Part 21 places conditions on the use of acceptable data that include—

- the data must be appropriate to the product, component, or appliance, and directly applicable

to the work being carried out

- for a foreign supplemental type certificate or supplemental type approval, the data must—
  - not introduce a complete new flight manual
  - not re-designated the aircraft type
  - reference a particular type certificate accepted by the Director
- the data provided by the manufacturer of a component must not conflict with data provided by the manufacturer of the product or assembly of which the component is to form a part

In summary—

Acceptable technical data may require a specific approval for use in a particular modification

2.6 Acceptable Technical Data

Subject to the conditions on the use of technical data, the following are acceptable technical data—

- Foreign type certificate data sheets used for the issue of a type acceptance certificate
- Type design data for type certificated products
- Design change data that support a design change approved by the means specified in 21.85
- Data approved by the Director under 21.95
- Data provided by the CAA in an advisory circular
- Airworthiness directives that give specific instructions for modification or repair
- Supplemental type certificates issued by the—
  - United States of America Federal Aviation Administration
  - Australian Civil Aviation Safety Authority
  - Transport Canada
- Supplemental type approvals issued by Transport Canada
- Aeronautical specifications
- Data giving specific instructions for modification or repair contained in a maintenance manual, repair manual, overhaul manual, continuing airworthiness document, service bulletin, or an equivalent provided by the manufacturer of the product for which it is to be used and which is listed in the type certificate or by reference in the type acceptance certificate
- AC43.13-1B and AC43.13-2A, issued by the United States of America Federal Aviation Administration
- Data included in, and specific to the category of, an airworthiness certificate

2.7 Data and maintenance demarcations

What part do the terms approved and major play in the modification process? The terms have distinct, separate applications in the modification process and should not be confused.

The following Sections will expand on the respective terms but in summary—

- Approved is used in reference to a modification's technical data
- Major is used to describe the extent of a modification and its likely consequences if embodied.

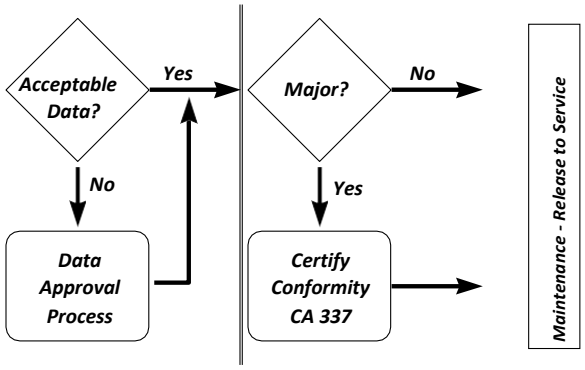

Figure 1. Modification process

Approved

Referring to Figure 1, the process originates with an idea or requirement for a modification. To proceed with embodiment of the modification acceptable or approved technical data must be available. Approval of data is required if—

- the data is not already considered acceptable, and has not already been approved; or
- acceptable data is not applicable to the work being carried out.

The approval of data is a function of the Director but authorised engineering representatives (AERs) with an appropriate authorisation under Part 183 can provide this function. Data must be approved before continuing on the process.

Major

The application of acceptable or approved data must then be assessed for the possible result of a failure. The embodiment of the modification must be assessed against the consequences included in the definition of major modification. Possible consequences are—

- structural collapse
- loss of control
- failure of motive power
- unintentional operation of, or inability to operate, any systems or equipment essential to the safety or operational function of the aircraft
- incapacitating injury to any occupant
- unacceptable unserviceability or maintainability

The assessment is made using the experience and judgement of the maintenance person involved. Consideration should be given to the type of modification, the difficulty of application, the likelihood of an error being introduced, and other safety implications. Once a determination has been made, the IA may have to be consulted and used to certify conformity of the major modification to the appropriate data.

Summary

Clearly, each term describes a different aspect of the modification process. There are, therefore, four possibilities for modifications—

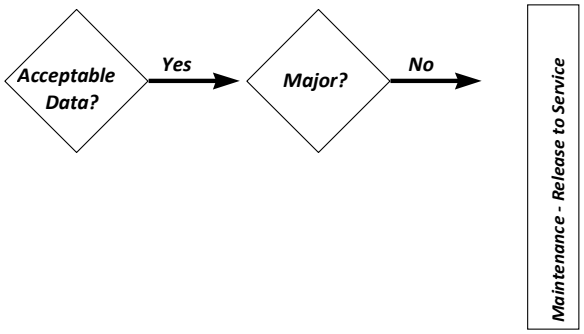

Figure 2. Acceptable data, non-major modification

Acceptable data, non-major modification. In this case the task can be carried out without further reference to the modification process, requirements or the CAA.

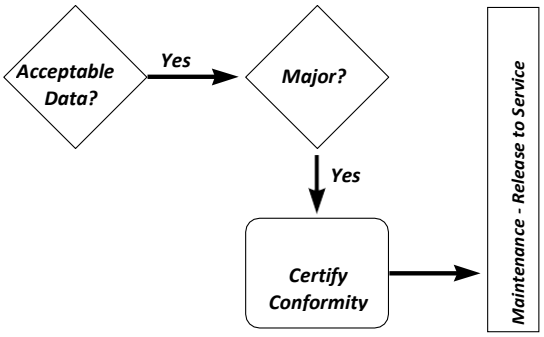

Figure 3. Acceptable data, major modification

Acceptable data, major modification. This requires no approval actions but does require the IA to certify conformity after embodiment on the form CA 337.

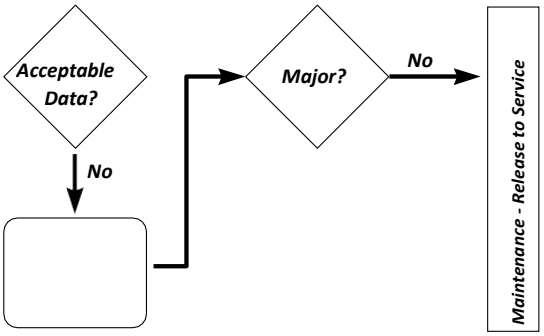

Figure 4. Unapproved data, non-major modification

Unapproved data, non-major modification. Whilst the actual embodiment can be achieved as normal maintenance the data must be approved first using a form CA 337.

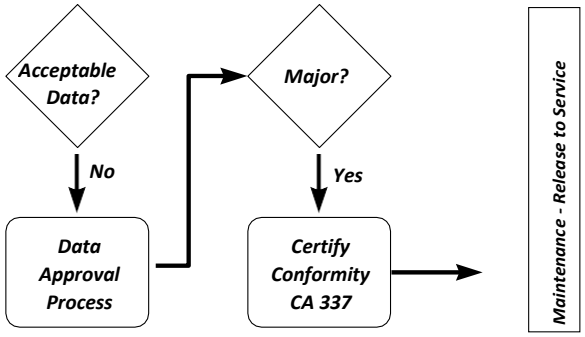

Figure 5. Unapproved data, major modification

Unapproved data, major modification. This is the most common case for a completely new idea and requires not only the approval of the data using a form CA 337, but the certification by an IA upon embodiment on the 337.

3. Section B – Technical Data

3.1 General

In developing a modification, technical data must be found or generated. This data describes and substantiates the design and provides the details for the embodiment of the modification.

Modification data may be developed by any person. The data itself need not be complicated or involved and straightforward descriptions of modifications are very effective. In the more complicated cases a design organisation should be contracted to source, develop, and approve the technical data based upon the customer's requirements. Appendix A to this advisory circular provides examples of modifications that generally require specific engineering design assistance.

The technical data must be assessed against the applicable airworthiness design standards. Part 21 requires compliance with these standards, and other airworthiness requirements, to be indicated by a statement of compliance issued by a design organisation.

Figure 6 shows the data approval process and indicates three possible options for the approval of a design—

- development of the modification by a certificated design organisation, a statement of compliance issued by a design organisation, and subsequent design approval by that organisation
- development of the modification by the originator, a statement of compliance issued by a certificated design organisation, and subsequent design approval by that organisation

Note

The CASA PNG is not a State of Design and thus does not issue statements of compliance.

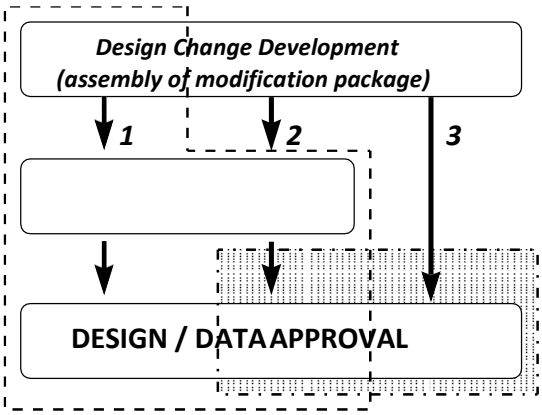

Figure 6. Data approval process

3.2 Sources of data

Information for a modification may be sourced from a number of places. The information may be acceptable itself but require additional substantiation when used in the application proposed. Information sources include—

- a concept from the modifier
- a previously approved modification
- supplemental type certificate data
- type certificate data sheets
- manufacturer's service documents
- airworthiness directives
- airworthiness design standards
- aeronautical specifications
- commercial specifications for non-critical areas
- materials handbooks such as Mil-HDBK-5, Mil-HDBK-17, Mil-HDBK-23, ANC-18, and AvP 970
- Engineering Science Data Unit (ESDU) data sheets
- standard engineering text books and recognised company research materials

3.3 Development of data

As the modification is developed the assembled technical data forms the modification package. This package includes descriptive data, substantiating data, and other data to support the embodiment of the modification. The sections of the package should be clearly identified with references to the applicable airworthiness requirements evident. The package should be included with the CA 337 and submitted to the CASA or Part 146 organisation for assessment and approval.

In developing the data the following aspects should be considered and features included to minimise any potential problems—

Structural requirements. If the structure is reduced, added to, or otherwise changed will its integrity be impaired?

Hazards to the aircraft or its occupants. Is the equipment added, or any associated supporting features, likely to create a danger to the safety of the occupants or the aircraft itself?

Operating aspects. Does the modification fulfil the operating requirement intended and has the integration of any equipment or kits been tested to ensure there are no adverse affects?

Detail design standards. Have the particular airworthiness design standards been met, such as flammability, vibration, noise, and evacuation provisions?

Where the current Papua New Guinea requirement exceeds the original airworthiness design standard, the current Papua New Guinea requirement takes precedent

Descriptive data

Descriptive data is required to be sufficient for the manufacture of parts and the embodiment of the modification. If the modification is limited to a single installation a reduction in descriptive data may be acceptable. Descriptive data should include, where applicable—

- the use and application of the design
- the purpose of the design
- maintenance, operating, and performance data including any limitations for the use of the design
- installation properties including any factors that affect the interaction of the design with other equipment
- references to standards and specifications used during the development of the design
- drawings, diagrams, and other physical descriptions of the design, including—
- special processes and their required outcomes, including—
    - heat treatments
    - surface finishes
    - weld quality
- all dimensions including undercuts, fillet radii, fits and tolerances
- wiring diagrams
- an equipment list that details the parts, including those sourced complete from other places, that make up the completed item by part number, location, and method of attachment
- a summary of particular manufacturing considerations, including—
    - pressures
    - temperatures

- environments
- a reference to the applicable airworthiness requirements
- a list that details the substantiating data for ease of reference

Substantiating data

Substantiating data should include, where applicable—

- load analyses
- failure analyses
- the requirement and suitability of any special processes chosen
- installation considerations
- methodology and results of tests as to the interaction and compatibility between existing units and the new items
- for an avionics design—
  - an electrical load analysis
  - a failure analysis ensuring that essential equipment are sufficiently independent to prevent complete system failure
  - the layout and ergonomics of applicable units, in particular instruments
- performance confirmation
- testing and inspection results
- crashworthiness assessments

Other data

Other data in the modification package should include, where applicable—

- weight and balance
- manufacturing data
- installation data
- maintenance data
- any required document amendments including flight manuals, normal procedures, and emergency procedures

3.4 Inspections and tests

Part 43 requires that the aircraft be returned to its original or properly modified condition. To ensure that the modification embodied performs correctly, inspections and tests are required. These inspections and tests should be detailed in the data and should include procedures for the confirmation that—

- the modified item complies with the applicable airworthiness requirements
- the materials used conform to the applicable specifications

- all components of the modification conform to the drawings in the applicable design

3.5 Weight and balance

Unless the design change results in a negligible weight change then weights and moment arms should be calculated in the description of the change. Alternatively a complete reweigh could be requested of the aircraft after embodiment of the modification.

What is considered negligible varies dependent on the aircraft size and type. The following are considered acceptable guidelines for weight and balance changes—

For aircraft less than or equal to 5700 kg MCTOW—

- a cumulative weight change of up to 1% is considered negligible
- a moment arm change of less than 1% is considered negligible

For aircraft greater than 5700 Kg MCTOW—

- a cumulative weight change of up to ½% is considered negligible
- a moment arm change of less than ½% is considered negligible

3.6 Manufacturing data

The manufacturing details should ensure that the equipment can be produced within the design limits. Considerations should include the application of special processes, particular pressures, temperatures, and environments, and the repeatability of production standards if appropriate.

Manufacturing data for designs that are subsequently sold for incorporation should consider the different environments in which production may be conducted. In many cases the production experienced during a prototype phase will not be achievable subsequently, from either the airworthiness or economic standpoints.

3.7 Installation data

For designs that progress to embodiment there should be some installation data provided. In many cases this is provided in a booklet to assist the person carrying out the work. Although a booklet is not required in all cases, design packages should include considerations for maintenance actions pre- and post- installation, performance testing when installed, and subsequent operation instructions.

3.8 Amendments

Amendments to documents and manuals is an important aspect of a complete design package. Maintenance manuals, illustrated parts catalogues, and flight manuals are documents that may require amendment as a result of a modification being incorporated.

In many cases the manuals will not be controlled by the design organisation and to amend the document would require approval of the issuing organisation. A design package may provide supplements to these types of manuals that would subsequently be provided to the purchaser of the design or equipment manufactured to that design. In many cases, if the design is significant enough to require substantial changes to manuals some liaison with the originator of the manual would be expected.

Flight manual supplements can be approved as part of the modification.

3.9 Approval of data

Proprietary information

After developing the data and constructing a modification package, what happens to the information? To what extent is the data available after it is approved?

The actual approval of a modification is publicly available information. The ownership of a modification is therefore based upon the technical data defining the modification. The developer of a design, the originator, is generally considered to be the owner of the technical data defining the modification.

The actions up to and including the statement of compliance can be taken as being commercially sensitive and owned by the originator.

The approval however, even if carried out in the design organisation, becomes publicly available information. This means that any pages containing the approving signature become public information. This can be extended to the form CA 337 as the form contains approval information. If someone wishes to make the same change on another aircraft a separate form CA 337 is required.

Figure 7 shows the relationship between proprietary information and public information.

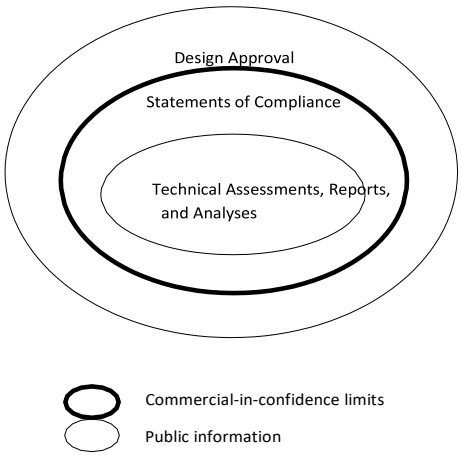

Figure 7. Proprietary information

Persons submitting technical data on the form CA 337 should ensure that information they consider to be commercially sensitive is attached to, rather than entered on, the form CA 337.

The CASA will not question the source or the method by which the originator obtained the technical data. The CASA assumes that any technical data or modification package provided has been developed by, or for, the originator.

In any application to the CASA for modification approval, the technical data is treated as commercial information and only the approval itself is generally available.

Data approval

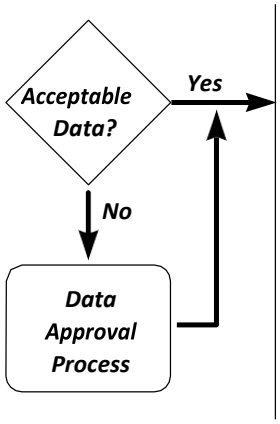

Figure 8. Data approval

Rule 21.85 states that the approval of a modification is by the approval of the technical data. This reinforces the fact that the technical data itself is approved, not the incorporation of that modification. The incorporation of the modification relies on acceptable techniques, methods, and practices in accordance with Part 43.

In most cases approvals will be one aircraft only, although if the data presented with the form CA 337 is in sufficient detail, and the inspections and tests necessary to substantiate compliance with the applicable airworthiness requirements are adequately specified, the approval may be granted to allow the original modifier to duplicate the modification on other identical aircraft makes and models.
The duplication-on-identical-aircraft type of approval may entail an increased amount of inspection and test by the approving person, depending on the nature and complexity of the particular modification. The approval relies on the original modifier's knowledge of the modification to ensure that the modifications are embodied uniformly on the different aircraft.

For the approval of a modification that is intended to be installed by any person on many different aircraft, a supplemental type certificate would be necessary.

Approval will be based upon the modification package meeting the applicable airworthiness requirements. The approving person will consider all aspects of the proposal's design, its application, and its possible results. The extent of the approval will depend on sufficient detail being provided to confirm the modification's performance. A person approving a design may indicate, in their opinion, whether the modification is a major modification or not.

Assessments of technical data may include, but is not normally limited to, the following questions—

- Is each item of the modification—
    - of a kind and design appropriate to its intended function
    - labelled as to its identification, function, or operating limitations, if necessary
    - able to be installed according to limitations prescribed for that item
    - able to be installed so that it functions correctly
- Does the modification—
    - adequately describe the design
    - describe placards and markings that may be required as to identification, function, and operating limitations

- describe any prescribed limitations for the installation of items of the modification
- if the modification is electronic in nature, state that the installation is free of hazards in itself, in its method of operation, and in its effect on existing items
- describe how the equipment will be functionally tested or inspected after installation to determine that it functions properly

4. Major Modifications

Once acceptable data is available, the embodiment of the modification must be assessed for its likelihood to affect the safety of the modified aircraft.

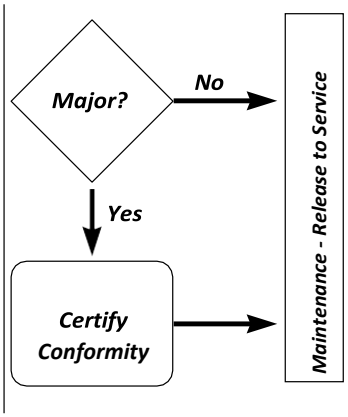

Figure 9. Major modifications

4.1 Embodiment potential

In respect of the modification, the embodiment should be assessed for its potential to cause—

- structural collapse
- loss of control
- failure of motive power
- unintentional operation of, or inability to operate, any systems or equipment essential to the safety or operational function of the aircraft
- incapacitating injury to any occupant
- unacceptable unserviceability or maintainability

In cases where the embodiment is simple and straightforward in nature, having little potential to cause the above problems, the IA is not required. The performance of the task is recorded in the maintenance records. The form CA 337 is required to be included in the maintenance records to indicate that the previously unapproved data has been approved.

If the potential results list above are possible, or the person embodying the modification is unsure, the IA should be consulted and will be required to certify conformity of the modification to the appropriate technical data. **[Note: Appendix B specifies a tabulated list of modifications that require approval by the Director prior to its embodiment on PNG registered aircraft]**

So how is the determination of whether a modification is major made in regard to the potential results?

This assessment relies upon the experience, training, and familiarity with the tasks involved of the licensed aircraft maintenance engineer to determine if the modification is major or not.

To those who do not have training and experience in a particular type of modification, that modification may be considered major. The fact that the effects are unknown, and the engineer knows they are unknown, the possibility of one of the above results would make it a major modification.

Assessment depends on an analysis of the particular modification based on the definition of a major modification. The person performing the modification is primarily responsible for making the determination of whether the modification is major or not.

The assessment should consider the types of effects that could result from the embodiment of the modification. The FAA uses the term *appreciably* when determining if a modification is major or not. This term, when defined as *enough to be perceived or estimated or noticed*, forms a good basis for the assessment.

Modifications that, by their nature, require supplemental type certificates are normally major.

The following sections provide guidance on the application of the term **appreciably** when used in relation to modifications.

4.2 Appreciable effect on weight and balance

What is considered appreciable varies dependent on the aircraft size and type.

The following are considered acceptable guidelines for weight and balance changes—

For aircraft less than or equal to 5700 kg MCTOW—

- a cumulative weight change of up to 1% is considered negligible
- a moment arm change of less than 1% is considered negligible

For aircraft greater than 5700 kg MCTOW—

- a cumulative weight change of up to ½% is considered negligible
- a moment arm change of less than ½% is considered negligible

If a modification does move the weight or centre of gravity outside the existing approved limits, (i.e. the change is not negligible), the modification is major as far as weight and balance is concerned.

4.3 Appreciable effect on structural strength

To assess an appreciable effect on structural strength the types of structure involved must be considered. The types of structure are commonly referred to as—

- **Primary** - that structure whose failure might directly result in one of the potential results listed previously
- **Secondary** - any item that the definition of primary would apply to but which is backed up by an alternative load path
- **Tertiary** - normally unstressed or lightly stressed parts not covered by the previous terms

Modifications to primary and secondary structure normally are considered major as far as structure is concerned. The failure of a change to these types of structure will directly affect the safety of the aircraft. For example—

- Modifications on non-pressurised aircraft that require cutting of metal or plywood stressed skin more than 150 mm in any direction
- Modifications that require drilling or cutting into any pressurised skin
- Modifications that require the making of additional seams in or splicing of skin sheets
- Installation of equipment having an appreciable weight
- Replacement of fabric covering using other than the original types of materials, fasteners, or both.

4.4 Appreciable effect on performance

Any of the following might appreciably affect the performance of an aircraft—

- any change in the external configuration of the basic aircraft design
- any change from the approved aircraft engine-propeller combination
- any change that might appreciably affect the weight or balance
- changes that may restrict or otherwise alter the operation of aircraft, engine, or propeller controls
- modification to any system that may appreciably affect the operation of the engine, propeller, landing gear, or other system

Flight performance can be appreciably affected by changes that might appear to be very insignificant. For example, different rivets or fasteners in wing skins might appreciably affect flight characteristics and also the performance of an aircraft.

4.5 Appreciable effect on engine operation

Any of the following might appreciably affect the operation of an engine—

- changing the cowling design
- changing the shape, size, position, or composition of engine air baffles
- changing the exhaust system
- major changes to the propeller
- fuel system changes that might affect fuel flow
- changes in the engine oil system such as oil filter installations
- changes that affect carburetor air induction
- changes involving engine controls.

4.6 Appreciable effect on flight characteristics

Any alteration that is likely to change the balance of a flight control might appreciably affect flight

characteristics. Changes in the external configuration of fixed and movable control surfaces or of any surface forward of a flight control might affect the proper airflow around the control surface and cause flutter or vibration.

4.7 Other qualities affecting airworthiness

Any of the following might appreciably affect other airworthiness qualities—

- changes to ground or water handling characteristics
- changes to personnel and cargo accommodations
- fire protection for the aircraft and the engine
- vibration characteristics
- functioning of required equipment In

Summary—

A major modification is a modification that, in the installer's estimation, opinion, or judgement, based upon their education, experience, and expertise, might have a noticeable effect on, or produce a noticeable change in, the weight and balance, structural strength, performance, characteristics, or operation of an aircraft or aircraft component.

5. Form CA 337 – Instructions for use

5.1 General

The form CA 337 serves to track the modification process from conception to embodiment. The form CA 337 records data approval and conformity certification. The form should be raised when no acceptable or approved technical data exists, or the use of that data constitutes a major modification.

The form CA 337 provides owners and operators with a record indicating details and approval of major modifications and major repairs and provides the CAA with a copy of the details and approval for their aircraft records.

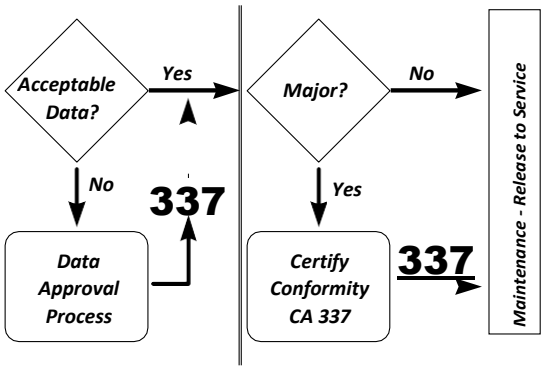

Figure 10. CA 337 Usage

Referring to Figure 10, the two uses for the form CA 337 are—

Technical data approval. Rule 21.85 requires modifications to be approved by the approval of the technical data in accordance with 21.95. The approval of technical data requires the use of the form CA 337.

Conformity certification. Part 43 Subpart E requires that major modifications and major repairs be certified for conformity by a holder of a PNG Part 66 Inspection Authorization (IA), or equivalent authorized person. The IA should determine airworthiness by inspecting major repairs or major modifications for conformity to approved technical data and compatibility with previous repairs or modifications made to the aircraft.

5.2 Process

The person wishing to perform a modification or repair should determine if acceptable data is available prior to commencement of the work. If there is no acceptable data, or the acceptable data is not applicable to the work being carried out, the form CA 337 must be raised and submitted with the descriptive, substantiating, and other data entered on, or attached to, the form. The technical data and the form CA 337 comprise the modification package or repair scheme described in more detail above.

The data must be approved by the CASA or an Authorised Engineering Representative appointed under Part 183 for approval of design changes. An IA cannot approve data. The approving person will assess the content of the modification package and, depending on the requirements of the originator and the detail of the package, approve the data for incorporation on one or more aircraft. The approving person may also suggest whether the modification or repair constitutes a major modification or major repair.

Once the technical data has been approved, the person wishing to perform the modification or repair should determine whether the work is major or not. This is discussed in more detail in the preceding section.

The work may be performed by a person in accordance with Part 43 but if the modification or repair is determined to be major, an IA is required to subsequently certify conformity on the form CA 337. The form CA 337 should include the technical data used and a description of the work completed to embody the modification or repair.

The inspection of a major modification or major repair by an IA consists of the following basic operations—

- determining that the modification or repair has acceptable or approved data
- inspecting the configuration of the modification or repair for conformity to the technical data and the maintenance performance standards of Part 43
- ensuring that the aircraft still complies with the applicable airworthiness requirements and the modification or repair does not conflict with other installations
- where applicable, ensuring a flight manual supplement is added to the aircraft flight manual
- determining that the proper aircraft maintenance record entries have been made and that the weight and balance data and equipment list has been revised, when appropriate. A statement on the form CA 337 should reflect any such revisions
- certifying conformity in Block 7 of form CA 337 and returning it to the person who performed the work for distribution as below

After inspection and certification by the IA the form CA 337 is returned to the person who performed the work who should then—

- give a signed copy to the aircraft owner to be entered in the aircraft maintenance records
- make the proper entry in the aircraft maintenance records making reference to the form CA 337
- forward a copy of the form CA 337 to the CASA within seven days.

If the form CA 337 has been completed for an aircraft component, a copy of the form should be attached to the component until it is installed on an aircraft. The person installing the component should then—

- complete the CAA Form 337 by filling out blocks one and two
- give a signed copy to the aircraft owner to be entered in the aircraft maintenance records
- make the proper entry in the aircraft maintenance records making reference to the form CA 337
- forward a copy of the form CA 337 to the CASA within seven days.

5.3 Completion of form CA 337

The following instructions apply to the corresponding blocks of the form CA 337. The form should only be used when there is no acceptable or approved technical data available or if the modification or repair is major.

Design Change Reference

A reference to the design change approval should be entered here. This could be a CASA number or a Part 146 Design Organisation reference.

Approval may be indicated in this panel when the CASA or the Authorised Engineering Representative determines that the data to be used in performing a modification or repair described in the appropriate block complies with all applicable Civil Aviation Rules.

Aircraft

Information to complete the make, model, and serial number panels will be found on the aircraft manufacturer's identification plate. The aircraft registration is the same as shown on the Papua New Guinea Certificate of Registration.

For a modification or repair to be used on a series of aircraft the serial number and registration panels should detail each individual aircraft. A copy of the form should be included in each aircraft's maintenance records when embodying the modification or repair.

If the aircraft numbers are unknown, a supplemental type certificate would be considered more appropriate than the form CA 337.

When a major repair or major modification is made to an aircraft component this block is left blank. The form CA 337 remains with the component until such time as the component is installed on an aircraft.

Originator

Enter the design change originator's complete name and address for service in Papua New Guinea.

This block identifies the owner of the design change. In the case of a series modification, this name would normally be that of the original modifier.

Unit Identification

These panels are used to identify the airframe, engine, propeller, or component that has been modified or repaired.

Type of Action

Identify in the appropriate column if the aircraft or component was modified or repaired.

Technical data

The person wishing to perform the modification or repair, the originator, should ensure that acceptable technical data is available. This block records that determination and who made it, indicating if further approval is required.

If technical data is acceptable, the form CA 337 is only required for major modifications and major repairs.

Modifications that, by their nature, require supplemental type certificates are normally major.

For a modification or repair using acceptable technical data, the technical data block is not required to be completed. The person should complete the modification or repair in accordance with acceptable methods, techniques, and practices and ensure that an IA certifies the form. The completed form should be distributed in accordance with this advisory circular.

For a modification or repair using technical data requiring approval, the form CA 337 should be forwarded to the CASA or a certificated design organisation. The technical data block indicates that the form is an application for the approval of technical data and will incur the appropriate fees. Supporting data such as stress analyses, test reports, sketches, or photographs should be submitted with, and detailed on the form. When the data is approved and the appropriate statement in the data approval block checked, the form CA 337 is returned to the applicant.

If the modification or repair is not considered major, the IA certification is not required. The form CA 337 should be included in the maintenance records and the work completed in accordance with acceptable methods, techniques, and practices.

Approval of technical data

If technical data requires approval the PART 183 Authorized Engineering Representative (AER) will assess the modification package or repair scheme against the applicable airworthiness requirements.

Approval will be based upon the modification package meeting the applicable airworthiness requirements. The approving person will consider all aspects of the proposal's design, its application, and its possible results.

The person approving the data should indicate in this block whether the modification or repair is appropriate for one aircraft only, or could be applied to several aircraft by the original modifier. This decision will require liaison with the person wishing to perform the modification.
The person approving a design may also indicate in this block whether, in their opinion, the modification or repair is major or not.

The entry of this decision is not a requirement for further processing of the form.

Conformity determination

For a modification or repair using acceptable technical data, this block should be completed only if the modification or repair is assessed as major.

For a modification or repair using technical data yet to be approved, this block should be left blank until the technical data approval block is completed by the appropriate person. Once the data is approved and the modification or repair embodied, this block should be completed by the IA who then returns the form to the person who performed the work.

One copy of the form CA 337 should be given to the aircraft owner, the work details should be entered in the appropriate maintenance record, and a copy of the form forwarding to the CASA within seven days of the work being inspected.

A signature in this block certifies that—

- the technical data was—
    - appropriate for the modification or repair described on the form
    - appropriate for the aircraft described on the form
- the modification or repair was accomplished in accordance with that technical data and Part 43.

The signatures on the form do not indicate approval of the work described on the form for release to service. Release to service must be completed in accordance with Part 43 in the appropriate maintenance record.

Technical Data and Description of Work Accomplished

The technical data requiring approval, or the acceptable technical data used as the basis for certifying the modification or repair for release to service should be identified and described in this area. For data listed as acceptable in Part 21 Appendix C or included on separate sheets, only a suitable reference need be included.

It is recommended that this block contain only a listing of the attached sheets and that the attached sheets contain the detail of the data. Extra sheets describing the repair or modification should be attached to the form CA 337 bearing the aircraft registration mark and the date the work was completed.

A clear, concise and legible statement describing the work carried out should be entered in this block. It is important that the location of the repair or modification, relative to the aircraft or component, be described. The description should refer to the applicable sections of the technical data used.

If the repair or modification is to be covered with other structure then a statement should be made certifying that a pre-cover inspection was carried out and the work completed is satisfactory.

If the modification is a radio or communications avionics modification the appropriate approval level sought should be indicated on the form.

In all cases where the weight and balance of the aircraft are affected, the changes should be recorded in the aircraft records with a reference to the form CA 337 that required the changes.

Appendix A – Modifications requiring specific engineering design assistance

Modifications that generally require specific engineering design assistance include, but are not limited to, the following—

- Increases in gross weight or changes in the centre of gravity range
- Installation or relocation of equipment and systems or changes which may adversely affect structural integrity, flight, or ground handling characteristics of the aircraft, including—
    - pressurisation systems
    - alternate static air or pressure systems
    - initial or prototype installation of an automatic pilot or automatic approach system
    - modification of automatic pilot or automatic approach system which changes servo forces, servo rates, or any flight control or performance characteristics
    - the relocation or change of throttle levers, flap controls, and similar items
- Changes to movable control surfaces which may adversely disturb the dynamic and static balance, alter the contour, or alter the weight distribution
- Changes in the control surface travel outside approved limits, control system mechanical advantage, location of control system component parts, or direction of motion of controls
- Changes in basic dimensions or external configuration of the aircraft, such as wing and tail plan- form or incidence angles, canopy, cowlings, contour or radii, or location of wing and tail fairings
- Changes to landing gear, such as internal parts of shock struts, length, geometry, numbers, or brakes and brake systems
- Changes to engine cowling and baffling which may adversely affect the flow of cooling air, and changes to manifolding
- Changes to primary structure which may adversely affect strength or flutter and vibration characteristics
- Changes to systems which may adversely affect aircraft airworthiness such as relocation of exterior fuel vents, use of hydraulic components, tube material, and fittings not previously approved, or the use of new type fusible hydraulic plugs
- Changes to oil and fuel lines or systems which may adversely affect their operation, such as new type of hose and hose fittings, changes in fuel dump valves, new fuel cell sealants, new fuel or oil line materials, and new fuel or oil system components
- Changes to the basic engine or propeller design controls or operating limitations.
- Changes in a fixed fire extinguisher or detector system which may adversely affect the system effectiveness or reliability, including—
    - relocation of discharge nozzle or detector units
    - use of new or different detector components in new circuit arrangements

- deletion of detector units or discharge nozzles
- changing the extinguishing agent or decreasing the amount of extinguishing agent

- Changes which do not conform to the minimum standards established in a Technical Standard Order under which a particular aircraft component or appliance is manufactured
- Modifications to radio communications and navigational equipment which may adversely affect reliability or airworthiness, including—
  - major changes in IF frequency
  - extension of receiver frequency range above or below the manufacturer's extreme design limits
  - major changes to the basic design of low approach aids
  - changes which deviate from the design environmental performance
- Changes to aircraft structure or cabin interior of aircraft which may adversely affect evacuation of occupants
- Changes in aircraft flight manuals or other operating information in the form of placards or markings

Other modifications that may require engineering design assistance, because the nature of the change, include, but are not limited to, the following—

- Use of synthetic covering materials
- Substitution of materials, parts, or processes on which insufficient information is available
- Ceramic coatings
- Use of synthetic resin glues
- New stripping or plating coatings
- New welding, brazing, or other processing techniques

Appendix B – Modifications requiring approval by the Director prior to its Embodiment

Whilst some modifications may be acceptable for embodiment on aircraft in foreign jurisdictions, they may not be acceptable to the Director for embodiment on PNG registered aircraft. Embodiment of these modifications on PNG registered aircraft require prior approval or acceptance by the Director.

Although a Part 183 AER may classify a modification on an engineering order, as "minor" from a design perspective, these modifications may be classified as "major", from a maintenance or embodiment perspective. **Incorrect embodiment of such modifications could potentially affect the safety of an aircraft or its occupants"**

Such modifications will require the person ***embodying*** the design change to obtain prior approval from the Director before embodying the modification on PNG registered aircraft.

The Modifications listed in the table below will require prior notification to and approval from the Director ***before embodiment*** on PNG-registered aircraft:

Modification Description	***Reason(s) for prior notification to/approval from Director?***
1.Modifications that facilitate the Carriage of cargo in the passenger cabin	1.Cargo is normally carried in the cargo hold of an aircraft and not in the passenger cabin. 2. A PNG AOC holder intending to carry cargo in the passenger cabin must notify and obtain prior approval from the Director for a change to the scope of air activities it undertakes under its AOC as per rule 119.111(b)(3), prior embodiment of such a modification.
2.Modifications that facilitate the carriage of medical patient in stretcher installations in the passenger cabin	1. A PNG AOC holder intending to carry medical patients in stretcher installations in the passenger cabin must notify and obtain prior approval from the Director for a change to the scope of air activities it undertakes under its AOC as per rule 119.111(b)(3) prior to the embodiment of such a modification.
Note 1: If in doubt, the person embodying the modification should consult CASA PNG for clarification. Note 2: The Director may modify the above list from time to time.	

For all such modifications, a **bold statement** is included in the Engineering Order (EO) to read as follows:

"Prior notification to and approval from the Director must be obtained by the Customer prior to embodiment of this modification on a PNG registered aircraft, as incorrect embodiment of this modification could potentially affect the safety of an aircraft or its occupants"

Appendix C – Modification / Repair Process

Civil Aviation Authority
of Papua New Guinea
Civil Aviation Rules

Appendix C -Modification / Repair Process

Part 1 - Definitions
Design Change:
a *change to a type design* or a change to any other part of a type certificate or type acceptance certificate that if incorporated would require the modification or repair of a product, its components, or an appliance.
Repair:
a *design change* that is intended to return the product, component or appliance to its original, or properly modified configuration
Modification:
a *design change* that generally results in a change to the configuration of a product, component or appliance.

Part 21, Appendix C - Summary
Acceptable Technical Data
(1) data listed in Appendix B
(2) type certificate data sheets
(3) foreign type certificate data sheets used for the issue of a type acceptance certificate
(4) type design date for type certificated products
(5) design change datea that support a design change approved by the means specified in 21.77
(6) data approved by the Director under 21.95
(7) data provided by the PNG CAA and published in an AC
(8) airworthiness directives that give specific instructions for modification or repair
(9)* supplemental type certificates issued by the
  (i) FAA
  (ii) CASA
  (iii) NZ CAA
  (iv) Transport Canada
(10)* supplemental type approvals issued by Transport Canada
(11) aeronautical specifications
(12) manufacturers specific instructions - AMM, SRM, O/HM, CAD, SB, etc.
(13) FAA AC43.13-1B/2A
(14) data included, and specific to the category of, an airworthiness certificate.
* *refer to rule for provisos*
NB: All acceptable technical data must be appropriate, directly applicable and not contrary to manufacturers data

Part 1 - Definitions
Major Modification/Repair:
A mod/repair, when potentially, incorrect embodiment could affect the safety of an aircraft or its occupants through one or more of the following incidents occuring:
(1) structural collapse.
(2) loss of control.
(3) failure of motive power.
(4) unintentional operation of, or inability to operate any systems or equipment essential to the safety or operational function of the aircraft.
(5) incapacitating injury to any occupant
(6) unacceptable unserviceability or maintainability

Form CAA 337 use

The technical data is:	*CAA 337 action*
Acceptable / not major	No CAA 337 action
Not acceptable / not major	Approval
Acceptable / Major	Conformity
Not acceptable / Major	Approval and Conformity

Maintenance Task

Am I carrying out a Design change?
- No → Maintenance IAW Part 43 Release to Service
- Yes ↓

Do I have Technical Data?
- No → Develop & collate data mod/ repair data for approval → Form CAA 337 Approval of Data Raised by originator and submitted for Approval of Data by Part 146 Design Org. 21.95
- Yes ↓

Is it Acceptable Technical Data?
- No → Form CAA 337 Approval of Data Raised by originator and submitted for Approval of Data by Part 146 Design Org. 21.95
- Yes ↓

Approved Data Becomes Acceptable Technical Data Part 21 App C (a)(6)

Is Mod/Repair Major?
- No → Acceptable Technical Data
  - For non major modification/repairs 21.78 still requires a letter to notify CAA 7 days
  - If CAA 337 raised for Approval of Data then to: Owner - A/C records
- Yes ↓

Conformity Required *Consult with authorised person (43.203) prior to* starting Install Mod/Repair IAW Acceptable Technical Data and Part 43

42.203 - Summary
To certify Major Mod/Repair conformity need to
(1) hold an IA issued under Part 66 or
(2) be authorised by a Part 145, or
(3) be authorised by the manufacturer

Form CAA 337 Conformity Inspection and Certification 43.205

CAA 337 for Conformity Copies to:
1. Holder of Certificate of Registration - A/C records
2. CAA within 7 Days 43.207

Release to Service by LAME with reference to CAA 337 and Acceptable Technical Data 43.103 & 43.105