Civil Aviation Safety Authority
of Papua New Guinea

# Advisory Circular

# AC146-1

## Aircraft Design Organization - Certification

**Revision 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.

### PURPOSE

This Advisory Circular provides methods, acceptable to the Director, for showing compliance with the Aircraft Design Organization certification requirements of Part 146 and explanatory material to assist in showing compliance.

### RELATED CAR

This AC relates specifically to Civil Aviation Rule 146.

### CHANGE NOTICE

This AC replaces AC 146-1 Initial Issued dated 01 July 2002.

### APPROVAL

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

# TABLE OF CONTENTS

# SUBPART A - GENERAL

## EM146.1 Purpose

The purpose of Part 146 is to prescribe the certification requirements for organizations wishing to conduct aircraft design activities in respect of aircraft registered, or to be registered, in PNG. Aircraft design activities in relation to this Part include designs and design changes for aircraft, engines, propellers, their components, and appliances.

Design organizations must have the capability to determine the compliance of designs with airworthiness requirements and design standards, e.g. FAR 23 and FAR 25, and employ, contract or engage professionally qualified engineers who can provide certifications for that compliance. To support its activities, a design organization is required to have an exposition that includes a design assurance system, an internal quality and safety management system, document and data control procedures and procedures for the exercise of any regulatory authorizations.

There is no such aeronautical design capability in PNG and therefore, organizations who undertake design work in respect of PNG registered aircraft are located offshore and undertake such work in accordance with approvals granted by other regulatory authorities.

Part 146 is therefore structured to accept or validate the design organization approvals granted by Contracting States. Subpart B provides for the Director's acceptance of a design approval issued by a foreign Contracting State on the basis of known equivalence.

## EM146.3 Reserved

## EM146.5 Requirement for Certificate

This rule prohibits any design activity encompassed by the ratings detailed in 146.11 from being carried out unless that activity is conducted by an organization certificated under Part 146.

## EM146.7 Application for Certificate

The application form CA 146/01 must be completed in full and must identify the full extent of the intended activity. This information will be used in determining the ratings to be issued under 146.11 and the assessment and preparation of any limitations associated with the certificate.

Form CA 146/01 can be downloaded from the CASA PNG website.

The applicant should submit the application not less than 120 working days before the date of intended commencement of activity. For applicants that apply without giving 120 working days notice the CASA may not be able to offer any confirmation that the organization will be certificated in time to meet the applicant's deadline.

Applicant's should plan their certification programme in advance and early consultation with the CASA will ensure all issues are dealt with well before the planned start-up date. Having said this, the time involved for certification is dependent on the quality and completeness of the application and exposition.

## EM146.9 Issue of Certificate

There are several requirements to be met for the issue of the certificate. Primarily, the applicant must meet the requirements of Subpart B to be issued a certificate.

CASA implements a 5-phase certification process as follows:

**Phase 1 PRE-APPLICATION**: The applicant writes a letter of intent (LOI) to the Director stating their strategic intent to hold a Part 146 approval. The LOI is normally submitted together with risk assessment and change management plans. The Director will respond to the LOI by either requiring further information from the applicant or allowing them to proceed to the next phase 2

**Phase 2 FORMAL APPLICATION**: The applicant submits application form CA 146/01 and pays the required application fees. CASA will meet with the applicant to discuss and agree on a schedule of events (SOE) for the project.

**Phase 3 DOCUMENT EVALUATION**: To be assessed as meeting the requirements of Part 146 the applicant's documentation will be checked for compliance with the rules and suitability for the type of design tasks the applicant is proposing to carry out.

**Phase 4 ENTRY INSPECTION**: After the documentation is accepted as satisfactory, an entry inspection of the applicant's facilities and resources will be made and will normally include interviews with key staff members.

**Phase 5 CERTIFICATION**: Once CASA is satisfied with the organisation and the applicant's nominated senior persons have been assessed fit and proper as required, a certificate will normally be issued for a limited period on completion of which, a full compliance audit will be conducted before full certification is given. The length of the initial induction period will depend on the type of design work proposed, the adequacy of resources, and the experience of the applicant and their staff.

To be assessed as meeting the requirements of Subpart B, the applicant will need to provide a copy of the foreign design organisation's certificate and exposition, and details of the senior person's who will be responsible for liaison with the PNG CASA on design matters. The documentation will be assessed for acceptance and the suitability of the persons nominated for liaison with PNG confirmed.

To be assessed as meeting the requirements of Subpart B the applicant's documentation will be checked for compliance with the PNG rules and suitability for the type of design tasks the applicant is proposing to carry out. The applicant's documentation may include an Interface Procedures Manual (IPM) that contains any differences between the PNG Part 146 rules and the foreign Part 146 or similar rules. After the documentation is accepted as satisfactory, an entry inspection of the applicant's facilities and resources will be made and will normally include the Fit-and-proper persons (FPP) interviews with key staff members.

Once the CASA is satisfied with the organization and the applicant's nominated senior persons have been assessed as fit and proper as required by the Act, the certificate is issued. A certificate will normally be issued for a limited period on completion of which, a full compliance audit will be conducted before full certification is given. The length of the initial induction period will depend on the type of design work proposed, the adequacy of resources, and the experience of the applicant and their staff.

The Director may prescribe limitations and conditions on a design organisation certificate. These additional limitations placed upon the certificate may include limitations based on the applicable requirements of Part 21, or general qualifications of the design activities considered appropriate. For example, a design organisation can be limited to modification and repair design work only, and not supplemental type certificates.

## EM146.11 Privileges of the Certificate Holder

The holder of a design organization certificate may—

- develop design changes for aeronautical products and their components (rating D1)
- develop designs and design changes for appliances (rating D2).

Whilst the ratings are general abilities, the detailed capability of an organization should be stated in its exposition. This detailed capability will largely be dependent on the facilities the organization has access to and the experience of the personnel the organization employs. An applicant should not detail activities the organization will not be able to provide.

***Holder of an authorization to approve design changes***

If a design organization wishes to approve design changes without reference to the CASA it must employ an Authorized Engineering Representative appointed under Part 183. This person must be employed as a senior person in the design organization.

***Additional limitations and qualifications on a certificate***

The Director may prescribe limitations and conditions on a design organization certificate. These additional limitations placed upon the certificate may include classes of design changes, limitations based on the applicable requirements of Part 21, or general qualifications of the design activities considered appropriate.

Classes of design changes are based on the approval abilities of the Authorized Engineering Representative. These abilities will be detailed on the authorization itself but also can be used to define the organization's abilities. For the purposes of defining the abilities of the design organization, design changes are classed as follows—

- Class A are those design changes that require comprehensive engineering justification, assessment, and substantiation
- Class B are those design changes that do not require comprehensive engineering justification, assessment, and substantiation.

Additional qualification of the scope of design development a certificated organization may perform may include, but is not limited to, the following—

- Structures, including load determination and stress analysis
- Systems, hydraulics, electrical, control, pneumatic, and fuel
- Flight test and performance determination
- Radio and navigation system installations

Part 21 defines the process for, and details of, design and design change approvals. The design organization may be limited further to specific areas of design work identified in accordance with the subpart of Part 21. For example, a design organization can be limited to modification and repair design work only, and not supplemental type certificates. This limitation would be reflected by reference to Subparts F and G of Part 21 on the certificate.

## EM146.13 Duration of the Certificate

The initial issue of a certificate will normally be for a period of six months to enable the organization to demonstrate compliance with their exposition and Part 146. Prior to the expiry of the initial certificate the CASA will conduct a full compliance inspection of the organization and, if satisfactory, a longer duration certificate, up to five years, will be issued.

The initial compliance audit should ensure that the organization is complying with their exposition and that the exposition accurately reflects the organization's activities. Future audits will examine similar compliance requirements and any other relevant matters.

Certificates which expire, or are revoked, must be returned immediately to the CASA Airworthiness Branch. Suspended certificates should also be forwarded immediately to the CASA for endorsement.

## EM146.15 Notification of Ceasing Design

If an organization decides to cease design activity, this rule requires the certificate holder to notify the Director. A letter should be sent to the Director, together with the certificate, within 30 days of ceasing activity.

As well as ensuring the CASA has an accurate picture of the aircraft design organizations supporting aircraft in Papua New Guinea, this rule ensures continuing airworthiness responsibilities are addressed when a

design organization ceases to operate.

## EM146.17 Renewal of Certificate

The rule specifies a period of 30 days before the certificate expires for application for renewal. The certificate holder should make provision for this in the exposition. The renewal of a design organization certificate may be delayed if the organization's application is not forwarded with the required lead-time.

An organization should allow sufficient time for the renewal process to be planned and carried out. The time involved will vary according to the type of design activity the organization is certificated for and carrying out, as well as the period the certification has been in force.

Where a certificate has been in force for the full five years, a re-entry application and audit process will be required to be followed. This process will ensure that all facets of the organization comply with Part 146 and the latest revision of its exposition. The extent of this re-entry process will depend on the organization's conduct to date, any changed circumstances, and results of safety audit findings over the period of validity.

# SUBPART B — ACCEPTANCE OF FOREIGN DESIGN ORGANISATIONS

## EM146.51 Purpose

This purpose of this Subpart is to provide a mechanism for the CASA to recognize acceptable foreign design organization certificates.

## EM146.53 Acceptable Foreign Certifications

This rule lists those authorities which the CASA has determined issue design organization certificates to the same standards as are prescribed in Part 21Subpart B. Where the certification processes for design organizations in other countries are either known to be different (e.g. in the USA) or are unknown, an applicant is not eligible for certification under this rule. Applications will be assessed on a case by case basis and if the foreign authority certification process is shown to be equivalent to this Part 146, that authority will be added to the list in rule 146.53.

An applicant seeking to have a certificate issued by one of these authorities accepted for the purpose of gaining PNG certification under Part 146 is only required to provide the CASA with a copy of the foreign design organization certificate and the associated exposition, together with the names of the senior persons in that organization who will liaise with the CASA on matters relating to PNG.

The rule does allow the CASA to verify the conditions of continuing validity of the foreign organization certificate and to impose any conditions and limitations of the PNG certificate.

# FOREIGN DESIGN EXPOSITION - MINIMUM CONTENT

## EM146.53(b)(2) General

This rule recognizes that an applicant may have an exposition which is approved by one of the foreign CAAs listed in rule 146.53(a), which is submitted to CASA with a PNG Part 146 rule compliance matrix that identifies any differences between the PNG and the foreign exposition requirements. The foreign exposition and the PNG Part 146 rule compliance matrix identifying any differences should be supplemented by an Interface Procedures Manual (IPM) that addresses PNG DOE Minimum content requirements listed below not considered to be met.

## EM146.53(b)(2) Personnel Requirements

An applicant must identify their Chief Executive and other key senior personnel. The applicant's nominated senior persons must be employed, contracted or otherwise engaged to work sufficient hours such that the individual can fulfil the management functions associated with the size and scope of the applicant's business.

The rule identifies what are considered the critical members of an organization who will exercise an appropriate level of control, direction, and responsibility, to ensure the continued effectiveness of the activity undertaken. Furthermore, the applicant must have in their exposition an organization chart showing the lines of responsibility extending from the CEO through to each location where design staff are located.

An applicant may utilize any organizational structure as part of their overall business structure provided the applicant can satisfy the Director as to the effectiveness of the reporting lines and control required to be exercised. Applicants should note that approval of alternative organization structures is not automatic.

## EM146.53(b)(2) Functions and Responsibilities of the CEO

The intent of the rule regarding the responsibility and authority of the Chief Executive is to ensure that:–

- the design activities carried out by the organization can be financed

- those activities are carried out in accordance with Part 146
- the organization complies with the requirements of Part 146.

It is clear that this person needs to have the authority to ensure the activities of the organization can be financed. A suggested method of demonstrating this could be by presenting an annual business forecast, annual business plans or historical financial audited reports showing a healthy financial trend, as a part of certification process. CEOs should demonstrate evidence that they have the authority to finance the operation as defined as part of the Chief Executive responsibilities.

The Chief Executive must assure that the exposition complies with the rules. The exposition amendment procedures should cover this.

The Chief Executive must also be assured that design activity is conducted in compliance with the exposition. Ensuring compliance with the exposition is the responsibility of the senior persons and the assurance that the Chief Executive requires could be shown through the medium of the internal audit reports or inspections.

This person will need to demonstrate during initial application and at any other time, that they have the knowledge to control the organization.

If an organization has several independent business units then it may be appropriate to apply for certification independently. If this is the case a Chief Executive will be required to be identified for the design unit specifically.

If, on the other hand, an organization retains one identity the Chief Executive should be clearly shown to have an appropriate level of authority. This may occur where an organization is certificated for other tasks such as maintenance or manufacturing and only one core exposition is used for all administrative functions.

## EM146.53(b)(2) Functions and Responsibilities of other Senior Persons

Under this rule, the organization must appoint senior persons responsible to the Chief Executive for —

- design control
- inspection and testing
- internal quality and safety management system
- if design approval is required by the organization, the functions of an AER appointed under Part 183.

Titles may vary between organizations but the requirements are for management representatives for design control, inspection and testing, and internal quality and safety management. If a particular area is specifically excluded, or specifically included, in the exposition the responsibilities required to be addressed may vary.

In smaller organizations the Chief Executive and the senior persons may be the same individual but in all cases there should be clear definitions of the position's responsibilities. The individual undertaking one or more functions in the organization should have a clear understanding of the division of the responsibilities and be able to show this to the CASA. Some functions should not be combined as they conflict with responsibilities assigned to the intended positions, for example, the functions of Design Control and Quality Assurance.

The person or persons nominated will represent the management structure of the organization and are required to be acceptable to the Director.

The senior persons should be responsible for ensuring that—

***Design control***

- the design control system is implemented and running effectively
- designs are processed in accordance with the requirements of the Civil Aviation Rules
- concessions are processed in accordance with the exposition and any CASA requirement
- the drawing system is effective in providing for the design activities of the organization
- the continued airworthiness facilities for any design produced are provided
- support systems are effective in providing for the activities of the design teams
- any corrective action relating to the design control system resulting from the internal quality assurance programme is quickly and effectively carried out

***Inspection and testing***

- any inspections and tests carried out are implemented and running effectively
- inspections and tests reflect the current state of the art of the aviation industry and provide the results necessary to show compliance with airworthiness requirements
- suitable arrangements with providers of testing equipment and facilities are established and reflected in the exposition
- support systems are effective in providing for the activities of the inspection personnel
- any corrective action relating to the inspection and testing resulting from the internal quality assurance programme is quickly and effectively carried out

***Internal quality and safety management system***

- the organization remains in compliance with Part 146 and Part 100
- the exposition and the associated procedures remain adequate for the scope of the organizations activities
- personnel meet the initial and on-going training and qualification criteria defined in the exposition
- staff are authorized appropriately for performing certifications on behalf of the organization
- support systems are effective in providing for the activities of any internal quality assurance personnel
- any corrective action relating to the exposition, procedures, qualifications, personnel, or support systems resulting from the internal quality assurance programme is quickly and effectively carried out

## EM146.53(b)(2) Part 183 Authorized Engineering Representative (AER)

Responsibility for the approval of designs and design changes resides with the Director. The Director may appoint a person meeting the requirements of Part 183 as an Authorized Engineering Representative (AER) to carry out specified design change approval functions.

The AER must be employed by a design organization to ensure that sufficient support systems are in place to complete the design approval function.

Whilst the AER acts as the Director for the design change approval functions under rule 21.77 or approval of technical data under rule 21.95, he or she is required to be authorized by the Part 146 organization to exercise their privileges. This ensures that control remains with the Part 146 organization maintaining the design control system. The organization cannot authorize the AER for functions beyond their Part 183 authorization.

The requirements for the approval of design changes are explained in Appendix A and are further expanded in PNG Rule Part 21, Part 43, and their associated advisory circulars.

The AER will have their responsibilities explained in their authorization, but as a senior person in a design organization he or she should be responsible for ensuring—

- any inspections and tests fulfil the requirements they specify before approving a design change
- design change descriptive and supporting data is assembled and distributed as required by the exposition
- they can supervise the design work and be readily available, in person, for consultation with those performing the work
- each complete design complies with the applicable airworthiness requirements
- they only approve design changes in areas that they are competent
- where the proof of compliance depends on calculations alone, and these calculations are extensive or are based on other than fundamental technical procedures, checking is done by competent persons other than those originally performing the work
- they prescribe relevant limitations and conditions to design changes to ensure an adequate level of safety is maintained
- support systems are effective in providing for their authorised privileges
- any corrective action relating to the approval of design changes resulting from the internal quality assurance programme is quickly and effectively carried out.

## EM146.53(b)(2) Personnel Manpower levels

The organisation's personnel levels should ensure that a sufficient number of suitably qualified people are available to carry out the design task.

## EM146.53(b)(2) Competence of Personnel

The competence of all staff should be determined on the basis of—

- academic qualifications
- certificates or approvals held
- employment records
- written, oral, or practical examination

The organization should provide for the assessment and maintenance of the levels of competency of all personnel.

At the time of application the applicant must consider how they will deal with transfer of the senior person functions, to other suitable and qualified persons during periods of absence. Although the rule does not make provision for or have any requirement for the situation where a senior person may be absent for a prolonged period of time, or vacates the position it is advisable to provide for this in advance in the exposition. Consideration should also be given to a situation where a senior person has been incapacitated. This would in effect cause the position to be vacant for the period of incapacitation and would require a substitute person to meet the requirements of this Part. In the event that the responsibilities and functions are transferred to another person they would also be required to be fit and proper, and meet the experience and qualifications

set out in the exposition.

In the event an applicant chooses not to provide for the situation where a senior nominated person vacates a position, it should be remembered that the Director has to be notified of such a situation and the certificate holder will also be called to provide details of the contingency arrangements to be implemented pending a permanent solution being achieved.

It should be noted that where a change of senior person is proposed, rule 146.203(b)(2) requires the prior notification of the change and acceptance by the Director.

In accepting such contingency arrangements, the Director may impose limitations or conditions of a temporary nature for the period of the contingency. The conditions or limitations imposed by the Director in all cases will be clearly stated to the certificate holder in writing, and could be as simple as providing a time frame for events to take place or a total suspension of design activity.

## EM146.53(b)(2) Facility Requirements

Office accommodation should be described in the exposition and should provide for management, planning, records, quality, design, and other staff. The offices should be sufficient to meet the requirements for the scope of design work to be undertaken.

As there is an ongoing requirement to retain design records the provision of storage and the methods of cataloguing and preventing deterioration of this material is required.

Testing facilities may include calibrated and critical equipment and this test and measurement equipment should have adequate protection and control.

## EM146.53(b)(2) Equipment and Tools

An applicant for Part 146 certification must show that all tools and equipment, necessary to accomplish the approved design activity will either be permanently on hand or available as required in accordance with documented arrangements in the exposition.

This rule requires the design organization to not only have the necessary equipment but to also have the procedures to ensure control of the process.

The requirements extend to the provision of—

- design data from organizations such as libraries, standards organizations, the Civil Aviation Authority, the military, and other design organizations
- tools and testing facilities requiring workshop, or other specialized environments
- equipment including measurement, drawing, and computer support equipment.

In undertaking design work the organization should ensure that it identifies, in its exposition, the testing locations it intends to use regularly. If testing equipment is located at these other premises then controls should be in place to ensure the equipment is controlled and calibrated as necessary.

Outside organisations, or organisations certificated under other Civil Aviation Rules, may be acceptable to provide testing facilities. In these instances a contractual arrangement would be expected and this agreement should be referenced in the exposition.

## EM146.53(b)(2) Design Control System

The design control system can be likened to the internal quality system but is more specific in its application. The design control system should ensure—

- design control procedures are published, maintained, and followed

- designs and design changes comply with the applicable airworthiness requirements and have no unsafe features

- subcontracted work is identified and the design organization exercises control over the performance of subcontractors

- responsibilities for issuing documents are clearly identified and personnel are given clear descriptions of the scope of their authorizations.

To ensure that there are no unsafe features in a design or design change may practically be impossible to achieve. For example, changes incorporated subsequent to the design entering service may introduce problems with the original design unforeseen by the designer. A design organization should include procedures that ensure designs have no unsafe features that could have reasonably been identified during the design process. The organization should take all possible compromises to airworthiness into account and may subsequently use limitations, conditions, operating instructions, and incorporation procedures to limit the effect of any otherwise unsafe features.

The design control system does not specify a requirement for a totally separate checking system. This allows the small design organizations consisting of few individuals to be certificated. Since the certificate can be limited in its scope, the smaller organizations may be required to rely on a degree of CASA involvement for the tasks that require independent checking. Such certificate limitations will be dependent upon the competency of the applicant's staff.

## EM146.53(b)(2) Design Control Procedures

The design control procedures form an integral part of the design control system. As part of the system there should be adequate copies of all technical data necessary to carry out the design activities for which the organization is certificated.

In providing this information, the organization should make the relevant data available to personnel requiring to use it. When computer systems are used, the number of terminals and the types of software should be adequate to provide for use by the relevant staff members. In providing electronic information the organization should ensure that the necessary software and information updates are scheduled to enable the correct reference material to be accessed.

The drawings produced by a design organization ultimately define a design and there is a requirement for drawing control procedures. Appendix B of this advisory circular details more considerations for the drawing production and control system.

As well as control of the drawings, a design organization has a requirement to provide document control procedures. These procedures should ensure that the correct reference materials are current and authorized for use in the design activities. These requirements extend to computerized records and documents as well as software updates. The procedures should include an electronic information control section if this is utilized by the organization.

The design control procedures include the requirement for methods for the inspection and testing of specimens of the design to demonstrate compliance with airworthiness requirements. The inspection and test procedures may not apply to all designs and design changes developed by the organization and the design control procedures should include methods to determine when testing is required.

***Documentation***

The design control procedures should include systems to control the documentation used by the organization.

The documentation required to be addressed in the procedures includes all company procedures, test procedures, technical data, and reports. The documents should be available to all employees requiring the information and should be reviewed prior to use.

The rule requires that each item of documentation is identifiable so that only that information relevant to the design is used. Documentation otherwise considered obsolete may therefore be required for a design task. If a design or design change is still in current use, then the documentation should not be considered obsolete. The rule however recognizes that otherwise superseded data may be appropriate to a design activity.

When utilizing documentation that is otherwise considered obsolete, the organization should ensure procedures provide for confirmation of the relevance of that documentation. This confirmation would normally be made by the person approving the design or issuing the statement of compliance. In accepting that documentation the appropriate person should ensure—

- the design activity cannot be carried out with otherwise acceptable documentation
- the documents are directly relevant to the product to which the design activity relates
- the level of safety is equivalent to those standards considered acceptable for the type of operation the product is to be submitted to.

***Proprietary information***

In determining the procedures to be employed by the design organization the issue of commercial-in-confidence and proprietary information is raised.

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

The approval however, even if completed by the design organization's AER, is carried out by the Director and becomes publicly available information. This means that any pages containing the approving signature become public information. One particular example of this is any supplemental pages for flight manuals, where they do not form the design change approval itself, but are however approved as part of the authorization holder'sfunctions.

Figure 1 shows the relationship between design organization commercial information and public information.

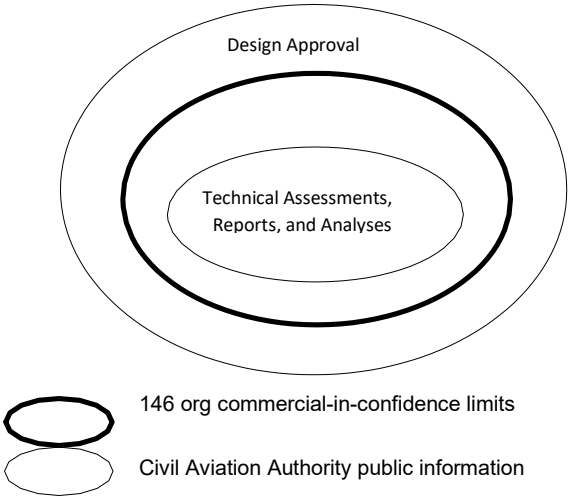


***Figure 1. Proprietary Information***

Any submission to the CASA for approval is treated in a similar manner and the approval itself is the only document generally available.

***Design stages***

There are three broad stages of design development and each has its final certification requirements. These stages are shown in Figure 2.

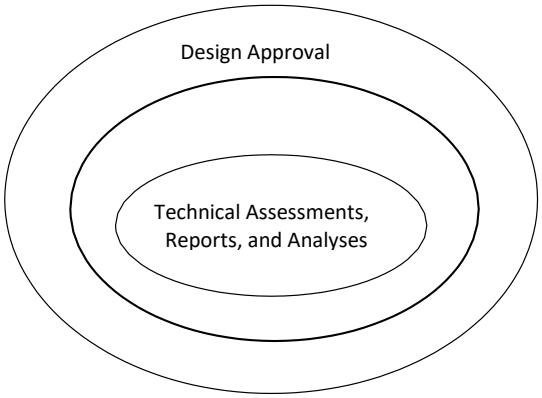


***Figure 2. Design Stages***

***Technical assessments, reports, and analyses***

This area forms the majority of the design organization's tasks. The technical assessment should examine all facets of the design or design change and conclude with a statement that the design meets the intended requirements.

At this stage this is not a certification of anything other than the fact that the design has been developed, all reports supporting the design are available, and any stress analyses or other testing has been concluded.

The format of technical assessments and reports is up to the organization but standard layout should be used and identified in the exposition or other design control manuals. The layout should include the following sections—

- the name of the organization and a reference number for the assessment
- the description of the items affected
- a brief description of the design change
- technical data that includes—
    - descriptive data
    - substantiating data
    - amendment requirements
    - other supporting data such as weight and balance calculations

***Statements of compliance***

This is the confirmation by an authorized company person that the design has been checked, complies with the airworthiness requirements, and is acceptable for approval.

The terms compliance and conformance are often used interchangeably. This is not strictly correct.

**Conformance** generally refers to the conformity of a design to an applicable type design. It is correct, therefore, that a statement of conformity attests to the design showing conformity with the type design.

**Compliance** has a much broader meaning and better reflects the entire design concept. A design comprises several parts and conformance to the type design is only one aspect.

A design or design change must meet the relevant airworthiness requirements including the following—

- conformity to the type design
- applicable design standards
- special conditions prescribed by the CASA
- general safety aspects of the design
- the design's fitness for use.

The statement of compliance therefore refers to the wider considerations a design must take into account.

A design organization may utilize the services of an outside agency to provide for some of the design activities. In these cases the details of the authorizations issued to other persons is a requirement of the exposition. It is appropriate that a design organization use contractual arrangements to formalize these authorities.

Commonly used subcontractors should be listed in the exposition and be acceptable to the Director. The scope of the tasks assigned to these subcontractors should be dependent on their competency and the assessment of the organization. Most examples of these arrangements will be for testing requirements that may be met by recognized laboratories and testing establishments.

In all cases a design organization should require statements of compliance or written reports attesting to the satisfactory completion of the contracted tasks.

***Design approval***

Design approval considerations are detailed in Appendix A and are further expanded in Part 21, Part 43, and their associated advisory circulars.

The design approval is the final stage of the design process and may or may not be required by a design organization. If a design organization wishes to approve designs they must employ an AER as described earlier. This person should be authorized by the organization so that positive control of the approval function is retained with the organization.

After design change approvals have been issued, copies should be forwarded to the CASA for their records.

This is an important requirement for two reasons. Firstly, the CASA retains a complete picture of the products, components, and appliances in use or available in the Papua New Guinea aviation environment. Secondly, in approving the design change, as the Director, the AER has carried out a CASA function. The procedures for the issue of design change approvals should detail the requirements the organisation expects to be met to enable the AER to sign the approval. These requirements would likely take into account commercial-in-confidence issues, corporate image issues, and other considerations that may not directly relate to the development of the design.

## EM146.53(b)(2) Continued Airworthiness

The design organization has a responsibility to ensure that the parts and appliances designed are monitored and supported. As with manufacturing organizations, part of this monitoring includes the investigation and analysis of defect incidents.

Defects that have no effect on safety, in any form, do not come under the definition of defect incidents and as such are not subject to this rule. These include defects which if corrected may aid production or make the item easier to use, resulting in an economic advantage to operating and maintenance organizations.

Defects that may result in injury, accidents, or hazards to other aviation activities are considered defect incidents. Under this rule, the design organization has a responsibility to keep the users of products which

they design and the manufacturer of those products informed of defect incidents.

The defect reporting responsibility of a design organization will generally cover those product features that are causing a problem that are introduced by poorly controlled design processes rather than manufacturing faults or maintenance practices. Defect reporting to the CASA is covered in Part 12.

As part of the documentation of a design, particular a product design, there is a requirement for Instructions for Continued Airworthiness. These instructions should be developed by the design organization but will involve collaboration with manufacturing and maintenance organizations.

Advisory circulars AC145-1 contain additional information on the continued airworthiness responsibilities of maintenance organizations.

Rule 146.207 is self-explanatory and prescribes a design organization's responsibility to ensure the transmission of design information to the State of Design of Modification where this is different from the State of Registry.

## EM146.53(b)(2) Records

***Design records***

The holder of a design certificate should provide procedures that ensure—

- a record is kept of all designs and design changes produced by the organization; and
- all drawings, analyses and reports for each design are recorded and retained
- all significant inspection and test records attesting to the conformity and compliance of each design are retained
- a record is kept of all calibrations on tools and equipment, including the standards used for calibration.

The procedures should also detail the method of identifying records that are no longer current, but are required to be held for research or other purposes.

Records should be legible and of a permanent nature.

Records can be kept electronically but systems should ensure the information security, integrity, and retrieval. A system of backing up electronic data would be considered appropriate. Procedures for electronic record and document keeping should consider—

- avoidance of data loss in the event of power interruptions
- software control, including amendments and prevention of corruption
- unauthorized access
- audit trail facilities
- archiving of data in a similar manner to hard copies, and for a similar period
- backup of critical information, preferably once a day, with storage for that backup information
- data verification, on entry and retrieval
- publication provision
- staff training

- amendment of stored data
- problem report register including the problem details and solutions

For ease of access records may also be microfilmed or magnetically stored but the original documents should be retained in a secure environment.

The rule requires the ideal retention of records to be 2 years from the date of the withdrawal of the last example of the product from service. This is a very onerous requirement but ensures that the information is available no matter how long the product remains in service. The rule recognizes the need for varying this time limit in special cases. The cases that may support the reduction of this period will vary considerable but may include, but not be limited to, the following—

- the only examples of the design in use are installed on aircraft limited to experimental operations
- although products conforming to the design still exist, the likelihood of restoring an operating example of the product is considered extremely rare.

***Personnel records***

A certificated design organization must establish procedures to ensure records are kept of all staff authorized to certify under its authority. The following minimum information should be kept in respect of each certifying person—

- name
- date of birth
- qualifications
- initial training
- continuation training
- experience
- qualifications relevant to the authorization
- privileges of the authorization
- date of first issue of the authorization
- the expiry date of the authorization
- identification number of the authorization

The records may be kept in any format but must be controlled by the organization's senior person responsible for Quality and Safety Management Systems. Safeguards must be put in place to ensure that the records cannot be altered in an unauthorized way. Personal information must not be accessible to unauthorized persons. Organizations should take account of Privacy of Information legislation in the management of personal information.

The persons to whom the records relate should be given access, on request, to his or her own records. The CASA is an authorized person in respect of any aviation documents and records. When the CASA is assessing eligibility for initial or continued approval, or when it has cause to doubt the competence of a particular certifying person, it may access those records.

An organization should keep the records for at least five years after the individual has ceased to be in its employment, or after withdrawal of the authorization, whichever is sooner. In addition certifying persons, on

leaving an organization, must be provided with a complete record of company certification authorizations which they have held.

## EM146.53(b)(2) Quality and Safety Management System

An applicant must establish an internal quality and safety system that meets the requirements of PNG Rule Part 100 Subparts C and B, respectively.

The requirements of this rule 100.1 are common to all certificated organizations which require an internal quality assurance system, for example all the organizations to which the 140 series and 170 series Parts apply.

Detailed information on what is required for an internal quality and safety management system is contained in PNG AC 100- 1.

## EM146.53(b)(2) Design Organization Exposition

This rule requires an applicant for a design organization certificate under Subpart B – Acceptance of Foreign Design Organizations to produce its foreign exposition, a completed PNG Part 146 Rule compliance matrix and an Interface Procedures Manual or equivalent document covering any differences between the PNG and the foreign requirements.

The purpose of an exposition is to express the Chief Executive's requirements for the conduct of the organization, to set out the means by which an organization defines its operation, and to show both its employees and the CASA how it will conduct its day-to-day business in compliance with Part 146.

An exposition must assure the CASA that the organization is in documentary compliance with the rule. Hence before the CASA grants an organization entry into the system, the exposition must be accepted by the Director.

***Makeup of exposition***

An exposition may be produced as a single volume or any number of separate manuals Depending on an organization's structure and size, separate manuals could cover—

- Management and Policy
- Personnel
- Design Procedures
- Document control
- Quality and Safety Management System
- Contractual Arrangements with Test and Calibration Organizations.

If the exposition comprises more than one volume, the makeup of the exposition and the content of individual manuals must be described in the management part of the exposition.

Procedures should be established to ensure Managers hold copies of those parts of an exposition which affect their areas of responsibility and staff are familiar with those parts of an exposition which affect their area of employment.

***Content***

The exposition should be constructed to address each element of difference between the foreign requirements and the PNG requirements is advisable. The foreign exposition and a properly completed PNG Rule Part 146 rule compliance matrix should be submitted to CASA PNG Airworthiness branch for review. Differences identified in this review, should set the platform for the development of the PNG Interface

Procedures Manual (IPM). The structure should reflect the hierarchy of Part 146 such that the exposition/IPM progressively moves from higher level organizational material such as policy, scope of approval, and duties of senior persons to more detailed procedures. The intent for producing an IPM is to avoid the need for the applicant having to re-write the entire foreign exposition again.

Structuring the exposition according to the flow of the rules in Part 146 should be avoided, the result will not be a user-friendly document.

The level of detail should be consistent with the size and complexity of the organization and the design activity undertaken.

***Exposition acceptance***

The acceptance of an organization's exposition by the Director will be one step in the 5-phase certification process of Part 146 approval. Unless an exposition is accepted by the Director, a Design Organization Certificate cannot be issued. Evidence of acceptance of the exposition is the issue of a certificate, however the CASA will normally stamp the log of pages to signify that they have found the exposition acceptable at a particular status.

***Multiple certification***

When an organization seeks certification under more than one Civil Aviation Rule Part each of which requires an exposition, it may be possible for some parts of the exposition to be common to each certificate. For instance, if the same management set-up is used for each certificate, the management and policy part of the exposition could be common. Equally, all of the quality assurance procedures for one or more certificates could be placed in one manual.

Whatever format of exposition is chosen, it must be possible to clearly show how the requirements of each Part are satisfied. It is desirable that a compliance matrix is provided showing where compliance is shown in the exposition for each Part. This matrix should distinguish between those requirements which are common and those which are specific. The PNG Part 146 rule compliance matrix may be downloaded from the CASA PNG website.

*Any difficulty in establishing compliance will require more investigation time to be expended, and can only result in delays and additional cost to an applicant.*

# SUBPART D — OPERATING REQUIREMENTS

## EM146.201 Continued Compliance

To ensure that all members of the organization have access to the exposition, a certificated organization is required to provide copies of its exposition, including its' PNG Interface Procedures Manual and up-to-date PNG Part 146 rule compliance matrix, at all places where work is normally carried out.

For continued compliance with the conditions of its Part 146 certificate, the organization must comply with all the procedures detailed in the exposition and continue to meet the standards and conditions, which were required for initial certification.

In the case of organisations accepted under Subpart B for issue of a PNG design certificate, that organisation's foreign certificate must remain valid. If that foreign certificate is suspended, revoked or cancelled, the organisation's PNG certificate will be suspended, revoked or cancelled.

## EM146.203 Changes to the Certificate Holder's Organisation

An organization should always ensure that its exposition remains an accurate description of the organization and its activities. When there are changes to staff, structure, location, or documented procedures the organisation should ensure the exposition reflects these changes.

Prior acceptance by the Director is required for certain changes including—

- the Chief Executive
- the listed senior persons
- the design activities undertaken
- the locations at which design work is carried out, including testing and inspection locations.

***Organizational changes***

When the holder of a design certificate changes their organization in such a way as to necessitate a revision of their manuals or exposition, the CASA is to be kept informed. An acceptable means of compliance with the notification requirements is to notify the CASA in writing of any changes. A facsimile message may be accepted as a notice in writing.

The CASA's agreement to the change may be more readily obtained if the proposed wording of the change is fully defined and any supplementary information is provided to assist the CASA in deciding whether the change is acceptable.

***Design certificate amendments***

An application to amend a design certificate is made in the same form and manner as the original issue. Where the changes include changes to the design organization's exposition, only the changes need be submitted.

## EM146.205 Safety Audits and Inspections

The organization must also comply with any reasonable requests from the Director to undergo audits and inspections. The Director is empowered by the Civil Aviation Act to make such requests.

The CASA operates a safety audit program for all participants in the aviation system. For design organizations the safety audit will be part of the total industry safety monitoring schedule and visits will be notified in advance. These arrangements will allow for forward planning by both the CASA and the certificated organizations.

An organization's policy and procedures will be accepted by the CASA during the entry process. These policies and procedures, documented in an organization's exposition, will form the agreed performance standard for an organization's safety audit programme. This safety audit programme will initially examine the certificate holder's internal quality assurance system. Any deficiency found at this level will result in a broader and deeper investigation until the causal factors of the deficiency are identified. The on-going frequency and depth of audit will depend directly on the performance of the organization.

The CASA's level of confidence in an organization will be raised when it is found to comply with its documented procedures. The CASA can then consider reducing the frequency and depth of the audit program, with consequent financial savings for the organization. Conversely where the level of confidence is low, due to non-compliance, the level of auditing and the consequent cost to an organization may be expected to increase. Whenever it is discovered, through an audit or other reporting method, that an organization is not conforming with its procedures, or complying with the Part 146 rules, the Director may suspend or revoke the certificate.

## EM146.207 State of Design of Modification

Rule 146.207 is self-explanatory and should be well covered in the design organization's exposition.

# Appendix A — Design Approvals

Design approval is an important stage of development as it finalizes the product, component, or appliance for manufacture and modifications for incorporation. The approving person for a design is the Director although certain design changes may be approved under design delegations.

## The Design Package

Designs generally consist of several distinct sections that together make up a package. The design package or modification package should consist of the following sections—

- descriptive data
- substantiating data
- other supporting data and consequential information

The package as a whole should be arranged inductively so that the purposes and summary of the design is provided in a covering document. Each subsequent section should be deductive permitting the person approving the work to follow the logical development of the design in each section.

***Descriptive data***

The completed design package requires descriptive data that fully describes all aspects of the design or design change for manufacturing purposes.

The descriptive data should include—

- use and application of the design
- 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, such as—
    - heat treatments
    - surface finishes
    - weld quality
- wiring diagrams
- an equipment list that details the items that make up the completed item
- a summary of particular manufacturing considerations, including—
    - pressures
    - temperatures
    - environments
- a list that details the substantiating data for ease of reference.

***Limited descriptive data***

In some cases the descriptive data may not be fully available, or considered required, by the design organisation. Limited descriptive data may be appropriate in the following cases—

- acceptance by the approving person
- the design change is a trial installation to be used for a limited time and under the direct control of the approving person
- the design change has been previously approved by acceptable military authorities
- where the design change is inadequately described for manufacture, the design can be fully checked by inspection during manufacture and installation.

***Substantiating data***

The substantiating data makes up the majority of the design package. It contains the supporting calculations and descriptions of special processes chosen to provide compliance with the airworthiness requirements.

Substantiating data should include—

- load analyses
- failure analyses
- the requirement and suitability of any special processes chosen
- installation considerations
- methodology and results of test 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
- crashworthiness assessments.

***Other support data***

The substantiating data makes up Other data that a design package should address includes weight and balance data, manufacturing data, manual amendment requirements, and installation or incorporation instructions.

***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.

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

- 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

***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 that production may be conducted. In many cases the ideal production of a prototype will not be achievable subsequently, from either the airworthiness or economic standpoints.

***Amendments***

Amendments to manuals is an important aspect of a complete design package. Maintenance manuals, illustrated parts catalogues, and flight manuals are three documents that may require amendment when a design is 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 manual issuer would be expected.

Flight manual supplements may be approved when they form part of the design change. As guidance a flight manual supplement should include the following sections—

- **Cover Page**; including—
    - the aircraft type / applicability
    - a contents table
    - a list of effective pages
    - the date and revision status
    - the identification of the design organisation developing the supplement
    - a signature, designation, and delegation reference of the approving person
- **General;** including a description of the application of the supplement, particular special considerations for installation or operation, and a drawing if necessary
- **Limitations**
- **Emergency Procedures**
- **Normal Procedures**; including the installation and performance of pilot maintenance as well as the normal operating procedures
- **Performance**

***Installation data***

For designs that progress to installation there should be some installation data provided. In many cases this is provided in an instruction 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.

## Design Checking

It is important that compliance with airworthiness requirements is adequately proven and checked. In some cases there is no need for the calculations to be checked by independent persons. For example, where structural testing confirms the results of structural calculations an independent calculation check would not normally be required.

Where the proof of compliance depends on calculations alone, and these calculations are extensive or are based on other than fundamental technical procedures, it is important that checking is done by suitably qualified persons other than those originally performing the work.

## Design Approval

It is the responsibility of an approving person to ensure the complete design complies with the applicable airworthiness requirements. In approving a design a person should ensure the following—

- only designs in areas that the person is competent in should be approved
- the design changes approved should be those that the person has—
    - personally performed; or
    - supervised and checked to the extent necessary to ensure that it complies with the applicable airworthiness requirements
- the applicable descriptive data is included in the design documentation
- ready availability in person for consultation with those performing the design, testing, or prototyping when supervising the design work
- a qualification such as OK by inspection or OK by comparison is provided to indicate how—
    - the final design has been assessed
    - the production units are to be assessed
- independent checking of calculations that may have a affect on structural airworthiness are carried out
- a determination is made that—
    - a product or appliance incorporating a design change, when operated in accordance with the flight manual or other prescribed operating limitations and conditions, amended as required by the design change—
        - meets the airworthiness design standards, or the provisions not complied with are provided for by equivalent levels of safety; and
        - has no unsafe feature or characteristic that makes it unsafe for its intended use;

and

- the maintenance data provided is adequate for the proper maintenance of the product, component, or appliance incorporating the change.

## Design Approvals Requiring "Prior Embodiment" statement insertion in EO

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.<br>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 Part 183 AER should consult CASA PNG for clarification.<br>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 B — The Drawing System

The drawing system of a design organization is a key element in the design control system. Drawings may range from sketches to fully drafted drawings to computer produced drawings. The design organization should ensure that the media it chooses to use is appropriate for the considerations of the drawing standards the organization wishes to maintain. The drawing system may use one or more of the following media for drawing it produces—

- paper
- acetate
- microfiche
- computer

In all instances the design organization should ensure that the system provides security, safety, integrity, and backup of the design data. Personnel should be fully trained on the system used. A blank or an example drawing would aid in any references to the drawing in an organization's procedures.

The drawing system detailed in a design organization's exposition should include the following features—

- a description of the drawing system and the standards the drawings are to, such as BS 5070, Mil-STD 100, or a suitable aviation specific drawing standard
- a method of identification of company drawing sheets
- a definition of the company drawing numbering system. The numbering system should be logical, provide a reference on each drawing to the modification package it is approved under, and utilized, as necessary, international recognized numbering standards such as ATA
- drawing certification procedures that include—
    - drawing checks
    - stress checks and agreements
    - a list of persons authorized to certify company documents
- procedures for the approval of designs and design changes after a drawing amendment
- the distribution of new or amended drawings to all personnel or customers requiring the use of the information. This may be an update service that identifies those drawing that have changed but should provide sufficient information for the person using the drawing to determine the relevant changes and their consequences
- temporary drawings control
- amendment control
- a drawing list that—
    - is adequately identified by the designation and by the issue number or date
    - lists all drawings or enables all drawings to be traced easily from the listed drawings
    - clearly identifies the designs covered
    - contains the approving persons signature

- procedures to ensure that—
    - if final drawings are not those used during the prototype stage, the approving person confirms that any new drawings are compatible with the drawing list
    - any amendment of the drawing list to incorporate modifications or to incorporate new designs follows the process detailed in the exposition.